EUROPEAN RESEARCH EXECUTIVE AGENCY (REA)

REA.C – Future Society
C.4 – Reforming European R&I and Research Infrastructures

GRANT AGREEMENT

Project 101057511 — EURO-LABS

PREAMBLE

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and

on the other part,

1. 'the coordinator':

ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN), PIC 999992789, established in Via Enrico Fermi 54, FRASCATI 00044, Italy,

and the following other beneficiaries, if they sign their 'accession form' (see Annex 3 and Article 40):

2. **GRAND ACCELERATEUR NATIONAL D'IONS LOURDS (GANIL)**, PIC 999957481, established in Boulevard Henri Becquerel, CAEN 14076, France,

3. **ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE (CERN)**, PIC 999988133, established in ESPLANADE DES PARTICULES 1 PARCELLE 11482 DE MEYRIN BATIMENT CADASTRAL 1046, GENEVE 23 1211, Switzerland,

4. **INSTITUT JOZEF STEFAN (JSI)**, PIC 999971837, established in Jamova 39, LJUBLJANA 1000, Slovenia,

5. **THE HENRYK NIEWODNICZANSKI INSTITUTE OF NUCLEAR PHYSICS, POLISH ACADEMY OF SCIENCES (IFJ PAN)**, PIC 999611579, established in RADZIKOWSKIEGO 152, KRAKOW 31 342, Poland,

6. **DEUTSCHES ELEKTRONEN-SYNCHROTRON DESY (DESY)**, PIC 999986969, established in NOTKESTRASSE 85, HAMBURG 22607, Germany,

7. **UNIVERSITE CATHOLIQUE DE LOUVAIN (UCL)**, PIC 999980664, established in PLACE DE L UNIVERSITE 1, LOUVAIN LA NEUVE 1348, Belgium,

8. **RUDER BOSKOVIC INSTITUTE (RBI)**, PIC 999875031, established in Bijenicka cesta 54, ZAGREB 10000, Croatia,

9. **CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (CNRS)**, PIC 999997930, established in RUE MICHEL ANGE 3, PARIS 75794, France,

10. **FONDAZIONE BRUNO KESSLER (FBK)**, PIC 999625450, established in VIA SANTA CROCE 77, TRENTO 38122, Italy,

11. **INSTITUTO TECNOLOGICO DE ARAGON (ITAINNOVA)**, PIC 999509341, established in MARIA DE LUNA 8, ZARAGOZA 50018, Spain,

12. **UNIWERSYTET WARSZAWSKI (UNIWARSAW)**, PIC 999572294, established in KRAKOWSKIE PRZEDMIESCIE 26/28, WARSZAWA 00 927, Poland,

13. **GSI HELMHOLTZZENTRUM FUR SCHWERIONENFORSCHUNG GMBH (GSI)**, PIC 999995214, established in PLANCKSTRASSE 1, DARMSTADT 64291, Germany,

14. **INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA-HORIA HULUBEI (IFIN-HH)**, PIC 999488777, established in STRADA REACTORULUI 30, MAGURELE ILFOV 077125, Romania,

15. **UNIVERSIDAD DE SEVILLA (USE)**, PIC 999862518, established in CALLE S. FERNANDO 4, SEVILLA 41004, Spain,

16. **INSTITUTO SUPERIOR TECNICO (IST)**, PIC 999992983, established in AVENIDA ROVISCO PAIS 1, LISBOA 1049 001, Portugal,

17. **ATOMMAGKUTATO INTEZET (Atomki)**, PIC 999869890, established in BEM TER 18/C, DEBRECEN H4026, Hungary,

18. **JYVASKYLAN YLIOPISTO (JYU)**, PIC 999842245, established in SEMINAARINKATU 15, JYVASKYLA 40100, Finland,

19. **UPPSALA UNIVERSITET (UU)**, PIC 999985029, established in VON KRAEMERS ALLE 4, UPPSALA 751 05, Sweden,

20. **COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA)**, PIC 999992401, established in RUE LEBLANC 25, PARIS 15 75015, France,

21. **KARLSRUHER INSTITUT FUER TECHNOLOGIE (KIT)**, PIC 990797674, established in KAISERSTRASSE 12, KARLSRUHE 76131, Germany,

22. **ACADEMISCH ZIEKENHUIS GRONINGEN (UMCG)**, PIC 999914801, established in HANZEPLEIN 1, GRONINGEN 9713 GZ, Netherlands,

23. **INSTYTUT CHEMII I TECHNIKI JADROWEJ (INCT)**, PIC 999464915, established in ul. Dorodna 16, WARSZAWA 03-195, Poland,

24. **AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC)**, PIC 999991722, established in CALLE SERRANO 117, MADRID 28006, Spain,

25. **UNIVERSITA DEGLI STUDI DI MILANO (UMIL)**, PIC 999995796, established in Via Festa Del Perdono 7, MILANO 20122, Italy,

Unless otherwise specified, references to 'beneficiary' or 'beneficiaries' include the coordinator and affiliated entities (if any).

If only one beneficiary signs the grant agreement ('mono-beneficiary grant'), all provisions referring to the 'coordinator' or the 'beneficiaries' will be considered — mutatis mutandis — as referring to the beneficiary.

The parties referred to above have agreed to enter into the Agreement.

By signing the Agreement and the accession forms, the beneficiaries accept the grant and agree to implement the action under their own responsibility and in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

The Agreement is composed of:

Preamble

Terms and Conditions (including Data Sheet)

Annex 1	Description of the action[1]
Annex 2	Estimated budget for the action
Annex 2a	Additional information on unit costs and contributions (if applicable)
Annex 3	Accession forms (if applicable)[2]
Annex 3a	Declaration on joint and several liability of affiliated entities (if applicable)[3]
Annex 4	Model for the financial statements
Annex 5	Specific rules (if applicable)

[1] Template published on Portal Reference Documents.
[2] Template published on Portal Reference Documents.
[3] Template published on Portal Reference Documents.

TERMS AND CONDITIONS

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DATA SHEET

1. General data

Project summary:

Project summary
Nuclear and High Energy Physics explore at different scales what the universe is composed of and how it functions. Breakthroughs in accelerator and detector technologies combined with innovative experiments represent the key to new discoveries. High Energy Physics, while preparing for the HL-LHC, is pursuing the design of the next generation particle accelerators and detectors, balancing the present and the future. Newly available beams of nuclei far from stability and intense stable beams have opened new avenues, ranging from the production of new elements to the exploration of nuclear properties at extremes of temperature, angular momentum and isospin. It is of vital importance to simultaneously optimize the use of existing and new Research Infrastructures (RIs) to conduct curiosity-driven research addressing fundamental questions and technological challenges, and also advance projects with broad societal impact. This project provides efficient access to the available resources to a large fraction of EUROpean Laboratories for Accelerator Based Sciences (EURO-LABS). It allows the diverse community of users to choose the best state-of-the-art RI or a network of RIs to conduct high impact research, fostering knowledge sharing across scientific fields. The proposal brings together, for the first time, the three communities engaged in Nuclear Physics, Accelerator and Detector technology for High Energy Physics, pioneering a super community of sub-atomic researchers. It allows a synergic implementation of best practices for data management and activities relating to targeted service improvements at these RIs. Joint training activities are foreseen to develop the skills of the next generation researchers to optimally use the RIs services for scientific and technological discoveries. EURO-LABS will create synergies and collaborations between the RIs of the Nuclear and High Energy communities, enhancing Europe's potential for successfully facing future challenges.

Keywords: not defined

Project number: 101057511

Project name: EUROpean Laboratories for Accelerator Based Science

Project acronym: EURO-LABS

Call: HORIZON-INFRA-2021-SERV-01

Topic: HORIZON-INFRA-2021-SERV-01-07

Type of action: HORIZON Research and Innovation Actions

Granting authority: European Research Executive Agency

Grant managed through EU Funding & Tenders Portal: Yes (eGrants)

Project starting date: fixed date: 1 September 2022

Project end date: 31 August 2026

Project duration: 48 months

Consortium agreement: Yes

2. Participants

List of participants:

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible costs (BEN and AE)	Max grant amount
1	COO	INFN	ISTITUTO NAZIONALE DI FISICA NUCLEARE	IT	999992789	2 574 442.50	2 573 880.00
2	BEN	GANIL	GRAND ACCELERATEUR NATIONAL D'IONS LOURDS	FR	999957481	779 611.75	779 611.00
3	BEN (IO)	CERN	ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE	CH	999988133	3 033 942.00	3 033 942.00
4	BEN	JSI	INSTITUT JOZEF STEFAN	SI	999971837	399 375.00	399 375.00

N°	Role	Short name	Legal name	Ctry	PIC	Total eligible costs (BEN and AE)	Max grant amount
5	BEN	IFJ PAN	THE HENRYK NIEWODNICZANSKI INSTITUTE OF NUCLEAR PHYSICS, POLISH ACADEMY OF SCIENCES	PL	999611579	598 200.00	418 200.00
6	BEN	DESY	DEUTSCHES ELEKTRONEN-SYNCHROTRON DESY	DE	999986969	356 820.00	356 820.00
7	BEN	UCL	UNIVERSITE CATHOLIQUE DE LOUVAIN	BE	999980664	200 562.50	200 562.00
8	BEN	RBI	RUDER BOSKOVIC INSTITUTE	HR	999875031	126 170.00	126 170.00
9	BEN	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	999997930	794 500.00	794 500.00
10	BEN	FBK	FONDAZIONE BRUNO KESSLER	IT	999625450	272 000.00	272 000.00
11	BEN	ITAINNOVA	INSTITUTO TECNOLOGICO DE ARAGON	ES	999509341	159 750.00	159 750.00
12	BEN	UNIWARSAW	UNIWERSYTET WARSZAWSKI	PL	999572294	264 375.00	264 375.00
13	BEN	GSI	GSI HELMHOLTZZENTRUM FUR SCHWERIONENFORSCHUNG GMBH	DE	999995214	1 437 081.25	1 437 081.00
14	BEN	IFIN-HH	INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA-HORIA HULUBEI	RO	999488777	512 417.50	512 417.00
15	BEN	USE	UNIVERSIDAD DE SEVILLA	ES	999862518	357 506.25	155 000.00
16	BEN	IST	INSTITUTO SUPERIOR TECNICO	PT	999992983	65 000.00	65 000.00
17	BEN	Atomki	ATOMMAGKUTATO INTEZET	HU	999869890	93 125.00	93 125.00
18	BEN	JYU	JYVASKYLAN YLIOPISTO	FI	999842245	635 625.00	635 625.00
19	BEN	UU	UPPSALA UNIVERSITET	SE	999985029	399 925.00	399 925.00
20	BEN	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR	999992401	441 765.25	438 780.00
21	BEN	KIT	KARLSRUHER INSTITUT FUER TECHNOLOGIE	DE	990797674	570 067.56	570 067.00
22	BEN	UMCG	ACADEMISCH ZIEKENHUIS GRONINGEN	NL	999914801	112 905.00	112 905.00
23	BEN	INCT	INSTYTUT CHEMII I TECHNIKI JADROWEJ	PL	999464915	150 000.00	150 000.00
24	BEN	CSIC	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	ES	999991722	180 000.00	180 000.00
25	BEN	UMIL	UNIVERSITA DEGLI STUDI DI MILANO	IT	999995796	189 000.00	45 000.00
26	AP	PSI	PAUL SCHERRER INSTITUT	CH	999994923	0.00	0.00
27	AP	RIKEN	RIKEN THE INSTITUTE OF PHYSICAL ANDCHEMICAL RESEARCH	JP	999628651	0.00	0.00
28	AP	MSU	MICHIGAN STATE UNIVERSITY	US	999864458	0.00	0.00
29	AP	TUD	TECHNISCHE UNIVERSITAET DRESDEN	DE	999897729	0.00	0.00
30	AP	LIP	LABORATORIO DE INSTRUMENTACAO E FISICA EXPERIMENTAL DE PARTICULAS LIP	PT	999661534	0.00	0.00
31	AP	ENEA	AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE	IT	999988521	0.00	0.00
32	AP	UoB	THE UNIVERSITY OF BIRMINGHAM	UK	999907526	0.00	0.00
33	AP	UKRI	UNITED KINGDOM RESEARCH AND INNOVATION	UK	906446474	0.00	0.00
Total						14 704 166.56	14 174 110.00

Coordinator:

- ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN)

3. Grant

Maximum grant amount, total estimated eligible costs and contributions and funding rate:

Total eligible costs (BEN and AE)	Funding rate (%)	Maximum grant amount (Annex 2)	Maximum grant amount (award decision)
14 704 166.56	100	14 174 110.00	14 174 110.00

Grant form: Budget-based

Grant mode: Action grant

Budget categories/activity types:

- A. Personnel costs
  - A.1 Employees, A.2 Natural persons under direct contract, A.3 Seconded persons
  - A.4 SME owners and natural person beneficiaries

- B. Subcontracting costs

- C. Purchase costs
  - C.1 Travel and subsistence
  - C.2 Equipment
  - C.3 Other goods, works and services

- D. Other cost categories
  - D.2 Internally invoiced goods and services
  - D.3 Transnational access to research infrastructure unit costs
  - D.4 Virtual access to research infrastructure unit costs

- E. Indirect costs

Cost eligibility options:

- In-kind contributions eligible costs

- Parental leave

- Project-based supplementary payments

- Average personnel costs (unit cost according to usual cost accounting practices)

- Limitation for subcontracting

- Travel and subsistence:
  - Travel: Actual costs
  - Accommodation: Actual costs
  - Subsistence: Actual costs

- Equipment: depreciation only

- Indirect cost flat-rate: 25% of the eligible direct costs (categories A-D, except volunteers costs, subcontracting costs, financial support to third parties and exempted specific cost categories, if any)

- VAT: Yes

- Other ineligible costs

Budget flexibility: Yes (no flexibility cap)

4. Reporting, payments and recoveries

4.1 Continuous reporting (art 21)

Deliverables: see Funding & Tenders Portal Continuous Reporting tool

4.2 Periodic reporting and payments

Reporting and payment schedule (art 21, 22):

Reporting					Payments	
Reporting periods			Type	Deadline	Type	Deadline (time to pay)
RP No	Month from	Month to				
					Initial prefinancing	30 days from entry into force/10 days before starting date – whichever is the latest
1	1	12	Periodic report	60 days after end of reporting period	Interim payment	90 days from receiving periodic report
2	13	30	Periodic report	60 days after end of reporting period	Interim payment	90 days from receiving periodic report
3	31	48	Periodic report	60 days after end of reporting period	Final payment	90 days from receiving periodic report

Prefinancing payments and guarantees:

Prefinancing payment	
Type	Amount
Prefinancing 1 (initial)	7 559 052.86

Reporting and payment modalities (art 21, 22):

Mutual Insurance Mechanism (MIM): Yes

MIM contribution: 5% of the maximum grant amount (708 705.50), retained from the initial prefinancing

Restrictions on distribution of initial prefinancing: The prefinancing may be distributed only if the minimum number of beneficiaries set out in the call condititions (if any) have acceded to the Agreement and only to beneficiaries that have acceded.

Interim payment ceiling (if any): 90% of the maximum grant amount

Exception for revenues: Yes

No-profit rule: Yes

Late payment interest: ECB + 3.5%

Bank account for payments:

IT05B0100539100000000200001

Conversion into euros: Double conversion

Reporting language: Language of the Agreement

4.3 Certificates (art 24):

Certificates on the financial statements (CFS):

Conditions:

Schedule: only at final payment, if threshold is reached

Standard threshold (beneficiary-level):

- financial statement: requested EU contribution to costs ≥ EUR 430 000.00

Special threshold for beneficiaries with a systems and process audit(see Article 24): financial statement: requested EU contribution to costs ≥ EUR 725 000.00

4.4 Recoveries (art 22)

First-line liability for recoveries:

Beneficiary termination: Beneficiary concerned

Final payment: Each beneficiary for their own debt

After final payment: Beneficiary concerned

Joint and several liability for enforced recoveries (in case of non-payment):

Individual financial responsibility: Each beneficiary is liable only for its own debts (and those of its affiliated entities, if any)

5. Consequences of non-compliance, applicable law & dispute settlement forum

Suspension and termination:

Additional suspension grounds (art 31)

Additional termination grounds (art 32)

Applicable law (art 43):

Standard applicable law regime: EU law + law of Belgium

Special applicable law regime:

– ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE (CERN): EU law + law of France + general principles governing the law of international organisations and the general rules of international law

Dispute settlement forum (art 43):

Standard dispute settlement forum:

EU beneficiaries: EU General Court + EU Court of Justice (on appeal)

Non-EU beneficiaries: Courts of Brussels, Belgium (unless an international agreement provides for the enforceability of EU court judgements)

Special dispute settlement forum:

– ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE (CERN): Arbitration

6. Other

Specific rules (Annex 5): Yes

Standard time-limits after project end:

Confidentiality (for X years after final payment): 5

Record-keeping (for X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

Reviews (up to X years after final payment): 2

Audits (up to X years after final payment): 2

Extension of findings from other grants to this grant (no later than X years after final payment): 2

Impact evaluation (up to X years after final payment): 5 (or 3 for grants of not more than EUR 60 000)

CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and terms and conditions applicable to the grant awarded for the implementation of the action set out in Chapter 2.

ARTICLE 2 — DEFINITIONS

For the purpose of this Agreement, the following definitions apply:

Actions — The project which is being funded in the context of this Agreement.

Grant — The grant awarded in the context of this Agreement.

EU grants — Grants awarded by EU institutions, bodies, offices or agencies (including EU executive agencies, EU regulatory agencies, EDA, joint undertakings, etc.).

Participants — Entities participating in the action as beneficiaries, affiliated entities, associated partners, third parties giving in-kind contributions, subcontractors or recipients of financial support to third parties.

Beneficiaries (BEN) — The signatories of this Agreement (either directly or through an accession form).

Affiliated entities (AE) — Entities affiliated to a beneficiary within the meaning of Article 187 of EU Financial Regulation 2018/1046[4] which participate in the action with similar rights and obligations as the beneficiaries (obligation to implement action tasks and right to charge costs and claim contributions).

Associated partners (AP) — Entities which participate in the action, but without the right to charge costs or claim contributions.

Purchases — Contracts for goods, works or services needed to carry out the action (e.g. equipment, consumables and supplies) but which are not part of the action tasks (see Annex 1).

Subcontracting — Contracts for goods, works or services that are part of the action tasks (see Annex 1).

In-kind contributions — In-kind contributions within the meaning of Article 2(36) of EU Financial

[4] For the definition, see Article 187 Regulation (EU, Euratom) 2018/1046 of the European Parliament and of the Council of 18 July 2018 on the financial rules applicable to the general budget of the Union, amending Regulations (EU) No 1296/2013, (EU) No 1301/2013, (EU) No 1303/2013, (EU) No 1304/2013, (EU) No 1309/2013, (EU) No 1316/2013, (EU) No 223/2014, (EU) No 283/2014, and Decision No 541/2014/EU and repealing Regulation (EU, Euratom) No 966/2012 ('EU Financial Regulation') (OJ L 193, 30.7.2018, p. 1): "**affiliated entities** [are]:
(a) entities that form a sole beneficiary [(i.e. where an entity is formed of several entities that satisfy the criteria for being awarded a grant, including where the entity is specifically established for the purpose of implementing an action to be financed by a grant)];
(b) entities that satisfy the eligibility criteria and that do not fall within one of the situations referred to in Article 136(1) and 141(1) and that have a link with the beneficiary, in particular a legal or capital link, which is neither limited to the action nor established for the sole purpose of its implementation".

Regulation 2018/1046, i.e. non-financial resources made available free of charge by third parties.

Fraud — Fraud within the meaning of Article 3 of EU Directive 2017/1371[5] and Article 1 of the Convention on the protection of the European Communities' financial interests, drawn up by the Council Act of 26 July 1995[6], as well as any other wrongful or criminal deception intended to result in financial or personal gain.

Irregularities — Any type of breach (regulatory or contractual) which could impact the EU financial interests, including irregularities within the meaning of Article 1(2) of EU Regulation 2988/95[7].

Grave professional misconduct — Any type of unacceptable or improper behaviour in exercising one's profession, especially by employees, including grave professional misconduct within the meaning of Article 136(1)(c) of EU Financial Regulation 2018/1046.

Applicable EU, international and national law — Any legal acts or other (binding or non-binding) rules and guidance in the area concerned.

Portal — EU Funding & Tenders Portal; electronic portal and exchange system managed by the European Commission and used by itself and other EU institutions, bodies, offices or agencies for the management of their funding programmes (grants, procurements, prizes, etc.).

CHAPTER 2 ACTION

ARTICLE 3 — ACTION

The grant is awarded for the action **101057511 — EURO-LABS** ('action'), as described in Annex 1.

ARTICLE 4 — DURATION AND STARTING DATE

The duration and the starting date of the action are set out in the Data Sheet (see Point 1).

CHAPTER 3 GRANT

ARTICLE 5 — GRANT

5.1 Form of grant

The grant is an action grant[8] which takes the form of a budget-based mixed actual cost grant (i.e. a

[5] Directive (EU) 2017/1371 of the European Parliament and of the Council of 5 July 2017 on the fight against fraud to the Union's financial interests by means of criminal law (OJ L 198, 28.7.2017, p. 29).
[6] OJ C 316, 27.11.1995, p. 48.
[7] Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).
[8] For the definition, see Article 180(2)(a) EU Financial Regulation 2018/1046: '**action grant**' means an EU grant to finance "an action intended to help achieve a Union policy objective".

grant based on actual costs incurred, but which may also include other forms of funding, such as unit costs or contributions, flat-rate costs or contributions, lump sum costs or contributions or financing not linked to costs).

5.2 Maximum grant amount

The maximum grant amount is set out in the Data Sheet (see Point 3) and in the estimated budget (Annex 2).

5.3 Funding rate

The funding rate for costs is 100% of the action's eligible costs.

Contributions are not subject to any funding rate.

5.4 Estimated budget, budget categories and forms of funding

The estimated budget for the action is set out in Annex 2.

It contains the estimated eligible costs and contributions for the action, broken down by participant and budget category.

Annex 2 also shows the types of costs and contributions (forms of funding)[9] to be used for each budget category.

If unit costs or contributions are used, the details on the calculation will be explained in Annex 2a.

5.5 Budget flexibility

The budget breakdown may be adjusted — without an amendment (see Article 39) — by transfers (between participants and budget categories), as long as this does not imply any substantive or important change to the description of the action in Annex 1.

However:

- changes to the budget category for volunteers (if used) always require an amendment
- changes to budget categories with lump sums costs or contributions (if used; including financing not linked to costs) always require an amendment
- changes to budget categories with higher funding rates or budget ceilings (if used) always require an amendment
- addition of amounts for subcontracts not provided for in Annex 1 either require an amendment or simplified approval in accordance with Article 6.2
- other changes require an amendment or simplified approval, if specifically provided for in Article 6.2
- flexibility caps: not applicable.

[9] See Article 125 EU Financial Regulation 2018/1046.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS AND CONTRIBUTIONS

In order to be eligible, costs and contributions must meet the **eligibility** conditions set out in this Article.

6.1 General eligibility conditions

The **general eligibility conditions** are the following:

(a) for actual costs:

(i) they must be actually incurred by the beneficiary

(ii) they must be incurred in the period set out in Article 4 (with the exception of costs relating to the submission of the final periodic report, which may be incurred afterwards; see Article 21)

(iii) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation

(v) they must be identifiable and verifiable, in particular recorded in the beneficiary's accounts in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary's usual cost accounting practices

(vi) they must comply with the applicable national law on taxes, labour and social security and

(vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency

(b) for unit costs or contributions (if any):

(i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(ii) the units must:

- be actually used or produced by the beneficiary in the period set out in Article 4 (with the exception of units relating to the submission of the final periodic report, which may be used or produced afterwards; see Article 21)

- be necessary for the implementation of the action and

(iii) the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 20)

(c) for flat-rate costs or contributions (if any):

(i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(ii) the costs or contributions to which the flat-rate is applied must:

- be eligible
- relate to the period set out in Article 4 (with the exception of costs or contributions relating to the submission of the final periodic report, which may be incurred afterwards; see Article 21)

(d) for lump sum costs or contributions (if any):

(i) they must be declared under one of the budget categories set out in Article 6.2 and Annex 2

(ii) the work must be properly implemented by the beneficiary in accordance with Annex 1

(iii) the deliverables/outputs must be achieved in the period set out in Article 4 (with the exception of deliverables/outputs relating to the submission of the final periodic report, which may be achieved afterwards; see Article 21)

(e) for unit, flat-rate or lump sum costs or contributions according to usual cost accounting practices (if any):

(i) they must fulfil the general eligibility conditions for the type of cost concerned

(ii) the cost accounting practices must be applied in a consistent manner, based on objective criteria, regardless of the source of funding

(f) for financing not linked to costs (if any): the results must be achieved or the conditions must be fulfilled as described in Annex 1.

In addition, for direct cost categories (e.g. personnel, travel & subsistence, subcontracting and other direct costs) only costs that are directly linked to the action implementation and can therefore be attributed to it directly are eligible. They must not include any indirect costs (i.e. costs that are only indirectly linked to the action, e.g. via cost drivers).

In-kind contributions provided by third parties free of charge may be declared as eligible direct costs by the beneficiaries which use them (under the same conditions as if they were their own, provided that they concern only direct costs and that the third parties and their in-kind contributions are set out in Annex 1 (or approved ex post in the periodic report, if their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants; 'simplified approval procedure').

6.2 Specific eligibility conditions for each budget category

For each budget category, the **specific eligibility conditions** are as follows:

Direct costs

A. Personnel costs

A.1 Costs for employees (or equivalent) are eligible as personnel costs if they fulfil the general eligibility conditions and are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action.

They must be limited to salaries (including net payments during parental leave), social security contributions, taxes and other costs linked to the remuneration, if they arise from national law or the employment contract (or equivalent appointing act) and be calculated on the basis of the costs actually incurred, in accordance with the following method:

{daily rate for the person

multiplied by

number of day-equivalents worked on the action (rounded up or down to the nearest half-day)}.

The daily rate must be calculated as:

{annual personnel costs for the person

divided by

215}.

The number of day-equivalents declared for a person must be identifiable and verifiable (see Article 20).

The actual time spent on parental leave by a person assigned to the action may be deducted from the 215 days indicated in the above formula.

The total number of day-equivalents declared in EU grants, for a person for a year, cannot be higher than 215, minus time spent on parental leave (if any).

For personnel which receives supplementary payments for work in projects (project-based remuneration), the personnel costs must be calculated at a rate which:

- corresponds to the actual remuneration costs paid by the beneficiary for the time worked by the person in the action over the reporting period
- does not exceed the remuneration costs paid by the beneficiary for work in similar projects funded by national schemes (‘national projects reference’)
- is defined based on objective criteria allowing to determine the amount to which the person is entitled

and

- reflects the usual practice of the beneficiary to pay consistently bonuses or supplementary payments for work in projects funded by national schemes.

The national projects reference is the remuneration defined in national law, collective labour agreement or written internal rules of the beneficiary applicable to work in projects funded by national schemes.

If there is no such national law, collective labour agreement or written internal rules or if the project-based remuneration is not based on objective criteria, the national project reference will be the average

remuneration of the person in the last full calendar year covered by the reporting period, excluding remuneration paid for work in EU actions.

If the beneficiary uses average personnel costs (unit cost according to usual cost accounting practices), the personnel costs must fulfil the general eligibility conditions for such unit costs and the daily rate must be calculated:

- using the actual personnel costs recorded in the beneficiary's accounts and excluding any costs which are ineligible or already included in other budget categories; the actual personnel costs may be adjusted on the basis of budgeted or estimated elements, if they are relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information

and

- according to usual cost accounting practices which are applied in a consistent manner, based on objective criteria, regardless of the source of funding.

A.2 and **A.3 Costs for natural persons working under a direct contract** other than an employment contract and costs for **seconded persons by a third party against payment** are also eligible as personnel costs, if they are assigned to the action, fulfil the general eligibility conditions and:

(a) work under conditions similar to those of an employee (in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed) and

(b) the result of the work belongs to the beneficiary (unless agreed otherwise).

They must be calculated on the basis of a rate which corresponds to the costs actually incurred for the direct contract or secondment and must not be significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.4 The work of **SME owners** for the action (i.e. owners of beneficiaries that are small and medium-sized enterprises[10] not receiving a salary) or **natural person beneficiaries** (i.e. beneficiaries that are natural persons not receiving a salary) may be declared as personnel costs, if they fulfil the general eligibility conditions and are calculated as unit costs in accordance with the method set out in Annex 2a.

B. Subcontracting costs

Subcontracting costs for the action (including related duties, taxes and charges, such as non-deductible or non-refundable value added tax (VAT)) are eligible, if they are calculated on the basis of the costs actually incurred, fulfil the general eligibility conditions and are awarded using the

[10] For the definition, see Commission Recommendation 2003/361/EC: micro, small or medium-sized enterprise (SME) are enterprises

- engaged in an economic activity, irrespective of their legal form (including, in particular, self- employed persons and family businesses engaged in craft or other activities, and partnerships or associations regularly engaged in an economic activity) and

- employing fewer than 250 persons (expressed in 'annual working units' as defined in Article 5 of the Recommendation) and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.

beneficiary's usual purchasing practices — provided these ensure subcontracts with best value for money (or if appropriate the lowest price) and that there is no conflict of interests (see Article 12).

Beneficiaries that are 'contracting authorities/entities' within the meaning of the EU Directives on public procurement must also comply with the applicable national law on public procurement.

Subcontracting may cover only a limited part of the action.

The tasks to be subcontracted and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2 (or may be approved ex post in the periodic report, if the use of subcontracting does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants; 'simplified approval procedure').

C. Purchase costs

Purchase costs for the action (including related duties, taxes and charges, such as non-deductible or non-refundable value added tax (VAT)) are eligible if they fulfil the general eligibility conditions and are bought using the beneficiary's usual purchasing practices — provided these ensure purchases with best value for money (or if appropriate the lowest price) and that there is no conflict of interests (see Article 12).

Beneficiaries that are 'contracting authorities/entities' within the meaning of the EU Directives on public procurement must also comply with the applicable national law on public procurement.

C.1 Travel and subsistence

Purchases for **travel, accommodation** and **subsistence** must be calculated as follows:

- travel: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel
- accommodation: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel
- subsistence: on the basis of the costs actually incurred and in line with the beneficiary's usual practices on travel .

C.2 Equipment

Purchases of **equipment, infrastructure or other assets** used for the action must be declared as depreciation costs, calculated on the basis of the costs actually incurred and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.

Only the portion of the costs that corresponds to the rate of actual use for the action during the action duration can be taken into account.

Costs for **renting or leasing** equipment, infrastructure or other assets are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

C.3 Other goods, works and services

Purchases of **other goods, works and services** must be calculated on the basis of the costs actually incurred.

Such goods, works and services include, for instance, consumables and supplies, promotion, dissemination, protection of results, translations, publications, certificates and financial guarantees, if required under the Agreement.

D. Other cost categories

D.2 Internally invoiced goods and services

Costs for internally invoiced goods and services directly used for the action may be declared as unit cost according to usual cost accounting practices, if and as declared eligible in the call conditions, if they fulfil the general eligibility conditions for such unit costs and the amount per unit is calculated:

- using the actual costs for the good or service recorded in the beneficiary's accounts, attributed either by direct measurement or on the basis of cost drivers, and excluding any cost which are ineligible or already included in other budget categories; the actual costs may be adjusted on the basis of budgeted or estimated elements, if they are relevant for calculating the costs, reasonable and correspond to objective and verifiable information

and

- according to usual cost accounting practices which are applied in a consistent manner, based on objective criteria, regardless of the source of funding.

'Internally invoiced goods and services' means goods or services which are provided within the beneficiary's organisation directly for the action and which the beneficiary values on the basis of its usual cost accounting practices.

This cost will not be taken into account for the indirect cost flat-rate.

D.3 Transnational access to research infrastructure unit costs

Unit costs for providing transnational access to research infrastructure are eligible, if and as declared eligible in the call conditions, if they fulfil the general eligibility conditions, are calculated in accordance with the method set out in Annex 2a and exclude any cost which are ineligible or already included in other budget categories.

Beneficiaries that declare costs under this cost category cannot use other cost categories such as internally invoiced goods and services or equipment costs (for charging the capital costs of the infrastructure), unless explicitly allowed in the call conditions.

This cost will not be taken into account for the indirect cost flat-rate.

D.4 Virtual access to research infrastructure unit costs

Unit costs for providing virtual access to research infrastructure are eligible, if and as declared eligible in the call conditions, if they fulfil the general eligibility conditions, are calculated in accordance with the method set out in Annex 2a and exclude any cost which are ineligible or already included in other budget categories.

Beneficiaries that declare costs under this cost category cannot use other cost categories such as internally invoiced goods and services or equipment costs (for charging the capital costs of the infrastructure), unless explicitly allowed by the call conditions.

This cost will not be taken into account for the indirect cost flat-rate.

Indirect costs

E. Indirect costs

Indirect costs will be reimbursed at the flat-rate of 25% of the eligible direct costs (categories A-D, except volunteers costs, subcontracting costs, financial support to third parties and exempted specific cost categories, if any).

Contributions

Not applicable

6.3 Ineligible costs and contributions

The following costs or contributions are **ineligible**:

(a) costs or contributions that do not comply with the conditions set out above (Article 6.1 and 6.2), in particular:

(i) costs related to return on capital and dividends paid by a beneficiary

(ii) debt and debt service charges

(iii) provisions for future losses or debts

(iv) interest owed

(v) currency exchange losses

(vi) bank costs charged by the beneficiary's bank for transfers from the granting authority

(vii) excessive or reckless expenditure

(viii) deductible or refundable VAT (including VAT paid by public bodies acting as public authority)

(ix) costs incurred or contributions for activities implemented during grant agreement suspension (see Article 31)

(x) in-kind contributions by third parties: not applicable

(b) costs or contributions declared under other EU grants (or grants awarded by an EU Member State, non-EU country or other body implementing the EU budget), except for the following cases:

(i) Synergy actions: not applicable

(ii) if the action grant is combined with an operating grant[11] running during the same period and the beneficiary can demonstrate that the operating grant does not cover any (direct or indirect) costs of the action grant

(c) costs or contributions for staff of a national (or regional/local) administration, for activities that are part of the administration's normal activities (i.e. not undertaken only because of the grant)

(d) costs or contributions (especially travel and subsistence) for staff or representatives of EU institutions, bodies or agencies

(e) other :

(i) country restrictions for eligible costs: not applicable

(ii) costs or contributions declared specifically ineligible in the call conditions.

6.4 Consequences of non-compliance

If a beneficiary declares costs or contributions that are ineligible, they will be rejected (see Article 27).

This may also lead to other measures described in Chapter 5.

CHAPTER 4 GRANT IMPLEMENTATION

SECTION 1 CONSORTIUM: BENEFICIARIES, AFFILIATED ENTITIES AND OTHER PARTICIPANTS

ARTICLE 7 — BENEFICIARIES

The beneficiaries, as signatories of the Agreement, are fully responsible towards the granting authority for implementing it and for complying with all its obligations.

They must implement the Agreement to their best abilities, in good faith and in accordance with all the obligations and terms and conditions it sets out.

They must have the appropriate resources to implement the action and implement the action under their own responsibility and in accordance with Article 11. If they rely on affiliated entities or other participants (see Articles 8 and 9), they retain sole responsibility towards the granting authority and the other beneficiaries.

They are jointly responsible for the *technical* implementation of the action. If one of the beneficiaries fails to implement their part of the action, the other beneficiaries must ensure that this part is implemented by someone else (without being entitled to an increase of the maximum grant amount and subject to an amendment; see Article 39). The *financial* responsibility of each beneficiary in case of recoveries is governed by Article 22.

[11] For the definition, see Article 180(2)(b) of EU Financial Regulation 2018/1046: '**operating grant**' means an EU grant to finance "the functioning of a body which has an objective forming part of and supporting an EU policy".

The beneficiaries (and their action) must remain eligible under the EU programme funding the grant for the entire duration of the action. Costs and contributions will be eligible only as long as the beneficiary and the action are eligible.

The **internal roles and responsibilities** of the beneficiaries are divided as follows:

(a) Each beneficiary must:

(i) keep information stored in the Portal Participant Register up to date (see Article 19)

(ii) inform the granting authority (and the other beneficiaries) immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 19)

(iii) submit to the coordinator in good time:

- the prefinancing guarantees (if required; see Article 23)
- the financial statements and certificates on the financial statements (CFS) (if required; see Articles 21 and 24.2 and Data Sheet, Point 4.3)
- the contribution to the deliverables and technical reports (see Article 21)
- any other documents or information required by the granting authority under the Agreement

(iv) submit via the Portal data and information related to the participation of their affiliated entities.

(b) The coordinator must:

(i) monitor that the action is implemented properly (see Article 11)

(ii) act as the intermediary for all communications between the consortium and the granting authority, unless the Agreement or granting authority specifies otherwise, and in particular:

- submit the prefinancing guarantees to the granting authority (if any)
- request and review any documents or information required and verify their quality and completeness before passing them on to the granting authority
- submit the deliverables and reports to the granting authority
- inform the granting authority about the payments made to the other beneficiaries (report on the distribution of payments; if required, see Articles 22 and 32)

(iii) distribute the payments received from the granting authority to the other beneficiaries without unjustified delay (see Article 22).

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including affiliated entities).

However, coordinators which are public bodies may delegate the tasks set out in Point (b)(ii) last indent and (iii) above to entities with 'authorisation to administer' which they have created or which are controlled by or affiliated to them. In this case, the coordinator retains sole responsibility for the payments and for compliance with the obligations under the Agreement.

Moreover, coordinators which are 'sole beneficiaries'[12] (or similar, such as European research infrastructure consortia (ERICs)) may delegate the tasks set out in Point (b)(i) to (iii) above to one of their members. The coordinator retains sole responsibility for compliance with the obligations under the Agreement.

The beneficiaries must have **internal arrangements** regarding their operation and co-ordination, to ensure that the action is implemented properly.

If required by the granting authority (see Data Sheet, Point 1), these arrangements must be set out in a written **consortium agreement** between the beneficiaries, covering for instance:

- the internal organisation of the consortium
- the management of access to the Portal
- different distribution keys for the payments and financial responsibilities in case of recoveries (if any)
- additional rules on rights and obligations related to background and results (see Article 16)
- settlement of internal disputes
- liability, indemnification and confidentiality arrangements between the beneficiaries.

The internal arrangements must not contain any provision contrary to this Agreement.

ARTICLE 8 — AFFILIATED ENTITIES

Not applicable

ARTICLE 9 — OTHER PARTICIPANTS INVOLVED IN THE ACTION

9.1 Associated partners

The following entities which cooperate with a beneficiary will participate in the action as 'associated partners':

- **PAUL SCHERRER INSTITUT (PSI)**, PIC 999994923
- **RIKEN THE INSTITUTE OF PHYSICAL ANDCHEMICAL RESEARCH (RIKEN)**, PIC 999628651
- **MICHIGAN STATE UNIVERSITY (MSU)**, PIC 999864458

[12] For the definition, see Article 187(2) EU Financial Regulation 2018/1046: "Where several entities satisfy the criteria for being awarded a grant and together form one entity, that entity may be treated as the **sole beneficiary**, including where it is specifically established for the purpose of implementing the action financed by the grant."

- **TECHNISCHE UNIVERSITAET DRESDEN (TUD)**, PIC 999897729
- **LABORATORIO DE INSTRUMENTACAO E FISICA EXPERIMENTAL DE PARTICULAS LIP (LIP)**, PIC 999661534
- **AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE (ENEA)**, PIC 999988521
- **THE UNIVERSITY OF BIRMINGHAM (UoB)**, PIC 999907526
- **UNITED KINGDOM RESEARCH AND INNOVATION (UKRI)**, PIC 906446474

Associated partners must implement the action tasks attributed to them in Annex 1 in accordance with Article 11. They may not charge costs or contributions to the action and the costs for their tasks are not eligible.

The tasks must be set out in Annex 1.

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper implementation), 12 (conflict of interests), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the associated partners.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the associated partners.

9.2 Third parties giving in-kind contributions to the action

Other third parties may give in-kind contributions to the action (i.e. personnel, equipment, other goods, works and services, etc. which are free-of-charge) if necessary for the implementation.

Third parties giving in-kind contributions do not implement any action tasks. They may not charge costs or contributions to the action, but the costs for the in-kind contributions are eligible and may be charged by the beneficiaries which use them, under the conditions set out in Article 6. The costs will be included in Annex 2 as part of the beneficiaries' costs.

The third parties and their in-kind contributions should be set out in Annex 1.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the third parties giving in-kind contributions.

9.3 Subcontractors

Subcontractors may participate in the action, if necessary for the implementation.

Subcontractors must implement their action tasks in accordance with Article 11. The costs for the subcontracted tasks (invoiced price from the subcontractor) are eligible and may be charged by the beneficiaries, under the conditions set out in Article 6. The costs will be included in Annex 2 as part of the beneficiaries' costs.

The beneficiaries must ensure that their contractual obligations under Articles 11 (proper

implementation), 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping) also apply to the subcontractors.

The beneficiaries must ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the subcontractors.

9.4 Recipients of financial support to third parties

If the action includes providing financial support to third parties (e.g. grants, prizes or similar forms of support), the beneficiaries must ensure that their contractual obligations under Articles 12 (conflict of interest), 13 (confidentiality and security), 14 (ethics), 17.2 (visibility), 18 (specific rules for carrying out action), 19 (information) and 20 (record-keeping)also apply to the third parties receiving the support (recipients).

The beneficiaries must also ensure that the bodies mentioned in Article 25 (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.) can exercise their rights also towards the recipients.

ARTICLE 10 — PARTICIPANTS WITH SPECIAL STATUS

10.1 Non-EU participants

Participants which are established in a non-EU country (if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)

- for the submission of certificates under Article 24: to use qualified external auditors which are independent and comply with comparable standards as those set out in EU Directive 2006/43/EC[13]

- for the controls under Article 25: to allow for checks, reviews, audits and investigations (including on-the-spot checks, visits and inspections) by the bodies mentioned in that Article (e.g. granting authority, OLAF, Court of Auditors (ECA), etc.).

Special rules on dispute settlement apply (see Data Sheet, Point 5).

10.2 Participants which are international organisations

Participants which are international organisations (IOs; if any) undertake to comply with their obligations under the Agreement and:

- to respect general principles (including fundamental rights, values and ethical principles, environmental and labour standards, rules on classified information, intellectual property rights, visibility of funding and protection of personal data)

[13] Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

- for the submission of certificates under Article 24: to use either independent public officers or external auditors which comply with comparable standards as those set out in EU Directive 2006/43/EC

- for the controls under Article 25: to allow for the checks, reviews, audits and investigations by the bodies mentioned in that Article, taking into account the specific agreements concluded by them and the EU (if any).

For such participants, nothing in the Agreement will be interpreted as a waiver of their privileges or immunities, as accorded by their constituent documents or international law.

Special rules on applicable law and dispute settlement apply (see Article 43 and Data Sheet, Point 5).

10.3 Pillar-assessed participants

Pillar-assessed participants (if any) may rely on their own systems, rules and procedures, in so far as they have been positively assessed and do not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries.

'Pillar-assessment' means a review by the European Commission on the systems, rules and procedures which participants use for managing EU grants (in particular internal control system, accounting system, external audits, financing of third parties, rules on recovery and exclusion, information on recipients and protection of personal data; see Article 154 EU Financial Regulation 2018/1046).

Participants with a positive pillar assessment may rely on their own systems, rules and procedures, in particular for:

- record-keeping (Article 20): may be done in accordance with internal standards, rules and procedures

- currency conversion for financial statements (Article 21): may be done in accordance with usual accounting practices

- guarantees (Article 23): for public law bodies, prefinancing guarantees are not needed

- certificates (Article 24):

    - certificates on the financial statements (CFS): may be provided by their regular internal or external auditors and in accordance with their internal financial regulations and procedures

    - certificates on usual accounting practices (CoMUC): are not needed if those practices are covered by an ex-ante assessment

and use the following specific rules, for:

- recoveries (Article 22): in case of financial support to third parties, there will be no recovery if the participant has done everything possible to retrieve the undue amounts from the third party receiving the support (including legal proceedings) and non-recovery is not due to an error or negligence on its part

- checks, reviews, audits and investigations by the EU (Article 25): will be conducted taking

into account the rules and procedures specifically agreed between them and the framework agreement (if any)

- impact evaluation (Article 26): will be conducted in accordance with the participant's internal rules and procedures and the framework agreement (if any)

- grant agreement suspension (Article 31): certain costs incurred during grant suspension are eligible (notably, minimum costs necessary for a possible resumption of the action and costs relating to contracts which were entered into before the pre-information letter was received and which could not reasonably be suspended, reallocated or terminated on legal grounds)

- grant agreement termination (Article 32): the final grant amount and final payment will be calculated taking into account also costs relating to contracts due for execution only after termination takes effect, if the contract was entered into before the pre-information letter was received and could not reasonably be terminated on legal grounds

- liability for damages (Article 33.2): the granting authority must be compensated for damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement only if the damage is due to an infringement of the participant's internal rules and procedures or due to a violation of third parties' rights by the participant or one of its employees or individual for whom the employees are responsible.

Participants whose pillar assessment covers procurement and granting procedures may also do purchases, subcontracting and financial support to third parties (Article 6.2) in accordance with their internal rules and procedures for purchases, subcontracting and financial support.

Participants whose pillar assessment covers data protection rules may rely on their internal standards, rules and procedures for data protection (Article 15).

The participants may however not rely on provisions which would breach the principle of equal treatment of applicants or beneficiaries or call into question the decision awarding the grant, such as in particular:

- eligibility (Article 6)

- consortium roles and set-up (Articles 7-9)

- security and ethics (Articles 13, 14)

- IPR (including background and results, access rights and rights of use), communication, dissemination and visibility (Articles 16 and 17)

- information obligation (Article 19)

- payment, reporting and amendments (Articles 21, 22 and 39)

- rejections, reductions, suspensions and terminations (Articles 27, 28, 29-32)

If the pillar assessment was subject to remedial measures, reliance on the internal systems, rules and procedures is subject to compliance with those remedial measures.

Participants whose assessment has not yet been updated to cover (the new rules on) data protection may rely on their internal systems, rules and procedures, provided that they ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subject
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the personal data.

Participants must inform the coordinator without delay of any changes to the systems, rules and procedures that were part of the pillar assessment. The coordinator must immediately inform the granting authority.

Pillar-assessed participants that have also concluded a framework agreement with the EU, may moreover — under the same conditions as those above (i.e. not call into question the decision awarding the grant or breach the principle of equal treatment of applicants or beneficiaries) — rely on the provisions set out in that framework agreement.

SECTION 2 RULES FOR CARRYING OUT THE ACTION

ARTICLE 11 — PROPER IMPLEMENTATION OF THE ACTION

11.1 Obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement, the call conditions and all legal obligations under applicable EU, international and national law.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 12 — CONFLICT OF INTERESTS

12.1 Conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective implementation of the Agreement could be compromised for reasons involving family, emotional life,

political or national affinity, economic interest or any other direct or indirect interest ('conflict of interests').

They must formally notify the granting authority without delay of any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The granting authority may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28) and the grant or the beneficiary may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 13 — CONFIDENTIALITY AND SECURITY

13.1 Sensitive information

The parties must keep confidential any data, documents or other material (in any form) that is identified as sensitive in writing ('sensitive information') — during the implementation of the action and for at least until the time-limit set out in the Data Sheet (see Point 6).

If a beneficiary requests, the granting authority may agree to keep such information confidential for a longer period.

Unless otherwise agreed between the parties, they may use sensitive information only to implement the Agreement.

The beneficiaries may disclose sensitive information to their personnel or other participants involved in the action only if they:

(a) need to know it in order to implement the Agreement and

(b) are bound by an obligation of confidentiality.

The granting authority may disclose sensitive information to its staff and to other EU institutions and bodies.

It may moreover disclose sensitive information to third parties, if:

(a) this is necessary to implement the Agreement or safeguard the EU financial interests and

(b) the recipients of the information are bound by an obligation of confidentiality.

The confidentiality obligations no longer apply if:

(a) the disclosing party agrees to release the other party

(b) the information becomes publicly available, without breaching any confidentiality obligation

(c) the disclosure of the sensitive information is required by EU, international or national law.

Specific confidentiality rules (if any) are set out in Annex 5.

13.2 Classified information

The parties must handle classified information in accordance with the applicable EU, international or national law on classified information (in particular, Decision 2015/444[14] and its implementing rules).

Deliverables which contain classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving classified information may be subcontracted only after explicit approval (in writing) from the granting authority.

Classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

Specific security rules (if any) are set out in Annex 5.

13.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 14 — ETHICS AND VALUES

14.1 Ethics

The action must be carried out in line with the highest ethical standards and the applicable EU, international and national law on ethical principles.

Specific ethics rules (if any) are set out in Annex 5.

14.2 Values

The beneficiaries must commit to and ensure the respect of basic EU values (such as respect for human dignity, freedom, democracy, equality, the rule of law and human rights, including the rights of minorities).

Specific rules on values (if any) are set out in Annex 5.

14.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

[14] Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

ARTICLE 15 — DATA PROTECTION

15.1 Data processing by the granting authority

Any personal data under the Agreement will be processed under the responsibility of the data controller of the granting authority in accordance with and for the purposes set out in the Portal Privacy Statement.

For grants where the granting authority is the European Commission, an EU regulatory or executive agency, joint undertaking or other EU body, the processing will be subject to Regulation 2018/1725[15].

15.2 Data processing by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with the applicable EU, international and national law on data protection (in particular, Regulation 2016/679[16]).

They must ensure that personal data is:

- processed lawfully, fairly and in a transparent manner in relation to the data subjects
- collected for specified, explicit and legitimate purposes and not further processed in a manner that is incompatible with those purposes
- adequate, relevant and limited to what is necessary in relation to the purposes for which they are processed
- accurate and, where necessary, kept up to date
- kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the data is processed and
- processed in a manner that ensures appropriate security of the data.

The beneficiaries may grant their personnel access to personal data only if it is strictly necessary for implementing, managing and monitoring the Agreement. The beneficiaries must ensure that the personnel is under a confidentiality obligation.

The beneficiaries must inform the persons whose data are transferred to the granting authority and provide them with the Portal Privacy Statement.

15.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

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[15] Regulation (EU) 2018/1725 of the European Parliament and of the Council of 23 October 2018 on the protection of natural persons with regard to the processing of personal data by the Union institutions, bodies, offices and agencies and on the free movement of such data, and repealing Regulation (EC) No 45/2001 and Decision No 1247/2002/EC (OJ L 295, 21.11.2018, p. 39).

[16] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (‘GDPR’) (OJ L 119, 4.5.2016, p. 1).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 16 — INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS —ACCESS RIGHTS AND RIGHTS OF USE

16.1 Background and access rights to background

The beneficiaries must give each other and the other participants access to the background identified as needed for implementing the action, subject to any specific rules in Annex 5.

'Background' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that is:

(a) held by the beneficiaries before they acceded to the Agreement and

(b) needed to implement the action or exploit the results.

If background is subject to rights of a third party, the beneficiary concerned must ensure that it is able to comply with its obligations under the Agreement.

16.2 Ownership of results

The granting authority does not obtain ownership of the results produced under the action.

'Results' means any tangible or intangible effect of the action, such as data, know-how or information, whatever its form or nature, whether or not it can be protected, as well as any rights attached to it, including intellectual property rights.

16.3 Rights of use of the granting authority on materials, documents and information received for policy, information, communication, dissemination and publicity purposes

The granting authority has the right to use non-sensitive information relating to the action and materials and documents received from the beneficiaries (notably summaries for publication, deliverables, as well as any other material, such as pictures or audio-visual material, in paper or electronic form) for policy, information, communication, dissemination and publicity purposes — during the action or afterwards.

The right to use the beneficiaries' materials, documents and information is granted in the form of a royalty-free, non-exclusive and irrevocable licence, which includes the following rights:

(a) **use for its own purposes** (in particular, making them available to persons working for the granting authority or any other EU service (including institutions, bodies, offices, agencies, etc.) or EU Member State institution or body; copying or reproducing them in whole or in part, in unlimited numbers; and communication through press information services)

(b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes)

(c) **editing or redrafting** (including shortening, summarising, inserting other elements (e.g.

meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation)

(d) **translation**

(e) **storage** in paper, electronic or other form

(f) **archiving**, in line with applicable document-management rules

(g) the right to authorise **third parties** to act on its behalf or sub-license to third parties the modes of use set out in Points (b), (c), (d) and (f), if needed for the information, communication and publicity activity of the granting authority

(h) **processing**, analysing, aggregating the materials, documents and information received and **producing derivative works**.

The rights of use are granted for the whole duration of the industrial or intellectual property rights concerned.

If materials or documents are subject to moral rights or third party rights (including intellectual property rights or rights of natural persons on their image and voice), the beneficiaries must ensure that they comply with their obligations under this Agreement (in particular, by obtaining the necessary licences and authorisations from the rights holders concerned).

Where applicable, the granting authority will insert the following information:

"© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the [name of granting authority] under conditions."

16.4 Specific rules on IPR, results and background

Specific rules regarding intellectual property rights, results and background (if any) are set out in Annex 5.

16.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

ARTICLE 17 — COMMUNICATION, DISSEMINATION AND VISIBILITY

17.1 Communication — Dissemination — Promoting the action

Unless otherwise agreed with the granting authority, the beneficiaries must promote the action and its results by providing targeted information to multiple audiences (including the media and the public), in accordance with Annex 1 and in a strategic, coherent and effective manner.

Before engaging in a communication or dissemination activity expected to have a major media impact, the beneficiaries must inform the granting authority.

17.2 Visibility — European flag and funding statement

Unless otherwise agreed with the granting authority, communication activities of the beneficiaries related to the action (including media relations, conferences, seminars, information material, such as brochures, leaflets, posters, presentations, etc., in electronic form, via traditional or social media, etc.), dissemination activities and any infrastructure, equipment, vehicles, supplies or major result funded by the grant must acknowledge EU support and display the European flag (emblem) and funding statement (translated into local languages, where appropriate):

Funded by the
European Union

Co-funded by the
European Union

The emblem must remain distinct and separate and cannot be modified by adding other visual marks, brands or text.

Apart from the emblem, no other visual identity or logo may be used to highlight the EU support.

When displayed in association with other logos (e.g. of beneficiaries or sponsors), the emblem must be displayed at least as prominently and visibly as the other logos.

For the purposes of their obligations under this Article, the beneficiaries may use the emblem without first obtaining approval from the granting authority. This does not, however, give them the right to exclusive use. Moreover, they may not appropriate the emblem or any similar trademark or logo, either by registration or by any other means.

17.3 Quality of information — Disclaimer

Any communication or dissemination activity related to the action must use factually accurate information.

Moreover, it must indicate the following disclaimer (translated into local languages where appropriate):

> "Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or [name of the granting authority]. Neither the European Union nor the granting authority can be held responsible for them."

17.4 Specific communication, dissemination and visibility rules

Specific communication, dissemination and visibility rules (if any) are set out in Annex 5.

17.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 18 — SPECIFIC RULES FOR CARRYING OUT THE ACTION

18.1 Specific rules for carrying out the action

Specific rules for implementing the action (if any) are set out in Annex 5.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such a breach may also lead to other measures described in Chapter 5.

SECTION 3 GRANT ADMINISTRATION

ARTICLE 19 — GENERAL INFORMATION OBLIGATIONS

19.1 Information requests

The beneficiaries must provide — during the action or afterwards and in accordance with Article 7 — any information requested in order to verify eligibility of the costs or contributions declared, proper implementation of the action and compliance with the other obligations under the Agreement.

The information provided must be accurate, precise and complete and in the format requested, including electronic format.

19.2 Participant Register data updates

The beneficiaries must keep — at all times, during the action or afterwards — their information stored in the Portal Participant Register up to date, in particular, their name, address, legal representatives, legal form and organisation type.

19.3 Information about events and circumstances which impact the action

The beneficiaries must immediately inform the granting authority (and the other beneficiaries) of any of the following:

(a) **events** which are likely to affect or delay the implementation of the action or affect the EU's financial interests, in particular:

(i) changes in their legal, financial, technical, organisational or ownership situation (including changes linked to one of the exclusion grounds listed in the declaration of honour signed before grant signature)

(ii) linked action information: not applicable

(b) **circumstances** affecting:

(i) the decision to award the grant or

(ii) compliance with requirements under the Agreement.

19.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 20 — RECORD-KEEPING

20.1 Keeping records and supporting documents

The beneficiaries must — at least until the time-limit set out in the Data Sheet (see Point 6) — keep records and other supporting documents to prove the proper implementation of the action in line with the accepted standards in the respective field (if any).

In addition, the beneficiaries must — for the same period — keep the following to justify the amounts declared:

(a) for actual costs: adequate records and supporting documents to prove the costs declared (such as contracts, subcontracts, invoices and accounting records); in addition, the beneficiaries' usual accounting and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documents

(b) for flat-rate costs and contributions (if any): adequate records and supporting documents to prove the eligibility of the costs or contributions to which the flat-rate is applied

(c) for the following simplified costs and contributions: the beneficiaries do not need to keep specific records on the actual costs incurred, but must keep:

(i) for unit costs and contributions (if any): adequate records and supporting documents to prove the number of units declared

(ii) for lump sum costs and contributions (if any): adequate records and supporting documents to prove proper implementation of the work as described in Annex 1

(iii) for financing not linked to costs (if any): adequate records and supporting documents

to prove the achievement of the results or the fulfilment of the conditions as described in Annex 1

(d) for unit, flat-rate and lump sum costs and contributions according to usual cost accounting practices (if any): the beneficiaries must keep any adequate records and supporting documents to prove that their cost accounting practices have been applied in a consistent manner, based on objective criteria, regardless of the source of funding, and that they comply with the eligibility conditions set out in Articles 6.1 and 6.2.

Moreover, the following is needed for specific budget categories:

(e) for personnel costs: time worked for the beneficiary under the action must be supported by declarations signed monthly by the person and their supervisor, unless another reliable time-record system is in place; the granting authority may accept alternative evidence supporting the time worked for the action declared, if it considers that it offers an adequate level of assurance

(f) additional record-keeping rules: not applicable

The records and supporting documents must be made available upon request (see Article 19) or in the context of checks, reviews, audits or investigations (see Article 25).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 25), the beneficiaries must keep these records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The granting authority may accept non-original documents if they offer a comparable level of assurance.

20.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs or contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 21 — REPORTING

21.1 Continuous reporting

The beneficiaries must continuously report on the progress of the action (e.g. **deliverables, milestones, outputs/outcomes, critical risks, indicators,** etc; if any), in the Portal Continuous Reporting tool and in accordance with the timing and conditions it sets out (as agreed with the granting authority).

Standardised deliverables (e.g. progress reports not linked to payments, reports on cumulative expenditure, special reports, etc; if any) must be submitted using the templates published on the Portal.

21.2 Periodic reporting: Technical reports and financial statements

In addition, the beneficiaries must provide reports to request payments, in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2):

- for additional prefinancings (if any): an **additional prefinancing report**
- for interim payments (if any) and the final payment: a **periodic report**.

The prefinancing and periodic reports include a technical and financial part.

The technical part includes an overview of the action implementation. It must be prepared using the template available in the Portal Periodic Reporting tool.

The financial part of the additional prefinancing report includes a statement on the use of the previous prefinancing payment.

The financial part of the periodic report includes:

- the financial statements (individual and consolidated; for all beneficiaries/affiliated entities)
- the explanation on the use of resources (or detailed cost reporting table, if required)
- the certificates on the financial statements (CFS) (if required; see Article 24.2 and Data Sheet, Point 4.3).

The **financial statements** must detail the eligible costs and contributions for each budget category and, for the final payment, also the revenues for the action (see Articles 6 and 22).

All eligible costs and contributions incurred should be declared, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Amounts that are not declared in the individual financial statements will not be taken into account by the granting authority.

By signing the financial statements (directly in the Portal Periodic Reporting tool), the beneficiaries confirm that:

- the information provided is complete, reliable and true
- the costs and contributions declared are eligible (see Article 6)
- the costs and contributions can be substantiated by adequate records and supporting documents (see Article 20) that will be produced upon request (see Article 19) or in the context of checks, reviews, audits and investigations (see Article 25)
- for the final periodic report: all the revenues have been declared (if required; see Article 22).

Beneficiaries will have to submit also the financial statements of their affiliated entities (if any). In case of recoveries (see Article 22), beneficiaries will be held responsible also for the financial statements of their affiliated entities.

21.3 Currency for financial statements and conversion into euros

The financial statements must be drafted in euro.

Beneficiaries with general accounts established in a currency other than the euro must convert the

costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union* (ECB website), calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal* for the currency in question, they must be converted at the average of the monthly accounting exchange rates published on the European Commission website (InforEuro), calculated over the corresponding reporting period.

Beneficiaries with general accounts in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

21.4 Reporting language

The reporting must be in the language of the Agreement, unless otherwise agreed with the granting authority (see Data Sheet, Point 4.2).

21.5 Consequences of non-compliance

If a report submitted does not comply with this Article, the granting authority may suspend the payment deadline (see Article 29) and apply other measures described in Chapter 5.

If the coordinator breaches its reporting obligations, the granting authority may terminate the grant or the coordinator's participation (see Article 32) or apply other measures described in Chapter 5.

ARTICLE 22 — PAYMENTS AND RECOVERIES — CALCULATION OF AMOUNTS DUE

22.1 Payments and payment arrangements

Payments will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

They will be made in euro to the bank account indicated by the coordinator (see Data Sheet, Point 4.2) and must be distributed without unjustified delay (restrictions may apply to distribution of the initial prefinancing payment; see Data Sheet, Point 4.2).

Payments to this bank account will discharge the granting authority from its payment obligation.

The cost of payment transfers will be borne as follows:

- the granting authority bears the cost of transfers charged by its bank
- the beneficiary bears the cost of transfers charged by its bank
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

Payments by the granting authority will be considered to have been carried out on the date when they are debited to its account.

22.2 Recoveries

Recoveries will be made, if — at beneficiary termination, final payment or afterwards — it turns out that the granting authority has paid too much and needs to recover the amounts undue.

Each beneficiary's financial responsibility in case of recovery is in principle limited to their own debt and undue amounts of their affiliated entities.

In case of enforced recoveries (see Article 22.4), affiliated entities will be held liable for repaying debts of their beneficiaries, if required by the granting authority (see Data Sheet, Point 4.4).

22.3 Amounts due

22.3.1 Prefinancing payments

The aim of the prefinancing is to provide the beneficiaries with a float.

It remains the property of the EU until the final payment.

For **initial prefinancings** (if any), the amount due, schedule and modalities are set out in the Data Sheet (see Point 4.2).

For **additional prefinancings** (if any), the amount due, schedule and modalities are also set out in the Data Sheet (see Point 4.2). However, if the statement on the use of the previous prefinancing payment shows that less than 70% was used, the amount set out in the Data Sheet will be reduced by the difference between the 70% threshold and the amount used.

The contribution to the Mutual Insurance Mechanism will be retained from the prefinancing payments (at the rate and in accordance with the modalities set out in the Data Sheet, see Point 4.2) and transferred to the Mechanism.

Prefinancing payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.2 Amount due at beneficiary termination — Recovery

In case of beneficiary termination, the granting authority will determine the provisional amount due for the beneficiary concerned. Payments (if any) will be made with the next interim or final payment.

The **amount due** will be calculated in the following step:

Step 1 — Calculation of the total accepted EU contribution

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the beneficiary for all reporting periods, by calculating the 'maximum EU contribution to costs' (applying the funding rate to the accepted costs of the beneficiary), taking into account requests for a lower contribution to costs

and CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution' for the beneficiary.

The **balance** is then calculated by deducting the payments received (if any; see report on the distribution of payments in Article 32), from the total accepted EU contribution:

{total accepted EU contribution for the beneficiary

minus

{prefinancing and interim payments received (if any)}}.

If the balance is **positive**, the amount will be included in the next interim or final payment to the consortium.

If the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount due, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered and ask this amount to be paid to the coordinator (**confirmation letter**).

If payment is not made to the coordinator by the date specified in the confirmation letter, the granting authority may call on the Mutual Insurance Mechanism to intervene, if continuation of the action is guaranteed and the conditions set out in the rules governing the Mechanism are met.

In this case, it will send a **beneficiary recovery letter**, together with a **debit note** with the terms and date for payment.

The debit note for the beneficiary will include the amount calculated for the affiliated entities which also had to end their participation (if any).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

The amounts will later on also be taken into account for the next interim or final payment.

22.3.3 Interim payments

Interim payments reimburse the eligible costs and contributions claimed for the implementation of the action during the reporting periods (if any).

Interim payments (if any) will be made in accordance with the schedule and modalities set out the Data Sheet (see Point 4.2).

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **interim payment** will be calculated by the granting authority in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the interim payment ceiling

Step 1 — Calculation of the total accepted EU contribution

The granting authority will calculate the 'accepted EU contribution' for the action for the reporting period, by first calculating the 'maximum EU contribution to costs' (applying the funding rate to the accepted costs of each beneficiary), taking into account requests for a lower contribution to costs, and CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions from beneficiary termination (if any). The resulting amount is the 'total accepted EU contribution'.

Step 2 — Limit to the interim payment ceiling

The resulting amount is then capped to ensure that the total amount of prefinancing and interim payments (if any) does not exceed the interim payment ceiling set out in the Data Sheet (see Point 4.2).

Interim payments (or parts of them) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

22.3.4 Final payment — Final grant amount — Revenues and Profit — Recovery

The final payment (payment of the balance) reimburses the remaining part of the eligible costs and contributions claimed for the implementation of the action (if any).

The final payment will be made in accordance with the schedule and modalities set out in the Data Sheet (see Point 4.2).

Payment is subject to the approval of the final periodic report. Its approval does not imply recognition of compliance, authenticity, completeness or correctness of its content.

The **final grant amount for the action** will be calculated in the following steps:

Step 1 — Calculation of the total accepted EU contribution

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 1 — Calculation of the total accepted EU contribution

The granting authority will first calculate the 'accepted EU contribution' for the action for all reporting periods, by calculating the 'maximum EU contribution to costs' (applying the funding rate to the total accepted costs of each beneficiary), taking into account requests for a lower contribution to costs, CFS threshold cappings (if any; see Article 24.5) and adding the contributions (accepted unit, flat-rate or lump sum contributions and financing not linked to costs, if any).

After that, the granting authority will take into account grant reductions (if any). The resulting amount is the 'total accepted EU contribution'.

Step 2 — Limit to the maximum grant amount

If the resulting amount is higher than the maximum grant amount set out in Article 5.2, it will be limited to the latter.

Step 3 — Reduction due to the no-profit rule

If the no-profit rule is provided for in the Data Sheet (see Point 4.2), the grant must not produce a profit (i.e. surplus of the amount obtained following Step 2 plus the action's revenues, over the eligible costs and contributions approved by the granting authority).

'Revenue' is all income generated by the action, during its duration (see Article 4), for beneficiaries that are profit legal entities (— with the exception of income generated by the exploitation of results, which are not considered as revenues).

If there is a profit, it will be deducted in proportion to the final rate of reimbursement of the eligible costs approved by the granting authority (as compared to the amount calculated following Steps 1 and 2 minus the contributions).

The **balance** (final payment) is then calculated by deducting the total amount of prefinancing and interim payments already made (if any), from the final grant amount:

{final grant amount

minus

{prefinancing and interim payments made (if any)}}.

If the balance is **positive**, it will be **paid** to the coordinator.

The amount retained for the Mutual Insurance Mechanism (see above) will be released and **paid** to the coordinator (in accordance with the rules governing the Mechanism).

The final payment (or part of it) may be offset (without the beneficiaries' consent) against amounts owed by a beneficiary to the granting authority — up to the amount due to that beneficiary.

For grants where the granting authority is the European Commission or an EU executive agency, offsetting may also be done against amounts owed to other Commission services or executive agencies.

Payments will not be made if the payment deadline or payments are suspended (see Articles 29 and 30).

If — despite the release of the Mutual Insurance Mechanism contribution — the balance is **negative**, it will be **recovered** in accordance with the following procedure:

The granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to recover, the final grant amount, the amount to be recovered and the reasons why
- requesting a report on the distribution of payments to the beneficiaries within 30 days of receiving notification and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received) and the coordinator has submitted the report on the distribution of payments, it will calculate the **share of the debt per beneficiary**, by:

(a) identifying the beneficiaries for which the amount calculated as follows is negative:

{{{total accepted EU contribution for the beneficiary

divided by

total accepted EU contribution for the action}

multiplied by

final grant amount for the action},

minus

{prefinancing and interim payments received by the beneficiary (if any)}}

and

(b) dividing the debt:

{{amount calculated according to point (a) for the beneficiary concerned

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)}

multiplied by

the amount to be recovered}.

and confirm the amount to be recovered from each beneficiary concerned (**confirmation letter**), together with **debit notes** with the terms and date for payment.

The debit notes for beneficiaries will include the amounts calculated for their affiliated entities (if any).

If the coordinator has not submitted the report on the distribution of payments, the granting authority will **recover** the full amount from the coordinator (**confirmation letter** and **debit note** with the terms and date for payment).

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.3.5 Audit implementation after final payment — Revised final grant amount — Recovery

If — after the final payment (in particular, after checks, reviews, audits or investigations; see Article 25) — the granting authority rejects costs or contributions (see Article 27) or reduces the grant (see Article 28), it will calculate the **revised final grant amount** for the beneficiary concerned.

The **beneficiary revised final grant amount** will be calculated in the following step:

Step 1 — Calculation of the revised total accepted EU contribution

Step 1 — Calculation of the revised total accepted EU contribution

The granting authority will first calculate the 'revised accepted EU contribution' for the beneficiary, by calculating the 'revised accepted costs' and 'revised accepted contributions'.

After that, it will take into account grant reductions (if any). The resulting 'revised total accepted EU contribution' is the beneficiary revised final grant amount.

If the revised final grant amount is lower than the beneficiary's final grant amount (i.e. its share in the final grant amount for the action), it will be **recovered** in accordance with the following procedure:

The **beneficiary final grant amount** (i.e. share in the final grant amount for the action) is calculated as follows:

{{total accepted EU contribution for the beneficiary

divided by

total accepted EU contribution for the action}

multiplied by

final grant amount for the action}.

The granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to recover, the amount to be recovered and the reasons why and
- requesting observations within 30 days of receiving notification.

If no observations are submitted (or the granting authority decides to pursue recovery despite the observations it has received), it will confirm the amount to be recovered (**confirmation letter**), together with a **debit note** with the terms and the date for payment.

Recoveries against affiliated entities (if any) will be handled through their beneficiaries.

If payment is not made by the date specified in the debit note, the granting authority will **enforce recovery** in accordance with Article 22.4.

22.4 Enforced recovery

If payment is not made by the date specified in the debit note, the amount due will be recovered:

(a) by offsetting the amount — without the coordinator or beneficiary's consent — against any amounts owed to the coordinator or beneficiary by the granting authority.

In exceptional circumstances, to safeguard the EU financial interests, the amount may be offset before the payment date specified in the debit note.

For grants where the granting authority is the European Commission or an EU executive agency, debts may also be offset against amounts owed by other Commission services or executive agencies.

(b) financial guarantee(s): not applicable

(c) joint and several liability of beneficiaries: not applicable

(d) by holding affiliated entities jointly and severally liable (if any, see Data Sheet, Point 4.4)

(e) by taking legal action (see Article 43) or, provided that the granting authority is the European Commission or an EU executive agency, by adopting an enforceable decision under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 100(2) of EU Financial Regulation 2018/1046.

If the Mutual Insurance Mechanism was called on by the granting authority to intervene, recovery will be continued in the name of the Mutual Insurance Mechanism. If two debit notes were sent, the second one (in the name of the Mutual Insurance Mechanism) will be considered to replace the first one (in the name of the granting authority). Where the MIM intervened, offsetting, enforceable decisions or any other of the above-mentioned forms of enforced recovery may be used mutatis mutandis.

The amount to be recovered will be increased by **late-payment interest** at the rate set out in Article 22.5, from the day following the payment date in the debit note, up to and including the date the full payment is received.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2015/2366[17] applies.

For grants where the granting authority is an EU executive agency, enforced recovery by offsetting or enforceable decision will be done by the services of the European Commission (see also Article 43).

22.5 Consequences of non-compliance

22.5.1 If the granting authority does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus the rate specified in the Data Sheet (Point 4.2). The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

[17] Directive (EU) 2015/2366 of the European Parliament and of the Council of 25 November 2015 on payment services in the internal market, amending Directives 2002/65/EC, 2009/110/EC and 2013/36/EU and Regulation (EU) No 1093/2010, and repealing Directive 2007/64/EC (OJ L 337, 23.12.2015, p. 35).

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only on request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

If payments or the payment deadline are suspended (see Articles 29 and 30), payment will not be considered as late.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.

22.5.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 29) and the grant or the coordinator may be terminated (see Article 32).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 23 — GUARANTEES

Not applicable

ARTICLE 24 — CERTIFICATES

24.1 Operational verification report (OVR)

Not applicable

24.2 Certificate on the financial statements (CFS)

If required by the granting authority (see Data Sheet, Point 4.3), the beneficiaries must provide certificates on their financial statements (CFS), in accordance with the schedule, threshold and conditions set out in the Data Sheet.

The coordinator must submit them as part of the periodic report (see Article 21).

The certificates must be drawn up using the template published on the Portal, cover the costs declared on the basis of actual costs and costs according to usual cost accounting practices (if any), and fulfil the following conditions:

(a) be provided by a qualified approved external auditor which is independent and complies with Directive 2006/43/EC[18] (or for public bodies: by a competent independent public officer)

(b) the verification must be carried out according to the highest professional standards to ensure that the financial statements comply with the provisions under the Agreement and that the costs declared are eligible.

[18] Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts or similar national regulations (OJ L 157, 9.6.2006, p. 87).

The certificates will not affect the granting authority's right to carry out its own checks, reviews or audits, nor preclude the European Court of Auditors (ECA), the European Public Prosecutor's Office (EPPO) or the European Anti-Fraud Office (OLAF) from using their prerogatives for audits and investigations under the Agreement (see Article 25).

If the costs (or a part of them) were already audited by the granting authority, these costs do not need to be covered by the certificate and will not be counted for calculating the threshold (if any).

24.3 Certificate on the compliance of usual cost accounting practices (CoMUC)

Not applicable

24.4 Systems and process audit (SPA)

Beneficiaries which:

- use unit, flat rate or lump sum costs or contributions according to documented (i.e. formally approved and in writing) usual costs accounting practices (if any) or
- have formalised documentation on the systems and processes for calculating their costs and contributions (i.e. formally approved and in writing), have participated in at least 150 actions under Horizon 2020 or the Euratom Research and Training Programme (2014-2018 or 2019-2020) and participate in at least 3 ongoing actions under Horizon Europe or the Euratom Research and Training Programme (2021-2025 or 2026-2027)

may apply to the granting authority for a systems and process audit (SPA).

This audit will be carried out as follows:

Step 1 – Application by the beneficiary.

Step 2 – If the application is accepted, the granting authority will carry out the systems and process audit, complemented by an audit of transactions (on a sample of the beneficiary's Horizon Europe or the Euratom Research and Training Programme financial statements).

Step 3 – The audit result will take the form of a risk assessment classification for the beneficiary: low, medium or high.

Low-risk beneficiaries will benefit from less (or less in-depth) ex-post audits (see Article 25) and a higher threshold for submitting certificates on the financial statements (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3).

24.5 Consequences of non-compliance

If a beneficiary does not submit a certificate on the financial statements (CFS) or the certificate is rejected, the accepted EU contribution to costs will be capped to reflect the CFS threshold.

If a beneficiary breaches any of its other obligations under this Article, the granting authority may apply the measures described in Chapter 5.

ARTICLE 25 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

25.1 Granting authority checks, reviews and audits

25.1.1 Internal checks

The granting authority may — during the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing costs and contributions, deliverables and reports.

25.1.2 Project reviews

The granting authority may carry out reviews on the proper implementation of the action and compliance with the obligations under the Agreement (general project reviews or specific issues reviews).

Such project reviews may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiary concerned and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent, outside experts. If it uses outside experts, the coordinator or beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The coordinator or beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The granting authority may request beneficiaries to provide such information to it directly. Sensitive information and documents will be treated in accordance with Article 13.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with the outside experts.

For **on-the-spot visits**, the beneficiary concerned must allow access to sites and premises (including to the outside experts) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a **project review report** will be drawn up.

The granting authority will formally notify the project review report to the coordinator or beneficiary concerned, which has 30 days from receiving notification to make observations.

Project reviews (including project review reports) will be in the language of the Agreement.

25.1.3 Audits

The granting authority may carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Such audits may be started during the implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the beneficiary concerned and will be considered to start on the date of the notification.

The granting authority may use its own audit service, delegate audits to a centralised service or use external audit firms. If it uses an external firm, the beneficiary concerned will be informed and have the right to object on grounds of commercial confidentiality or conflict of interest.

The beneficiary concerned must cooperate diligently and provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. Sensitive information and documents will be treated in accordance with Article 13.

For **on-the-spot** visits, the beneficiary concerned must allow access to sites and premises (including for the external audit firm) and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a **draft audit report** will be drawn up.

The auditors will formally notify the draft audit report to the beneficiary concerned, which has 30 days from receiving notification to make observations (contradictory audit procedure).

The **final audit report** will take into account observations by the beneficiary concerned and will be formally notified to them.

Audits (including audit reports) will be in the language of the Agreement.

25.2 European Commission checks, reviews and audits in grants of other granting authorities

Where the granting authority is not the European Commission, the latter has the same rights of checks, reviews and audits as the granting authority.

25.3 Access to records for assessing simplified forms of funding

The beneficiaries must give the European Commission access to their statutory records for the periodic assessment of simplified forms of funding which are used in EU programmes.

25.4 OLAF, EPPO and ECA audits and investigations

The following bodies may also carry out checks, reviews, audits and investigations — during the action or afterwards:

- the European Anti-Fraud Office (OLAF) under Regulations No 883/2013[19] and No 2185/96[20]

- the European Public Prosecutor's Office (EPPO) under Regulation 2017/1939

[19] Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18/09/2013, p. 1).

[20] Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15/11/1996, p. 2).

- the European Court of Auditors (ECA) under Article 287 of the Treaty on the Functioning of the EU (TFEU) and Article 257 of EU Financial Regulation 2018/1046.

If requested by these bodies, the beneficiary concerned must provide full, accurate and complete information in the format requested (including complete accounts, individual salary statements or other personal data, including in electronic format) and allow access to sites and premises for on-the-spot visits or inspections — as provided for under these Regulations.

To this end, the beneficiary concerned must keep all relevant information relating to the action, at least until the time-limit set out in the Data Sheet (Point 6) and, in any case, until any ongoing checks, reviews, audits, investigations, litigation or other pursuits of claims have been concluded.

25.5 Consequences of checks, reviews, audits and investigations — Extension of results of reviews, audits or investigations

25.5.1 Consequences of checks, reviews, audits and investigations in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to rejections (see Article 27), grant reduction (see Article 28) or other measures described in Chapter 5.

Rejections or grant reductions after the final payment will lead to a revised final grant amount (see Article 22).

Findings in checks, reviews, audits or investigations during the action implementation may lead to a request for amendment (see Article 39), to change the description of the action set out in Annex 1.

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations in any EU grant may also lead to consequences in other EU grants awarded under similar conditions (‘extension to other grants’).

Moreover, findings arising from an OLAF or EPPO investigation may lead to criminal prosecution under national law.

25.5.2 Extension from other grants

Results of checks, reviews, audits or investigations in other grants may be extended to this grant, if:

(a) the beneficiary concerned is found, in other EU grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and

(b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — within the time-limit for audits set out in the Data Sheet (see Point 6).

The granting authority will formally notify the beneficiary concerned of the intention to extend the findings and the list of grants affected.

If the extension concerns **rejections of costs or contributions**: the notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings

(b) the request to submit revised financial statements for all grants affected

(c) the correction rate for extrapolation, established on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected, if the beneficiary concerned:

(i) considers that the submission of revised financial statements is not possible or practicable or

(ii) does not submit revised financial statements.

If the extension concerns **grant reductions**: the notification will include:

(a) an invitation to submit observations on the list of grants affected by the findings and

(b) the **correction rate for extrapolation**, established on the basis of the systemic or recurrent errors and the principle of proportionality.

The beneficiary concerned has **60 days** from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method/rate**.

On the basis of this, the granting authority will analyse the impact and decide on the implementation (i.e. start rejection or grant reduction procedures, either on the basis of the revised financial statements or the announced/alternative method/rate or a mix of those; see Articles 27 and 28).

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs or contributions insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 27), and the grant may be reduced (see Article 28).

Such breaches may also lead to other measures described in Chapter 5.

ARTICLE 26 — IMPACT EVALUATIONS

26.1 Impact evaluation

The granting authority may carry out impact evaluations of the action, measured against the objectives and indicators of the EU programme funding the grant.

Such evaluations may be started during implementation of the action and until the time-limit set out in the Data Sheet (see Point 6). They will be formally notified to the coordinator or beneficiaries and will be considered to start on the date of the notification.

If needed, the granting authority may be assisted by independent outside experts.

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

26.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the granting authority may apply the measures described in Chapter 5.

CHAPTER 5 CONSEQUENCES OF NON-COMPLIANCE

SECTION 1 REJECTIONS AND GRANT REDUCTION

ARTICLE 27 — REJECTION OF COSTS AND CONTRIBUTIONS

27.1 Conditions

The granting authority will — at beneficiary termination, interim payment, final payment or afterwards — reject any costs or contributions which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 25).

The rejection may also be based on the extension of findings from other grants to this grant (see Article 25).

Ineligible costs or contributions will be rejected.

27.2 Procedure

If the rejection does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the rejection, the amounts and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the rejection (payment review procedure).

If the rejection leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

27.3 Effects

If the granting authority rejects costs or contributions, it will deduct them from the costs or contributions declared and then calculate the amount due (and, if needed, make a recovery; see Article 22).

ARTICLE 28 — GRANT REDUCTION

28.1 Conditions

The granting authority may — at beneficiary termination, final payment or afterwards — reduce the grant for a beneficiary, if:

(a) the beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:

(i) substantial errors, irregularities or fraud or

(ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) the beneficiary (or a person having powers of representation, decision-making or control, or

person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (see Article 25).

The amount of the reduction will be calculated for each beneficiary concerned and proportionate to the seriousness and the duration of the errors, irregularities or fraud or breach of obligations, by applying an individual reduction rate to their accepted EU contribution.

28.2 Procedure

If the grant reduction does not lead to a recovery, the granting authority will formally notify the coordinator or beneficiary concerned of the reduction, the amount to be reduced and the reasons why. The coordinator or beneficiary concerned may — within 30 days of receiving notification — submit observations if it disagrees with the reduction (payment review procedure).

If the grant reduction leads to a recovery, the granting authority will follow the contradictory procedure with pre-information letter set out in Article 22.

28.3 Effects

If the granting authority reduces the grant, it will deduct the reduction and then calculate the amount due (and, if needed, make a recovery; see Article 22).

SECTION 2 SUSPENSION AND TERMINATION

ARTICLE 29 — PAYMENT DEADLINE SUSPENSION

29.1 Conditions

The granting authority may — at any moment — suspend the payment deadline if a payment cannot be processed because:

(a) the required report (see Article 21) has not been submitted or is not complete or additional information is needed

(b) there are doubts about the amount to be paid (e.g. ongoing audit extension procedure, queries about eligibility, need for a grant reduction, etc.) and additional checks, reviews, audits or investigations are necessary, or

(c) there are other issues affecting the EU financial interests.

29.2 Procedure

The granting authority will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day the notification is sent.

If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining time to pay (see Data Sheet, Point 4.2) will resume.

If the suspension exceeds two months, the coordinator may request the granting authority to confirm if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the report and the revised report is not submitted (or was submitted but is also rejected), the granting authority may also terminate the grant or the participation of the coordinator (see Article 32).

ARTICLE 30 — PAYMENT SUSPENSION

30.1 Conditions

The granting authority may — at any moment — suspend payments, in whole or in part for one or more beneficiaries, if:

(a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:

  (i) substantial errors, irregularities or fraud or

  (ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant.

If payments are suspended for one or more beneficiaries, the granting authority will make partial payment(s) for the part(s) not suspended. If suspension concerns the final payment, the payment (or recovery) of the remaining amount after suspension is lifted will be considered to be the payment that closes the action.

30.2 Procedure

Before suspending payments, the granting authority will send a **pre-information letter** to the beneficiary concerned:

- formally notifying the intention to suspend payments and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

At the end of the suspension procedure, the granting authority will also inform the coordinator.

The suspension will **take effect** the day after the confirmation notification is sent.

If the conditions for resuming payments are met, the suspension will be **lifted**. The granting authority will formally notify the beneficiary concerned (and the coordinator) and set the suspension end date.

During the suspension, no prefinancing will be paid to the beneficiaries concerned. For interim payments, the periodic reports for all reporting periods except the last one (see Article 21) must not contain any financial statements from the beneficiary concerned (or its affiliated entities). The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

ARTICLE 31 — GRANT AGREEMENT SUSPENSION

31.1 Consortium-requested GA suspension

31.1.1 Conditions and procedure

The beneficiaries may request the suspension of the grant or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 35) — make implementation impossible or excessively difficult.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the suspension takes effect; this date may be before the date of the submission of the amendment request and
- the expected date of resumption.

The suspension will **take effect** on the day specified in the amendment.

Once circumstances allow for implementation to resume, the coordinator must immediately request another **amendment** of the Agreement to set the suspension end date, the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the amendment. This date may be before the date of the submission of the amendment request.

During the suspension, no prefinancing will be paid. Costs incurred or contributions for activities implemented during grant suspension are not eligible (see Article 6.3).

31.2 EU-initiated GA suspension

31.2.1 Conditions

The granting authority may suspend the grant or any part of it, if:

(a) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed or is suspected of having committed:

(i) substantial errors, irregularities or fraud or

(ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.), or

(b) a beneficiary (or a person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant

(c) other:

(i) linked action issues: not applicable

(ii) the action has lost its scientific or technological relevance, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

31.2.2 Procedure

Before suspending the grant, the granting authority will send a **pre-information letter** to the coordinator:

- formally notifying the intention to suspend the grant and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the suspension (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

The suspension will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification).

Once the conditions for resuming implementation of the action are met, the granting authority will formally notify the coordinator a **lifting of suspension letter**, in which it will set the suspension end date and invite the coordinator to request an amendment of the Agreement to set the resumption date (one day after suspension end date), extend the duration and make other changes necessary to adapt the action to the new situation (see Article 39) — unless the grant has been terminated (see Article 32). The suspension will be **lifted** with effect from the suspension end date set out in the lifting of suspension letter. This date may be before the date on which the letter is sent.

During the suspension, no prefinancing will be paid. Costs incurred or contributions for activities implemented during suspension are not eligible (see Article 6.3).

The beneficiaries may not claim damages due to suspension by the granting authority (see Article 33).

Grant suspension does not affect the granting authority's right to terminate the grant or a beneficiary (see Article 32) or reduce the grant (see Article 28).

ARTICLE 32 — GRANT AGREEMENT OR BENEFICIARY TERMINATION

32.1 Consortium-requested GA termination

32.1.1 Conditions and procedure

The beneficiaries may request the termination of the grant.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why
- the date the consortium ends work on the action ('end of work date') and
- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

The termination will **take effect** on the termination date specified in the amendment.

If no reasons are given or if the granting authority considers the reasons do not justify termination, it may consider the grant terminated improperly.

32.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before the end of work date (see Article 22). Costs relating to contracts due for execution only after the end of work are not eligible.

If the granting authority does not receive the report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

Improper termination may lead to a grant reduction (see Article 28).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.2 Consortium-requested beneficiary termination

32.2.1 Conditions and procedure

The coordinator may request the termination of the participation of one or more beneficiaries, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must submit a request for **amendment** (see Article 39), with:

- the reasons why

- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing)

- the date the beneficiary ends work on the action ('end of work date')

- the date the termination takes effect ('termination date'); this date must be after the date of the submission of the amendment request.

If the termination concerns the coordinator and is done without its agreement, the amendment request must be submitted by another beneficiary (acting on behalf of the consortium).

The termination will **take effect** on the termination date specified in the amendment.

If no information is given or if the granting authority considers that the reasons do not justify termination, it may consider the beneficiary to have been terminated improperly.

32.2.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a **report on the distribution of payments** to the beneficiary concerned

(ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement, the explanation on the use of resources, and, if applicable, the certificate on the financial statement (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3)

(iii) a second **request for amendment** (see Article 39) with other amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before the end of work date (see Article 22). Costs relating to contracts due for execution only after the end of work are not eligible.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/ contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that

- the beneficiary concerned must not repay any amount to the coordinator.

If the second request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the second request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

Improper termination may lead to a reduction of the grant (see Article 31) or grant termination (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

32.3 EU-initiated GA or beneficiary termination

32.3.1 Conditions

The granting authority may terminate the grant or the participation of one or more beneficiaries, if:

(a) one or more beneficiaries do not accede to the Agreement (see Article 40)

(b) a change to the action or the legal, financial, technical, organisational or ownership situation of a beneficiary is likely to substantially affect the implementation of the action or calls into question the decision to award the grant (including changes linked to one of the exclusion grounds listed in the declaration of honour)

(c) following termination of one or more beneficiaries, the necessary changes to the Agreement (and their impact on the action) would call into question the decision awarding the grant or breach the principle of equal treatment of applicants

(d) implementation of the action has become impossible or the changes necessary for its continuation would call into question the decision awarding the grant or breach the principle of equal treatment of applicants

(e) a beneficiary (or person with unlimited liability for its debts) is subject to bankruptcy proceedings or similar (including insolvency, winding-up, administration by a liquidator or court, arrangement with creditors, suspension of business activities, etc.)

(f) a beneficiary (or person with unlimited liability for its debts) is in breach of social security or tax obligations

(g) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has been found guilty of grave professional misconduct

(h) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed fraud, corruption, or is involved in a criminal organisation, money laundering, terrorism-related crimes (including terrorism financing), child labour or human trafficking

(i) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) was created under a different jurisdiction

with the intent to circumvent fiscal, social or other legal obligations in the country of origin (or created another entity with this purpose)

(j) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed:

(i) substantial errors, irregularities or fraud or

(ii) serious breach of obligations under this Agreement or during its award (including improper implementation of the action, non-compliance with the call conditions, submission of false information, failure to provide required information, breach of ethics or security rules (if applicable), etc.)

(k) a beneficiary (or person having powers of representation, decision-making or control, or person essential for the award/implementation of the grant) has committed — in other EU grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (extension of findings from other grants to this grant; see Article 25)

(l) despite a specific request by the granting authority, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its affiliated entities or associated partners that is in one of the situations under points (d), (f), (e), (g), (h), (i) or (j) and to reallocate its tasks, or

(m) other:

(i) linked action issues: not applicable

(ii) the action has lost its scientific or technological relevance, for EIC Accelerator actions: the action has lost its economic relevance, for challenge-based EIC Pathfinder actions and Horizon Europe Missions: the action has lost its relevance as part of the Portfolio for which it has been initially selected

32.3.2 Procedure

Before terminating the grant or participation of one or more beneficiaries, the granting authority will send **a pre-information letter** to the coordinator or beneficiary concerned:

- formally notifying the intention to terminate and the reasons why and
- requesting observations within 30 days of receiving notification.

If the granting authority does not receive observations or decides to pursue the procedure despite the observations it has received, it will confirm the termination and the date it will take effect (**confirmation letter**). Otherwise, it will formally notify that the procedure is discontinued.

For beneficiary terminations, the granting authority will — at the end of the procedure — also inform the coordinator.

The termination will **take effect** the day after the confirmation notification is sent (or on a later date specified in the notification; 'termination date').

32.3.3 Effects

(a) for **GA termination**:

The coordinator must — within 60 days from when termination takes effect — submit a **periodic report** (for the last open reporting period until termination).

The granting authority will calculate the final grant amount and final payment on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before termination takes effect (see Article 22). Costs relating to contracts due for execution only after termination are not eligible.

If the grant is terminated for breach of the obligation to submit reports, the coordinator may not submit any report after termination.

If the granting authority does not receive the report within the deadline, only costs and contributions which are included in an approved periodic report will be taken into account (no costs/contributions if no periodic report was ever approved).

Termination does not affect the granting authority's right to reduce the grant (see Article 28) or to impose administrative sanctions (see Article 34).

The beneficiaries may not claim damages due to termination by the granting authority (see Article 33).

After termination, the beneficiaries' obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

(b) for **beneficiary termination**:

The coordinator must — within 60 days from when termination takes effect — submit:

(i) a **report on the distribution of payments** to the beneficiary concerned

(ii) a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, the financial statement, the explanation on the use of resources, and, if applicable, the certificate on the financial statement (CFS; see Articles 21 and 24.2 and Data Sheet, Point 4.3)

(iii) a **request for amendment** (see Article 39) with any amendments needed (e.g. reallocation of the tasks and the estimated budget of the terminated beneficiary; addition of a new beneficiary to replace the terminated beneficiary; change of coordinator, etc.).

The granting authority will calculate the amount due to the beneficiary on the basis of the report submitted and taking into account the costs incurred and contributions for activities implemented before termination takes effect (see Article 22). Costs relating to contracts due for execution only after termination are not eligible.

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 21).

If the granting authority does not receive the termination report within the deadline, only costs and contributions included in an approved periodic report will be taken into account (no costs/ contributions if no periodic report was ever approved).

If the granting authority does not receive the report on the distribution of payments within the deadline, it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

If the request for amendment is accepted by the granting authority, the Agreement is **amended** to introduce the necessary changes (see Article 39).

If the request for amendment is rejected by the granting authority (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the grant may be terminated (see Article 32).

After termination, the concerned beneficiary's obligations (in particular Articles 13 (confidentiality and security), 16 (IPR), 17 (communication, dissemination and visibility), 21 (reporting), 25 (checks, reviews, audits and investigations), 26 (impact evaluation), 27 (rejections), 28 (grant reduction) and 42 (assignment of claims)) continue to apply.

SECTION 3 OTHER CONSEQUENCES: DAMAGES AND ADMINISTRATIVE SANCTIONS

ARTICLE 33 — DAMAGES

33.1 Liability of the granting authority

The granting authority cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of the implementation of the Agreement, including for gross negligence.

The granting authority cannot be held liable for any damage caused by any of the beneficiaries or other participants involved in the action, as a consequence of the implementation of the Agreement.

33.2 Liability of the beneficiaries

The beneficiaries must compensate the granting authority for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement, provided that it was caused by gross negligence or wilful act.

The liability does not extend to indirect or consequential losses or similar damage (such as loss of profit, loss of revenue or loss of contracts), provided such damage was not caused by wilful act or by a breach of confidentiality.

ARTICLE 34 — ADMINISTRATIVE SANCTIONS AND OTHER MEASURES

Nothing in this Agreement may be construed as preventing the adoption of administrative sanctions (i.e. exclusion from EU award procedures and/or financial penalties) or other public law measures,

in addition or as an alternative to the contractual measures provided under this Agreement (see, for instance, Articles 135 to 145 EU Financial Regulation 2018/1046 and Articles 4 and 7 of Regulation 2988/95[21]).

SECTION 4 FORCE MAJEURE

ARTICLE 35 — FORCE MAJEURE

A party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties' control,
- was not due to error or negligence on their part (or on the part of other participants involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

CHAPTER 6 FINAL PROVISIONS

ARTICLE 36 — COMMUNICATION BETWEEN THE PARTIES

36.1 Forms and means of communication — Electronic management

EU grants are managed fully electronically through the EU Funding & Tenders Portal ('Portal').

All communications must be made electronically through the Portal, in accordance with the Portal Terms and Conditions and using the forms and templates provided there (except if explicitly instructed otherwise by the granting authority).

Communications must be made in writing and clearly identify the grant agreement (project number and acronym).

Communications must be made by persons authorised according to the Portal Terms and Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a 'legal entity appointed representative (LEAR)'. The role and tasks of the LEAR are stipulated in their appointment letter (see Portal Terms and Conditions).

[21] Council Regulation (EC, Euratom) No 2988/95 of 18 December 1995 on the protection of the European Communities financial interests (OJ L 312, 23.12.1995, p. 1).

If the electronic exchange system is temporarily unavailable, instructions will be given on the Portal.

36.2 Date of communication

The sending date for communications made through the Portal will be the date and time of sending, as indicated by the time logs.

The receiving date for communications made through the Portal will be the date and time the communication is accessed, as indicated by the time logs. Formal notifications that have not been accessed within 10 days after sending, will be considered to have been accessed (see Portal Terms and Conditions).

If a communication is exceptionally made on paper (by e-mail or postal service), general principles apply (i.e. date of sending/receipt). Formal notifications by registered post with proof of delivery will be considered to have been received either on the delivery date registered by the postal service or the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

36.3 Addresses for communication

The Portal can be accessed via the Europa website.

The address for paper communications to the granting authority (if exceptionally allowed) is the official mailing address indicated on its website.

For beneficiaries, it is the legal address specified in the Portal Participant Register.

ARTICLE 37 — INTERPRETATION OF THE AGREEMENT

The provisions in the Data Sheet take precedence over the rest of the Terms and Conditions of the Agreement.

Annex 5 takes precedence over the Terms and Conditions; the Terms and Conditions take precedence over the Annexes other than Annex 5.

Annex 2 takes precedence over Annex 1.

ARTICLE 38 — CALCULATION OF PERIODS AND DEADLINES

In accordance with Regulation No 1182/71[22], periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

'Days' means calendar days, not working days.

ARTICLE 39 — AMENDMENTS

[22] Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8/6/1971, p. 1).

39.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

39.2 Procedure

The party requesting an amendment must submit a request for amendment signed directly in the Portal Amendment tool.

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3). If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

- the reasons why
- the appropriate supporting documents and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The granting authority may request additional information.

If the party receiving the request agrees, it must sign the amendment in the tool within 45 days of receiving notification (or any additional information the granting authority has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected.

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date of entry into force or other date specified in the amendment.

ARTICLE 40 — ACCESSION AND ADDITION OF NEW BENEFICIARIES

40.1 Accession of the beneficiaries mentioned in the Preamble

The beneficiaries which are not coordinator must accede to the grant by signing the accession form (see Annex 3) directly in the Portal Grant Preparation tool, within 30 days after the entry into force of the Agreement (see Article 44).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 44).

If a beneficiary does not accede to the grant within the above deadline, the coordinator must — within 30 days — request an amendment (see Article 39) to terminate the beneficiary and make any changes

necessary to ensure proper implementation of the action. This does not affect the granting authority's right to terminate the grant (see Article 32).

40.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 39. It must include an accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool.

New beneficiaries will assume the rights and obligations under the Agreement with effect from the date of their accession specified in the accession form (see Annex 3).

Additions are also possible in mono-beneficiary grants.

ARTICLE 41 — TRANSFER OF THE AGREEMENT

In justified cases, the beneficiary of a mono-beneficiary grant may request the transfer of the grant to a new beneficiary, provided that this would not call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiary must submit a request for **amendment** (see Article 39), with

- the reasons why
- the accession form (see Annex 3) signed by the new beneficiary directly in the Portal Amendment tool and
- additional supporting documents (if required by the granting authority).

The new beneficiary will assume the rights and obligations under the Agreement with effect from the date of accession specified in the accession form (see Annex 3).

ARTICLE 42 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE GRANTING AUTHORITY

The beneficiaries may not assign any of their claims for payment against the granting authority to any third party, except if expressly approved in writing by the granting authority on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

If the granting authority has not accepted the assignment or if the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the granting authority.

ARTICLE 43 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

43.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.

Special rules may apply for beneficiaries which are international organisations (if any; see Data Sheet, Point 5).

43.2 Dispute settlement

If a dispute concerns the interpretation, application or validity of the Agreement, the parties must bring action before the EU General Court — or, on appeal, the EU Court of Justice — under Article 272 of the Treaty on the Functioning of the EU (TFEU).

For non-EU beneficiaries (if any), such disputes must be brought before the courts of Brussels, Belgium — unless an international agreement provides for the enforceability of EU court judgements.

For beneficiaries with arbitration as special dispute settlement forum (if any; see Data Sheet, Point 5), the dispute will — in the absence of an amicable settlement — be settled in accordance with the Rules for Arbitration published on the Portal.

If a dispute concerns administrative sanctions, offsetting or an enforceable decision under Article 299 TFEU (see Articles 22 and 34), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice — under Article 263 TFEU.

For grants where the granting authority is an EU executive agency (see Preamble), actions against offsetting and enforceable decisions must be brought against the European Commission (not against the granting authority; see also Article 22).

ARTICLE 44 — ENTRY INTO FORCE

The Agreement will enter into force on the day of signature by the granting authority or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

Eugenio SCAPPARONE with ECAS id nscappeu signed in the Participant Portal on 15/06/2022 at 11:05:30 (transaction id SigId-161712-pn6xiKxVPXPzzQizKFSBgyvRPRMCN6mpPvEOxAHDCMxAbhqAksbsHrC4BocGGwmnoTpnNFzi3zmYXUgGeOV9PAU-yntOf97TTHq9QCab4GzIaj-MNRfjPZ5qmmu8p5HcJoPKqWmKAvqcmOP3bzh2pGzbt1F1OhxwzxbsHzJETep5A0iBzxucxovW12wKbu3YF3GOob). Timestamp by third party at 2022.06.15 12:05:39 CEST

For the granting authority

Signed by Danielle BARBIEUX with ECAS id barbide as an authorised representative on 15-06-2022 12:53:49 (transaction id SigId-162624-QzIxaMzn7TJBaNFqYrcFQehT7pqRvzsKNi5ahPbEU1NT8zuKmDAyzujPJPPPngWk72L3KrGbi6GPfWYmxzdcH28G-yntOf97TTHq9QCab4GzIaj-MCCuIQpXuw6VzmzpIglTszx0PeebzO76UEyuVULaXLsaC72qpExzMbdCvWatJZwqqhzTHJFLU0YUmdWwdCeCJdOG)
2022.06.15 12:53:56 CEST

ANNEX 1

Horizon Europe (HORIZON)

Description of the action (DoA)

Part A

Part B

Associated with document Ref. Ares(2022)4410236 - 15/06/2022

DESCRIPTION OF THE ACTION (PART A)

COVER PAGE

Part A of the Description of the Action (DoA) must be completed directly on the Portal Grant Preparation screens.

PROJECT *Grant Preparation (General Information screen) — Enter the info.*	
Project number:	101057511
Project name:	EUROpean Laboratories for Accelerator Based Science
Project acronym:	EURO-LABS
Call:	HORIZON-INFRA-2021-SERV-01
Topic:	HORIZON-INFRA-2021-SERV-01-07
Type of action:	HORIZON-RIA
Service:	REA/C/04
Project starting date:	fixed date: 1 September 2022
Project duration:	48 months

TABLE OF CONTENTS

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PROJECT SUMMARY

Project summary

Grant Preparation (General Information screen) — Provide an overall description of your project (including context and overall objectives, planned activities and main achievements, and expected results and impacts (on target groups, change procedures, capacities, innovation etc)). This summary should give readers a clear idea of what your project is about.

Use the project summary from your proposal.

Nuclear and High Energy Physics explore at different scales what the universe is composed of and how it functions. Breakthroughs in accelerator and detector technologies combined with innovative experiments represent the key to new discoveries. High Energy Physics, while preparing for the HL-LHC, is pursuing the design of the next generation particle accelerators and detectors, balancing the present and the future. Newly available beams of nuclei far from stability and intense stable beams have opened new avenues, ranging from the production of new elements to the exploration of nuclear properties at extremes of temperature, angular momentum and isospin. It is of vital importance to simultaneously optimize the use of existing and new Research Infrastructures (RIs) to conduct curiosity-driven research addressing fundamental questions and technological challenges, and also advance projects with broad societal impact. This project provides efficient access to the available resources to a large fraction of EUROpean Laboratories for Accelerator Based Sciences (EURO-LABS). It allows the diverse community of users to choose the best state-of-the-art RI or a network of RIs to conduct high impact research, fostering knowledge sharing across scientific fields. The proposal brings together, for the first time, the three communities engaged in Nuclear Physics, Accelerator and Detector technology for High Energy Physics, pioneering a super community of sub-atomic researchers. It allows a synergic implementation of best practices for data management and activities relating to targeted service improvements at these RIs. Joint training activities are foreseen to develop the skills of the next generation researchers to optimally use the RIs services for scientific and technological discoveries. EURO-LABS will create synergies and collaborations between the RIs of the Nuclear and High Energy communities, enhancing Europe's potential for successfully facing future challenges.

LIST OF PARTICIPANTS

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
1	COO	INFN	ISTITUTO NAZIONALE DI FISICA NUCLEARE	IT	999992789
2	BEN	GANIL	GRAND ACCELERATEUR NATIONAL D'IONS LOURDS	FR	999957481
3	BEN	CERN	ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE	CH	999988133
4	BEN	JSI	INSTITUT JOZEF STEFAN	SI	999971837
5	BEN	IFJ PAN	THE HENRYK NIEWODNICZANSKI INSTITUTE OF NUCLEAR PHYSICS, POLISH ACADEMY OF SCIENCES	PL	999611579
6	BEN	DESY	DEUTSCHES ELEKTRONEN-SYNCHROTRON DESY	DE	999986969
7	BEN	UCL	UNIVERSITE CATHOLIQUE DE LOUVAIN	BE	999980664
8	BEN	RBI	RUDER BOSKOVIC INSTITUTE	HR	999875031
9	BEN	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	FR	999997930

PARTICIPANTS

Grant Preparation (Beneficiaries screen) — Enter the info.

Number	Role	Short name	Legal name	Country	PIC
10	BEN	FBK	FONDAZIONE BRUNO KESSLER	IT	999625450
11	BEN	ITAINNOVA	INSTITUTO TECNOLOGICO DE ARAGON	ES	999509341
12	BEN	UNIWARSAW	UNIWERSYTET WARSZAWSKI	PL	999572294
13	BEN	GSI	GSI HELMHOLTZZENTRUM FUR SCHWERIONENFORSCHUNG GMBH	DE	999995214
14	BEN	IFIN-HH	INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA-HORIA HULUBEI	RO	999488777
15	BEN	USE	UNIVERSIDAD DE SEVILLA	ES	999862518
16	BEN	IST	INSTITUTO SUPERIOR TECNICO	PT	999992983
17	BEN	Atomki	ATOMMAGKUTATO INTEZET	HU	999869890
18	BEN	JYU	JYVASKYLAN YLIOPISTO	FI	999842245
19	BEN	UU	UPPSALA UNIVERSITET	SE	999985029
20	BEN	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	FR	999992401
21	BEN	KIT	KARLSRUHER INSTITUT FUER TECHNOLOGIE	DE	990797674
22	BEN	UMCG	ACADEMISCH ZIEKENHUIS GRONINGEN	NL	999914801
23	BEN	INCT	INSTYTUT CHEMII I TECHNIKI JADROWEJ	PL	999464915
24	BEN	CSIC	AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS	ES	999991722
25	BEN	UMIL	UNIVERSITA DEGLI STUDI DI MILANO	IT	999995796
26	AP	PSI	PAUL SCHERRER INSTITUT	CH	999994923
27	AP	RIKEN	RIKEN THE INSTITUTE OF PHYSICAL ANDCHEMICAL RESEARCH	JP	999628651
28	AP	MSU	MICHIGAN STATE UNIVERSITY	US	999864458
29	AP	TUD	TECHNISCHE UNIVERSITAET DRESDEN	DE	999897729
30	AP	LIP	LABORATORIO DE INSTRUMENTACAO E FISICA EXPERIMENTAL DE PARTICULAS LIP	PT	999661534
31	AP	ENEA	AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE	IT	999988521
32	AP	UoB	THE UNIVERSITY OF BIRMINGHAM	UK	999907526
33	AP	UKRI	UNITED KINGDOM RESEARCH AND INNOVATION	UK	906446474

LIST OF WORK PACKAGES

Work packages

Grant Preparation (Work Packages screen) — Enter the info.

Work Package No	Work Package name	Lead Beneficiary	Effort (Person-Months)	Start Month	End Month	Deliverable No(s)
WP1	Project management and coordination (MGT)	1 - INFN	72.00	1	48	D1.1
WP2	TA1/VA1: RIs for Nuclear Physics	5 - IFJ PAN	339.60	1	48	D2.1, D2.4, D2.2, D2.3, D2.5
WP3	(TA2): Access to Research Infrastructures for Accelerator R&D	3 - CERN	112.50	1	48	D3.5, D3.2, D3.4, D3.6, D3.3, D3.1, D3.7
WP4	WP4 (TA3): Access to Research Infrastructures for Detector R&D	4 - JSI	173.10	1	48	D4.4, D4.1, D4.3, D4.2
WP5	Open, Diverse and Inclusive Science	24 - CSIC	159.00	1	48	D5.2, D5.5, D5.4, D5.7, D5.6, D5.1, D5.3
WP6	Ethics requirements	1 - INFN	0.00	1	48	D6.1

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Work package WP1 – Project management and coordination (MGT)

Work Package Number	WP1	Lead Beneficiary	1. INFN
Work Package Name	Project management and coordination (MGT)		
Start Month	1	End Month	48

Objectives

Task 1.1. Project management and coordination
- Management and steering of the whole project
- Monitoring of the scientific and technical progress in all Work Packages
- Ensuring the contractual and administrative implementation
- Following and reporting on the use of resources

Preparation of the periodic and final project reports

Description

Task 1.1 Project management and coordination (INFN, CERN, GANIL)
This task will comprise the administrative management, carried out by the Project office (PO) and the overall scientific management of the project by the Management team (MT) along with the Steering Committee (SC). This will be carried out within the managerial structure of the project, described in Section 3.2. The work includes the overall coordination and continuous monitoring of the EURO-LABS programme of work, the organisation of the Governing Board (GB) and SC meetings, the preparation of the Annual Meetings and the Mid-term Review, as well as the regular communication with the European Commission on administrative and technical aspects of the project.
The MT, proposed by INFN and approved by the GB, will also comprise the administrative, financial and contractual follow-up of EURO-LABS, according to the EC Grant Agreement and its annexes. The work will cover the preparation of the periodic and final activity reports and the monitoring, reviewing and release of the Deliverable and Milestone reports. The financial follow-up will consist of resource utilisation control, cost reporting and collection, review and submission of the Financial Statements of all beneficiaries, as well as the distribution and payments of the EU funding.
As Coordinator of EURO-LABS, INFN will take the responsibility for providing appropriate Information Technology tools in order to ensure the effective management of the project, the timely flow of information and availability of project documentation to the beneficiaries, the SC and the GB. The PO, organised by INFN, will describe and announce all the offers proposed by the various research infrastructures available in EURO-LABS. These will be connected to the project's web page allowing for an easier access to all potential users. To streamline the access to the facilities of the project described in WP2, WP3 and WP4 the PO will take care of all related issues and prepare common access forms.
Management structure and procedures
The management structure of EURO-LABS is based on the experience and best practice from the management of EU projects of similar size and complexity. Members of the Project Management Team will be proposed by INFN and approved by the GB when formed.
Governing Board (GB)
The Governing Board is the top decision-making and arbitration body. It has one representative from each participant in the project, except for institutes participating with several laboratories (e.g., INFN, CNRS), which may have more than one representative. The Scientific Coordinator, the Deputies and the Project office Manager are ex-officio members without voting rights. The types of decisions and the corresponding voting procedure and rules will be described in the Consortium Agreement.
Based on the recommendations of the Steering Committee the GB will decide on strategic issues, such as modifications of the project programme of work, and admission of new beneficiaries. The GB will review the progress of the project at the annual EURO-LABS meetings, and, when necessary, will decide on changes in the work plan and budget allocation among the partners for the next reporting period. In addition to the Annual Meetings, the chairperson of GB chairperson may call for intermediary tele/video-conference meetings. The Chairperson of the GB is elected by its members.
Management Team (MT)
The Scientific Coordinator, the three Deputy Coordinators and the Project office Manager form the Management Team in charge of the regular follow-up and management of the project. To this end, they are supported by the Project Support Office at INFN, which includes other staff (on a part-time basis), namely Administrative Assistants, Finance Officer, and Communication Officer. The Project Management Team meets on a regular basis to follow-up closely the implementation of the project.
Steering Committee (SC)

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The SC is composed of the Scientific Coordinator, the three Deputy Coordinators, the Programme office Manager, and the Work Package Coordinators (WP). The SC reviews the work progress, milestones and deliverables of the EURO-LABS project, consolidates the reports received from the task leaders and discusses technical and scientific matters. The SC brings strategic issues forward to the GB for consideration, e.g. possible modifications of the work programme or re-distribution of the EC funding among beneficiaries or Work Packages/tasks. The SC is chaired by the Scientific Coordinator and will have regular meetings .

Scientific Coordinator (ScCo)

The Scientific Coordinator (ScCo) is responsible for the scientific management and overall follow-up and coordination of activities of the EURO-LABS project and organises reviews when needed. The ScCo is in charge of the communication with the European Commission on all scientific and technical aspects of the project. The ScCo chairs and organises the Steering Committee meetings, and will be responsible for the preparation of the technical and management sections of the Periodic Reports to the EC. The SC leads the EURO-LABS management WP (WP1). The designated Scientific Coordinator of EURO-LABS is Dr. Navin Alahari (GANIL) with three deputies: Dr. Maria Colonna (INFN-Catania), Dr. Ilias Efthymiopoulos (CERN), and Dr. Marko Mikuz (Univ. Ljubljana), representing the Nuclear Physics, Accelerator and Detector communities and laboratories in this joint proposal.

Project office (PO)

The project office is responsible for the administrative, financial and contractual follow-up of EURO-LABS. This will cover the preparation of the periodic and final activity reports and the continuous monitoring, reviewing and release of the deliverable and milestone reports. The project office will also provide the necessary Information Technology tools to ensure the effective management of the project, the timely flow of information and availability of project documentation to the beneficiaries, the SC and the GB. It is to be noted that the Coordinating Institute (INFN) has participated in over 128 H2020 projects and coordinated successfully more than 29 EU projects. The project office will hire two full time temporary staff with the relevant skills dedicated to the project, in addition to the relevant INFN staff. Moreover a person will be hired by the CERN EU Projects office and dedicated half time to EURO-LABS.

Project office Manager (PM)

The PM is responsible for the administrative and contractual follow-up of the project, including budget and cost reporting. The PM is in charge of financial issues, such as payments and distribution of EU funding received, collection of financial statements for the periodic reports and justification of costs. The PM will prepare the financial sections of the Periodic Reports to the EC. The PM maintains the communication with the European Commission on all administrative and contractual aspects of the project. The designated PM of EURO-LABS is Dr. Paolo Giacomelli (INFN).

Work Package Coordinators

The WP Coordinators have the responsibility for ensuring the effective cooperation between the task leaders and participants in each WP, for monitoring the progress of the tasks, and for periodically reviewing the Milestone and Deliverable reports that are prepared by the Task Leaders within the respective WPs. As members of the SC they regularly report to the MT. They make the results of the WP available to the EURO-LABS collaboration and are in charge of providing the relevant public dissemination material to Task 5.1 (Communication, dissemination and outreach) of WP5. They coordinate the review of all publications that will result from the work in their WP.

(Sub) Task Leaders and Facility Coordinators

The EURO-LABS structure also comprises: a) sub-Task leaders, reporting to their respective Task leaders; b) each facility will have a well identified Facility Coordinator, who will follow all aspects related to the TA, and the scientific and technical work related to facilities improvements for EURO-LABS at that facility. He/she will be the contact point to the corresponding Task and WP leaders. The SC will meet with the facilities coordinators twice a year, including the EURO-LABS annual meeting.

Decision-making mechanisms

Before the beginning of the project the participants will formally conclude a Consortium Agreement that sets forth the terms and conditions pursuant to which they agree to function and cooperate in the performance of their respective roles in the project. The Consortium Agreement will specify the responsibilities of the Coordinating Institution and the terms of reference of the GB and the SC, including the relevant decision-making mechanisms and voting procedures.

Decisions on the implementation of the work programme within the WPs will be taken by the WP Coordinators and Task Leaders. Issues concerning the overall work programme and connections between the WPs will be discussed and decided by the SC. In the rare cases where modifications of the work programme and/or re-distribution of EC funding are deemed necessary by the SC, such matters will be brought forward to the GB for decision.

The project implementation will be aimed at taking decisions by consensus on a majority of issues. Where this is not possible, decisions will be taken after voting by the SC or the GB, with necessary majority depending on the issue being considered.

EURO-LABS will use IT tools, e.g. collaborative workspace, to guarantee the timely distribution and availability of all project related information and documentation to the participants, so that decisions can be taken with all necessary information available in advance. Further details on intra and extra project communication and dissemination are provided in WP5 Task 5.1.

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Reserve budget
To maintain a certain degree of flexibility in the allocation of funds for TA, a small reserve budget of 220 k€ will be stored within WP1, and then dynamically allocated during the course of the project, to increase the TA to RIs that ensure a very good usage of their facility.
The field of nuclear and particle physics has seen ever-larger complicated projects involving JRAs and TA activities completed successfully at major European facilities. The EURO-LABS structure is based on the experience on the organization structures of these successful projects of similar scale and complexity, aligned to the needs of this programme. With common scientific and technical goals as a main driving factor, complemented but a well-defined effective management structure, democratic and collegial decision making and professional administrative support, the EURO-LABS consortium is in a strong position to bring the project to successful completion.

Work package WP2 – TA1/VA1: RIs for Nuclear Physics

Work Package Number	WP2	**Lead Beneficiary**	5. IFJ PAN
Work Package Name	TA1/VA1: RIs for Nuclear Physics		
Start Month	1	**End Month**	48

Objectives

The goal of the work-package WP2 “RIs for Nuclear Physics”, coordinated by IFJ PAN Krakow, is the access provision, complemented by improved access services, to Research Infrastructures (RIs) for nuclear (fundamental and applied) physics experiments and related theoretical support.
TA is provided at European accelerator facilities providing a myriad of ion beams covering a huge range of elements, masses, energies and intensities. The ion beams are either “stable” – produced from naturally-occurring isotopes or “radioactive” – produced from secondary reactions initiated by stable beams. In addition, the neutron beams will be employed. Correspondingly, three tasks can be identified for access provision:
- Task 1: TA to RIs delivering Stable Ion Beams, coordinated by JYFL Jyvaskyla;
- Task 2: TA to RIs delivering Radioactive Ion Beams (RIB), coordinated by ALTO IJCLab Orsay;
- Task 3: TA to RIs delivering Neutron Beams, coordinated by n-TOF CERN.

The RIs participating in those 3 tasks are listed in the table below:

RI ALTO CLEAR GANIL GSI/FAIR IFIN-HH ISOLDE CERN JYFL LNL-LNS NLCSLCJ(Warsaw CCB Krakow) n-TOF CERN
Tasks 1, 2, 3 1, 3 1, 2, 3 1, 2 1 2 1, 2 1, 2, 3 1 3

Many of the RIs contribute to multiple tasks. Coupled with state-of-the-art instrumentation, these accelerator facilities provide the versatility and complementarity required to fully understand fundamental processes and phenomena in the scientific fields listed above. The access is offered also to the interdisciplinary users, for example offering the cluster beams.
Theory support is also available by the strong nuclear physics theory teams at several RIs. Many of RIs offer services in several of the above tasks.
In addition, Task 4 encompasses two RIs targeted to offer theoretical support for experiments (TA + VA): ECT* FBK Trento (TA) (Coordinator) and Theo4Exp VA (Krakow, Seville, Milano).
Finally, activities aimed at service improvement are described in Task 5, coordinated by GSI.

Description

A. Tasks 1-3: Description of RIs offering access to the beams (stable ions, radioactive ions and neutrons)
The RIs contributing to Tasks 1- 3 are complementary, for the beam offer and the associated instrumentation.
They all offer trans-national access. In the following text, we give a separate description of each of them. Common points (concerning Modality of Access, Outreach to the new users and Review procedures) are described at the end.
Provision of access to the following infrastructure(s):
A1) ALTO
Description of the infrastructure:
Name of the infrastructure: ALTO – Accélérateur Linéaire et Tandem a Orsay
Location (town, country) of the infrastructure: IJCLab, Orsay, France
Web site address: https://www.ijclab.in2p3.fr/en/platforms/alto/

Annual operating costs (excl. investment costs) of the infrastructure (€): 1.55 M€
Description of the infrastructure:
The ALTO facility consists of two accelerators: a Tandem accelerator for stable beams (ions and cluster beams for interdisciplinary physics) (Task 1) and a linear electron accelerator to produce radioactive beams (Task 2). In addition, the LICORNE neutron converter is providing intense (up to 108 neutrons/s/str), kinematically focused, quasi-mono-energetic neutron beams (Task 3) with energies between 0.5 and 4 MeV.
The Orsay Tandem Van de Graaff accelerator (15 MV) is usually operated up to 14.6 MV. Stable ion beams ranging from protons to gold can be delivered. “Cluster-beams” and micro-droplets can also be delivered (C60 and gold droplets), but at lower voltage (10 MV). The ion sources were recently improved to deliver 5-time higher intensity. Rare ion beams (3He, 14C, 48Ca, ...) are also available.
The ALTO electron accelerator (50 MeV, 10 μA) is used as a driver to induce fission (photofission) in a thick heated uranium carbide target (up to 1011 fissions/s). Very exotic pure neutron-rich nuclei are obtained and used for studies of nuclear structure, decay heat in reactors and of solid-state physics. Research and development on target and ion sources for all the future second-generation radioactive ion beam projects (SPIRAL2, EURISOL…) is at the heart of the activity at ALTO. A new area is also open to particle physics users with the use of electron beam for tests of small units of particle physics detectors (vertex detectors, several layers of calorimeters w/o absorber etc.) before going to the large facilities such as DESY and CERN.
The associated research instrumentation with ALTO: six beam lines are available for experiments for stable beams, one is devoted to industrial irradiation and two others to cluster physics. Light, non-permanent experimental devices are used in any of the three experimental areas.
There are 4 Radioactive Ion Beam (RIB) lines dedicated to the study of very neutron-rich nuclei from photo-fission. Fast tape transport systems are available for studying short-lived nuclei. Several target ion source ensembles are developed at the facility: surface ionisation, laser ion source, FEBIAD ion source.
Main detector setups include: BEDO (a high efficiency gamma setup for decay properties of neutron rich nuclei studies); TETRA (an 3He neutron detector used to measure neutron emission from neutron rich nuclei); LINO: for collinear laser spectroscopy and laser-induced nuclear orientation; POLAREX (an instrument based on the On-Line Nuclear Orientation method to observe the decay of a spin-oriented ensemble of nuclei); Split-Pole (magnetic spectrometer used for the study of “two-body” reactions with high resolution and for nuclear astrophysical studies); the nu-Ball gamma spectrometer, which consists of a hybrid LaBr3/HPGe array; AGAT (a detector for Cluster Physics used for atomic astrophysical studies); and SIHL (an offline separator to test and develop target ion sources). Detailed list of instrumentation: https://alto.ijclab.in2p3.fr/en/instrumentation-en/.
Services currently offered by the infrastructure:
In addition to the instrumentation described above, the Detector Laboratory is among the most advanced in Europe for testing and repairing HPGe detectors and is used by several European Laboratories (http://ipnweb.in2p3.fr/GePool); the Target Laboratory produces thin films for targets; Experimental Hall services provide the technical assistance for new installation and maintenance. Computer centres (CC IN2P3/Lyon) and Data-Acquisition services provide help with hardware and data-acquisition software. A Laser laboratory is available to test new ionisation schemes for the production of radioactive ion beams. ALTO has a long tradition to work with different research communities: nuclear, atomic, solid-state, and acceleration physics, nanotechnology and biology. Nearly 400 researchers (250 from abroad) from 41 institutions (31 from abroad) come to the ALTO for experiments profiting from the available beams and devices.
Description of work:
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A. For ALTO, the duration of a user’s stay can range between a few days for the short solid-state physics experiments to several weeks for long nuclear physics experiments or campaigns of experiments.
Support offered under this proposal:
A number of main services are offered to users, including: 1) engineering project service and mechanical machine shops, 2) vacuum laboratories; 3) cryogenics and superconductivity laboratory; 4) target laboratory 5) detector laboratory 6) accelerator division. Important logistics support includes: 1) Canteen and cafeteria service for IJCLab employees and ALTO users; 2) Guest house with 7 rooms for ALTO users. Communal kitchen and rest areas. 4) Library and documentation service.
A2) CLEAR
Description of the infrastructure:
Name of the infrastructure: CLEAR (Cluster of Low Energy Accelerators for Research)
Location (town, country) of the infrastructure: Sevilla (Spain), Debrecen (Hungary), Lisbon (Portugal)
Operating costs: CNA 1.3 M€; ATOMKI 375 k€; IST 500 k€;
Websites: http://institucional.us.es/CLEAR; www.cna.us.es; https://atomki.hu/en/accelerators; http://tecnico.ulisboa.pt
CLEAR is a consortium of three installations: ATOMKI in Debrecen, CNA in Seville and IST in Lisbon, offering access to stable-ion beams (Task 1) and neutron beams (Task 3). The consortium has a common Program Advisory Committee.

Accelerator Complexes: ATOMKI: 2MV Tandem, 18 MeV Cyclotron, ECR Ion Source; CNA: 3MV tandem, 18 MeV Cyclotron, 1 MV Tandetron for Accelerator Mass Spectrometry (AMS); IST: 2.5 MV van de Graaf.
Available Beams: protons from 20 keV to 20 MeV, deuterons up to 9 MeV, alphas up to 20 MeV, low energy heavy ions, neutrons up to 3 MeV, electrons 8-12 MeV, photons 4-10 MeV.
Main detectors/spectrometers:
ATOMKI: split pole magnetic spectrograph, La(Br) detectors, Ge, Si detectors, including DSSD, crossed beam reaction chambers, time of flight spectrometers, scintillator detectors.
CNA: Microprobe (3MV Tandem); Neutron TOF beam line (3MV Tandem); 1.5 m tracking chamber (3MV Tandem), Irradiation chamber (cyclotron), Mass spectrometer (Tandetron).
IST: Microprobe (van de Graaf). External beam. Detectors to perform different ion beam techniques: Silicon and SDD for X-ray, Germanium for gamma-ray, particle detector, pin-diode, electrons detector, spectrometer.
Services currently offered by the infrastructure:
The three installations (ATOMKI, CNA, IST) are user-oriented facilities, with a long experience on carrying out experiments with international users, which are typically 10-20% of the total users. The installations provide, on top of the instrumentation above, the support of the local researchers and technicians for the experiments of the external users. The low energy CLEAR installations will offer access to perform complementary experiments to those of the higher energy facilities and will facilitate the access of cross-disciplinary users to EURO-LABS facilities. Moreover, training of scientific and technical staff on accelerator techniques will be carried out at these small-scale RIs.
Description of work:
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A. The proposals will be typically of a duration of one week, corresponding to 40 hours of beam time, and require a team of 6-8 scientists. Proposals can cover all areas of nuclear physics, nuclear applications and nuclear technology, for which low energy facilities are relevant. Proposals will be selected by a common scientific panel for the three CLEAR installation, following criteria of scientific excellence, cross-disciplinary relevance and training capability.
Support offered under this proposal:
EURO-LABS users will benefit of the services already offered by the installations to all external users. Besides, the participation of local scientists in EURO-LABS projects will be specially encouraged, both for the benefit of the external users, and to widen the international connections of the CLEAR installations. Contact scientists for each installation will be nominated, to facilitate the writing of successful proposals by first time users. Access to common facilities, such as computing access, meeting rooms, and detector laboratories, are provided.
A3) GANIL
Description of the infrastructure:
Name of the infrastructure: GANIL - Grand Accélérateur National d'Ions Lourds
Location: Caen, France
Web site address: http://www.ganil-spiral2.eu/
Annual operating costs (excl. investment costs) of the infrastructure (€): 11 M€ (GANIL without manpower), 29 M€ (including manpower)
Description of the infrastructure:
GANIL-SPIRAL2 is one of the major nuclear physics facilities in the world with SPIRAL2 selected at the ESFRI roadmap. The accelerator complex delivers three different beams for users: high-intensity stable beams, from Carbon up to Uranium between ~ 1 MeV to 95 MeV/nucleon; very high-intensity light beams such as p, d, Helium (Task 1); wide range of high-intensity exotic beams produced either in flight with the LISE and S3 (from ~2024) fragment separators or with the ISOL method at the SPIRAL1 facility (Task 2); and neutron beams with Neutron For Science (NFS) since 2020 (Task 3).
The infrastructure consists of the following parts:
• Two injector cyclotrons equipped with two ECR ion sources, which can be operated in parallel.
• The IRRSUD beam line allowing to use low-energy beams from injectors.
• CSS1: separated-sector cyclotron number 1 (delivers beams in the energy range 5-15 MeV/nucleon).
• CSS2: separated-sector cyclotron number 2, fed by CSS1, to reach the maximum beam acceleration (E=30-95 MeV/nucleon).
• SPIRAL 1 provides low energy radioactive beams (30 keV) at the LIRAT facility. These beams can also be accelerated by the CIME cyclotron to 2-25 MeV/nucleon. This facility is unique in Europe.
• SPIRAL 2 Phase 1: Superconducting LINAC accelerates beams (with the highest worldwide intensity) from protons to heavy-ions with A/Q=3 in the energy range from 0.75 MeV/u to 20 MeV/u. The future A/Q=7 injector (~2028) will further increase the intensity of heavy ion beams.
In the GANIL experimental halls, a variety of experimental infrastructures is fully available to all users with local technical support. Among them are:

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• VAMOS, a large acceptance spectrometer used essentially for direct, fusion-evaporation reactions and deep-inelastic reactions for spectroscopy studies of exotic nuclei,
• The LISE III spectrometer, which separates, focuses and unambiguously identifies projectile-like fragments using several types of detectors. LISE is also used for atomic physics experiments.
Two new experimental halls with corresponding instrumentation have been built at SPIRAL 2 Phase 1 that will open new opportunities: Neutrons For Science (NFS) facility (commissioned in 2019-2020) and Super Separator Spectrometer (S3) for nuclei far from stability (to be operational by 2024). The Decay, Excitation, and Storage of Radioactive Ions (DESIR) hall is expected to be commissioned around 2026.
Other detectors at GANIL, designed for investigations of exotic and highly excited nuclei are: EXOGAM (high efficiency array of germanium detectors); MUST2/MUGAST (set-ups consisting of Si array); ACTAR TPC (an active target and time projection chamber); INDRA and FAZIA (4π multi-detectors of charged particles), PARIS (scintillator array for γ rays), and the Neutron Wall.
In addition, three beam lines with dedicated equipment are now available for atomic and condensed matter physics, at low energy (around 1 MeV/nucleon), at medium energy (after CSS1) and at high energy (95 MeV/nucleon). Another beam line is devoted to industrial applications, and to biological research. In total, between 50 and 60% of GANIL beam time is allocated to interdisciplinary and applied research to tackle major societal challenges including cancer therapies, medical radioisotopes and energy.
Detailed list of instrumentation: https://www.ganil-spiral2.eu/scientists/ganil-spiral-2-facilities/accelerators/.
Services currently offered by the infrastructure:
All stable and rare isotope beams and all experimental areas at GANIL-SPIRAL2 are available to external users. Each area has both a technical and a scientific coordinator, who act as liaisons with the outside users. In 2021, GANIL provides around 9 months of beam time. The GANIL community gathers around 1000 users, among which 740 are from EU (including 370 from France). International users contribute actively to funding and construction of all major experimental devices. The average number of scientific publications related to GANIL experiments is around 120 per year. The laboratory has access to the major computer centres of the CNRS (CC IN2P3 in Lyon) and the CEA. It is located in an active academic environment, the EPOPEA science and innovation park.
Description of work:
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A. The duration of a user's stay can range between a few days for the short solid-state physics experiments to several weeks for long nuclear physics experiments or campaigns of experiments. Each experiment is attributed a DOI number. Data taken at GANIL are managed according to a dedicated Data Management Plan following EU standards.
Support offered under this proposal by GANIL-SPIRAL2:
A number of main services are offered to users, including: 1) engineering project service and mechanical machine shops, 2) vacuum laboratories, 3) cryogenics and superconductivity laboratory, 4) target laboratory, 5) detector laboratory, 6) accelerator division. At GANIL-SPIRAL2 Users Executive Committee (GUEC) specifically ensures that user teams receive maximal support; it oversees the adequacy of the physics equipment for experimental programs. Important logistics support includes: 1) canteen and cafeteria service, 2) rooms for guests and users, 3) library and documentation service.
A4) GSI/FAIR
Description of the infrastructure:
Name of the infrastructure: GSI Helmholtzzentrum für Schwerionenforschung, FAIR - Facility for Antiproton and Ion Research
Location (town, country) of the infrastructure: GSI and FAIR are both located at: Darmstadt, Germany
Web site address: https://www.gsi.de, https://fair-center.eu/
Annual operating costs (excl. investment costs) of the infrastructure (€): 6.14M€ (2019), 8.70M€ (2020)
Description of the infrastructure:
GSI is operating a large accelerator complex consisting of the linear accelerator UNILAC, the heavy-ion synchrotron SIS18 and the experimental storage and cooler ring ESR, which are offering both stable ion beams (Task 1) and relativistic radioactive ion beams (Task 2).
With the UNILAC, ions of all chemical elements from protons up to and including uranium can be accelerated up to 11 MeV/u, at SIS-18 up to ~2 GeV/u for Carbon and 4.2 GeV for protons. In the ESR, equipped with powerful stochastic and electron cooling devices, stable or radioactive ion beams can be stored and cooled up to energies of ~560 MeV/u (for uranium). The accelerator facility allows for up to seven parallel experiments. FAIR, the Facility for Antiproton and Ion Research, an ESFRI landmark for nuclear and hadron physics, is presently under construction close to GSI. The CRYRING, a Swedish contribution to FAIR without cost to the project, is already operational at the ESR of GSI. CRYRING offers cooled primary and secondary beams of 4 MeV/u down to 10 keV/u. It is equipped with internal ion sources for stand-alone experiments with stable beams.
The existing GSI accelerator facilities are being upgraded towards higher beam intensities to serve as injectors for the

FAIR facility. A future beamline will connect the existing SIS-18 with the heavy-ion synchrotron SIS-100 and the Super-FRS of FAIR. The Super-FRS is planned to be available with SIS18 beams for first experiments end 2025.
State-of-the-art equipment dedicated to nuclear, atomic, biophysics and applications at the UNILAC are: The velocity filter SHIP and the gas-filled separator TASCA for the separation and detection of super-heavy elements, SHIPTRAP, a Penning trap at SHIP for super-heavy nuclei/atoms; ALBEGA (detector setup for complete spectroscopy of chemically separated samples) and the M-branch for materials science.
The fragment separator FRS for production and in-flight separation of exotic nuclei serves a number of experimental sites for research at and beyond the driplines: FRS Ion Catcher facility for experiments with thermalized exotic nuclei, for mass measurements and isomer studies with a multiple-reflection time-of-flight mass spectrometer, for decay spectroscopy; the WASA@FRS setup to study hypernuclei, eta-mesic nuclei and nucleon resonances; in the ESR: Schottky mass spectrometry as well as isochronous time-of-flight mass spectrometry, an internal gas-jet target for atomic spectroscopy and nuclear reaction studies; high-resolution Ge detectors and fast-timing arrays for atomic and nuclear spectroscopy experiments; the R3B nuclear reaction set-up with the new dipole magnet GLAD to study collective states and complete kinematics reactions is available for experiments.
Equipment and projects dedicated to other or multidisciplinary research: highly energy-efficient computing centre “Green IT-Cube”, currently equipped with close to 10.000 cores and 700 GPUs, and 7 PB disk storage for data analysis and simulations; for atomic physics, the chain of trapping and storage facilities for heavy, highly-charged ions (HITRAP, CRYRING, ESR); High power density beam bunches and various equipment for plasma physics research and the Kilojoule/Petawatt Laser PHELIX; proton microscope PRIOR for radiographic imaging of dynamic systems with high spatial, temporal and density resolution; several experimental stations dedicated to materials research and biophysics for irradiation experiments combined with in-situ characterization of materials and/or biological specimen; Multipurpose test stations, e.g. for tests of electronic components, or of detectors built for particle/nuclear physics and also for space missions.
A detailed list of instrumentation - https://www.gsi.de/en/work/research.
The Super-FRS of FAIR, even in its start phase, will allow for unprecedented experiments with exotic nuclear beams at relativistic energies; a variety of new experiments with exotic nuclei will be possible, which cannot be performed at GSI today; its high-acceptance features will provide higher secondary-beam intensities even with SIS18 beams for reaction studies and spectroscopy of the most exotic nuclei.
Services currently offered by the infrastructure:
GSI-FAIR is a user facility open to national and international user groups. The beam time application procedure is described at https://www.gsi.de/en/work/organisation/wissenschaftliche_gremien/user/beamtime/applying_for_beamtime.
On top of the wide breadth of services described above, all experimental facilities including electronics, computing, etc. are provided free of charge to research groups with approved experiments.
Total number of users from the nuclear and hadron physics community: 660 users per year, thereof 93 % external. Total number of users from the atomic physics, biophysics and materials science community: 450 users / year thereof 91 % external.
Description of work:
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A . The beam time is granted in shifts (of 8 hours each). A written project proposal has to be submitted to the GSI/FAIR scientific director, which is then reviewed by the international program advisory committee G-PAC.
Support offered under this proposal:
A contact person is assigned to each experimental project. This person provides scientific, technical and logistical support to set-up and to perform the experiment. Further support provided by GSI includes: office space and access to the GSI computing facilities; training courses and briefings on the general safety regulations at GSI and on the specific regulations at the experimental facilities; access to the GSI detector and target laboratories, as well as access to a maintained workshop for experimentalists and assistance from the GSI general mechanics shops; the GSI Welcome Office is providing logistic support with regard to accommodation, travel and payments; bus shuttle from the nearby train and tram stations; lodging facilities in walking distance from the institute.
A5) IFIN-HH
Name of the infrastructure: Tandem accelerator complex
Location (town, country) of the infrastructure: Magurele, Romania.
Web site address: http://www.nipne.ro
Annual operating costs (excl. investment costs) of the infrastructure: 923,624.26 € (2019)
Description of the infrastructure:
The IFIN-HH accelerator complex, consisting of a 9-MV Tandem, a 3-MV Tandetron and a 1-MV Tandetron accelerators. offers access to a variety of stable ion beams (Task 1).
The 9-MV Tandem accelerator of IFIN-HH is one of the most reliable facilities in Europe providing a wide range

of accelerated stable ions, with high intensity and stable operating conditions, attracting a growing international user community. The 3-MV TandetronTM accelerator is mainly dedicated to applied nuclear physics: material characterization and modifications, radiobiology, archaeometry, radiation hardness, but also used for fundamental research, e.g. nuclear astrophysics studies. The 1-MV TandetronTM is a state-of-the-art equipment that plays the key-role in the AMS studies. 14C dating is by far the most common application with more than 80% of the beam time allocated. Besides radiocarbon, other isotopes (10Be, 26Al, 129I and more recently actinides) were successfully measured within geological and environmental studies.
Equipment available for users include: ROSPHERE (a state-of-the-art spectrometer housing up to 25 detectors, HPGe or LaBr3(Ce), dedicated mainly to lifetime measurements); a setup dedicated to nuclear reaction and nuclear astrophysics; the neutron array of 81 BC400 plastic scintillators; a low-background measurements setup for nuclear reaction cross-sections through the activation method; a Ion Beam Analysis (IBA) setup at the 3-MV TandetronTM; an external beam setup with He-flow for in-air PIXE with applications in archaeometry and radiobiology studies.
The approximate numbers are: 100 foreign users + 100 local users.
Services currently offered by the infrastructure:
• The entire research infrastructure described above is open for external users around the world. The research activities are coordinated in collaboration with our local staff. The average beam time per year for each accelerator is around 5000 hours of beam on target.
• A fully equipped electronics laboratory, a state-of-the-art target laboratory and a HPGe detector maintenance laboratory are supporting the experimental activity at Tandem accelerator complex. The electronics lab offers expertise on several topics, including the development of front-end electronics for SIPM readout or digital data acquisition systems. The target lab has already produced a significant number of targets for a wide range of experiments at different facilities in Europe and around the world, and it will deliver high-quality products for the research units involved in this project.
The Tandem accelerator complex manages to attract users and obtain relevant scientific results through a combination of factors that include local expertise that is able to open niche research opportunities and beam availability that makes possible weeks long low cross-section experiments.
Description of work:
Modality of access under this proposal:
The modality of access, common to all RIs, is described at the end of section A.
Support offered under this proposal:
Any research group running experiments at IFIN-HH has access to the local infrastructure (detectors lab, target lab, electronics lab) and is being actively supported by the local staff in setting up and performing the experiments. A local contact person is assigned to each accepted proposal in order to ensure the best technical and logistical local support.
A6) ISOLDE CERN
Description of the infrastructure:
Name of the infrastructure (and its installations, if applicable): ISOLDE CERN
Location (town, country) of the infrastructure: Geneva, Switzerland
Web site address: https://isolde.cern/
Annual operating costs (excl. investment costs) of the infrastructure (€): 4.6 M€ (10.1 M€ including manpower)
Description of the infrastructure:
ISOLDE is the radioactive ion beam (RIB) facility at CERN (Task 2). The isotopes are made through a 1.4 GeV proton beam from the PS-Booster (2 μA) impinging thick targets. More than 1200 different isotopes/isomers of more than 74 chemical elements are available either at low energy (30-60 keV) or as post-accelerated radioactive beams up to 10 MeV/u. The radioactive beams are produced in two target/ion source units using 20 different targets and five types of ion sources. The RILIS lasers ion source is used for 70% of all experiments, providing element selective and efficient ionization for more than 20 elements. Isobaric on-line mass separation of isotopes is achieved with two mass separators. A gas filled Paul trap (ISCOOL) can be used to produce bunched beams with a user-defined bunch/release time. Beams are distributed to more than a dozen experimental devices (including the HIE-ISOLDE post-accelerator and its 3 experimental stations).
Research topics: about 60% nuclear structure research, explored via measurements of ground state properties (mass, radii, moments) and decay studies or Coulomb excitation and transfer reaction studies. A small fraction is devoted to nuclear astrophysics and tests of the Standard Model of particle physics (10%), while about 25% of the beam time is given to materials research and life sciences with broad societal benefits.
Research instrumentation: the ISOLDE users have access to an electronics pool, radiation detectors, multi-parameter data acquisition systems, chemistry and radioactive laboratories, liquid nitrogen and liquid He. Dedicated shielded collection points and laboratories for (off-line) materials research using long-lived radioactivity (hours to days) are available. Permanent experimental set-ups are owned, maintained and operated by “external” collaborations, both at the low- and high-energy beam lines. Small set-ups can be coupled for a single experiment to the low-energy branch or at the HIE-ISOLDE post-accelerator.
The HIE-ISOLDE post-accelerator has 3 beam lines: (1) the MINIBALL highly efficient germanium array is coupled

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to line 1 and is used for Coulomb excitation studies. In combination with a Si-Array T-REX also for transfer reaction studies. It can host a plunger for lifetime measurements of short-lived excited states. Since 2015, an electron conversion spectrometer, SPEDE, has been added for spectroscopy studies on actinides; (2) the ISOLDE superconducting solenoid (ISS) on line 2 provides a magnetic field up to 2 T. Its room temperature bore diameter of nearly 1 m can host two types of detectors: a Si array and an active target (SPECMAT). First successful experiments with the Si array were performed in 2018; (3) a multipurpose scattering chamber is available at line 3 for user to mount their own detection systems (inside or behind).
The low-energy part of ISOLDE hosts a suite of permanent experimental set-ups: fluorescence detected collinear laser spectroscopy set-up (COLLAPS) and collinear resonance ionization laser spectroscopy set-up (CRIS) to determine ground-state and isomeric state charge radii, spins, magnetic and quadrupole moments. CRIS can also be used for decay studies on isomerically pure samples, using dedicated alfa- and beta-decay detection set-ups; the ISOLTRAP Penning traps and an MR-TOF spectrometer for high-precision mass measurements; the ISOLDE Decay Station (IDS) includes efficient gamma detection, beta-detection and tape station, neutron array, LaBr3(Ce) for lifetime measurements; SPEDE detector for electron conversion detection; Total Absorption Spectrometer (TAS) for beta decay studies. There are also dedicated beam lines for applications in material science, biology, fundamental interactions, as well as material and biochemical studies.
Detailed list of instrumentation - https://isolde.cern/experimental-setups.
Services currently offered by the infrastructure:
Radioactive beams are provided up to the switchyards towards the experimental beam line. ISOLDE presently provides about 4500 hours of beam time per year for about 50 experiments with the leading and participation of more than 600 external users per year. The scientific output from ISOLDE can be found on the web (isolde.cern/publications) and includes an average of 80 publications per year, many in high-impact journals (PRL, PRX, PBL, Nature, Nature Physics, Nature Communications, …). A new class C laboratory is available for the users, which hosts an extended laboratory for condensed matter and bio-physics with a separate chemistry laboratory, as well as two large laser laboratories, a mechanical workshop, and a detector laboratory.
All ISOLDE users have access to the standard CERN services, including computing, library 24h, a small store, electronics pool, restaurants, housing service, hourly bus transfer to/from airport etc. The top floor of the new users building is accessible for visits and includes data acquisition rooms for the different collaborations, a visitors' area, the ISOLDE control room, and a kitchen and meeting area.
Description of work:
Modality of access under this proposal: General features, common to all RIs, are described at the end of section A. Beam time is granted based on a scientific proposal submitted to an international advisory panel, the INTC (ISOLDE and n_TOF Committee https://committees.web.cern.ch/intc), which meets 3 times per year. New users are recommended to contact the Physics Coordinator or the spokesperson of an experimental device (https://isolde.cern/experimental-setups) prior to submitting a proposal. The beam time is granted in 'shifts' (1 shift = 8h). The access to the radioactive beams is defined by the CERN operational schedule (typically from end of March to mid-December) whereas other infrastructures of the ISOLDE facility are continuously available for all users. The work is done on-site for 3-15 days depending on the project, typically accompanied by further measurements and/or data analysis performed in the users' home institutes. Some experiments can be performed in parallel operation, using protons on both target stations, coupled to respectively the HRS and GPS mass separators.
Support offered under this proposal: An ISOLDE support office as well as the CERN Users Office are available to users for administrative, logistic and organizational problems. The ISOLDE and CERN websites provide information on access, experiments, schedules, safety, lodging, etc. All new users are fully integrated into the scientific environment via seminars, lectures, etc. and access to libraries and computing facilities. Both internal and external transport services for material exist. The so-called "team accounts" are provided to assist collaborations in managing their finances at CERN. The ISOLDE technical teams are comprised of some of the world-leading technical experts in radioactivity handling, in high-temperature target technologies, ion sources, and radioactive beam production. This gives excellent possibilities for users to discuss and optimize related aspects of their proposals and experiments. The physics group hosts CERN PhD students and post-doctoral fellows, as well as several external users who stay on-site for longer periods (months to years). This guarantees the necessary support and allows for continues development at the experimental stations.
A7) JYFL
Description of the infrastructure:
Name of the infrastructure: Accelerator Laboratory, Department of Physics, University of Jyväskylä (JYFL)
Location of the infrastructure: Jyväskylä, Finland
Web site address: https://www.jyu.fi/accelerator/
Annual operating costs (excl. investment costs) of the infrastructure: 6.55 M€ (Real Estate + Operating Costs typically 2.55 M€, Salaries 3.7 M€)
Description of the infrastructure:
The facility can provide stable ion beams (Task 1) with two accelerator facilities: a K=130 heavy ion cyclotron with

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three ECR ion sources and a multi-cusp ion source delivering a large variety of stable-ion beams (from p to Au) suitable for modern nuclear physics research and applications. In the past decade, the third 18 GHz ECR Ion Source HIISI has allowed the intensity and energy range of the beams delivered by the K130 cyclotron to be increased (up to energies of 16 MeV/u for Xe and 22 MeV/u for Kr) and an 800 m2 extension of the JYFL target hall was equipped with an additional K=30 light-ion cyclotron. The cyclotrons also drive the IGISOL ion-guide facility, delivering various species of cooled and bunched radioactive ion beams at low energies (Task 2). The annual operating time of these facilities has been about 7000 hours during the last years.
Associated research instrumentation:
Instrumentation for in-beam and decay spectroscopic studies of exotic nuclei at the proton drip line and of super-heavy elements such as the RITU gas-filled recoil separator and new vacuum-mode recoil-mass spectrometer MARA. Coupled with detector arrays at the target area (JUROGAM III Ge detector array) and at their respective focal planes, they form some of the most flexible and efficient systems in the world for such studies. Optionally, the SAGE spectrometer composed of the JUROGAM III array of Ge clover detectors and a novel in-beam electron spectrometer are also available. The IGISOL facility provides beam lines equipped with ion traps (e.g. JYFLTRAP) for accurate nuclear mass measurements, detector systems for exotic decay modes and laser spectroscopy systems for hyperfine structure studies and resonance ionisation. Two beam lines are available for nuclear reaction studies and test experiments. One of them is equipped with a scattering chamber of 1.5 meters in diameter.
The JYFL Accelerator Laboratory has close contacts with the experts of experimental and theoretical high-energy and materials physics at the Department of Physics and at the adjacent Nanoscience Centre (http://www.jyu.fi/nsc/en/).
Services currently offered by the infrastructure:
All the accelerators and associated instrumentation are available for the users. In addition, JYFL has well-equipped mechanical and electronics workshops ready for rapid delivery of purpose-built equipment and to carry out repairs. The requested beams are delivered by the JYFL staff. Each experiment proposed by the users has a local liaison and is typically carried out in collaboration with one of the in-house research teams. The total staff is currently around 80 persons. The international exchange programmes have led to a significant transfer of foreign users (around 300 foreign visitors and over 2000 visitor-days annually) and equipment (value of 10 M€) to JYFL.
As a university laboratory, JYFL provides a unique environment for graduate students and young scientists for active participation in experiments as well as in the design and construction of instrumentation.
There is a strong national support for the research activities at JYFL: the Academy of Finland awarded the status of a Finnish Centre of Excellence (CoE) in Nuclear and Accelerator Based Physics in 2012-2017. It also has a special task given by the Ministry of Education as a centre of expertise in radiation- and ion beam applications and is one of 29 large-scale infrastructures awarded a position on Finland's "Roadmap of National Research Infrastructures 2021-2024.
Description of work
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A. Beam times of typically one week are allocated for the user groups based on the proposals approved by the Programme Advisory Committee (two calls per year). The users' experiments can employ the JYFL research instrumentation (see above), their own instrumentation or combinations of the two. The user group is responsible for the analysis of the collected data and has its proprietary right.
Support offered under this proposal:
In preparing and running the experiment one of the local research teams offers all the scientific, technical and logistic support needed to perform a successful experiment. Help is offered in setting up the instrumentation, running the data acquisition systems and analysis of the data. The facility also takes responsibility for data management and long-term storage of data. The accelerator team is responsible for delivering of the ion beams and stable running conditions through the entire experiment. Accommodation for the users is organised by the JYFL staff on request.
A8) LNL-LNS
Description of the infrastructure:
Name of the infrastructure: Laboratori Nazionali di Legnaro and Laboratori Nazionali del Sud
Location (town, country) of the infrastructure: Legnaro, Padua (LNL) and Catania (LNS) - Italy
Web site address: www.lnl.infn.it, www.lns.infn.it
Annual operating costs (excl. investment costs) of the infrastructure: 10.000.000 €
Description of the infrastructure:
LNL and LNS are property of the Istituto Nazionale di Fisica Nucleare (INFN) and are devoted to Fundamental and Applied Nuclear Physics Research. Their activities are complementary and strictly coordinated.
Accelerator Facilities:
The LNL-LNS laboratories offer an access to stable-ion beams (Task 1), radio-active ion beams (Task 2) and also to neutron beams, delivered by the BELINA facility at LNL (Task 3).
The LNL and LNS laboratories have different accelerator complexes providing light and heavy ion beams up to 80 MeV/u. In particular, the accelerators in use are:

• the PIAVE RFQ injector + ALPI linear accelerator at LNL, which delivers ion beams with A>90 and energies up to 15 MeV/u;
• the 16 MV Tandem XTU + ALPI linear accelerator complex at LNL, which delivers ion beams with A<90 and energies up to 10 MeV/u
• the Superconducting Cyclotron at LNS providing a wide variety of heavy-ion beams with energies up to 80 MeV/u.
• the 15 MV SMP Tandem accelerator at LNS providing heavy-ion beams with energies of a few Mev/u.
The LNS Superconducting Cyclotron will be equipped with a second beam extraction system to improve the intensity of stable beams. This will allow the use of the new FRAgment Ion Separator (FRAISE) for exotic beams production via projectile fragmentation.
At LNL the SPES facility will come into operation during the period of the offered access. SPES is an ISOL type facility for radioactive beam production based on the fission of a UCx target induced by a primary proton beam delivered by the high intensity cyclotron B70.
Applied, interdisciplinary and biomedical physics activities are based on:
• The Van de Graaff accelerators 2.5 MV AN2000 and 7 MV CN at LNL delivering light-ion beams.
• The CATANA facility at LNS where, besides the proton-therapy, biomedical physics experiments using proton and carbon beams from the cyclotron are performed.
• The B70 Cyclotron at LNL for research activities in the field of radioisotopes for medicine and neutrons for applied physics.
Research instrumentation:
Among the several state-of-the-art detection systems we can mention: GALILEO at LNL, a high-resolution Ge array implemented with various complementary detectors for nuclear structure studies; The heavy-ion magnetic spectrometers PRISMA at LNL and MAGNEX at LNS for the study of quasi-elastic processes and single and double charge exchange reactions; The charged particle array detectors GARFIELD+RCo at LNL and CHIMERA at LNS for the study of the dynamics and thermodynamics of nuclear reactions; The PISOLO set-up at LNL, based on a electrostatic deflector followed by a time-of-flight spectrometer, for the study of sub-barrier fusion reactions; The BELINA facility installed at the CN accelerator of LNL, which is devoted to the production of neutron beams through the 7Li (p,n) reaction for both astrophysics and applied research studies; The STARTRACK detector for micro dosimetry studies and the micro-beam line at the AN2000 accelerator for elemental analysis at LNL; the LANDIS laboratory at LNS for non-destructive in situ analysis of archaeological samples; A beta-decay station and an electron spectrometer for nuclear structure studies using non-reaccelerated SPES beams are in the installation phase at LNL. The European gamma spectrometer AGATA is currently (summer 2021) moving to LNL. The experimental campaign is expected to start in spring 2022.
Services currently offered by the infrastructure:
The main services offered to users are the following:
• A Detector Laboratory at LNL, one the most advanced laboratories in Europe for testing and repairing High-Purity Germanium detectors.
• Target laboratories at LNL and LNS for the production of targets and thin films depositions for nuclear physics experiments and interdisciplinary projects, respectively.
• Technical assistance for the installation of new set-ups, the maintenance of vacuum instrumentation, pumping systems, electrical components and mechanical parts of the existing apparatuses.
• Computer centres and Data Acquisition Services.
• Cellular and molecular biology laboratories at LNS.
• A surface technology and superconductivity laboratory at LNL.
The international relevance and quality of the research performed at LNL and LNS, are testified by about 350 scientific papers per year published in Scientific Journals with high impact factor and the number of users from foreign institutions (about 500 researchers per year).
Description of work:
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A. The average duration of stay is of 7 days per user (including preparation work, data taking and preliminary data analysis).
Support offered under this proposal:
The support offered include: engineering project service, mechanical machine shops, vacuum and electrical maintenance; vacuum laboratories; cryogenics and superconductivity laboratory; laboratories for target production; laboratory for sputtering and composite materials; laboratory for treatment of materials; Nuclear Analytical Laboratory and micro and nano dosimetry Test laboratory. Logistics support includes: General store for goods and components; Canteen and cafeteria service at LNL; Guesthouse; Library and documentation service.
A9) NLC (SLCJ Warsaw & CCB Krakow) – National Laboratory of Cyclotrons
Description of the infrastructure:
Name of the infrastructure: NLC (SLCJ Warsaw & CCB Krakow) – National Laboratory of Cyclotrons
Location (town, country) of the infrastructure: Warsaw, Poland (SLCJ) - Kraków, Poland (CCB)

Web site address: SLCJ: www.slcj.uw.edu.pl, CCB: https://experimentsccb.ifj.edu.pl
Annual operating costs (excl. investment costs) of the infrastructure: SLCJ: ca. 1.7 M€ (excluding isotope research and production centre), CCB (incl. medical part): ca. 2.0 M€
Description of the infrastructure:
NLC is a consortium of the two institutions – Heavy Ion Laboratory of the University of Warsaw (SLCJ) and Cyclotron Center Bronowice (CCB) at Institute of Nuclear Physics Polish Academy of Sciences in Kraków. It offers access to a wide range of stable ion beams (Task 1) to conduct complementary (by using high energy protons in CCB Krakow and low energy heavy ions in SLCJ Warsaw) research activities, encompassing the fields of nuclear structure, nuclear reactions dynamics, radiochemistry, radiobiology, nano-dosimetry, material sciences, industrial application, medical research and proton therapy.
Accelerator Complex: SLCJ: Isochronous heavy-ion cyclotron (K=160) with two ECR sources, proton/deuteron GE PETtrace cyclotron (K=16.5); CCB: Medical proton cyclotron PROTEUS-230.
Available Beams: SLCJ: from He up to Ar up to 10 MeV/A, protons/deuterons 16 MeV/A; CCB: protons 70-230 MeV.
Main detectors/spectrometers:
SLCJ Warsaw: EAGLE (4π gamma-ray array) and associated ancillary detectors with possible integration with the PARIS gamma-ray calorimeter and the NEDA neutron detector; scattering chambers ICARE (obtained from Strasbourg) and CUDAC for charged particle spectroscopy; array JANOSIK for nuclear giant resonance studies; irradiation station for radiobiology (with a cells' laboratory infrastructure) and material interdisciplinary studies; irradiation station with target water cooling; low background lead shielded HPGe counters. Detailed list of instrumentation: http://slcj.uw.edu.pl/en/experiments-and-research-facilities-at-hil/
CCB Krakow: BINA (Big Instrument for Nuclear Data Analysis for in-beam experimental investigations of the dynamics of few-nucleon systems; high-energy gamma-ray detection array HECTOR, which can be complemented with the PARIS array; KRATTA (Kraków Triple Telescope Array- 35 multi-module telescopes for charged-particle detection); large reaction chamber; large volume LaBr3 detectors; DSSS detectors. Detailed list of instrumentation: https://experimentsccb.ifj.edu.pl/?static=3.
It shall be mentioned that some of the offered instrumentation (HECTOR, PARIS, KRATTA, DSSS, NEDA, Ge-detectors), as well as the associated electronics, can be moved between the 2 infrastructures.
Services currently offered by the infrastructure:
SLCJ has at its disposal: mechanical and electronics workshops, target laboratory, detector laboratory, library, two conference rooms, 15 scientists and 38 technicians ready to help an external user.
CCB Krakow offers library and a conference room. CCB has at its disposal mechanical and electronics workshops. In addition, 7 scientists and 6 technicians can help the external users.
The user's community gathers: at NLC_SLCJ – 110 (70 foreign), at NLC_CCB – 130 (foreign 75) users.
Description of work:
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A. TA will be provided to about 10 experiments in the areas of nuclear physics, biology, nano-dosimetry and medical applications, including isotope production.
Since CCB Krakow is also a medical facility, where proton therapy of tumors with the two gantries has a priority, the nuclear physics experiments will have to be conducted during the time free of patients' treatment. This will be mainly at nights and during the weekends.
Support offered under this proposal:
Technical assistance of all kinds is provided by the SLCJ and CCB technical staff. Mechanical and electronic workshops are available for the users. Both might help in manufacturing and setting up equipment for use in experiments. A target laboratory can produce targets and a detector laboratory will help with handling/repairing detectors. The beam is tuned to the user's target, after discussion with beam engineers to define the experimentalist's goals. In house physicists assist and support the experimental teams in setup of experimental facilities and to perform measurements. A hostel for experimental teams (9 rooms) is available at SLCJ.
A10) n_TOF CERN
Description of the infrastructure:
Name of the infrastructure: The CERN neutron time-of-flight facility
Location (town, country) of the infrastructure: Geneva, Switzerland
Web site address: www.cern.ch/n_TOF
Annual operating costs (excl. investment costs) of the infrastructure: 14.7 M€ (for 6-month full-time operation).
Description of the infrastructure:
Accelerators involved: LINAC injector, CERN Booster, CERN Proton Synchrotron, offering access to the neutron beams (Task 3). The n_TOF facility is based on the 20 GeV/c proton beam from the CERN Proton-Synchrotron accelerator, transported to a target/moderator assembly that feeds two beam lines of length respectively of 185m (horizontal) and 18.2m (vertical) with respect to the incident proton beam direction. At the end of each beam line there are two fully equipped areas, EAR1 and EAR2, where the experimental activities are taking place. A third area, located at 2-3 meters

from the spallation module has been recently constructed (the n_TOF NEAR Station) which can provide higher neutron flux for irradiation activities and activation measurements.
The n_TOF facility is a world-wide unique installation which offers a pulsed neutron beam with an extremely wide energy spectrum covering the thermal region (sub-meV) up to the fast region with neutrons up to GeV energies. Very high resolution in low-background conditions in both experimental areas are characteristics of the facility, which coupled to the low duty-cycle/high-intensity characteristics of the driver accelerator makes n_TOF a unique neutron source for nuclear physics experiments.
Specific instrumentation, presently available in the experimental areas for neutron induced reactions studies includes beam monitoring, fission reaction detectors, Si-based detectors for neutron-induced light-charged-particle reactions, multi-detection spectrometer, a total-absorption calorimeter. Additional detection systems for capture gamma-ray spectroscopy (iTED, sTED), for neutron detection (TarT) and others are being developed and will be ready for innovative experimental activities from 2022.
Services currently offered by the infrastructure:
The n_TOF facility is embedded in the research infrastructure provided by CERN, which enables thousands of users worldwide to perform experiments for basic science. The n_TOF users are organized in a Collaboration which includes over 130 researchers from Europe. The n_TOF Collaboration, established in 2000, has so far performed 120 experiments, resulting in over 200 publications. The scientific activities have covered research domains in nuclear astrophysics (big-bang nucleosynthesis, nuclear cosmo-chronometry, stellar evolution models), in advanced nuclear technologies (accelerator driven systems, basic data for improved safety of nuclear installations) and basic science (medical applications, neutron radiography).
The beam for n_TOF is measured in terms of number of protons delivered to the target station. This amounts to (2.1–2.5)x1019 in a year-run (the equivalent of about 6-7 months). The proton pulses are spaced by an average of 6s (with a minimum of 1.2s) and intensities of 7x1012 protons/pulse. Experiments at n_TOF are characterized by large variation of the number of protons requested to achieve the required statistical accuracy. Some of the measurements performed so far have requested 6x1017 protons (less than a week), while others needed 10 times as much. At n_TOF, some experiments can run in parallel in the same experimental area. In addition, EAR1 and EAR2 receives neutrons at the same time, doubling the capabilities of measurements. Even more, the new NEAR Station will receive a neutron beam in parallel with EAR1 and EAR2, expanding further the accessibilities to neutron beams for experimental activities.
Description of work
Modality of access under this proposal:
General features, common to all RIs, are described at the end of section A. Measurement proposals are discussed by the n_TOF Collaboration Board before submitting to the INTC (ISOLDE and n_TOF Committee, which evaluates each measurement proposal based on the scientific merit and feasibility, eventually endorsing the project for approval to the Research Board which is responsible for the use of all beams at CERN, including the protons for n_TOF. It is reasonable to envisage (3-6)x1018 protons to be allocated for EURO-LABS projects in a year run, if the requested budget for TA access will be allocated. All the projects will be executed by users, which will be responsible for shifts during data taking, analysis of the results and for the scientific publications and dissemination.
Support offered under this proposal:
The technical and logistic support which CERN are providing to the large user communities are commonly shared with the n_TOF users and will be extended to the EURO-LABS project users for experiments with neutrons. This support is routinely provided to the nuclear physics communities operating at CERN, including those of ISOLDE and n_TOF. The quality of the scientific environment present at CERN needs not to be described in detail here, but it is certainly of top-level quality.
Common points for all RIs from A1) to A10)
Modality of access under this proposal:
The RIs described above fully meet the requirements for open access to international users. Access has to be asked by submitting a written proposal. An additional application form has to be submitted by the users interested in the EC support. Preliminary contacts with the responsible of the facility of interest must be established in advance in order to ascertain the feasibility of the experiment and to comply with the scientific scheduling and safety rules. Local research groups are in charge of technical support for the offered instrumentation. The unit of access is the beam hour, and it will be declared on the basis of unit cost, as already used for previous European projects (ENSAR, ENSAR2). The beam hour covers the experimental time when particle beam is delivered to the detector hall. It includes the preparatory work for the experiment. In all cases, the unit access costs charged to the EURO-LABS project are a small fraction of the real costs. Around 80% to 90% of the full cost of all fundamental research experiments performed at the various RIs will be covered by their own budget. Eligible users will receive support for travel and subsistence costs, as detailed in Tables 3.1h.
Outreach to new users:
Information on User Meetings, conferences or workshops relevant to users of each of the RIs are posted on the RI websites and widely announced via extended mailing lists. In addition, surveys are made when decisions have to be taken concerning the scheduling of beam time or developing of new beams. In most of the RIs, users are registered, and

this allows for an easy monitoring of their number on a year-by-year basis. In the present project this will be a standard for all involved RIs.
The breadth of the access provision of WP2 will be extremely attractive also to new users, to undertake advanced programs for fundamental research and for applications. Increased interest within the growing community involved in material science and quantum technology research will be triggered by the availability of new Radioactive Ion Beams. For industrial, medical and biophysics applications, outreach is achieved via dedicated sections in the RI web-pages and in the main EURO-LABS webpage, and an active participation in related conferences.
Review procedure under this proposal:
All of the RIs are issuing once or twice a year Calls for Proposals or Letters of Intent, widely announced to the user community by RI webpages, to conduct an experiment at a given facility. For each RI, submitted proposals are evaluated and ranked by a Program Advisory Committee (PAC), which is formed mainly by experts from abroad. Proposals for experiments are presented by their spokespersons in public sessions. The evaluation process by the PAC is based entirely on the criteria of scientific excellence. The selection of international users benefitting from the TA support is evaluated by individual User Selection Panels, where at least half of the members are external. It will also be based solely on scientific merit and communicated to the spokespersons. As a rule, all approved experiments that fulfil the TA eligibility criteria receive some degree of funding. The level of funding per experiment is chosen to be proportional to the number of beam hours scheduled. Priority is given to new users, young researchers and to researchers with limited funding for pursuing their research program at a given RI.
B. Task 4: Description of research infrastructures offering theoretical support for experiments
B1) ECT*, European Centre for Theoretical Studies in Nuclear Physics and Related Areas
Location (town, country) of the infrastructure: Villa Tambosi, Trento, Italy,
Web site address: www.ectstar.eu/
Annual operating costs (excl. investment costs) of the infrastructure: approx. 1.2 M€
Description of the infrastructure:
ECT* is a unique facility for research, collaboration and networking, and training in theoretical nuclear physics and related areas (Task 4). Established in Trento in 1993 by a concerted action of the European Nuclear Physics community, it is the only Centre of this kind in Europe and is similar in scope to the Institute for Nuclear Theory (INT) in Seattle, which started operating in 1990. Its mission is defined in the Statutes, and entails
• to be a Centre at the frontline of research in theoretical nuclear physics;
• to promote active contacts between theory and experiments, and to related areas of research;
• to further the training of young researchers.
The ECT* infrastructure consists of the beautiful Villa Tambosi and the adjacent Villa Rustica. Both villas offer ample discussion and office space over several floors. Villa Rustica contains a lecture room for up to 39 participants on the top floor and, at ground level, the main lecture theatre Aula Renzo Leonardi, for up to 70 participants. The latter is currently prepared for hybrid meetings, with in-person and remote participation enabled via the installation of cameras, microphones and screens. Hybrid delivery will start at the end of September 2021, covid permitting.
ECT* is the home of an active research group in nuclear physics and computational science, currently consisting of 5 permanent researchers and 10 postdocs. In the autumn of 2021, two PhD students will join, working collaboratively with colleagues in the Physics Department at the University of Trento.
Services currently offered by the infrastructure:
The ECT* scientific programme is built around 3 components: i) Workshops and collaboration meetings, currently about 22 week-long meetings each year; ii)Training of PhD student and early-career researchers via the Doctoral Training Programme and the TALENT School, each lasting 3-4 weeks; iii) Visitor programme.
Proposals for both workshops and training activities are solicited from researchers in the field and selected by the ECT* Scientific Board, see below. Visitors apply for extended stays directly to the Director.
The ECT* administrative staff, currently a team of three, delivers all supporting aspects of the activities. This includes setting up and maintaining the indico webpage and registration, hotel bookings, video links, and all non-scientific requests. The administrative staff is fully available during a workshop or training school, allowing the organisers to focus on the scientific aspects.
ECT* attracts about 800 participants each year (pre-covid), coming from around the world. It is a globally recognized place for nuclear science in the broadest sense and many participants return every other year or so. Under current Covid conditions, workshops are delivered via zoom meetings, allowing more participants to join for meetings. Similarly, the Doctoral Training Programme and TALENT school both attract PhD students from all around the world, enabling a diverse and inclusive environment.
The strength of ECT* is the openness to explore new topics and the willingness to support ideas which are very much under development or bring together various communities. As examples, the training programme for this year contains
• Doctoral Training Program 2021 on High-Energy and Nuclear Physics within Quantum Technologies, a 4-week programme combining lectures on quantum computing with lattice field theory;

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• TALENT School 2021 on Machine Learning applied to Nuclear Physics, Experiment and Theory, a 2-week hands-on programme training PhD students on the basics of machine learning, with relevance for nuclear physics.
The 2021 workshop programme includes meetings on heavy-ion collisions and new physics, neutron star mergers and nuclear astrophysics, the origin of mass, nuclear physics meets condensed matter physics, fermions in flatland, saturation at the future Electron-Ion Collider, the edge of stability, strangeness, and more. Particular attention is paid that every year workshops bringing together theoretical and experimental colleagues are being supported.
Description of work
Modality of access under this proposal:
Users typically visit ECT* as an organizer or participant in a workshop. It is also possible to join as a visitor, on an individual basis. Workshops usually last one working week, and participants are supported by the ECT* administrative staff for all practical aspects.
Unit costs are employed to cover all costs related to the running of the workshops in the infrastructure, i.e. use of facilities, running costs, research and professional staff.
Support offered under this proposal:
Participants are supported financially via lunch and coffee breaks, reduced rates at local hotels, and selected workshop dinners. Travel is typically not reimbursed. Participants sign daily declarations for monitoring purposes. ECT* provides a highly stimulating environment for discussion, not curtailed by administrative duties or other limitations. The availability of discussion rooms and offices enables smaller and larger groups of scientists to develop their research without interruption.
Outreach to new users:
ECT* announces its calls for proposals on its website and via email shots to individual researchers and research labs around the world. Moreover, the ECT* Director and members of the ECT* Scientific Board stimulate researchers to submit proposals in new, underexplored and/or interdisciplinary areas, to ensure a diverse programme of activities.
Bringing together experimental and theoretical researchers is of utmost importance for the field, as it stimulates new developments in both areas. With increased funding tied to this call, ECT* will be able to increase the number of workshops relating theoretical and experimental research supported each year, creating new opportunities. Workshop proposals tied to this call will be actively solicited and selected workshops will be assigned to this call specifically. These activities will be highlighted on the website, the poster of annual activities and the workshop Indico page. Monitoring will be carried out by reporting which workshops are supported by this grant, including the number and origin of participants.
Review procedure under this proposal:
The review and approval of scientific proposals for workshop and training activities is carried out by the ECT* Scientific Board. Current membership can be found on the ECT* website. Every five years ECT* is reviewed by an international review panel.
The annual scientific programme is constructed in a bottom-up approach, inviting proposals from researchers in the field in two calls per year. The ECT* Scientific Board selects the proposals to be supported. Membership of this Board itself is built upon proposals from the community, enforcing the community-led approach. The Scientific Board consists of esteemed researchers in theoretical and experimental nuclear physics in the broadest sense, as well as the Chair of NuPECC. The Scientific Board, together with the ECT* Director, plays an important role in steering the direction of ECT*.
Equality, diversity and inclusion is enacted by stimulating organisers to incorporate these principles in both the composition of the organizing committee, the selection of the participants and the construction of the workshop programme.
B2) Theo4Exp Virtual Access Infrastructure
Description of the infrastructure:
Name of the infrastructure: Theo4Exp
Installation 1: MeanField4Exp; Installation 2: Reaction4Exp; Installation 3: Structure4Exp
Location (town, country) of the infrastructure: Installation 1: IFJ PAN Krakow, Poland; Installation 2: University of Seville, Spain; Installation 3: University of Milano, Italy
The three installations will provide a virtual access (Task 4) to scientists requiring theory calculations of nuclear structure (inst. 1 and 3) and reactions (inst. 2), needed to interpret experimental data obtained in all the TA facilities listed in Task 1. Each installation will produce results from codes that will be gradually made interoperable, so that the output of some codes on one installation could be used as an input of the code in another installation.
Web site address: http://institucional.us.es/theo4exp
Annual operating costs (excl. investment costs) of the infrastructure:
Installation 1: 67.5 k€; Installation 2: 73.1 k€; Installation 3: 47.25 k€.
Description of the infrastructure: Theo4Exp virtual access infrastructure will provide theoretical tools for the EURO-LABS project as well as for the wider experimental nuclear physics community. It is designed as an open access platform, where key computer codes, as well as results of calculations, will be made accessible to the community. The relevant state-of-the-art codes for nuclear physics will be for the first time installed in an open access platform. Beneficiary

groups intend to maintain Theo4Exp as a long-term installation, and they will strive to maintain and update it beyond the scope of EURO-LABS.
Installation 1 (MeanField4Exp) will provide access to mean-field theory service in the domain of nuclear structure physics, including nuclear potential-energy surfaces, equilibrium deformations, shape coexisting minima, etc. Installation 2 (Reaction4Exp) will provide codes used for nuclear reaction calculations. The platform will focus on direct reaction calculations between a projectile and a target nucleus. Installation 3 (Structure4Exp) will provide virtual access to other codes that use advanced tools of nuclear structure theory. The codes make predictions about the bulk properties and the low- and high-lying excitations of spherical nuclei, based on various microscopic models. In this respect, installations 1 and 3 are complementary.
The results from the three installations are crucial to assess the feasibility of many experiments, as well as to compare experimental findings with well-established theoretical models. Most of the codes considered here are operational and can produce results of high scientific value. So far, they are rather independent. The initial scope (within 12-24 months) of the project is to create a common internet web site advertising the initiative and providing links to the three installations. In the second phase, the uniformed way of access to all codes and to pre-calculated theoretical databases will be provided, as well as the integration of the three components in terms of input/output structure. This will be achieved in three stages. Firstly, the codes and the data, offered by each installation, will be made available in a server at the corresponding host institutions. In a second stage, with the help of the contracted staff, the access to the three installations, that is, to the server of the three host institutions, will be accessible via the infrastructure website (http://institucional.us.es/theo4exp), with two types of open access: (1) Free access contents; (2) Remote computing and downland via access codes to be provided on request. At the last stage, the results from codes at the three installations will be gradually made interoperable, making it possible that the output of codes in one installation could be used as an input for a code in another installation. In that way, the required structure information about interacting nuclei in the installation 2 could make use of the outcome of installations 1 and 3. Cf. http://institucional.us.es/theo4exp/index.html for more information.
Services currently offered by the infrastructure:
Installation 1: MeanField4Exp
The installation will provide access to codes to perform calculations based on the mean-field theory and Hartree-Fock-Bogoliubov (HFB) approach. Six pre-defined themes available for the users will include calculations of: i) Static macroscopic nuclear energies (code Lublin-Strasbourg-Drop (LSD), Myers-Swiatecki) and macroscopic energies vs. spin, ii) Quasiparticle Routhians and alignments, Yrast and quasiparticle band energies and moments of inertia (HFB-Cranking), iii) Energies and structures of nuclear K- and yrast-trap-isomers, iv) Giant Dipole Resonance profiles at increasing spins and temperatures, v) Nuclear density functions for deformed nuclei, as well as access to vi) Large sets of pre-calculated results such as potential energy maps, electric and mass moments, reduced transition probabilities. The self-consistent HFB cranking theory has proven over the years its capacity to describe various nuclear structure phenomena. We will make access to the use of the HFB codes widely available, to provide tools of description of new findings of the experiments at the EURO-LABS TA facilities, from the mass measurements of nuclei far from stability to the study of new symmetries in nuclei.
Installation 2: Reaction4Exp
Key nuclear reaction codes will be included, which allow performing state-of-the-art calculations for experimental observables applicable for neutron-, stable- and exotic-beams. Fundamental structure properties such as spectroscopic factors, electric matrix elements, deformation parameters, etc., can be studied experimentally through the measurement of the relevant transfer, inelastic, or break-up cross sections. However, the quantitative relation of the measured cross sections with the structure properties can only be accurately established by sophisticated reaction codes, which will be made available in this installation.
The following four themes will be considered: i) optical model calculations (code FRESCO), ii) coupled-channels calculations, including elastic, inelastic, transfer, break-up and fusion cross-sections (FRESCO), iii) semiclassical calculations including inelastic scattering and breakup, more suitable for high-energy collisions (EPM_SEV) and iv) double folding potentials from density distributions (DFPOT, SPP).
Installation 3: Structure4Exp
The key nuclear structure codes available (SKYRME-RPA, HFBCS-QRPA and their dedicated versions) will produce output for basic observable quantities for spherical nuclei that are the subject of four themes of current experimental activity: i) binding energies, density distributions and mean square radii, ii) energies and wave functions/transition densities of the excited states, as well as electromagnetic transition probabilities to the ground state. This service is complementary with respect to that offered by Installation 1. In addition, we provide access to iii) calculations of charge-changing transitions, and iv) beta-decay half-lives.
In the experimental studies of high-lying Giant resonances and soft-mode states (e.g. Pygmy Resonances), theory is the only way to provide a link with the basic features of the nuclear equation of state, like incompressibility or symmetry energy. For low-lying states identified in stable and exotic nuclei, theoretical calculations can establish the relationship between measured electromagnetic transition probabilities and the underlying shell structure, giving rise to new sets of magic numbers.

The above mentioned predefined 14 (or more in the future) themes will be offered for the projects realized by the users. The codes, mentioned above, are described in more detail in the infrastructure web page: http://institucional.us.es/theo4exp.

Description of work

Modality of access under this proposal: The installations will offer open access of two types: (1) Free access contents. The nodes will contain information considered as free access for the general users. The free access to the webpage will be recorded for getting feedback but will not be computed as a unit of access. (2) Remote computing and download. The nodes will offer the possibility to run remotely some codes and download results and also to download pre-calculated data and some computer codes. Users will file an application to verify that they are linked to research institutions, and they will receive access codes. The unit of access will be the connection to the codes and files of the VA facility, using the access codes. If the access exceeds the hour, one unit of access will be added for each extra hour.

As Theo4Exp is a new facility, access costs will be reported on the basis of actual access costs.

Support offered under this proposal: Registered users will receive technical support from the computing scientists, contracted for the project, related to specific questions associated with the implementation of the codes downloaded or the remote running of the codes and scientific advice from contact scientists identified in each installation. This scientific advice will be associated with the applicability of different codes for a particular physical problem or set of experimental data at hand. The procedure to request support will be by e-mail addressed to the contact persons. Technical support will be monitored, to establish the satisfaction of the users.

Outreach to new users: The outreach will be achieved by a Theo4Exp web page, linked to the EURO-LABS sections, and will be also linked to the web pages of the relevant laboratories, research centres, etc. The web page will contain a section called “guide for first time users”. The use of the codes in the platform for training purposes, such as TALENT workshops (see the description of ECT*), will be encouraged. The present European project is a key opportunity to set a framework of key computing codes, on open access platforms, and the funding of personnel to set the common platform will create a virtuous circle of increased collaboration between theorists and experimentalists.

Review procedure under this proposal: An international review panel (IRP) for Theo4Exp will be established. This will be composed of three scientists from the beneficiary institutions, plus three external scientists. The chairperson of the IRP will be an experimentalist. The Theo4Exp IRP will meet annually. The Theo4Exp coordinating team (CT) will provide the IRP a comprehensive list of results and achievements, access statistics and users feedback. The IRP will produce yearly internal assessment reports.

N.B. FIUS (University of Seville Research Foundation) is the University of Seville´s third which will be in control of the financial issues of University of Seville (USE) with this project, offering its services without cost.

C. Task 5: Description of the offered service improvements

This task, coordinated by GSI, will provide improvements of the services offered by the RIs from the Tasks 1-3. Service improvement is a foremost perk of EURO-LABS, whose goal is indeed to provide advanced, state-of-the-art services to users of the RIs described in Part A, to make them more attractive and competitive. We have identified five major services, described below, which will be carried out in collaboration among different institutions, for the benefit of the entire community. Some of these tasks also address new issues created by the pandemics (remote access and INTRANS); others will lead to substantial improvements in target, ion sources, and beam delivery for biomedical applications. The work will be done to a large extent by local teams, with only a modest request for manpower charged to the project.

C1) Streamlined and remote access

Participants: UNIWARSAW (coordination), GSI, IFIN-HH, INFN Milano, UMCG. Associated partner: TUD Dresden.

The streamlined and remote access subtask aims at the improvement of accessibility to the European accelerator facilities. The task’s main objectives are: a) the implementation of a database and related webpage containing relevant information from all EURO-LABS accelerator nuclear physics facilities, also reachable by the main EURO-LABS website, and allowing a single-point access for TA proposal submission; b) development of a toolkit to improve off-site accessibility to European accelerator facilities.

The main goals are:

• improved dissemination of facility characteristics allowing an efficient access to the available resources in terms of the beam type, beam time availability, optimal exploitation of the facilities network by the users;

• streamlined proposal submission and complied information on the accepted proposals and the beamtime allocation;

• unified forms for the supported personal access to the TA experiments and comprehensive database of the TA support usage;

• minimisation of required access to experimental areas and travel time for on-call experts (leading to more beam on target and reduced load on expert resources on-site (local and external));

• fostering of off-site participation (leading to increased training opportunities for early-career scientists, improved inter-institutional knowledge transfer, early problem recognition and timely intervention);

The first three items will be developed in close synergy with the Dissemination objectives of the whole project (see WP5, Task 1).

The primary implementation of the Remote Access will imply two steps: firstly, the development of a comprehensive

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"toolkit", comprising a user-friendly, web-based database containing information relevant to the tools required for effective remote operations at the participating facilities; secondly, the relevant necessary items from the toolkit will be selected and implemented by the users, supported through training carried out both virtually and in-person (where possible). The toolkit itself will include, for example, recommended hardware/software, template scripts, operating manuals, web-based tools and procedural recommendations. Details regarding the development of effective online/real-time communication channels (hardware and protocols) between on-site and off-site personnel will also be incorporated.

C2) Targets

Participants: INFN (LNL-LNS) (coordination), CNRS (IPHC), GANIL, CNRS (IJCLab Orsay), CEA (Saclay), GSI, INFN (Turin), UNIWARSAW, IFIN-HH. Associated partners: LIP, PSI

The goal of the subtask is to gather, at a European level, the community of “nuclear target makers” having specific expertise in the field of target manufacturing and characterization, both for nuclear and applied physics purposes. Different research areas and applications, indeed, require high quality targets, ranging from fundamental physics (nuclear reaction studies, nuclear data measurements, etc.), passing through specific targets for strippers and neutron converters, up to the development of (usually) isotope-enriched targets for high quality standard medical radioisotope production. Target preparation is often a crucial step on the path towards the achievements of nuclear physics experimental results, or specific final nuclear “products”.

Specific activities will deal with: Study of existing and novel materials; Improvement of current and development of novel fabrication techniques; Characterization procedures; Sharing of knowledge.

The outcome will be a database, publicly available, containing the information about the preparation and the characteristics of available targets and those newly developed in various laboratories within this subtask. The first version of the database will be ready after the first year of the project and will be continuously updated during the duration of the project.

C3) Biomedical application (FLASH@EURO-LABS)

Participants: GSI (coordination)

The community working on biomedical applications at particle accelerators is already connected in the International Biophysics Collaboration (IBC: www.gsi.de/bio-coll). IBC is based at FAIR (GSI) but extends to all major current and future large-scale accelerators including those within EURO-LABS (GSI, GANIL, INFN and PARTREC). One major issue raised in IBC is to standardize and compare the beam delivery systems and dosimetry, especially in view of the FLASH irradiation, which is now a major trend in radiotherapy. FLASH is a novel ultra-high dose rate delivery system that has the potential to widen the therapeutic window in radiotherapy and where large research efforts are ongoing in all accelerators. These very high dose rates, where a therapeutic dose is delivered in <1 s, can only be achieved with charged particles, and indeed efforts are ongoing in different proton and carbon ion therapy centres in Europe (a similar activity is described in WP3, with electron beams). However, these efforts need to be co-ordinated. Different facilities will work together to upgrade the dosimetry and beam delivery system, eventually reaching a similar service level within the distinct capabilities of the different centres. FLASH poses challenges in dosimetry (because of the saturation at high intensity) and beam delivery (range modulators are needed to produce Spead-Out Bragg Peak at FLASH rates). We will share dosimetry and beam delivery systems among the facilities to optimize them. The main goal will be an inter-comparison of the FLASH beam delivery and dosimetry, demonstrating reliable and accurate service to the many users of this new modality.

C4) Improving Ion Beam services (ERIBS)

Participants: JYU (coordination), ATOMKI, CNRS (IPHC, LPSC), GANIL, GSI, INFN (LNL-LNS), UMCG.

ERIBS (European Research Infrastructure - Beam Services) aims at providing high-level ion beam services for the EURO-LABS research infrastructures by focusing on improvements in two key categories: a) ion beam variety and production efficiency; b) short and long-term ion beam stability.

All the main accelerator facilities in Europe rely on electron cyclotron resonance ion sources (ECRIS) for the production of high charge state heavy ion beams, and several other facilities utilize these sources as injectors or independent research installations. The final performance of all these facilities depends on the properties of the initial highly charged ion beams produced by the ion sources. Thus, the continuous source development is crucial for the future competitive operation of these laboratories on a global scale. Innovative and original approaches will be developed to make a significant improvement in terms of overall ion source performance, exploring non-conventional solutions in the plasma and ion beam monitoring and material evaporation techniques. This activity will lead to the improved production of metal ion beams for the user community (by induction oven and sputtering methods) and to improved operation stability and durability of highly charged ion beams, thanks to upgraded diagnostics methods and techniques.

C5) Optimal employment of travelling gamma detectors (INTRANS)

Participants: GSI (coordination), CNRS (IJCLab-Orsay), INFN (LNL)

This INTRANS (Instrumentation and Training for Nuclear Spectroscopy and Reaction Dynamics) subtask takes the challenge of providing an expertise on an optimal employment of experimental setups in EURO-LABS for nuclear spectroscopy and nuclear reactions communities. Large research collaborations in those two fields are investing huge efforts and resources in developing new instrumentation (such as, e.g., the AGATA detector array, to name the most

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challenging one), experimental methods and techniques for front-line research at the different research centres and universities across the world. Most of these techniques are of common interest and the exchange of information as well as the pooling and maintaining of resources will be of great benefit to the whole research community working at all facilities. This subtask will promote coordinated efforts of different collaborations owning detectors and experimental resources that can travel and be shared among the infrastructures of EURO-LABS for an optimal time period, leading to enhanced quality and scientific outputs of the experimental programs. Moreover, an optimal service for existing travelling detectors, including a crucial training of new experts on the state-of-art detector technology, will be provided, which guarantees a long-term availability of those resources.

Work package WP3 – (TA2): Access to Research Infrastructures for Accelerator R&D

Work Package Number	WP3	**Lead Beneficiary**	3. CERN
Work Package Name	(TA2): Access to Research Infrastructures for Accelerator R&D		
Start Month	1	**End Month**	48

Objectives

The work-package groups leading Research Infrastructures (RIs) offering trans-national access related to accelerator R&D across Europe. The activities are organized in the tasks below:
Task 3.1 – (TA) Material testing – participating RIs : CERN-HiRadMat
Task 3.2 – (TA) Technology infrastructures – participating RIs : UU-FREIA, INFN(LASA,THOR), CNRS/IJCLAB-SUPRATECH, CEA/IRFU-Synergium, CERN-XBOX
Task 3.3 – (TA) Electron and plasma beams – participating RIs : KIT-ALFA(KARA,FLUTE), UKRI-CLARA, INFN-LNF(BTF, SPARC-LAB), CEA/LIDYL-LPA-UHI100
Task 3.4 – (TA) Applications – participating RIs: INCT-RAPID, CERN-CLEAR.
A description of each RIs and the work planned follows below. A part of the EURO-LABS resources in WP3 will be devoted to service improvements towards the users, summarized in the table below. Details are provided in the description of work of each RI.

Task RI Improvement Impact
3.1 HiRadMat Studies to: Use lower extracted proton beam energy (50-100 GeV), and accept higher ion beam intensity. Acces interesting energy range for muon collider studies. Energy density depostion on materials for ion beams comparble to other facilities but at higher rigidities.
3.2 FREIA Upgrade instrumentation to: widen the available range of RF cavity frequency range, and add the possiblity of magnetic field eaurements at cold Expand user spectrum, improved test quality and possiblities.
3.2 LASA Upgrade of control systems, data storage, HMI Easier exploitation of the facility capabilities
3.2 THOR Propose general purpose mechanical interfaces and high-sensitivity temperature sensors Easier and flexible installation, improve data quality for experiments
3.2 IRFU-Synergium Improve range of magnetometer to 200 mT Improved RF cavity test performance, assess new SCRF materials with performances exceeding bulk Niobium
3.3 KIT-ALFA Development of an integrated simulation and measuremetn framework Facilitate preparation of experiments, improved test conditions and data availablity and analysis
3.3 LPA-UHI100 Increase electron source rep reate to 1Hz from 0.03Hz presently. Improved experiment conditions, in particular for medical applications

Common review procedure to be used for user selection:
Each task in WP3 will have a User Selection Panel (USP), established at the beginning of the project. The members of the USP will be the Task Leader (chair), the Facility Coordinators (FC) of each RI, and international experts in the field, independent from the beneficiaries, up to one half of its members. The WP Coordinator will also be member of the USP, and to facilitate communication, avoid duplication of experiments, and direct experiments towards the most appropriate facility, the Task Leaders of the other tasks can attend the meetings as well. The user groups must request access by submitting (in writing) to the EURO-LABS WP3 Task USP a description of the work that they wish to carry out for testing of and the names, nationalities, and home institutions of the users. A web-based application procedure hosted in the EURO-LABS website provides an entry to EURO-LABS TA(or VA) of each RI. Requests are first reviewed by the FC of the corresponding RI that examines if they fit some basic technical criteria to be accepted, and then passed over to the USP for review and evaluation based on scientific excellence. In case of requests with the same scientific merit, priority will be given to new users and users coming from countries where such infrastructure is not available. Willing to

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promote the values of EURO-LABS, the mixed teams from different countries, different universities formed by senior and junior scientists or even with industrial partners would be given priority and stronger recommendations from the USP. Then the ranking of the proposals will be handed over to the Local Selection Committee (LSC) of each RI which will allocate access for each project and user. In case of incompatibility with the technical requirements or with the facility schedule, the LSC will have the right to refuse applications and send them back to the Task USP with recommendations for technical improvements or schedule changes. Typically, requests are handled on a yearly basics or other frequency defined by the USP; urgent requests will be evaluated ad-hoc. In case certain facilities receive an overwhelming number of excellent proposals, the USP may recommend some of the projects to be carried out at another facility.

Description

Task 3.1 : (TA) Material testing
Provision of access to the following infrastructure(s): CERN-HiRadMat
Description of the infrastructure
Name of the infrastructure: CERN-HiRadMat
Location (town, country) of the infrastructure: CERN, Geneva, Switzerland
Web site address: http://cern.ch/hiradmat
Annual operating costs (excl. investment costs) of the infrastructure :1’920’000€
Description of the infrastructure:
HiRadMat (High-Radiation to Materials) is a user facility at CERN, designed to provide high-intensity pulsed beams to an irradiation area where material samples as well as accelerator component assemblies can be tested. HiRadMat uses the extracted beam from the CERN-SPS (Super Proton Synchrotron) with up to a few 10E13 protons/pulse with the LHC time structure and momentum of 440 GeV/c. The fast (single turn) extracted beam is transported into the HiRadMat experimental area where the test setup of various radiation-to-material experiments are installed. The beam spot size at the focal point at the experiment can be varied from 0.5 to 4 mm^2 to offer sufficient flexibility via different deposited energy densities. The facility can also provide heavy ion beams like Pb82+ with a beam energy of 177.4 GeV/nucleon (36.9 TeV per ion) resulting in a pulse energy of up to 21 kJ. HiRadMat as a dedicated facility for material and component testing with LHC type particle beams parameters is unique today
Services currently offered by the infrastructure:
Users of the facility have access to all available infrastructures at CERN and receive technical support from the CERN HiRadMat facility’s team. Apart from the irradiation area this also includes a preparation area with easy access, a control room, the support on logistics like transport, installation and radiation-protection monitoring as well as specialized, high-performance instrumentation for tests and measurements during the experiments. In the framework of EUROLABS at least 20 experiments are expected, with participation from several countries including Norway, UK, US, Italy, Austria, Japan, Czech Republic and Malta.
Description of work
Modality of access under this proposal:
The operation time (including beam time) will be provided free of charge to the participating partners. During several periods of the SPS operational year windows for experiments with beam will be provided (on average 6 slots per year). The dates for these windows will be defined in the framework of the yearly SPS scheduling and in agreement with the CERN relevant scientific committees.
Considering the necessary installation time and personnel resources, the HiRadMat facility can host experiments with at least 4 weeks interval in-between. With the availability of experimental team and equipment the average delay between beam slots is typically 7 weeks interval. During the EUROLABS project (assuming spring 2022 to spring 2026) the Long Shutdown 3 at CERN is presently planned, resulting in beam unavailability between 2025 and 2026. The HiRadMat Beam Time (HRM-BT) is defined as the time with a HiRadMat cycle within the SPS Super Cycle. On average an experiment needs 1 shift (8 hours) of beam preparation by the BE-OP team and one 8-hour shift for beam-based alignment that certain experiments require. The beam time per experiment typically amounts to 1 shift (8 hours). An average of 21.5 shifts per year is expected for the duration of EURO-LABS.
Support offered under this proposal:
CERN operates the accelerator complex including the SPS and the beam transfer towards the HiRadMat facility. This includes the infrastructure for the experiments, installation of the experiments, preparation of the beams, and the beam operation during the experiments. The HiRadMat users will also have access to all available infrastructure like on-site hostels and restaurants, bank and post, library, temporary office space and internet.
For each approved project (experiment) in HiRadMat the TA support could cover travel costs and subsistence expenses of the collaborators for any of the activities related to the experiment: participation to preparatory discussions during approval phases, training on safety and usage of the facility, pre-assembly and experimental setup at the surface lab, installation of the experiment, beam operation, dismantling and final transport and safety clearance procedures.

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Consumables and small works for the adaptation of the infrastructure, handling and transport of radioactive material related to the experiments in/out and within CERN could be covered within capacity.
Service improvements within EURO-LABS
The HiRadMat facility of CERN SPS, is a unique test-bench for performing single-pulse experiments and studies of a variety of beam-to-material effects. The applications for beam intercepting devices or accelerator components are numerous. To-date, the facility operates in “single pulse" mode, and with the maximum SPS momentum of 440 GeV/c. The possibility of a proton beam with lower momentum of the order of 50 or 100 GeV/c, keeping the 3ns bunch structure of HiRadMat and a repetition rate of ~50 Hz could open the possibility for dedicated experiments both for material science (high-power targetry), but also for unique physics experiments and detector R&D. The latter would be of particular interest towards a future muon collider. This extraction of lower proton energies, as well as most importantly the possibility of a suitable repetition rate needs to be studied in detail.
In terms of ion physics, currently HiRadMat is not competitive compared with other ion facilities, given the very small baseline number of 5E7 ions / bunch. This maximum allowed intensity is a limiting factor, since the important quantity is the deposited energy density. For protons, HiRadMat is world-unique with ~20 kJ/g, while the case of ions the facility remains at 0.34 kJ/g, orders of magnitude lower compared with FAIR or GSI, or future facilities in China that will be providing ions in the order of 1E11 ions / bunch. The improvement of this intensity (complemented possibly by lower ion momenta) will open new possibilities for the facility, making HiRadMat either complementary to FAIR or other ion facilities, or even more competitive, given the fact that HiRadMat would be able to provide ions in much higher rigidities (up to 440 GeV/c/Z) than all the other facilities.
We propose a DOCT to study the above possibilities, shared between BE-OP, BE-EA and/or TE-ABT for 36 months based at CERN. EURO-LABS will cover 50k€, while the laboratory will cover the remaining funds
Outreach to new users:
Since its conception, HiRadMat has been widely advertised to the accelerator and HEP community with presentations at international workshops, seminars in major labs and publications including EUCARD, EUCARD2, and ARIES newsletters. The presently established user community includes research teams involved in high power target studies, in accelerators for neutrino production, in modelling and tests of shock waves, and in High Energy Density Matter. Recently an international workshop has attracted wide interest from other communities as plasma physics or astrophysics. Moreover, the yearly call to establish the experimental schedule of the facility will be advertised by a dedicated e-mail distribution list, published in EUROLABS newsletters, and advertised at conferences and workshops. Dedicated workshop for ion physics will be also organized that will drive studies for the upgrades of the facility.
Task 3.2 : (TA) Technology Infrastructures
Provision of access to the following infrastructure(s): UU-FREIA, INFN(LASA, THOR), CNRS/IJCLAB-SUPRATECH, CEA/IRFU-Synergium, CERN-XBOX
Description of the infrastructure
Name of the infrastructure: FREIA (GERSEMI and HNOSS)
Location (town, country) of the infrastructure: Uppsala, Sweden
Web site address: https://www.physics.uu.se/research/freia
Annual operating costs: 1,732,353 €
Description of the infrastructure:
The Facility for Research Instrumentation and Accelerator development (FREIA) laboratory at the Department of Physics and Astronomy of Uppsala University, is a leading facility for accelerator R&D in Sweden and is contributing to international and national accelerator projects, such as ESS, HL-LHC, CLIC, MAX IV etc. It is equipped with RF and cryogenic infrastructure which allows development and testing of state-of-the art superconducting accelerator components. In particular, the laboratory owns two multi-purpose cryostats for accelerator research based on superconducting technology. The first is a vertical cryostat GERSEMI for superconducting magnets and cavity testing. The availability of testing both magnets and cavities is unique in the world. The second is a horizontal cryostat HNOSS for superconducting cavity testing. This cryostat offers simultaneous experiments of two cavities equipped with high power couplers and such opportunity is unique in the Europe.
Services currently offered by the infrastructure:
The FREIA laboratory has been focusing on prototyping components for the ESS and HL-LHC projects. An ESS elliptical cavity and double-spoke cavity were firstly qualified with their fundamental power couplers in HNOSS. Also, cryogenic and RF equipment was used to qualify the prototype ESS double-spoke cryomodule. A prototype crab cavity and corrector magnet for HL-LHC were tested in GERSEMI. These tests were partially supported by the ARIES Transnational Access. These achievements demonstrated that the equipment could be used for future R&D of large-scale superconducting technology in the accelerator community.
Description of work
Modality of access under this proposal:
A user or user group will get an access to test their superconducting cavities or magnets in GERSEMI or HNOSS, which will be operated by FREIA personal. A typical duration of a project is 6 weeks. The project fits in between other ordinary

projects of FREIA. 240 units (6 weeks * 5 days * 8 hours) of access will be offered for one experiment per one year. This includes on-site preparation, which blocks the infrastructure. In total, we offer 4 experimental opportunities for 4 years. The total access cost is estimated to be 191250 EUR.
Support offered under this proposal:
Academic staff will advise and assist the users. Engineers with academic training will assist the users during preparation, installation and operation of the facility in areas like vacuum, cryogenics RD and use of control systems offered by the facility. Facility staff can arrange logistic support through local companies. The facility is located at the Polacksbacken campus of Uppsala University which houses the departments of Physics and Astronomy, Mathematics, Engineering Sciences, Chemistry and Computer Sciences. Students at all levels are an active part of the campus. These supports were qualified by the past projects at FREIA, such as ESS, HL-LHC and ARIES Transnational Access.
Service improvements within EURO-LABS
To provide services for a wider user community, FREIA needs to develop more general-purpose instrumentation. Moreover, procurement of some critical instruments currently shared with other projects is an asset to provide smooth service to external users to avoid complicated scheduling and delays. Therefore, we propose to develop using in-house expertise the following instrumentation:
• For the RF cavity test stand: i) a dedicated self-excited-loop system for broadband based on NI-PXI FPGA card (40 k€), ii) CW power amplifiers (700 MHz, 1.3 GHz) (40 k€), iii) magnetic field (<1uT) sensors based on fluxgate technology (10 k€), and iv) dedicated residual gas analyser (10 k€)
• For the magnet testing: i) a magnetic field measurement system based on rotating coils (50 k€), and ii) an upgrade to the cryogenic regulation in order to allow stable operation above 4 K for HTS magnets (50 k€).
The timeline of realization is 1-2 years after the start of EURO-LABS. We will prioritize the improvements depending on the projects proposed by users. The EURO-LABS contribution to these improvements is at the level of 200 k€, while the additional costs will be covered by FREIA.
Outreach to new users:
The opportunity will be advertised in a web page and mailing list of the relevant communities. The potential user community is established: superconducting cavity and magnet groups in Europe and in the world. There are plenty of on-going R&D activities for future superconducting accelerator projects, including HL-LHC, Future Circular Collider, International Linear Collider, CW upgrade of Eu-XFEL, MYRRHA, EUROSOL, etc. The bottleneck of these activities is a conflict against present projects under the limited cryogenic resources. The FREIA laboratory can offer a very precious opportunity for researchers who develop new superconducting components without having chances to test it in their own laboratory. In particular, the unique cryostats in FREIA would open up for completely new experiments in prototyping activities for future accelerators. For example, no other infrastructure in Europe can host two superconducting cavities unlike HNOSS at FREIA.
Description of the infrastructure
Name of the infrastructure: INFN-LASA
Location (town, country) of the infrastructure: Milano, Italy
Web site address: https://homelasa.mi.infn.it
Annual operating costs (excl. investment costs) of the infrastructure: 200’000€
Description of the infrastructure:
The INFN laboratory LASA (Laboratory for Accelerators and Applied Superconductivity), is a centre of excellence at an international level in the field of advanced technology for particle accelerators based in Segrate, near Milan. The LASA develops advanced technologies for superconductivity, cryogenics and the productions of high intensity DC and RF electromagnetic fields. Here the first European superconducting cyclotron, and third ever realized worldwide, was designed, assembled, and tested. The cyclotron has been in operation since 1994 at the INFN National Laboratories of the South in Catania. The main mission of LASA currently is the development of radiofrequency superconducting resonators for particle beam acceleration and superconducting magnets for particle beam orbit and focusing. Alongside this, LASA perpetuates its tradition in the experimental field by participating in the study and development of experiments in the field of innovative acceleration schemes.
The activities undergoing and starting at LASA foresee the presence of four main test installations devoted to: i) Superconducting Magnets, ii) Superconducting RF cavities, iii) High Brightness Photocathodes for Electron Sources, and iv) Laser Applications to High Power Fabry Perot Cavities and Advanced Timing Systems. A short description of the three first facilities and their usage in the last years is provided below. The Laser related facility is under final assembling, and it will be ready for operations in September 2021 in a new area of the lab, specifically designed for this activity. The main experimental area of the laboratory has nearly 1000 square meters of footprint.
Services currently offered by the infrastructure:
The superconducting magnets group has experience in design, construction and test of superconducting magnets, both for accelerators facility and for detectors. The experimental infrastructure includes facilities for very precise critical current measurements (at 1.9 K or 4.2 K, with back-ground field up to 15 T and current up 2 kA) and for testing of superconducting magnets from medium to large dimensions. The internal laboratories for model and prototype

development include winding machines, a small furnace for high temperature thermal treatment and an oven for vacuum impregnation. These activities are part of many international collaborations in Europe (CERN, CEA CIEMAT, etc.) and abroad (FNAL, LBNL, BNL, etc.) in the framework of different projects for development of superconducting magnets as HiLumi-LHC and FCC-hh. The activities above described are intrinsically based on International Collaborations.
The superconducting RF Group at LASA has a long-standing experience in many fields related to Superconducting RF and Photocathodes. The RF experimental infrastructure available at LASA includes a test stand for measuring cavities in cryogenic conditions (lowest temperature 1.5 K) with dedicated diagnostic for quench detection (Second Sound and Fast thermometry) and field emission measurement (photodiodes at cold, energy spectra at warm). An ISO4 Clean Room and High-Pressure System complete the facility. Moreover, a complex UHV system is available for growing alkali-based photocathodes that includes different light sources for optical measurement and a Time Of Flight spectrometer for low energy electrons. These activities are part of many international collaborations in Europe (CEA; UKRI, DESY, HZB, etc.) and abroad (JLAB, FNAL, LBNL, TSINGUA Univ., Pecking University, etc.) in the framework of different projects as European-XFEL, ESS, PIP-II, PITZ, SHINE to mention a few. The activities above described are intrinsically based on International Collaborations.
The test facility for Laser Applications to is devoted to 3 different aims: i) provide a suitable setup for investigating the physics and the technology related to Fabry-Pérot (FP) cavities for inverse Compton scattering (ICS) X-Ray sources, ii) provide a high power, tunable repetition rate laser system for exciting a High Voltage photocathode-based test bench to assess the quality and the capability to provide high intensity electron bunches, iii) provide the source for high quality reference timing systems for advanced accelerators and related experimental facilities. The core of the test facility is based on a complex laser system arranged on two optical tables, as shown in the picture below. On the first one, are positioned the main oscillator, the fibre amplifier system and the two FP cavities. On the second, located near to the photocathode, will be the second fibre amplifier system, the Pockels cell and the process chain that treats the light pulses before they reach the photocathode. A small portion of the light coming from the primary oscillator on the first optical table will be brought to the second through an optical fibre. The user community is expected firstly to belong to LAL (Orsay-France) and Paris Sud University and then we expect to expand since the setup is potentially attractive for different categories of users. A third optical table is devoted to the HV photocathode Test bench and to host the main opto-electrical interfaces for timing applications. The activities that allowed us to design and assemble the facility have been carried out within a noticeable collaboration with researchers of the Paris Sud University. This collaboration will continue now that the facility is ready and there are already general agreements to perform common research activities there.
Description of work
Modality of access under this proposal:
The users that had access to the LASA facilities above described in the past years were part of the International Collaborations where the research teams of LASA were involved. The presences were organized based on the single requests arising from them. Within the frame of EURO-LABS, user requests will be evaluated and prioritized via the WP3-Task3.2 USP as defined above. At the local level, we are going to organize the simultaneous presence of several groups to improve coactivity conditions. The planning of the activities will be organized on a yearly timescale with some provisional stops for maintenance operations. The schedule so far defined may be reviewed to better fit specific user needs. The typical duration of an experimental campaign is one week for the setup of the experiment to be carried out and one week more for data acquisition. In detail, for the SC magnet tests we expect access to our infrastructure for 2 persons for three weeks for superconducting magnet tests, 3 weeks for participation to critical current measurements and at least 2 weeks for development and construction of superconducting magnets. For the superconducting RF tests we expect access to our infrastructure for 2 persons for three weeks on photocathodes (PITZ), 2 weeks for participation to cavity preparation and testing (CEA) and at least 2 weeks for development of cavities and related ancillaries (HZB). Last, for the laser applications the activities related to this facility will surely foresee the access of 2 persons for at least 4 weeks immediately in the short and medium term.
Support offered under this proposal:
The users will be fully supported during their experiments. Scientific and technical assistance will be provided by the people of the LASA lab. At the beginning of the activities of each group a specific training course will be organized to face all the aspects involved by the presence and operation at LASA.
Service improvements within EURO-LABS
The possibility to expand the number and the panorama of possible users will request few improvement activities on the following subsystems: control system performances, new data storage and analysis networks, more comfortable HMI facilities, improvement of user related common instrumentation. The EURO-LABS contribution to these improvements is at the level of 100 k€, while the laboratory will cover the remaining funds.
Outreach to new users:
New potential users can find useful information and news in a specific page of the INFN-LASA Web site. Starting from this point they may contact the reference researchers mentioned for the different facilities available at LASA to verify

the feasibility of their proposals. With special reference to the more recent activities above described the proposals from external users may provide unique opportunities to better tune the structure of the facilities.
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): INFN-THOR
Location (town, country) of the infrastructure: Salerno, Italy
Web site address: http://www.eu-amici.eu
Annual operating costs (excl. investment costs) of the infrastructure: 600,000€
Description of the infrastructure:
THOR is an infrastructure dedicated to horizontal test of accelerator superconducting magnets, specifically built to perform final test of complete cryomodules. The actual laboratory size is 30 m x 15 m, with a 20 ton crane (8 m clearance below). It also has dedicated workshops. The infrastructure includes a refrigerator system in the isobaric mode (200 W @[4.5-6] K, 15 g/s, plus 500W @[50-80] K for shields), but it also has the J-T stage for LHe production (up to 120 l/h), and it is provided with a gas purifier. The laboratory is also equipped with a fast ramped Danfysik power converter [10+10] kA (series/parallel switchable, +25/-20V each). The facility will include two test lines to host two modules (presently the first is under commissioning while the second has just been awarded for manufacture).
Services currently offered by the infrastructure:
THOR is a new facility, expected to start operation and receive users by January 2022. Further than magnets tests, it can also be used also for developing cryogenic tests with LHe in the liquid or gas phase, e.g. for cryogenic flowmeters or other cryogenic sensors.
Description of work
Modality of access under this proposal:
THOR will participate for first time in a TA programme, so will follow practices and experience form other facilities in WP3. A Web page will be setup with the facility information and access possibilities. Users will submit a request for a specific experimental work for evaluation by the USP and the Local Coordinator. THOR will offer up to two units of access (for a total of 1 month/year) under specific cryogenic test. We include the local support, both for the preparatory work and for operating the facility.
Support offered under this proposal:
The INFN local group is presently made of three scientist and two technicians, integrated by a development scientist and a technician from University, which can provide support for development of specific test, including the design and the manufacturing of adaptation work when required.
Service improvements within EURO-LABS
In the framework of EURO-LABS an effort to improve the design of the mechanical adaptation parts towards unified solutions will be done. Further, high-sensitivity sensors for temperature measurements at cryogenic temperatures will be installed that should add to the quality of the results for the experiments. The EURO-LABS contribution to these improvements is at the level of 20 k€, while the laboratory will cover the remaining funds.
Outreach to new users:
AMICI Web page where THOR is participating (http://www.eu-amici.eu) will be the entry point for users.
Description of the infrastructure
Name of the infrastructure: CNRS/IJCLab-SUPRATECH
Location (town, country) of the infrastructure: Orsay, France
Web site address: https://www.ijclab.in2p3.fr/plateformes/supratech/
Annual operating costs (excl. investment costs) of the infrastructure: 220’000 €
Description of the infrastructure:
The SUPRATECH research platform is dedicated to R&D on superconducting accelerating cavities intended to constitute future powerful accelerators of high-energy particles. It provides all the equipment necessary to prepare, condition, assemble and test a superconductive cavity and its associated components, with in particular: an ISO4 clean room, a laboratory for surface treatment by chemical etching, an oven for thermal treatment under vacuum, an installation producing superfluid liquid helium, a calibration station for cryogenic thermometers, as well as various experimental zones equipped with RF power sources and several cryostats also allowing generic tests at cryogenic temperatures.
The platform consists of: a) An etching laboratory: where the cavity surfaces are treated in acidic baths, in order to eliminate all defects likely to generate electron spurious emissions, b) Cleanrooms: an ISO4 classroom clean room (covering 80 m2, 50m2 of which are class10) essential for the cleaning and assembly of superconducting cavities. Two Cleanrooms for power coupler activities: a split cleanroom ISO4 (12m2) + ISO6 (25m2) for cleaning and assembly, and a second ISO5 (40 m2) for baking, RF conditioning, assembly and disassembly, c) An assembly hall: dedicated to the integration of the cryostats, d) Three experimental halls: 2 halls equipped with vertical and horizontal cryostats to test and RF validate the cavities. And a third for power coupler conditioning activities.
To optimize the use of these infrastructures, the platform is equipped with: RF power sources operating at 88 MHz, 350 MHz, 700 MHz, 1.3 GHz and 325 MHz frequencies, a station including a helium liquefier and its associated recovery

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and compression system ; this very expensive gas, the release into the atmosphere of which would be anti-ecological, and which is here carefully recycled, and a 400 kW and 300 kW cooling systems (HF sources and cleanrooms)
Services currently offered by the infrastructure:
The SUPRATECH facility includes equipment and technical area for the development, the preparation, assembling and testing of SRF cavity, power couplers and accelerating cryomodules equipped with the cryogenic cold box and housing SRF cavities fully dressed with their ancillaries (e.g. power coupler, magnetic shielding, cold tuning system, pumping systems, instrumentation). The cold tests are performed at liquid helium temperature in the range 1.7 K- 4.2K. The RF instrumentation and RF power sources allow to perform both low (up to 200 W) and high RF power (from 80 kW to MW peak power) tests at three main frequencies (352 MHz, 704 MHz and 1.3 GHz) and soon a fourth one at 325 MHz.
Description of work
Modality of access under this proposal:
IJCLab will make available the Supratech platform for 30 days of RF tests in the upcoming 4 years. Virtual access (VA) will be used for the expected tests of RF cavities constructed in the framework of PIP-II project, requested by teams from FermiLab, US as final validation test before shipment to US. The global cost of the tests is 105 k€.
Support offered under this proposal:
A strong support of all the required expertise (RF, Cryogenics, vacuum, control system) will be made available during the test duration.
Outreach to new users:
Opportunities on Supratech and its availabilities will be advertised on several Websites such as IJCLab, I.FAST and AMICI Collaboration website and through communications on conferences, workshops, industrial forums and all other relevant events.
Description of the infrastructure
Name of the infrastructure:CEA/LRFU-Synergium
Location (town, country) of the infrastructure: CEA Paris Saclay, 91191 Gif-sur-Yvette (France)
Web address: http://irfu.cea.fr/dacm/en/index.php
Annual operating costs (excl. investment costs) of the infrastructure: 220’000(€):
Description of the infrastructure:
The CEA/Irfu-Synergium includes two installations: a platform for the manufacturing and characterization of thin film of superconducting layers on radiofrequency cavities (MACHAFILM), and a platform for the characterization, analysis and measurement of materials at low temperature (CRYOMECH)
The performances of many particle accelerators key components, like the SRF accelerating cavities or the beam lines themselves, are often limited by the behaviour of the component materials, which is subjected to stringent operating conditions in the specific accelerator extreme environment (e.g. ultra-high-vacuum, cryogenic temperatures, high electromagnetic fields, irradiations). To face the next scientific and technical challenges of particle acceleration systems, it is therefore mandatory to go beyond the present state-of-the-art and try to develop new materials, new fabrication methods, new innovative surface treatments (chemical, thermal, mechanical…) and master in an optimal way the preparation and assembling processes, including quality control procedures.
This especially applies to the case of SRF accelerating cavities, the performance of which is limited by phenomena occurring in a very thin surface layer inside the cavities like anomalous RF losses, field emission, multipacting or thermal quench. These phenomena are always strongly linked with the material properties: electrical and thermal conductivity, purity, surface defects, secondary electron emission yield, surface desorption... It is therefore crucial to pursue a strong and focused R&D program on these aspects to be able to push forward the present limits and propose new optimized technical solutions, using possibly new superconducting materials for example.
CEA teams have presently a world-leading expertise in superconducting linacs and more generally in SRF science, based on top-level technological platforms. They are specially recognized for mastering the technology of low beta superconducting cavities and for the researches and results obtained on superconducting material for acceleration (preparation, treatment, innovative materials).
To further strengthen their influence in the field and provide them the means to realize technological breakthroughs in the near future, the CEA Irfu proposes to partners to use their specific equipment and analysis devices dedicated to materials characterization (MACHAFILM) and to the development of innovative material deposition technologies for the next generation of SRF cavities and associated cryomodules. MACHAFILM includes: an Atomic Layer Deposition reactor, with deposition chamber, 50 cm long and 5 cm in diameter, with an adjustable temperature of 30 to 500°C and seven precursor distribution lines, and a characterization apparatus of superconducting samples by measurements of the Residual Resistivity Ratio ($Ø \leq 0.15$ m, $h \leq 1$ m, $4.5\ K \leq T \leq 300\ K$), the first critical field HC1 ($Ø \leq 0.3$ m, $h \leq 1.33$ m, $2\ K \leq T \leq 40\ K$) by magnetometer and mapping of the superconducting surface properties of samples by tunnel spectroscopy to infer some of the fundamental quantities related to the superconductor (i.e., its superconducting gap Δ, its critical temperature TC, and its quasiparticle inelastic scattering coefficient Γ).
The future projects foreseen in the European roadmap of nuclear and particle physics are based on radically enhanced performances and dimensions of accelerator facilities. More precisely, there is an increasing demand to characterize

materials for superconducting magnets (SC-magnets) for various applications: 1) High Luminosity upgrade of the LHC and preparation of the next-generation high-energy frontier colliders, which require fields in the range (12T to 20 T), 2) detectors for High-Energy Physics (HEP), 3) fusion reactors (i.e. ITER in Europe and JT 60 SA in Japan), 4) medical imaging and materials science, which need fields up to 25 T, 5) power applications (i.e. SC wind turbines and SC motors for electrical planes).
To support this R&D and search for possible alternative optimized technical solutions, it is essential to use suited technological equipment dedicated to mechanical testing, of the materials used in the prototypes. To achieve this goal, CEA proposes to use one already existing platform, i.e. a mechanical test bench for mechanical tests on samples (CRYOMECH), at high stress level and cryogenic temperature. CRYOMECH includes: a test station dedicated to the measurement of thermal conductivity of insulators and conductors at low temperature with the following specification: Ø ≤ 0.5 m, 3.8 K ≤ T ≤ 300 K, and a mechanical test laboratory: traction, compression, bending and slippage (T= 4.2 K or 77 K or 300 K) with: a hydraulic press with a compression capacity of 1600 kN, an Instron electromechanical machine with a traction and compression force of 300 kN, an Instron electromechanical machine with a traction and compression force of 150 kN. This machine can be fitted with two cryostats for tests at cryogenic temperatures: one with a traction and flexion capacity of 45 kN, and the other with a traction capacity of 80 kN and a compression capacity of 150 kN.
Services currently offered by the infrastructure:
The CEA Irfu team working on MACHAFILM for thin film technologies for SRF cavities is internationally renowned. It is involved in many collaborations with US (ANL, JLAB, Fermilab…) and in Europe, for instance within the former ARIES H2020 project. A full WP, co-coordinated by CEA Irfu is devoted to thin film technologies in the recently started I.FAST H2020 project, demonstrating the interest of the community.
In the CRYOMECH installation, different types of studies are performed in the mechanical test laboratory: studies aiming at selecting technical solutions, tests of prototype components and R&D studies on the mechanical behaviour of materials, such as austenitic stainless steels, aluminium alloys, titanium alloys and composite materials, either for foreign partners (Jlab, Fermilab, CERN…) or for industry (Velan, Air liquide, Airbus Group…). As examples of tests done recently, one can cite: i) optimization tests (tightening and surface preparation) of the friction on fastening components of the Tokamak JT-60SA « Outer Intercoil Structure », ii) validation tests of mechanical concepts for the manufacturing of the support ferrule (diameter d ≈ 30 cm) of the LNCMI project magnet, and iii) qualification tests of welding processes.
Description of work
Modality of access under this proposal:
The two platforms will be available for test/characterization/measurement of components or samples brought or sent by users or groups of users, but they will be operated by CEA personnel. 640 access units (hours) will be offered for the duration of the project, in periods fitting with the ordinary occupation of the platforms. The scientific and/or technical relevance of the applications will be evaluated by the USP and a local committee.
The access cost is a combination of personnel costs and consumables (which depend on the type of test) and the total is estimated to 236,155€.
Support offered under this proposal:
CEA Irfu will make available an engineer who will be the contact person for the user and will help him/her for the whole duration of the project. The preparation and operation of the platforms will be performed by Irfu personnel.
Service improvements within EURO-LABS
MACHAFILM: The magnetometer MACHAFILM is used for the characterization of the first critical field on superconducting samples, field that relates to the maximum accelerating field achievable in a RF cavity. Its original design allows measurements in the operating conditions of SRF cavities (fields in the 150-170 mT range, temperatures between 2-4 K). To assess new SRF materials with performances exceeding bulk Niobium, one needs to push the applied field above the 250 mT. For this purpose, we need to develop a new coil structure and modify the acquisition electronics, mainly by developing a more compact design and implementing a low noise signal amplifier able to deliver several Amperes in the circuit. The cost of this development is estimated to 10 k€.
CRYOMECH: during mechanical tests at cold temperature, the sensors must be connected to dedicated racks to take into account the temperature effect. The present software driving the tensile machine cannot be easily interfaced with these racks and that influences the measurement quality. Instron, the tensile machine manufacturer, proposes an update of our present software. The cost of this upgrade, including the training, is 50 k€. A total of 40 k€ is asked to EC, the rest will be covered by the laboratory.
Outreach to new users:
CEA Irfu will advertise on the availabilities offered by the two platforms on several websites such as the Irfu, I.FAST and AMICI collaboration website (http://eu-amici.eu/) and through presentations, posters, flyers during conferences, industry days and any relevant event.
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): CERN-XBOX
Location (town, country) of the infrastructure: CERN, Geneva – Switzerland
Web site address: http://clic-study.web.cern.ch/content/clic-x-band-technologies

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Annual operating costs (excl. investment costs) of the infrastructure: 300,000 €
Description of the infrastructure:
The XBOX at CERN refers to state-of-the art klystron-based X-band (11.994 GHz) test stands dedicated to the development of high-gradient accelerating structures, in the range of 100 MV/m, and very high peak power, above 100 MW, RF devices. The XBOX facility contains three stands: two powered with a 50 MW/1.5μs/50 Hz klystron each, and one is powered by four combined 6 MW/5 μs/400 Hz klystrons.
The test stands have been constructed in the context of the CLIC linear collider study primarily to support the development of the main linac accelerating structures. However, they are equally adapted for developing high gradient and power structures for XFELs, Compton/Thomson sources etc. and represent potential RF units for the linacs of such applications. Xbox 1 and 2 are fully operational and Xbox 3 is scheduled to be operational by mid- 2016. The only other high-power X-band infrastructure in Europe are the energy linearizer systems of Fermi@ELECTRA and SwissFEL but they run at only the 20 MW level, with accelerating gradients in the range of 25 MV/m. In addition, they are operational elements of their host accelerators so are not available for any development or testing.
Services currently offered by the infrastructure:
XBOX provides four fully powered and instrumented testing slots for high power and high gradient X-band RF structures with all of the required support infrastructure (radiation shielding, water cooling, vacuum, etc.). The test stands have, along with test facilities at KEK and SLAC, operated at the highest ever gradients for RF accelerating structures putting them at the forefront of high-performance accelerator development. This accelerator development spans TeV-range linear colliders, multi-GeV XFELS, low energy high-rep rate XFELS, Inverse Compton and Thomson sources as well as medical linacs.
The XBOX test stands are at the heart of the CLIC X-band development activity that is a collaboration of over twenty institutes and laboratories. Collaborators which have directly used the Xboxes and participated in experiments over the past few years include: University of Lancaster, University of Valencia, PSI, Tsinghua University, Uppsala University, SINAP, SLAC and KEK. The worldwide high-gradient and X-Band community is very dynamic and attracting new participants all the time.
Description of work
Modality of access under this proposal:
Access to the facility will be made in two basic modes. Primary access is given to accelerating structures and RF components which are directly powered by RF. Operating parameters (power level, pulse length etc.) of the XBOX stands will be determined by the requirements of the components during the access time. Such devices could include accelerating structures, deflecting cavities, pulse compressors etc. Parasitic access will also be given to experiments dedicated to for example high-gradient research with specialized sensors (acoustic, X-ray, etc.) and diagnostic developments (fibre optic signal transport for example). Down time due to experimental set-up will be charged against the access time, although this is typically a small fraction of total experiment time in the case of the XBOX stands since they run 24 h/day for weeks on end.
Support offered under this proposal:
The XBOX is located at CERN, which has a long tradition of supporting complex scientific infrastructure and working with visiting scientists. The users of the XBOX will benefit from this tradition. In addition, many of the leading experts in the field of high gradient, power and frequency systems are located at CERN so users of the XBOX will benefit from interaction with a dynamic intellectual environment.
Outreach to new users:
The worldwide high-gradient and X-Band community is very dynamic and attracting new participants all the time. Outreach and news of this TA will benefit directly from this excitement and growth. The most recent workshop of an annual series dedicated to X-band and high-gradient drew over 90 participants from numerous institutes from around the world and covered a wide range of applications including linear colliders, XFELS, Compton scattering sources, medical linacs, neutron sources, B-factories and rf power sources. This series will be a good opportunity to advertise the TA among a wide audience of accelerator scientists. Another example of a workshop series relevant to this TA is the MeVArc series which brings together a diverse range of university groups, especially in material science, which study the fundamental issues related to high-gradient. The TA format is particularly well adapted to the experimental needs of these groups. Finally, presentations at the standard accelerator conference series such as LINAC, IPAC, etc. as well as the CLIC workshop will all be used to highlight and advertise the TA.
Task 3.3 : Electron and proton beam testing
Provision of access to the following infrastructure(s): KIT-ALFA(KARA, FLUTE), UKRI-CLARA, INFN-LNF(BTF, SPARC-LAB), CEA/LIDYL-LPA-UH100
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): KIT-ALFA (KARA, FLUTE)
Location (town, country) of the infrastructure: Karlsruhe, Germany
Web site address: https://www.ibpt.kit.edu/alfa.php
Annual operating costs: 5,939,292 € (KARA+FLUTE)

Description of the infrastructure:
The Karlsruhe Institute of Technology (KIT) is the research university in the Helmholtz Association. KIT aligns its research fields with the long-term challenges of society to develop sustainable solutions. The focus is on energy, mobility, and information. Further focuses are climate and environment, man and technology as well as elementary particle and astro-particle physics. With around 9 300 employees, including more than 4 500 in science and teaching, and over 25 000 students, KIT is one of the largest research and teaching institutions in Europe. KIT's research covers the complete range from fundamental and applied research to close-to-industry and from small research partnerships to long-term large-scale research projects. KIT, supported by a central organizational unit with about 70 members, has a strong focus on innovation and relation to industry, with more than 20 new spin-off companies per year. The development of viable technologies and their use in industry and society are the cornerstones of KIT's activities.
KIT hosts the Accelerator Technology Platform (ATP), which combines accelerator-relevant infrastructures, technologies and research in a unique way, taking advantage of the widespread expertise of KIT institutes to advance accelerator science and technology. Technological developments range from high-throughput beam diagnostics systems to superconducting undulators and high temperature superconducting magnets. Within a multi-disciplinary environment with a strong engineering tradition, ATP researchers strive to understand fundamental processes to develop compact and energy efficient accelerators technologies. As a part of the infrastructure portfolio of the ATP, KIT operates the Accelerator Facilities (AFLA), including KARA and FLUTE:
KARA, the Karlsruhe Research Accelerator, the electron storage ring of the KIT synchrotron light source and used as a test facility for accelerator research, technology, and detector development, operated by KIT-IBPT.
The Institute for Beam Physics and Technology (IBPT) and the Laboratory for Applications of Synchrotron Radiation (LAS) at KIT have a highly recognized expertise in fast ultra-short bunch diagnostics, remote operating of accelerators as well as a proven experience in developing and testing accelerator components like superconducting insertion devices and related magnetic characterization techniques.
KARA - available technical equipment and facilities relevant to the project
KARA is an electron storage ring, a platform for development and testing of new beam and acceleration technologies, pooling research of new accelerator concepts and development of new detectors. KIT operated KARA for more than 20 years, serving a variety of experiments with synchrotron radiation in the areas of condensed matter, nano- and micro-technologies, actinide research, and environmental research. In 2015, the KIT executive committee decided that KIT-IBPT also operate KARA as a test facility for accelerator and detector research with electrons and photons and no longer offer free access for national users but access for collaboration partners.Accelerator studies at KARA profit from its flexible lattice, large energy range (0.5 - 2.5 GeV), adjustable bunch lengths (50 ps down to a few ps in a dedicated short, single or multi bunch operation mode), and the fully synchronized, fast, transversal and longitudinal beam diagnostics. The latter includes novel single-shot, high repetition rate electro-optical longitudinal bunch profile monitoring and in-house developed detector systems (e.g., THz detectors) with bunch-by-bunch and turn-by-turn multi-channel readout. KIT-IBPT implemented different operation modes and lattice versions at KARA. Low optics are routinely used at 1.3 GeV for studies of beam bursting effects caused by coherent synchrotron radiation in THz frequency range. A specific optic with negative compaction factor was simulated and implemented. KIT-IBPT also hosts the cryogenic test bench experiment (BESTEX) operated by CERN and KIT at KARA down to 80 K, to explore photon stimulated desorption, photon reflectivity, photon heat loads, and photoelectron generation originated on vacuum beam screen prototypes under irradiation of the FCC-hh-like synchrotron radiation spectrum.
FLUTE, the far-infrared, linac and test experiment, a compact linac-based test facility for accelerator R&D and future source of intense THz radiation for photon science, operated by KIT-IBPT.
FLUTE, available technical equipment and facilities relevant to the project
FLUTE, a far-infrared, linac and test experiment, serves as an accelerator test facility for a variety of accelerator physics studies, generating pico- down to femto-second long electron bunches of 5 up to 41 MeV (planned up to 90 MeV), also providing coherent radiation in ultra-short, very intense, light pulses spanning the terahertz and far-infrared spectral range and beyond. FLUTE consists of a 7 MeV photo-injector, a 41 MeV S-band linac and a D-shaped chicane to compress electron bunches covering a large bunch charge range, from 1 pC to 1 nC, and bunch lengths from 500 fs down to a few fs. In 2018 the FLUTE operation started with the 7 MeV section and the KIT presidium decided that KIT-IBPT operate FLUTE as a test facility for accelerator and detector research with electrons and photons and no offer of free access for national users but access for collaboration partners. The linac is in commissioning since June 2021. The chicane for compressing electron bunches of ps length of about 41 MeV energy into the range of a few fs is currently being built and will be operated in 2022.
Several diagnostic systems are available, for example, to measure the bunch energy, bunch charge and position. In addition, the laser pulses for generating electrons can be monitored. FLUTE is equipped with the following fully synchronized diagnostics: beam position monitors (BPMs), integrating current transformer (ICT), energy spectrometer with screens in straight direction and below 15 degrees after dipole magnet, Faraday-cup, from mid of 2022 also an electro-optical sampling.
Services currently offered by the infrastructure:

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KIT-IBPT operates the accelerators and provide technical and IT support, in addition to pursuing R&D in the fields of superconducting insertion devices, advanced beam diagnostics and dynamics of ps and fs electron and photon beams. In 2017 KIT and Bilfinger Noell GmbH installed the first superconducting undulator, SCU20 at KARA, to reach series-production readiness. Compared to conventional permanent magnet devices, SCUs can produce stronger magnetic fields at a given period length and vacuum gap. During the EU projects EuroCirCol and ARIES first FCC-hh beam screen prototype has been testing at KARA. KARA has been chosen because its synchrotron radiation spectrum, photon flux and power match quite well the one foreseen for the 50+50 TeV FCC-hh proton collider.
Within the framework of Transnational Access of the EU project ARIES, PSI has successfully installed an experimental chamber in the 7 MeV diagnostic area of FLUTE. Together, PSI, the University of Bern, both in Switzerland, and KIT have conducted experiments on split-ring resonators to establish a diagnostic method for determining the longitudinal size of electron bunches. The experimental chamber as well as the corresponding space is available for future user experiments.
Access to KIT facilities is granted either within the framework of collaborative research projects to partners who participate with a comparable share in the research project, such as in the EU projects EUDAT, EuroCirCol, FCCIS, I.FAST, or to users who participate within the framework of third-party funding contracts or within funded European projects, such as ARIES (Transnational Access) or CALIPSOplus (Integrating Activity). The research work and technology developments at KARA have been providing contributions to European and international projects for two decades, such as the current developments for FCC, CLIC or ultra-low emittance electron storage rings. During regular operation of KARA, KIT-IBPT offers the electron storage ring for accelerator research and technology development or for the use of emitted synchrotron radiation from insertion device and bending magnet beamlines. KARA delivered 3240 hours in 2019 and 2809 hours in 2020 access for accelerator, detector and scID technology studies and synchrotron radiation users from Germany, Europe and beyond. Scientists from EU member states performed a share of about 20% of the experiments. During regular operation of FLUTE, KIT-IBPT offers the accelerator for accelerator research and technology development. In 2019 (2450 h) and 2020 (1650 h) FLUTE was 4100 hours (about 2050/y) in operation for a few users from KIT, Germany and Europe. Scientists from EU member states performed a share about 20% of the experiments.
Description of work
Modality of access under this proposal:
Within Transnational Access of EURO-LABS, KIT-IBPT will provide with the Accelerator Facilities ALFA 880 hours in total of access to KARA for 8 periods of 5 days per experiment (22 hours a day for user operation mode). 330 hours in total of access to FLUTE for 6 periods of 5 days per experiment (22 hours a day) in the project years Y1 to Y3. (KIT plans to shut down FLUTE in project year Y4 due to a major rebuild).
In addition, a preparation time for each experiment of up to 5 days is foreseen for the installation and/or first test runs before the actual experiment.
The web tool "ANNA" (https://proposal.ibpt.kit.edu/anna/) simplifies the access procedure or the application for the experiments desired by the users according to the established application procedure that has existed for more than 20 years of operation of KARA as a large-scale facility in the Helmholtz Association. The application is checked for scientific excellence, feasibility at the accelerator experimental facility and regarding safety and, if successful, is scheduled in the framework of the beam scheduling in dialogue with the users.
Users of KIT-ALFA will profit from the existing user office and support procedures as well as the workshops assisting experimental installations. After arrival, the users visit the user office to complete a safety course and prepare for the experiment with the support of KIT staff. Users can get hints for their local routes and search for accommodation. If there are any technical equipment failures, KIT will help according to its possibilities. After the experiment, users are required to submit an experiment report and regularly update the resulting publications via the ANNA tool. The reports and publications will be taken into account in the approval of future applications.
Support offered under this proposal:
At the KIT facilities, experienced accelerator physicists, engineers, technicians and beamline scientists are available for scientific discussions, assistance and cooperation with the users on site. Their working hours are usually 8 hours per day, between about 8 a.m. and 5 p.m. A user office organizes and support access to the web tool ANNA, internet, office communication, computer facilities, caching of experimental data and library services. The users carry out their experiments usually in collaboration with KIT staff (e.g., technicians, vacuum, diagnostics, and beam dynamics specialists, depending on the needs of the experiments). This means KIT staff helps with the installation of the user experiment according to available capacity and operates the accelerator. Remote access is available to monitor the accelerator and experiment status as well as Web conference Tools. Remote control can be granted for special application upon request.
Service improvements within EURO-LABS
KIT will develop an integrated simulation and measurement framework for facilities with huge amounts of data and complex dependencies, like accelerator facilities, so that users and operators can prepare, plan, perform and evaluate experiments more efficiently. This integrated simulation and measurement framework will be implemented at ALFA

within two years based on B2SHARE - EUDAT services and will be tested at the KIT facilities KARA and FLUTE. If successful, other research facilities beyond accelerator R&D can take over the development of this integrated simulation and measurement framework.
ALFA provide a multitude of operation modes as well as diagnostic devices with high data throughput. These diagnostic sensor networks are capable to take synchronized data from different detector system which enables new beam diagnostic methods and detailed beam dynamic analysis. For the analysis, the knowledge of all machine settings at the same time of the data is essential.
Due to the flexibility of KARA and FLUTE the parameter space is too large for a parameter scan for each measurement. Hence, it is essential to implement a meta database, e.g., based on B2SHARE (EUDAT) to collect all parameter settings and link them to the data set. This would make it possible to combine data from different measurements in the data analysis. With this tool, users could make use of other measurements carried out in the past. The careful preparation and planning of experiments is essential to make use of the expensive beam time at accelerator test facilities. An integrated simulation and measurement framework could help to prepare much more in detail and would allow for more automated measurements and data analysis. With the availability of a meta data base measurement could be simulated and tested in advance to identify the optimum setting for the planned experiment at the accelerator test facilities KARA and FLUTE.
The proposed service improvements will be developed in the first two years of the project, thus to be in operation from M30 at the least. The EC contribution is for 150k€ with the remaining budget to be covered by the institute.
Outreach to new users:
Information and access for new users to KIT accelerator facilities will be provided on a website hosted by KIT and to be linked to the main EURO-LABS website. The Transnational Access Portal will be linked to the ANNA web tool, which will support the dissemination of scientific results via news reports, host the annual reports and link to the user publications resulting from the experiments. The access options will also be advertised through the various research areas at KIT.
Access to new users will also be facilitated through user publications of experimental results obtained at KIT accelerator facilities. Further dissemination and outreach to new users is envisaged through the IFAST, CALIPSOplus and EURO-LABS networks.
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): UKRI-CLARA
Location (town, country) of the infrastructure: Warrington, Cheshire, WA4 4AD, United Kingdom.
Web site address: http://www.stfc.ac.uk/about-us/where-we-work/daresbury-laboratory/versatile-electron-linear-accelerator/
Annual operating costs: 770,000 €
Description of the infrastructure: CLARA (Compact Linear Accelerator for Research and Applications) is a high performance, modular injector facility capable of delivering a highly stable, highly customisable, short pulse, high quality electron beam to a series of test enclosures. The principal aim of CLARA is to test advanced free-electron laser (FEL) schemes, which can later be implemented on existing and future short wavelength FELs. CLARA is intimately linked to the VELA (Versatile Electron Linear Accelerator) facility, which has delivered beam to academic and industrial users, including transnational access as part of the H2020 Aries programme. The CLARA front end consists of a 10 Hz S-band RF gun, a 2m long S-band Linear accelerator, diagnostics devices, a dedicated collimator, quadrupoles and a spectrometer dipole. An S-bend incorporating the spectrometer dipole, a quadrupole triplet and a Lozenge dipole transports high-energy beam from CLARA to the existing VELA beam line. The quadrupole triplet provides achromatic transport. The spectrometer dipole transports beam to the VELA spectrometer beam line equipped with beam viewer and Faraday Cup (FCUP) for energy, energy spread and charge measurements. The straight-on CLARA line transports beam to a temporary FCUP. The 10 Hz RF gun, earlier used on VELA is now installed on the CLARA beam line. With this gun, the CLARA will provide electron bunches at 10 Hz repetition rate and beam momentum up to ~50 MeV/c. CLARA will facilitate research into the underlying beam dynamics and accelerator technology sub-system challenges in photoinjector, RF acceleration, timing and synchronisation, beam diagnostics, accelerator controls and feedback processes whilst also providing high quality beam to dedicated experimental enclosures. A 400 Hz repetition rate RF gun including its load lock system for photocathode exchange is under commissioning.
The facility delivers a capability for the innovative development and qualification of advanced accelerator systems, enabling industry to expedite their technology development from prototypes to market ready products. In doing so it has the potential to help revolutionise the use of accelerators in priority areas such as healthcare (imaging, radiotherapy development and sterilization) security (cargo scanning), energy (development of components for accelerator driven sub critical reactors), industrial processing (development of machines for polymer crosslinking and rheological modification), environment (water treatment and environmental clean-up) and science as well as opening up further high technology commercial markets. The facility uniquely combines a highly customisable femtosecond electron beam with fully configurable test enclosures. In addition, access can be offered to the accelerator hall to allow direct adaptation of the accelerator system to trial new accelerator technology solutions or novel concepts.
Services currently offered by the infrastructure: Typically, a pico- to femto-second MeV electron pulse is delivered into

a fully shielded, searchable end station at 1 – 10 Hz. The beam is fully characterised for energy, bunch charge, position, size and time of arrival, and can be customised on-the-fly to optimally match the user requirements. The shielded user area (Beam Area 2) is large enough (approx. 4m x 9m x 3m) to accommodate virtually any sample mounting, detector and data acquisition requirements. These can be supplied by the user or developed/supplied in collaboration with UKRI.
Description of work
Modality of access under this proposal: Whilst there will always be exceptions to the norm, what is detailed here represents the typical usage model. The beamtime usage is allocated in days, with the machine being available for a single daily shift of 8 hours between 9:00am and 5:00pm (i.e. 8 units). Initial start-up of the machine, stabilisation of the beam output and set-up to a standard beam recipe is incorporated within that timescale. Training in the use of safety systems and operation of the user areas is provided on the first day and takes a further 20 mins. Additional site safety and radiation hazards training (mandatory) can be done remotely in advance using web-based tools.
The control room is staffed at all times by at least one operator who is able to make beam adjustments and verify optimum performance. The user areas are supplied either as a capped beamline, or a series of standard vacuum environments with basic service provision. In all cases it is essential that all user groups discuss their experimental apparatus requirements prior to the beamtime (>2 months). Shorter notice periods can be accommodated but this will limit the range of support equipment and sample environments available. Work involving hazards (pressurised vessels, laser systems, heating etc.) will require additional safety assessments for provision.
For each beamtime allocation period (6 months) beamtime, whether academic, industrial or internal R&D is allocated under review by an UKRI internal panel against agreed assessment criteria. It can be expected that Transnational Access would be allocated a ring-fenced number of days in each allocation period, dependent on the level of funding provided, for their dedicated use. If the number of allocations fell short of the assigned limit, the days would be left available for short-notice experiments.
The unit cost would be one hour. A minimum of three concurrent days would be required for each user to enable efficient scheduling (i.e. minimum 24 units) with each additional day charged at the appropriate rate (+8 units). Each unit covers the machine running costs, the human resource costs to operate the facility, any training requirements and the provision of an experiment coordinator to oversee facility/user interfaces. The access and scheduling of the machine will be independent of the other access requirements. However, if Transnational Access is required inside the accelerator hall (i.e. direct exploitation of the accelerator system) the scheduling will need to be coordinated with all other users of the facility due to possible disruption of beam delivery.
Support offered under this proposal: A budget allocation of €125 per person, per day, has been requested to cover daily subsistence. No travel costs are included in the proposal.
UKRI operates across a diverse and broad range of science frontiers. Users of its facilities also benefit from the National Laboratory scale of UKRI, bringing activities such as supercomputing, machining and tooling, rapid prototyping, analytical equipment, test and validation, vacuum science etc. onto the same site. CLARA Users can take advantage of these other services. If it is identified that these services are required as part of the prior review and allocation process, suitable discussions and the preparation of quotations and/or development of suitable collaborations can be undertaken.
UKRI supports academic study and cross-pollination of R&D ideas between user groups, academia, industry and UKRI. This approach, and the provision of equipment and services on a single campus has driven the expansion of the Sci-Tech Daresbury campus which houses a growing roster of over 130 businesses operating across nearly all research sectors. A budget of 10k€ has been assigned for the development of experimental support apparatus and interfaces.
Outreach to new users: From an industrial perspective, usage of CLARA is not restricted to any market sector or size of business – all are eligible to apply for access. Academic usage will be broadened through the publication of regular calls for applications. UKRI will use its well-developed global presence (web, social media, conferences and workshops) to publicise such calls, as well as notification of the availability of transnational funding schemes to encourage their uptake.
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): INFN-BTF (BTF1, BTF2)
Location (town, country) of the infrastructure: Frascati, Italy
Web site address: http://da.lnf.infn.it/projects/btf/
Annual operating costs: 1,300,000€
Description of the infrastructure:
The Beam-Test Facility (BTF) is an infrastructure mainly dedicated to the development and testing of particle detectors, providing primary, fixed energy beam and secondary electron or positron beams with continuously tunable energy from 30 MeV to 780 MeV from the the Frascati accelerator complex DAΦNE. The beam current (multiplicity) can be varied from 1e10 particles/pulse, down to a single particle per pulse in a Poisson stochastic regime. The facility was successfully running with an average of 200 beam days/year, 25 experimental groups, 150-200 users booking since 2004 apart from a few minor stops. It is commonly booked for several applications ranging from detector development, characterization, and calibration to beam-diagnostics testing. In 2017, BTFEH1 and BTF1 are fully involved in a long term, fixed-based experiment called PADME in BTF1, bent line. Furthermore, in 2020, a regional-funded project called eRAD is the object of dedicated BTF1 high-intensity runs.

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So, starting from the second half of 2017 the BTF of was the object of two topics: i) a fixed target experiment with permanent installation, PADME, in BTFEH1, and ii) a major upgrade, with the main purpose of splitting the existing beamline and adding a second experimental hall for user activities to permit weekly based experimental periods for external users, in BTFEH2. Today the line is under safety and beam commissioning. The two areas will be not in time-sharing: only one at a time could be used and booked. The standard beam pulse length is 10ns and the BTF injections regime is available via pulsed magnet, steering away DAΦNE transfer line some of the LINAC 20(40) ms spaced beam bunches. The beam could be pulsed electron and positron bunches: up to 49 pulses/second in relation to DAΦNE injection cycle type and operation mode, down to 1. The operation modes of the facility are two: a) dedicated: only when DAΦNE collider shutdown, exclusive for BTF users, to be handshake with DAΦNE head. Beam top parameters defined by LINAC and BTF staff, and b) time-sharing: DAΦNE spare pulses injection. Beam top parameters defined by DAΦNE injections needs.
The overall description is fully applicable to the BTF1 line, commonly used as secondary beam production and low multiplicity regime. Hence, less frequently, BTF hosted high-intensity runs for electrons, high- intensity studies of electromagnetic phenomena, and fixed-target experiments. The area is released for a maximum current of 3e10 particles per second. There will be a limitation of area occupancy that will lead to a maximum team elements number that could change with period and setup.
BTF2 is the new line that steers bunches from BTF1 to a new experimental area, BTFEH2. The area and the beamline installations started in February 2021 and positively ended in June 2021. Nowadays under beam commissioning, started in July 2021, intended to end in October 2021. The area will be released for a maximum current of 1e6 particles per second. There will be a limitation of area occupancy that will lead to a maximum team elements number. The experimental area surface at user disposable is about 10m2 with a top height of about 2.5m. Nowadays the BTF1 line is not available to new external users until PADME experiments removal. After the beam commissioning, BTF2/BTFEH2 will be the only line open to external users.
Services currently offered by the infrastructure:
BTF1 offers standard beam line services for users doing tests, including: BTF DAQ and DCS data (BTF standard, delivered on MemCached server), four Gas pipelines (Inert Mix, CO2, Flammable Mix, Isobutane) Gas has to be provided by user, High Voltage (Caen SY5527 crate, 4 slots, some spare board), Networking (BTF standalone DHCP server and ETH switch), Detectors, Timing for beam synchronization, Payload setup logistics (trolley tables, remotely controlled; High load rotational stage. Standard Optic, Bars and joints, Fitting support platforms), and more importantly dedicated expert staff. In addition, standard charged particle detection setups are available for the users, including: pixel detector (FItPixKit, used for particle/bunch counting and transverse dimension diagnostics), lead Glass Calorimeter (Particle/bunch counting, low and intermediate multiplicity regime), ICT (Particle/bunch counting, high multiplicity regime), Flags (Transverse dimension, high multiplicity regime).
Description of work
Modality of access under this proposal:
The typical timing of the BTF facility is here described, tuned with BTF staff, BTF user commission, Directorate and DA secretariat offices timing. The BTF user commission is renewed every 3 years. The typical scheduled annual periods are divided into two user calls: a longer one from January to August and a short one from September to December. The calendar in the period of interest could have booked days, weeks, or extended periods due to previous approved delayed users, Laboratory and BTF staff programs, holidays and shutdown. An International Call is opened about 4 months before the first run. The call is public, broadcasted on INFN-LNF web pages, emailed in the mailing lists, communicated in scientific events. It closes 1 month 3 weeks before the first run.
The BTF staff will filter all the requests from the technical side, excluding what is impossible to implement, so acting from the point of view of the requested services (what is at the disposable of the facility and the LNF services groups if needed by users ex. logistics, line elements change...) and the line's performance in the requested period (available detectors, flux, number of setup changes, number and load capability of the scientific and technical people involved to get the goal).
In the output of this action, the BTF users commission is informed on the possible requests after having collected all the information. After the commission filtering, the weeks will be scheduled as first assignments in a trial calendar, mainly respecting the users selected period and moving a little bit the overlapped run, in order of importance. In two days, the calendar will be delivered to users, opening the handshaking with them to a better shift scheduling for better settling the calendar.
At this stage, the calendar is completely accepted by users. Once the booked week is stated and further rejected, the week will be considered as lost by the user and rearranged on the BTF opportunity. The secretariat service sends a contact mail to the group leader as reported in BTF referring instructions. The group leader must provide needed information within the BTF secretariat timing.
The typical shift lasts one week, maximum allowed two weeks/call/team and the maximum number of team elements, and their access mode will be decided concerning safety and SARS- CoV-2 prevention rules, in their dependence on

National and Institute ones. To start the shift, the team must be fully present on Monday morning, following a training course handled by BTF personnel about facility rules and duties.
At the end of this course, the team will be set as “experimental” in the access status on the Lab environment, thus providing them the 24/7 free access to BTF areas. The beamline scientist will identify some elements of the team’s people that will be informed of. The access process will identify the team leader as GLIMOS. They will be leaders of the BTF/LNF services needed by the group, providing continuous instructions on their usage. At the end of the shift, the team must remove their apparatus the next Monday morning.
Support offered under this proposal:
The team will be followed 24/7 by a beamline scientist (BS) that will act as a consultant for the scientific and technical management of the facility. The BS will follow the group during the installation phase and the data taking both in presence and on call. The BS will help in troubleshooting the installation, respecting the BTF compliant rules previously handshakes previously in one or more contacts with the team leader.
The beamline scientist will support the team in the data-taking optimization processes. As told, this process starts with preliminary contacts in the previous weeks, to get BTF environment as close as possible to the original team laboratory (i.e. the remote connections between the control room, sub-elements, and their remote controls in the ethernet and power network...), users’ installation and setup time optimizations and uptime optimization by defining the best effort data taking procedures
Outreach to new users:
From 2017 surveys, we estimate the average team compositions as 0.85 of Italians Institute people provenience and 0.15 coming from EU and not EU. We count an average of 1 team/year for 1 week/year with more than 50% of non-IT people. The main geographical experiment base is for the 0.6 not-IT, in the 2015- 2017 range.
Our most recent activity with SMEs is the eRAD project, in the technological frame of irradiation. In the past, we have been performing analogous few runs, CERN/ASI/ESA based projects.
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): INFN-SPARC-LAB
Location (town, country) of the infrastructure: Frascati, Italy
Web site address: http://sparclab.lnf.infn.it
Annual operating costs (excl. investment costs) of the infrastructure: 1,600,000€
Description of the infrastructure:
SPARC_LAB consists of two distinct installations that are the SPARC high-brightness electron photo-injector and the FLAME high-power laser. The two buildings are close to each other and can operate both independently and in combined mode. The two pillars of the SPARC_LAB facility are able to provide unique features in terms of electron beams and laser pulses, especially on the overall resulting quality.
The SPARC photo-injector produces electron beams with energies in the range 5- 140 MeV, 10 pC-1 nC charge and with duration tunable in the range 20 fs-5 ps (rms). The beam is provided completely characterized in the 6D phase-space and can be delivered to three different beamlines that have been dedicated so far to Free-Electron Laser (FEL), tests for advanced diagnostics and laser-electron interaction (Thomson scattering). Recently, at the end of the LINAC, a plasma accelerator module has been installed providing accelerating fields up to 1 GV/m.
FLAME is based on a Ti:Sa laser has been produced by Amplitude Technologies and can deliver ultra-short pulses (~20 fs, 60-80 nm bandwidth) with energies up to 6 J in the IR range (800 nm). The resulting peak power is ~250 TW. So far, the facility has been used for solid-target experiments (production of electrons, protons and heaver ions), laser-driven plasma-based acceleration and as a betatron radiation source.
Services currently offered by the infrastructure:
SPARC_LAB offers to the users the possibility to perform innovative experiments involving electron beams and laser pulses. The two pillars are largely inter- connected and share some diagnostics and the respective networks. SPARC_LAB is configured as a test-facility, in the framework of the EuPRAXIA project, thus the schedule of the activities can be planned and re-arranged just few months in advance without big constraints. So far, the facility hosted experiments from external users coming from both Italian and foreign Universities and research centres. The users will be supported by the SPARC_LAB researchers and LNF technical services the setup and data acquisition during the experiment.
The electron beams provided by SPARC have been employed in experiments concerning the generation of radiation in different ranges (visible, EUV, THz, and X- rays), for the development of advanced diagnostics (based on THz, OTR and Electro-Optical Sampling) and, in recent years, for the development of innovative acceleration techniques based on plasma.
The laser pulses provided by FLAME have been employed in experiments concerning plasma-based acceleration (up to few hundreds of MeVs adopting gas-jets in the self-injection regime) and protons/ions generation and acceleration by means of solid-target interactions.
Description of work
Modality of access under this proposal:
The users will be supported during all the tasks of the experiments (setup, data taking, data analysis). The electron beam

and/or laser pulses will be provided completely characterized. Typical equipment that can be made available to the users can include common tools (as digital scopes, PCs, etc.) as well as more specific ones (optics, motorized stages, vacuum components, etc.). The typical duration of the experimental campaign is one week for the preparation of the machine working point (mainly operated by the SPARC_LAB researchers) plus another week for the data acquisition. Usually, the planning of the activities is obtained on a yearly timescale with some provisional stops of the activity for maintenance and/or installations. The schedule can be partly rearranged to accommodate the user needs.
SPARC: While most of the machine "space" is filled by operative devices (RF structures, magnets, diagnostics, etc.), there is some available space at the end of the three beamlines. This applies especially to the second one, usually devoted to tests of advanced diagnostics. Here users are allowed to install also large equipment including vacuum chambers.
FLAME: the user's equipment can be installed in a dedicated experimental area. Here the users will find both the main laser pulse and a probe one (with less energy but same spectral properties) that can be used for multiple purposes.
Support offered under this proposal:
The users will be fully supported during their experiment. From the scientific point of view, the SPARC_LAB researchers can help with deep knowledge on accelerator and plasma physics, beam and laser dynamics, optics, diagnostics, etc. The technical and logistic support can be provided by the LNF services directly. Such a support has been already provided in recent years for the experimental activities carried out by external users. At the beginning of the activities a specific training course will be organized by the SPARC_LAB scientists.
Outreach to new users:
Potential users can find useful information and news about the SPARC_LAB facility and activities on the web and contact directly the researchers involved in a particular area of interest. Currently SPARC_LAB is fully involved in the development of next-generation accelerators based on plasma by using both the electron linac and the laser system, thus users can find most of the necessary tools and equipment already available onsite. Such an activity is expected to be of interest for the continuously growing European community working on the field
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): CEA/LIDYL - LPA-UHI100
Location (town, country) of the infrastructure: Gif-sur-Yvette, France
Web site address: http://iramis.cea.fr/slic/UHI100.php
Annual operating costs: 1,160,640 €
Description of the infrastructure:
The CEA-LIDYL laboratory activities are focused on laser-matter interactions from physical up to chemical aspects. The research programs are extended from simple molecular systems to biomolecular ones up to plasmas. The UHI100 laser facility is the most intense laser of the laboratory and already opened for access through LASERLAB-Europe program. It is mostly used by the Physic at High Intensity (PHI) group to study laser-matter interaction at ultra-high intensity. Topics of research mostly concern generation and applications of laser-driven particle sources and attosecond intense XUV beams.
The LPA-UHI100 facility consists of the UHI100 laser which delivers 100TW at 10Hz with 25fs pulse duration and one experimental radio protected area where a laser-driven electron source is available for internal and external users. Intensities on target in the 1018-1020 W/cm2 range have been obtained using a deformable mirror. UHI100 also features a very high temporal contrast obtained thanks to 2 temporal filtering steps. First, a saturable absorber in the front end enables to get temporal contrast as high as 109 at the compressor output. Second, a double plasma mirror (DPM) is inserted between the compressor and the experimental chamber to further increase the temporal contrast. The short pulse duration, ultra-high contrast and intensity together with radiation-protected experimental area, fully equipped for ultrahigh intensity experiments under vacuum make this facility unique. A geographic move from CEA-Saclay to CEA-Orme des Merisiers (a few kilometres away) has given the opportunity to optimise and redesign a new experimental area with 2 experimental chambers available, offering the possibility to use two high intensity beams in the same chamber. Available diagnostics include Thomson parabola for ion detection, magnetic spectrometer, ICT for electronic charge characterisation, and CCD cameras for spatial characterisation of the particle beams. The LPA UHI100 installation will be accessible by the EURO-LABS users.
Services currently offered by the infrastructure:
The LPA-UHI100 installation provides an electron beam line operating around 100 MeV, and an experimental area dedicated to laser-driven electron acceleration studies in plasma media. The radioprotection has been specifically dimensioned for electron acceleration and the survey is insured by radioprotection service from CEA. The LPA-UHI100 is equipped with control and diagnostics of the laser beam crucial to control the electron beam properties such as a deformable mirror linked to a wavefront sensor to optimise the spatial profile of the laser, and a set of different focusing parabola for various range of intensities. Two types of gas target can be provided, a gas jet and a variable length gas cell. A magnetic spectrometer is available for electron spectrum characterization. The LPA-UHI100 is strongly linked to APOLLON PW laser facility, a PW laser facility located on the same site (CEA-Orme des Merisiers), open for international call in May 2021. Part of the scientific program that will be developed in the long focus area (HE0) is currently in preparation on LPA-UHI100. EURO-LABS users may test new concepts or diagnostics using LPA-UHI100,

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benefitting from the higher repetition rate and larger number of shots available, before implementing them at APOLLON, operating at higher energy.
The facility is operated by a team of 2 technicians, 2 engineers and 1 local co-investigator in charge of the access in the experimental room. Users receive complete technical and scientific assistance, from the conceptual design of the experiment to its realization. A workshop will be accessible during campaigns, as well as administrative assistance if needed.
Description of work
Modality of access under this proposal:
During the 4 years access period, we propose to offer 4 campaigns of 4 weeks each for 3 users per campaign with physical access to the facility. A total of 640 access units (hours) will be provided. As soon as the project is validated through EURO-LABS, it is included in the planning of the laser facility. We plan to install the specific required equipment for the experiment during the first 3 days and then to spend 17 days of experiment. A specific beam (laser diode) will be accessible during the first 3 days of preparation and then the laser at full energy will be available, driving the electron beam in standard conditions.
Access cost will be declared on the basis of actual cost.
Support offered under this proposal:
An engineer will be assigned to the project to implement the specific parts on the existing experimental chamber. A researcher will be the co-local investigator during the preparation and the whole duration of the campaign. The Laboratory will help the users with administrative support as well as a workshop (2 persons).
The laser facility is daily operated by a team which will help the users as soon as they need it.
Service improvements within EURO-LABS
The LPA-UHI100 facility delivers electron source in the 100MeV range, issued from laser-plasma acceleration mechanism. The maximum repetition rate of the source is directly linked to the repetition rate of the laser itself. Most of the laser-driven electron source are generated from Ti:Sapphire laser system, delivering from few to 100's of TW power. The maximum repetition rate of such system is generally around 10 Hz, but the electron source doesn't often exploit this property as it requires a specifically designed target coupled to very demanding pumping system.
Among the various parameters of the electron source that can be improved, two main objectives are tackled at that time by the community: the energy and the frequency. This last point remains a big issue for medical applications in particular. In our group and for LPA-UHI100 facility, we plan to increase the pumping capacity with the objective to deliver an electron source at 1Hz, instead of 0,03Hz, which is the actual repetition rate. This will offer new possibilities for data accumulation and then could attract more users on the facility. And in addition, this is the less costly solution before changing the driving laser for higher frequency system, keeping the same level of power. This is not yet commercially available but already in development.
Details of the budget: 25k€ for the pumping system, 5k€ for mechanical adjustment on the experimental chamber
Planning - milestones: (T0 + 12 months) : LPA-UHI100 laser –driven electron source operational at 1Hz
Outreach to new users:
To attract new users, we plan to communicate in conferences gathering "laser-plasma interaction" community. We will advertise on the possibilities of access offered through EURO-LABS TA program on our website. If we attract more than the 3 users, corresponding to the planned access offered for the 4 years TA program, we could share our own beamtime with them, without charging EU for this, planning to ask for more funding on the next call, on the basis of the past 4 years experiment.
Review procedure under this proposal (specific):
The ranking of the proposals from the EURO-LABS User Selection Panel WP3 Task 3.3 will be handed over to the LPA-UHI100 Local Selection Committee that will allocate the time for each project and user. A web-based application procedure (that will be described on the EURO-LABS website) provides an entry to EURO-LABS TA for LPA-UHI100. In case of budget or scheduling constraints, users may however be re-directed at a later stage of the selection procedure. The Local Selection Committee consists of 3 members designated by the coordinator of the facility; it will allocate the access time and check that the requested access is not covered by LASERLAB. The facility representative will have the possibility to reject a proposal in case of technical incompatibility with the installation.
Task 3.4 : Access to RIs for applications
Provision of access to the following infrastructure(s): RAPID, CLEAR
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): INCT-RAPID
Location (town, country) of the infrastructure: Warsaw, Poland
Web address: https://www.gov.pl/attachment/b3cc211e-39d5-4de1-a914-5796bc5944a4
Annual operating costs: 448,500€
Description of the infrastructure:
The Institute of Nuclear Chemistry and Technology (INCT) offers access to its infrastructure RAPID, located at the Centre of Radiation Research and Technology. INCT-RAPID is included in the Polish Roadmap for Research

Infrastructures. RAPID can be used for research, and demonstration of pilot scale irradiation with electron beam characterised with a wide range of beam parameters with several installations detailed below. The installations include A) a Linear electron beam accelerator LAE 10 with nanosecond pulse radiolysis UV/VIS detection set-up. Pulse radiolysis is an invaluable tool for studying the kinetics and spectra of transient chemical species in chemistry and biochemistry. The LAE 10 has been dedicated to pulse radiolysis experiments with the following nominal parameters: electron energy 10 MeV, pulse duration 4-10 ns and 100 ns, peak current 1A, beam power 0.2 kW and repetition rate 1, 12.5, 25 Hz and single pulse mode, B) A linear electron beam accelerator emits beam of electron of energy 10 MeV, beam power up to 15 kW. The processing parameters with the electron beam of energy 10 MeV allows to irradiation bulk materials having high density, with the dose ranging from 0,5 to 40 kGy in one pass or as accumulated dose ranging hundreds of kGy. The installation is used for radiation sterilization and microbial decontamination of solids and liquids, for modification and degradation of polymeric materials, C) A pilot plant facility equipped in ILU 6 accelerator. The accelerator can emit a beam of electrons of energy ranging from 0.15 to 2 MeV, beam power up to 20 kW. This is a unique infrastructure for pilot scale irradiation with the electron beam, which energy can be modified in the range of 0.15-2 MeV energy range and average beam power up to 20 kW. The experimental works and demonstration, which can be performed with the use of ILU-6 accelerator and additional systems include irradiation of gas, liquid and solid type of products. The area of research supported by ILU 6 includes environmental applications to eliminate chemical or microbial contaminants from different media. The ILU 6 accelerator can be also used for modification of polymers such as radiation induced graft polymerisation or crosslinking. Additionally, use of electron beam energy as low as 0.15-0.3 MeV allows performing experiments on surface modification and surface microbial decontamination, and D) the Laboratory for Measurements of Technological Doses (ISO Accredited) equipped in photometric equipment, Electron Spin Resonance Spectrometer, Gamma Cell and the auxiliary equipment for absorbed dose measurements using calorimetric, Fricke's, alanine and polymer foil dosimeters.

Services currently offered by the infrastructure:

INCT, as a leader in the basic research based and development of industrial use of electron accelerators has been actively supporting the development of electron beam applications. However, due to the wide range of possible applications, the electron beam parameters such as the energy of electrons or beam power must be selected for specific use and verified experimentally. The infrastructure offered by the INCT is unique in EU, allowing irradiation with an electron beam in a wide range of processing parameters, which can be customised for the defined products. The INCT international cooperation with the scientific society is supported by the International Atomic Energy Agency (IAEA) which nominated the Institute to be IAEA Collaboration Centre on Radiation dosimetry and industrial radiation processing.

The research work conducted using offered infrastructure includes: pulse radiolysis for fast chemical reaction (investigation on a role played by free radicals in biology and life sciences), irradiation effects on solid, liquids and gas phase components, solid phase physics, semiconductors irradiation, investigation on radiolysis mechanism for biochemistry, experiments on the elimination of contaminants from the exhaust gas (simultaneous removal of SO2 and NOx from flue gases), radiation inactivation of biological hazards, radiation decomposition of chemical contaminants, use of ionising radiation to facilitate the elimination of solids from water, sterilisation of tissue transplants, radiation modification of natural compounds to enhance their bioactivity and extractability, irradiation of polymers in order to induce crosslinking, modification of polymers surface by grafting or microbial decontamination of surfaces.

Description of work

Modality of access under this proposal:

Access to the infrastructure is available to external users either in person (hands-on) or through provision to the user of remote scientific services, such as the performance of sample irradiation or analysis.

Access to the offered infrastructure includes training on safety requirements, stage of preparation (samples preparation, instalment of an additional infrastructure), logistical, technological and scientific support, training, the time needed to run an experiment, dose determination procedures and measurements, if needed analytical analysis using available equipment at the INCT. The INCT will provide personnel to operate the infrastructure and to support users in the selection of appropriate irradiation conditions. It is assumed that within the project 6 experiments per year can be run. It is about 4% of the total access to the infrastructure. One group of users will spend 10 days at the infrastructure, which includes 5 days of preparation and 5 days of experiments. A total of 12000 access units (hours) will be provided for four years. The average cost of the access to the infrastructure is 130 Euro/h.

Support offered under this proposal:

Supports the customers includes consultation with INCT experts to determine the most appropriate parameters for planned experiments, experimental conditions, and post irradiation samples treatment, based on their knowledge and experience. As the main parameter of radiation processing is the dose absorbed, the access to the offered infrastructure includes dose measurements with dosimetry systems used in the Institute ensuring traceability of measured doses to the NPL (UK) primary standard.

The other research infrastructure available at the INCT which can be used to supports experiments using electron beam accelerators includes Electron Paramagnetic Resonance (EPR) spectroscopy, apparatus for material characterization –

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DSC, TGA, GC, Diffuse Reflectance Spectroscopy (DRS), Gas Chromatography (GC), mechanical and rheological tests, dynamic contact angle measurements.
Outreach to new users:
New users will be reached, among others, through information on the Institute's website, which is also available in English, and through the organisation of inter-national meetings in the framework of the cooperation with the IAEA, where the research infrastructure is operated as the RAPID. It is also foreseen to invite proposals from specific user groups such as users representing new areas of research and users representing SMEs. The activities carried out under this proposal will increase the number of transnational users and will contribute to an increase in its demand. It is worth noting that a high assessment of the potential of the possessed research infrastructure is the fact that it has been included officially in the Road Map of scientific infrastructure in Poland.
Description of the infrastructure
Name of the infrastructure (and its installations, if applicable): CERN-CLEAR
Location (town, country) of the infrastructure: Geneva, Switzerland
Web address: https://clear.cern
Annual operating costs (excl. investment costs) of the infrastructure: 1,240,000€
Description of the infrastructure:
CLEAR is a versatile accelerator installation, including a 200 MeV electron linac followed by an experimental beamline and operated at CERN as a multi-purpose user facility, providing high quality e- beams with high availability and easy access to a broad user community.
Its primary focus is general accelerator R&D and component studies for existing and future accelerators covering two of the top priorities identified by the European Strategy for Particle Physics, namely the prototyping and validation of accelerator components for the upgrade of the Large Hadron Collider and its injector chain, and studies of high-gradient acceleration methods, including X-band accelerating structures for linear accelerators, beam diagnostics and novel concepts as plasma and THz acceleration. CLEAR also provides irradiation test capability, already exploited in the areas radiation hardness electronics testing (e.g., for space applications in collaboration with the European Space Agency) and medical applications. In particular, CLEAR is the only facility providing electron beams in the 200 MeV energy range to perform dosimetry studies and explore potential applications of Very High Energy Electron (VHEE) beams to radiotherapy, including the exploitation of the so-called FLASH effect.
Services currently offered by the infrastructure:
Users of the facility have access to all available infrastructures at CERN and receive technical support from the CLEAR facility’s operation team. Support includes help on transport, installation, and access, including radiation protection. The CLEAR operation team is charged of preparing, characterizing and delivering the electron beam within the specified parameters, as determined by existing high-performance beam diagnostics. Data taking and, if needed, data analysis are also typically performed in conjunction between the operation team and the users.
Since its first beam in September 2017, the facility hosted typically about 20 experiments from different users each year, distributed among the following fields: beam diagnostics R&D, medical applications, electronics radiation hardness and space applications, advanced acceleration techniques and others. About half of the users came for external institutes. More than 25 papers related to research carried out at CLEAR have been published so far, and 6 PhD thesis projects completed.
Description of work
Modality of access under this proposal:
The operation time (including beam time) will be provided free of charge to the participating partners. Any user willing to access the facility has to fill-up a beam time request form containing a description of the experiment, its scientific aim and justification, the needed beam parameters and details on the experimental apparatus, logistics, and safety aspects. The CLEAR Technical Board is responsible to check technical, safety and RP issues before giving the final authorization to proposals, following indications by the CLEAR Scientific Committee, and will then allocate the beam time in the yearly schedule in agreement with the users. Typically CLEAR is operated for about 35 weeks/year, with two daily shifts. Depending on the characteristics of each experiment, more than one experiment can share beam time in each week. The shifts are pre-allocated and confirmed or modified in a weekly coordination meeting including the users and taking place on Monday morning. In the framework of this proposal the unit of access being offered is measured in hours of operation, including time for installation/removal of equipment and access during tests if required. Training will be provided to cover access needs if required. External users normally stay on the CERN site to follow-up their experiment from a few days to a couple of weeks (in general they don’t have exclusive use of the facility during the period but may share it with other experiments/groups). A total of 300 units/years is expected to be available for transnational access users.
Support offered under this proposal:
CERN operates the CLEAR accelerator complex, including infrastructure for the experiments, their installation, preparation of the beams, and the beam operation during the experiments. The users will also have access to all available infrastructure like on-site hostels and restaurants, bank and post, library, temporary office space (subject to availability – temporary work-space is always available) and internet access. For each approved project (experiment) in CLEAR the

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TA support could cover travel costs of the collaborators for any of the activities related to the experiment, including visit to the installation and participation in preparatory discussions during the approval phase. It is envisaged to give priority to young/early-stage career researchers (students, fellows). Number of hours used, and people supported per experiment may vary. TA funds will be used to support the users for their travel and subsistence expenses during the experiment preparation, training on safety and facility usage, installation of the experiment, beam operation, dismantling and final transport and safety clearance procedures, and also for some consumables and small works needed for the adaptation of the infrastructure to the needs of the experiment, and if needed for the handling and transport of radioactive material related to the TA experiments in/out and within CERN. TA funds may be used for the eventually necessary meetings and discussions for the CLEAR scientific committee members (max ~1 per year).
Service improvements within EURO-LABS
In order to improve user turn-around time and better adapt beam conditions to user requests, a new beam line is currently under design, which will provide a couple of additional testing slots (one in-vacuum and one in-air). The new beam line will consist of a double-bend achromat and will branch out after the linac, at the level of the first spectrometer magnet, and run parallel to the present beam line for about 8 m. Magnets, power supplies and some beam diagnostics will be recovered from the previous CTF3 installation, while a new Beam Current Transformer (BCT), vacuum pumps, cabling and new or adapted vacuum chambers and supports will be needed. The timeline of realization is 1-2 years after the start of EURO-LABS. The EURO-LABS contribution to these improvements is at the level of 50 k€, while the additional costs will be covered by CLEAR.
Outreach to new users:
CLEAR has been widely advertised to the accelerator community, starting with a dedicated workshop to collect proposals for experiments before the facility approval, and later with presentations at international workshops, seminars, and publications, including articles on the CERN Courier and Accelerating News. The presently established user community includes research teams not just from the accelerator and HEP communities, but also from fields like electronics R&D for space applications, and radiotherapy studies for cancer treatment.
An international workshop on Very High Energy Electrons (VHEE) and FLASH radiotherapy has been organized at CERN in October 2020 on the initiative of the CLEAR team and has attracted more than 400 scientists with diverse backgrounds, from clinicians to biologists and accelerator physicists to dosimetry experts. We plan to have a yearly call for experimental proposals advertised in the CLEAR users e-mail distribution list and others connected lists, published in EUROLABS newsletters and advertised at conferences and workshops. The CLEAR user community has been steadily growing in the last years and we expect transnational access to help new groups to join the community and strengthen the participation – and the corresponding scientific output – of some of the groups already collaborating with us. We routinely keep track of user experiments and will of course keep track of the ones using TA.
Review procedure under this proposal (specific):
In case of budget or scheduling constraints, users may however be re-directed at a later stage of the selection procedure. The Local Selection Committee consists of 3 members designated by the coordinator of the facility; it will allocate the access time and check that the requested access is not covered by LASERLAB. The facility representative will have the possibility to reject a proposal in case of technical incompatibility with the installation.

Work package WP4 – WP4 (TA3): Access to Research Infrastructures for Detector R&D

Work Package Number	WP4	**Lead Beneficiary**	4. JSI
Work Package Name	WP4 (TA3): Access to Research Infrastructures for Detector R&D		
Start Month	1	**End Month**	48

Objectives
This work package provides access to world-class research infrastructures needed to carry out research and development of innovative HEP detectors required in the next generations of HEP experiments. While Tasks 4.1-4.3 are focused on user access in the Transnational Access modality, Task 4.4 provides service improvements to the RI. The service improvements are targeted at the needs of the project but will be exploited also beyond its duration. Therefore, a good fraction of the total cost of the service improvement is expected to be borne by the RI. Deliverables of RI's are pledged and measured in Access Units (AU) that typically represent an hour of facility operation (test beam, irradiation, EMC test facility). Regarding user support, there are two modalities. For test beams, SEE and EMC tests, and for operating module/electronics irradiations users have to be present at the RI to install and run their set-up. In this case (physical user access) user travel support can be granted. For the majority of sensor or material

irradiations, however, users send their samples to the RI. There dedicated RI personnel executes the irradiations including adequate sample preparation and takes care of the post-irradiation treatment (cooling, dosimetry, shipment), returning the samples to the user for evaluation. For such cases (remote user access) additional personnel for user technical support can be granted to the RI.
Users seeking to apply for projects at the RI's are strongly encouraged to first contact the scientific coordinator of the respective RI to check for technical aspects of the proposal. The scientific coordinator can discourage the application on technical grounds, propose changes to the project or direct the users to a different RI more suitable for the execution of the project.
The allocation of EURO-LABS resources (Access Units) in WP4 needs to be approved and is overseen by the WP4 User Selection Panel (USP). The USP is composed of international experts from the community, including members from outside the Consortium. USP is chaired by the WP4 leader. Membership includes one representative of the WP4.1, WP4.2 and WP4.3 tasks and members representing the major user communities (e.g. ATLAS, CMS, R&D collaborations, Higgs factory, etc.). The USP will also look at ways of combining requests so that multiple groups could benefit from the same allocated beam time. In case certain facilities receive an overwhelming number of excellent proposals, the USP may recommend some of the projects to be carried out at another facility that offers TA in EURO-LABS.

Generic review procedure in WP4: The scientific RI coordinator checks the technical requirements and eligibility of applications. Then the EURO-LABS WP4 User Selection Panel gets notified the application and decides on the allocation of resources.

Description

Task 4.1 (Test beams) is split across three research infrastructures (sub-tasks)
• 4.1.1: CERN PS and SPS test beams
• 4.1.2: DESY-II Test beam Facility
• 4.1.3: PSI PiM1 and UCN test beams
Provision of access to the following infrastructure(s):
Description of the infrastructure
Name of the infrastructure: 4.1.1: CERN PS and SPS test beams
Location (town, country): CERN, Geneva, Switzerland
Web site address: http://cern.ch/sba
Annual operating costs (excl. investment costs) of the infrastructure: 13,520,135.21 €
Description of the infrastructure: The CERN PS (proton synchrotron) and SPS (super proton synchrotron) test beams provide particle beams in the energy range from ~1 GeV to ~350 GeV. Upstream of the physicist's test set-up sophisticated beam line equipment allows selecting the type, polarity and energy of particles as well as the beam intensity. A total of seven general purpose test beam lines and their large, well-equipped experimental areas are available for RI for Detectors.
Services currently offered by the infrastructure: General services and amenities available to users at CERN include a user's office, three on-site hostels, three restaurants, several cafeterias, Swiss and French banks and post offices, as well as a scientific information service with a large library. Seven general purpose test beams are available to the users; each beam line ends in a large experimental area with adjacent huts to house data acquisition and control electronics. Standard infrastructures like electricity, water cooling, gases (including safety systems for flammable gases), cranes with operators, computer networks and electronics racks are available. Users are provided platforms made of concrete blocks to allow installation of their equipment at the adequate beam height and are being assisted by a survey team for precise alignment of their equipment in the beam. Specialised additions such as motorised X-Y tables, beam telescopes, wire chambers and scintillators for beam monitoring etc. can be put in place with the professional help of CERN services. This will be covered by EURO-LABS as part of the technical infrastructure support, within the limit of available resources. Some of the special equipment will be at the charge of the users. Test beam users profit from the professional advice and technical support of experts, who are specialised in the optimisation of test beams following the user's requirements. Safety and radiation protection experts are guiding the users before and during the use of the test beams.
Description of work
Modality of access under this proposal: Access to the CERN test beams and irradiation facilities and the beam itself is provided free of charge. Users are given access to the experimental areas, where they can install and test their equipment. Professional crews operate the beam lines, while the users themselves can carry out standard setting-changes. The minimum duration of access to the test beam area is 8 hours and can span to several weeks. Scheduling of the facilities takes place on a yearly basis for users requiring long exposure times. For shorter exposures, the schedules allow for more short-term flexibility. RI users are treated on an equal footing with normal users. Availability of the beam is subject to the technical stops and machine developments of PS and SPS necessary for the injector complex.
Support offered under this proposal: In addition to the services and support described above, RI users are eligible to

receive subsistence payments, financed by EC funding. The EURO-LABS project offers additional user support for liaising with the specialised CERN services required for beam tests and for identifying the most appropriate beam line and technical solutions.
Outreach to new users: The CERN test beam and irradiation facilities are well-known within the particle physics community worldwide. CERN presently has about 13,500 registered users, many of them participating in beam tests and detector irradiation. Nevertheless, through EURO-LABS and its infrastructure improvements an even larger user community can be served. Outside particle physics, CERN's facilities have assets for space applications, development of radiation monitoring devices and research in plasma physics and fusion as well as meteorology. Information on RI in EURO-LABS will be spread via the existing CERN scientific committees, in which users propose new experiments and present test beam requests. CERN also plans to advertise actively in media such as CERN Courier, LC Newsline, EIROforum communication media, ITER communication media, as well as via the EURO-LABS outreach activities.
Review procedure under this proposal: The selection of users proceeds through the review procedure that is already in place at CERN: Requests for more than two weeks (one week) of beam time at the PS (SPS) have to be examined and recommended by the "PS and SPS experiments committee"; those requests which concern R&D projects for the upgrade of LHC experiments are considered by the "LHC experiments committee". Both are international committees composed of well-known experts in particle physics, they meet typically five times per year and report to the CERN "Research Board". Shorter requests for beam time are usually easier to fulfil. They are examined, in accordance with the present CERN procedure, by the "CERN PS and SPS physics coordinator". Where appropriate the requests are discussed with the DESY and PSI test beam coordinators and the EURO-LABS management. In all cases, the selected requests for test beam at the PS or SPS are sent to the USP for endorsement and allocation of EURO-LABS resources.
Description of the infrastructure
Name of the infrastructure: 4.1.2: DESY II Test Beam Facility
Location (town, country): DESY, Hamburg, Germany
Web site address: http://testbeam.desy.de
Annual operating costs (excl. investment costs) of the infrastructure: 703,725.00 €
Description of the infrastructure: DESY presently operates at Hamburg several particle accelerators of worldwide relevance including PETRA III, FLASH and the European XFEL. For PETRA III, the DESY II synchrotron is used as an injector and delivers in parallel electron or positron beams for up to three test beam areas using a fixed secondary target. Due to high demands on the PETRA III light source, DESY II has a very high availability of > 99%. Access to these beam lines is the subject of the Transnational Access activity described here. DESY II can provide beams with an energy between 1 GeV and 6 GeV, a small energy spread of about 5%, and rates up to several 10 kHz, depending on beam line and the choice of the secondary target. Next to CERN, DESY is currently the only laboratory in Europe delivering high energetic particles in the multi-GeV range for test beam use. Due to its easy handling, the DESY test beam is an excellent facility for prototype testing where either many accesses to the beam area or continuous beams are required. The DESY Test Beam Facility usually operates from February until the Christmas Shutdown and calls for beam time are published twice a year.
The support for users requested in this project encourages and enlarges the continued use of this infrastructure upgraded in FP6, FP7 and Horizon2020 projects.
Services currently offered by the infrastructure: The three test beam areas provide sufficient space for the installation of large-scale detector prototypes. They are equipped with huts to house data acquisition and control electronics. Each area provides high-speed Ethernet and fibre links as well as HV and BNC patch panels to make connections between devices in the area and the control huts. Safety equipment is available such that gas detectors can be used even with flammable gases. Translation stages – the DESY green tables - are available in the beam lines for remote controlled positioning of test equipment with a load of up one Ton. Within the FP6-EUDET and FP7-AIDA project the infrastructure was equipped with a high field superconducting magnet with a field strength of up to one Tesla, and a high precision silicon pixel telescope – the so-called EUDET-type Pixel Beam Telescope -with a point resolution of down to two microns. Two additional telescopes have now been installed as well using different funding sources. This allows to offer telescopes in all three areas and a dedicated telescope support team is available to support the telescope user. All telescopes also come with a precision xy and rotational stage for the device-under-test. During the Horizon-2020 AIDA-2020 Project, a common slow-control system and a larger-are strip telescope have been installed as well. The areas are equipped to handle irradiated sensors and a dedicated freezer for storage is available as well.
This existing infrastructure makes the DESY II test beam facility one of the few places in Europe where detector can be tested with high energetic particles. It has been extensively used in the past decades for the development of new detectors and prototype tests. In recent years the DESY test beam played an important role for the LHC programme – in particular the HL-LHC upgrades – other major experiments like Belle II or T2K, Linear Collider detector R&D and Heavy-Ion detector facilities. The LHC experiments – with a strong focus on the silicon-strip and silicon-pixel detectors have been the major user with a share of about 50% of all the users. The DESY II Test Beam facility has been also a key facility for the testing of the Belle II silicon tracking system and the T2K TPC. Several groups performed experiments with highly granular or dual-readout calorimeter prototypes as well as small pixel detectors aimed at next generation Higgs

factories or heavy-ion facilities. The results obtained at the DESY II Test Beam facility contributed very significantly to the current state of these R&D efforts.
Another cornerstone are education and outreach, the test beam has been used for summer student projects every year and we have been hosting the Beamline4Schools Competition in 2019 and 2020, as the CERN Beam lines were in shutdown. The use of the facility continues to grow, in the year 2019 in total 702 users from 31 countries have used the DESY II Test Beam Facility. Even in 2020, where operations and particularly user travel was severely affected due to the COVID-19 pandemic, COVID-19 induced difficulties, it was a very successful run with 345 users from 27 countries. With the next shutdown of the CERN accelerator complex looming in a few years, DESY will be again the only facility offering test beams in Europe and hence remain a key facility for the Detector R&D in Europe.
Description of work
Modality of access under this proposal: Access to the DESY Facility is granted after evaluation of received applications. The primary criterion for selection of a proposal is scientific merit, but factors such as the previous usage of the facility and operational constraints will also be taken into account. The selection procedure will be undertaken by DESY test beam coordinators in close cooperation with the User Selection Panel (see below); after this the selected experiment group can appoint the concert date and the length of access. The typical length of access to the test beam is between one and four weeks with an average of about twelve days. The average size of user groups is about four researchers. Typical infrastructures used by groups in the DESY test beam are the telescopes, translation stages or trigger electronics. Once the groups are set-up in the beam area and familiar with the DESY safety rules, the studies are conducted independently. During DESY operational periods the beam is available at the experimental areas for about 95% of the time. The remaining time is needed to refill the accelerator replacing the spent beam and to synchronize with the other accelerators on the DESY site. The overall dead time of 5% includes also all losses due to technical problems of the machine. The operation of the beam and therefore access to the test beam area is under the control of the experimenter.
Access to the DESY II Test Beam Facility is provided free of charge.
Support offered under this proposal: The DESY test beam coordinators are the central point of contact for the experimenter at DESY and ensure safety and proper technical support of the experimenter during their time at DESY. This includes access to technical services, safety instructions and assistance during the setup and dismantling phase. DESY provides access to the shop service according to the standard conditions for DESY users, access to stores, office and IT infrastructure. The test beam coordinators also instruct and support the researcher in the use of the additional equipment such as the telescope or the superconducting magnet. User accounts for the central computing facilities are granted on request. All users granted access to the DESY facility under this proposal will also receive needed administrative support for the whole time of their state at DESY. There are several guesthouses on the DESY site providing accommodations at cost price. External users are an integral part of the life and are invited to seminars and other scientific events at the laboratory. They profit from the highly international and stimulating atmosphere at the laboratory.
Outreach to new users: The DESY test beam is in the international detector R&D community already well known as an easy to access, reliable facility. Scientific results obtained were published at many conferences and in numerous journals, giving rise to higher recognition of this facility. The DESY II Test Beam Facility is advertised on the web (http://testbeam.desy.de), by dedicated email lists and suitable scientific media, at least once a year. It is listed in the CATRIS database. Another way to actively increase the user community is by giving talks at international conferences and using social media networks. Additionally, DESY hosts user workshop every few years, which act as a very efficient exchange forum.
Review procedure under this proposal: Access to the DESY Facility is granted after evaluation of received applications. The selection procedure will be undertaken by DESY test beam coordinators in close cooperation with the User Selection Panel. They evaluate the proposals and rank them into three categories (A: Approved, B: Approved, but on waiting list, C: Rejected) based on the scientific merit of the proposed experiment, but factors such as previous usage of the facility and operational constraints will be also be taken into account.
Description of the infrastructure
Name of the Infrastructure: 4.1.3: PSI-CHRISP, PiM1 and UCN West-2
Location: PSI, Villigen, Switzerland
Websites: https://www.psi.ch/de/sbl/pim1-beamline https://www.psi.ch/de/ucn
Annual operating costs: 1.3 MCHF (for the two beam lines only)
Description of infrastructures and services offered: The Paul Scherrer Institut is a multidisciplinary Swiss national research laboratory. It runs several accelerators: the synchrotron Swiss Light Source SLS, the free-electron X-ray laser SwissFEL, and the high intensity proton accelerator (HIPA) complex which delivers protons to the SINQ neutron spallation source, the SμS muon source and the Swiss research infrastructure for particle physics CHRISP. All these facilities are run as user laboratories for external and internal users. PSI hosts approximately 5000 external scientists per year.
Both installations of this proposal, PiM1 and UCN belong to CHRISP and serve both, physics experiments and as test beam areas for detector qualification.

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All necessary services (power, cooling, network, space outside the beam area, support by experienced PSI staff including crane and dosimetry services, accommodation and catering) are available to user of both facilities.
The secondary beamline PiM1 is very flexible and can be configured by the users. It is designed to provide pions with a very well-defined momentum between 100 and 500 MeV/c. However, a beam operation mode for electrons and muons exists also. The beam profile and particle flux are adjustable by the users. The beam is continuous with a bunch frequency of 50MHz. The experimental area provides sufficient space for the test of most tracking devices. In order to improve the service to the users it is planned to build a new beam position monitor with scintillating fibres and Silicon-PMs utilizing the time-of-flight measurement for particle identification. In the last years beam time at PiM1 was well demanded. Not all requests could be fulfilled. Users came e.g. from Timespot, Mu3e (DMAPS), CMS (R&D for silicon and diamond pixels), LHCB (pixels), and IDEA (micromegas).
The ultracold neutron facility UCN has 2 beamlines (West-1, West-2) which are available to external users for annual beamtime requests. West-1 provides a world-leading UCN intensity and is operated in a pulsed mode with UCN pulses every 300s, or at adjustable longer intervals or lower intensity on user request. West-2 provides about a factor 10 lower intensity. UCN equipment like UCN guides, monitor detectors, UCN chopper, UCN spin flipper, spin polarizer and analyser, UCN storage bottle, UCN shutters, vacuum pumps and measurements sensors are available to users. The experimental area provides enough space for testing UCN detectors of all sizes currently in use. The UCN port can be split to allow for parallel testing of detectors. In the last years users doing detector R&D at the UCN beamlines came e.g. from Cracow University (OTUS), LPSC-CAEN (NANOSC, DUKE) and TRIUMF (TUCAN).
Description of work
Modality of access under this proposal: Beamtime has to be requested to the annual user's meeting which takes place in the beginning of each year. Proposals are evaluated on scientific merit by the international scientific committee (ISC) which grants (or rejects) beamtime and proposes a schedule. Deadline for proposals is every January. Although the operation of facilities is very expensive, users are not charged for the beam time.
Support offered under this proposal: In addition to the services and support described above, external users from foreign countries are eligible to receive subsistence payments, financed by SERI complement to EURO-LABS funding.
Outreach to new users:
The experimental areas of the Swiss research infrastructure for particle physics CHRISP [1,2] are well known in the community of particle physicists. This can be seen from the large number of applications for beam time which in most years exceed the available time slots. The results of measurements done at PSI are typically published with mentioning of PSI in the article. The annual public users meeting in which all applicants for beam time report on their activities is a good occasion for exchange between the present and prospective users. Information on the research infrastructure and the application process is available online. The digital users office (duo [3]) integrates and facilitates all processes necessary, from beam time applications up the reservations of rooms in the guest house. The resources applied for in this proposal will mainly be used to allow transnational users to visit PSI. This will be mainly help students which do not have access to travel funds to carry out their research at PSI which can be considered as the most effective outreach to new users.
[1] https://www.psi.ch/en/sbl
[2] https://www.psi.ch/en/media/our-research/the-swiss-research-infrastructure-for-particle-physics-chrisp
[3] https://duo.psi.ch/duo/
Review procedure under this proposal: After approval by the ISC, EURO-LABS resources are allocated subject to approval of the project by USP.

Task 4.2 (Detector characterization) is split across two research infrastructures (sub-tasks):
• 4.2.1: RBI-AC, Croatia
• 4.2.2: ITAINNOVA EMC Lab, Spain
Description of the infrastructure
Name of the infrastructure: 4.2.1: Ruđer Bošković Institute Accelerator Facility (RBI-AF)
Location: RBI, Zagreb, Croatia
Websites: https://www.irb.hr/eng/Divisions/Division-of-Experimental-Physics
Annual operating costs: 490,697 €
Description of infrastructure: RBI runs the Tandem accelerator facility (RBI-AF) used for experiments in nuclear physics and applications. RBI-AF is equipped with 1 MV Tandetron and 6 MV EN Tandem accelerators and 9 end-stations, including two ion microbeams, end station for Time-of-Flight Elastic Recoil Detection Analysis (TOF-ERDA), end-station for ion channelling experiments, large vacuum chamber for ion irradiation experiments, etc. Ion microbeam stations have multifunctional capabilities, including ion irradiations at microscopic scale and the use of ion beams as a probe for detector characterization studies using for example Ion Beam Induced Charge technique (IBIC). This facility is a key instrument for detector characterisation at microscopic scales. RBI-AF has been regularly used by many international research groups for various applications, including detector characterisation, mainly by exploiting the IBIC and TRIBIC techniques and irradiation by MeV ions for radiation hardness studies.
Description of work

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Modality of access under this proposal: Access could be provided according to either of the following modalities:
– In person/hands-on' (the presence of the user group is required/recommended during the whole operation period)
– Partially remote (the presence of the user group is required at some stage e.g. installing and un-installing user's equipment)
– Remote (the measuring system is implemented by the operator of the installation and the presence of the user group is not required).
In persons/hands-on modality is highly preferable, especially for in-situ/operandi characterisation of detector prototypes and related electronic systems under development by user groups. In such cases user presence and expertise at some point would be mandatory. Remote modality could be exceptionally accepted for radiation hardness studies on detector materials and similar studies.
Modality used to declare access costs: TA-UC. User access: average 42 units (hours) beam per user project in up to 5 days.
Support offered under this proposal: Scientific, technical and logistic support during their experiments and some help for post-experiment analysis of data. Users will be given access to RBI-AF to study: (i) in vacuum and in-air IBIC imaging of charge collection properties using protons of up to 10 MeV with 1 μm resolution and heavier ions on demand and/or time resolved IBIC (lateral and frontal TRIBIC); (ii) real-time controlled damaging of small detector areas using protons or heavier ions for radiation hardness studies. For such studies users will have on disposal our heavy ion microprobe and other end stations depending on the actual objectives of the proposed work.
Outreach to new users: We will promote access to users and user-groups, widely through the web, mailing lists, other public access media and at scientific conferences where we will participate.
Review procedure under this proposal: Selection of proposals will be on the basis of scientific excellence, innovation status and impacts for the research community, having in mind to include new users and users coming from countries where our infrastructure is not available. The detailed review procedures will be defined at the beginning of the project, following the principles of transparency, fairness and impartiality. After submission, the RBI-AF staff will perform preliminary technical feasibility screening and provide the opinion to the WP4 USP for resources allocation.
Description of the infrastructure
Name of the infrastructure: 4.2.2 EMC Laboratory at ITAINNOVA
Location (town, country): ITAINNOVA, Zaragoza, Spain
Annual operating costs (excl. investment costs) of the infrastructure: 400,000 €
Description of the infrastructure: The Instituto Tecnológico de Aragón (ITAINNOVA) is a non-profit Research and Technology Organisation (RTO). The EMC lab is fully equipped to perform any EMC measurement. Two semi-anechoic chambers and Faraday cage will allow to carry out standardized EMC tests as well as EM characterization of mid-scale prototypes. The lab is an accredited laboratory for European Directive and several product standards. The laboratory has several current probes to measure and inject conducted noise from DC up to 400 MHz, antennas to measure noise from few kHz up to 18 GHz and inject noise with generators up to 20 GHz and amplifiers up to 6 GHz.
Since 2008 ITAINNOVA has been working in the domain of physics experiments. ITAINNOVA has been involved in several International R&D programs for new generation of particle accelerators (Super Large Hadron Collider, Super KEK B and International Linear Collider) and EU projects (AIDA2020) designing new power supply distribution systems for next generation of physics experiments and performing the EMC characterization of new physics detectors. Over the last years, ITAINNOVA has collaborated with several research centres, such as CERN, Max Planck Institute, KEK, SLAC and FERMILAB. These collaborations have allowed adapting part of the EMC facility and to define new test procedures in order to perform non-standard tests focused on HEP, which makes this facility unique for noise and grounding diagnosis. While there are several EMC facilities focused on aerospace, automobile or household appliances, there is no EMC facility specialised on physics experiments other than ITAINNOVA.
Services currently offered by the infrastructure: ITAINNOVA offers the possibility to perform any EMC test for a period of 4 weeks per year. There will be two different types of access. Standard access, which will be mainly focused on component characterisation and extended access which is required to perform a full electromagnetic characterisation of large systems. ITAINNOVA staff will help users to prepare the test set-up. They have to be present at ITAINNOVA during the test while ITAINNOVA engineers will operate the testing equipment of the facility. For ITAINNOVA_EMC, typically 2 or 3 experiments are expected per year.
Description of work
Modality of access under this proposal: EMC facilities and related equipment at ITAINNOVA will be available for noise characterisation and grounding diagnosis within the studies carried out to improve operation of physics detectors. ITAINNOVA will take care of the operation of the infrastructure, while the user is expected to participate with ITAINNOVA specialists in the definition of the goals of the tests. Users will be responsible with the analysis of the test results. Auxiliary test-boards that may be required for non-standard tests will be provided by ITAINNOVA.
Total period of ITAINNOVA availability for all the EMC tests is estimated to 4 weeks per year. Access duration will be 1 or 0.5 week for component testing (standard access) and 2-3 weeks for large systems (extended access). This period will be devoted to the access required for the experiment performance.
Prior to the testing phase, user reception and distribution of basic information of the premises and safety issues related

to the stay during the experiments will be arranged. Identification badges will be provided by ITAINNOVA for test requester personnel. Users are expected to request access a few months in advance and to have a technical discussion about their specific needs prior to the access.
Support offered under this proposal: ITAINNOVA will offer infrastructure or equipment and expert support to carry out both standard and non-standard tests (focused on HEP), including the characterisation of EM noise emission and immunity levels. ITAINNOVA support will start with an initial contact in which the specific needs will be discussed with the users. Meetings and trips of ITAINNOVA personnel required at this stage will be scheduled as needed. The experiment protocols will be defined, and a testing plan will be defined according to the goals specified by the user. During the experiment, two members of ITAINNOVA personnel will be available for equipment operation. Finally, ITAINNOVA will provide users with a data package which will include a description of the tests performed, conditions under which the experiments were carried out, and the results obtained during the tests. ITAINNOVA will provide users with the necessary logistics support. The budget from EURO-LABS covers the use of ITAINNOVA installations and test set-up as well as the travel expenses for 1 user per access. Transport of equipment to/from ITAINNOVA premises is not covered.
Outreach to new users: ITAINNOVA facilities are currently used for EM noise characterisation in different international projects, including HEP, both at component and at whole system level. Results of tests for HEP experiments will be published in workshops and specialised conferences, as well as through the EURO-LABS dissemination channels.
Review procedure under this proposal: generic (see WP4 introduction)

Task WP4.3 (Irradiations) is split across six research infrastructures (sub-tasks):
• 4.3.1: CERN IRRAD, Switzerland
• 4.3.2: CERN GIF++, Switzerland
• 4.3.3: JSI TRIGA reactor, Slovenia
• 4.3.4: IFJ PAN AIC-144 cyclotron, Poland
• 4.3.5: UCLouvain CRC, Belgium
• 4.3.6: UoB MC40 Cyclotron, United Kingdom
Description of the infrastructure
Name of the infrastructure: 4.3.1: IRRAD
Location (town, country): Geneva, Switzerland
Web site address: http://www.cern.ch/ps-irrad
Annual operating costs (excl. investment costs) of the installation: 736,119 €
Description of the installation: The irradiation facility is located in the EAST AREA of the CERN PS (Proton Synchrotron) and underwent a major upgrade in 2013/2014 to cope with the increased demands for high energy high flux irradiations in view of the LHC upgrade projects. It offers the possibility to expose materials to protons of 24 GeV/c. Objects with an area of up to 10x10 cm2 can be exposed to fluences of up to 1015 particles/cm2. Smaller objects can be irradiated up to higher fluences reaching up to 1017 particles/cm2 in irradiation experiments for which a beam spot of 5x5mm2 FWHM is sufficient. The majority of the users originate from the particle physics community. In 2018, the last year of operation before the general CERN accelerator shutdown 2 (LS2), about 800 objects had been irradiated for about 80 different users from 20 different institutes in 227 days with beam. In 2019/2020 the technical area of IRRAD was further improved (partially in the framework of the AIDA-2020 project) to increase the capabilities of the facility in handling and characterizing radioactive material and samples after irradiation.
Services currently offered by the installation: A number of core technical services are provided with the proton beam facility: Users receive professional advice on irradiation issues and are supported in planning their irradiation experiments. Storage space for activated material is provided as well as access to the counting room with infrastructure to install read-out and control systems for the components under irradiation. The dosimetry is provided by the facility operation team with dosimeters that are analysed and calibrated in-house. An online beam monitoring system allows analysing each individual proton spill impinging on the samples. All irradiated materials are registered in a central database, traced, handled, stored and, on user request, they are eventually packaged and shipped strictly following safety regulations. Where needed, shipping is performed in containers that keep the samples cold for several days.
Description of work
Modality of access under this proposal: Access to the CERN proton facility is provided free of charge. Approved users are given access to the irradiation area, where they can install their equipment on remote controlled irradiation tables. The beam itself is operated by a professional operations crew which works closely together with the irradiation facility team that provides the local service (see above). Availability of the irradiation beam is subject to the technical stops of the PS and the schedule of the SPS and LHC operation. The unit of access is an hour of preparation time or time of the sample in the beam line. 4,000 units will be provided with an anticipated splitting of about 1,400 units for irradiations requiring user presence on site and about 2,600 units for irradiations that will be performed by the facility team for the users. Estimated number of projects: 16.
Support offered under this proposal: The selected projects and users will have access to the services described above.

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Users performing irradiation experiments at CERN will receive subsistence payments, financed by the EC funding. Additionally, and only for irradiation experiments that do not require any online readout or other electrical connections (passive irradiations), irradiations will be performed by the facility operation team. Material can be shipped to CERN where it will be prepared for irradiation, exposed to the beam and then shipped back to the user.
Outreach to new users: See common description of outreach for "CERN test beam and irradiation facilities" in sub-task 4.1.1 – CERN Test Beams.
Review procedure under this proposal: Requests for irradiations, reviewed and selected through the User Selection Panel (USP), have in parallel to follow the standard CERN access procedure for irradiation facilities and have to comply with the CERN radiation safety regulations. The access is granted through the PH-DT (The Detector Technologies group in the Physics department) service team, which annually performs beam requests towards the "PS and SPS coordinator", who reports towards the relevant CERN committees (see task 4.3.2 GIF++ for more details).
Description of the infrastructure
Name of the installation: 4.3.2: GIF++
Location (town, country): Geneva, Switzerland
Web site address: http://cern.ch/gif-irrad
Annual operating costs (excl. investment costs) of the installation: 736,119 €
Description of the infrastructure: The GIF++ facility is located in the H4 beam line of the CERN SPS North Area. It is a unique facility which combines a high energy charged particle beam (mainly muon beam with momentum up to 100 GeV/c) with a 12 TBq 137Cesium source. The main purpose of this facility is to perform test beam experiments of gas detectors in an intense gamma background field. The >100 m2 GIF++ irradiation bunker (extended during the LS2 in 2019/2020) has two independent irradiation zones making it possible to test real size detectors, of up to several m2, as well as a broad range of smaller prototype detectors and electronic components. The photon flux of each irradiation zone can be tuned using a set of lead filters with attenuation factors up to 50,000.
Services currently offered by the installation: Services and infrastructure including electronic racks, gas systems, radiation and environmental monitoring systems, and a sample preparation zone allow time effective installations of detectors. A dedicated control system is providing the overview of the status of the facility and archives relevant information. Most of these user-infrastructure systems have been built and upgraded in the framework of the AIDA and AIDA-2020 projects.
Description of work
Modality of access under this proposal: Access to the CERN GIF++ facility is provided free of charge. Users are however charged for their gas consumption and special services they might request. Approved users are given access to the irradiation area, where they can install and test their equipment. The beam itself is operated by a professional operations crew, while the users themselves can carry out or request standard setting-changes. Availability of the irradiation beam is subject to the technical stops of the SPS, beam time attributed to the users of the H4 beam line by the according committees and the overall schedule of the CERN accelerator complex operation. Experiments can also be performed without beam, using the cosmic tracker and/or the gamma source only. The unit of access is an hour of preparation time or time of the device under test in the irradiation area. 4,000 units will be provided serving an estimated number of 14 projects.
Support offered under this proposal: The selected projects and users will have access to the services described above. Users performing experiments at the GIF++ facility will receive subsistence payments, financed by the EC funding.
Outreach to new users: See common description of outreach for "CERN test beam and irradiation facilities" for sub-task 4.1.1 – CERN Test Beams.
Review procedure under this proposal: Requests for irradiations are reviewed and selected through the User Selection Panel (USP). They have in parallel to follow the standard CERN access procedure for irradiation facilities and test beam lines. Requests for more than two weeks (one week) of beam time at the PS (SPS) have to be examined and recommended by the "PS and SPS experiments committee"; those requests concerning R&D projects for the LHC experiments are considered by the "LHC experiments committee". Both committees meet typically five times per year, are composed of well-known experts in particle physics, and report to the CERN "Research Board".
Description of the infrastructure
Name of the infrastructure: 4.3.3: Jožef Stefan Institute (JSI) TRIGA Reactor
Location (town, country): Ljubljana, Slovenia
Web site address: https://ric.ijs.si/en/
Annual operating costs (excl. investment costs) of the infrastructure: 318.447 €
Description of the infrastructure: The infrastructure consists of a TRIGA-Mark-II reactor with hot-cell laboratories and various neutron irradiation facilities. Reactor power is 250 kW, maximum total flux is ~ 7 × 1012 cm-2 s-1 (central channel). The reactor is equipped with several in-core and ex-core irradiation channels. Power can be scaled down to a few 10 mW for lower fluxes. Typical flux at highest power in the in-core channels is 1-6 × 1012 cm-2s-1 and in the ex-core (in which samples are placed at the side of the core) channels < 1012cm-2s-1. The typical thermal-to-total flux

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ratio is 1/2. The maximum uninterrupted irradiation time is 20 h. Irradiation facilities (channels) are described in detail in https:/ric.ijs.si/en/info-za-uporabnike/lastnosti-obsevalnih-kanalov/
In the core, channels are circular tubes occupying an empty fuel element position inside the core. In these channels, samples have to fit in a cylinder with 2.5 cm diameter and a length of 10 cm. There are two larger channels with an approximately triangular shape that occupy 3 fuel elements position in which samples with the lateral dimension of about 6 cm can be inserted. Recently installed tangential (ex-core, beam port no. 5 and no. 6) channels allow irradiation of objects with lateral dimensions of up to 12 cm at maximal fast neutron flux close to 5 × 1011 cm-2 s-1. There is a plan to install a cadmium shield in the tangential channel no. 6 to absorb thermal neutrons and so reduce radioactivation of samples.
In last years' reactor has been used also as a source for Total Ionizing Dose (TID) tests. Samples are exposed to the radiation arising from radioactivity of the reactor core by inserting them in irradiation channels when the reactor (i.e. the fission chain reaction) is switched off and neutron flux in the core is negligible. Dose rates depend on reactor operation history and doses of tens of 100 kGy can be accumulated over a weekend.
All irradiation channels technically allow connections to the samples with cables during irradiation.
The reactor is routinely used in the following research: irradiation of detectors, test structures and electronics for HEP; activation analysis; neutron dosimetry and spectrometry; activation of materials, nuclear waste and decommissioning; irradiation of materials for fusion reactors; neutronics and reactor physics.
TRIGA reactor has been recognised as a relevant tool for the measurement of radiation effects. There is wide interest in the HEP community for irradiations of sensors, electronic components and materials. In the last three years, more than 600 irradiations were made only for the HEP community and a large number of scientific papers were published as a result of these irradiations.
Services currently offered by the infrastructure: Fluences as high as 1018 cm-2 can be delivered to small (several cm2) samples. Reactor staff is licensed for and experienced in performing the irradiations for scientific and other purposes.
Description of work
Modality of access under this proposal: Qualified JSI reactor staff members perform the irradiation of samples (inserting and extracting of samples, operation of the reactor). Users are shipped the irradiated samples after activation inspection. Irradiations are performed according to the reactor operation plan. Normally, the reactor is available for irradiation every day from 8h00 to 15h00. One 20-hour irradiation is feasible per week. If samples are read out during irradiation users have access to the reactor during normal operating hours. The operation plan can be adjusted to the users' needs.
Support offered under this proposal: Scientific support: The external users may benefit from the measurements of the gamma spectroscopy laboratory at the reactor facility equipped with high sensitivity gamma detection system and corresponding software. Additional facilities (manual ultrasonic bonder, probe station, C/V-I/V characterisation, CCE measurement) are available within the Experimental Particle Physics Department. Local scientific staff members are experienced in neutron activation methods, neutron, gamma and alpha spectroscopy and characterisation of neutron and gamma irradiation fields (Monte-Carlo calculations). Complete radiation protection and health physics services are provided. Manipulation of the radioactive samples can be entirely performed by the reactor staff. The radioactive waste is conditioned, stored and disposed of by the JSI staff.
Outreach to new users: Basic information can be found on the web page: https://ric.ijs.si/en/
The reactor is also included in the IAEA information system and is well known among users in the nuclear technology field. However, the potential users outside the nuclear community are usually not aware of the research possibilities that it offers. In this respect, new users are attracted mainly through conferences, visits, and personal communication.
Review procedure under this proposal: generic (see WP4 introduction)
Description of the infrastructure
Name of the infrastructure: 4.3.4: AIC-144 cyclotron (IFJ PAN)
Location (town, country): Kraków, Poland
Web site address: www.ifj.edu.pl
Annual operating costs (excl. investment costs) of the infrastructure: 400,000 €
Description of the infrastructure: The infrastructure is located at the premises of IFJ PAN Kraków in a single building complex. The AIC-144 is the 60 MeV proton isochronous cyclotron, constructed and developed at the Institute of Nuclear Physics, Kraków in the 1990s. The cyclotron was primarily developed for nuclear physics research and experimental radiochemistry. Between 2011-2016 the cyclotron was used for ocular proton radiotherapy. Nowadays it used for experimental work in radiation biology, developments in the field of medical physics, dosimetry, testing new detectors and for irradiations of electronic components.
AIC-144 cyclotron parameters: Magnet Leg Diameter: 144 cm; Magnetic Structure: 4 spiral sectors with angle from 45º to 54º; Magnetic Field: 0.85 ÷ 1.8 T; Main Coil Current: 0 ÷ 650 A; Number of Trim Coils: 20; Number of Harmonic Coils: 4; Trim Coils Current: ±400 A; Number of Dees: 1 (α=180º); RF Generator Frequency: 10 ÷ 27 MHz; RF Generator Power: 120 kW; Dee voltage: 65 kV; Ion beam extraction system: - method of the precession of orbits: 4 harmonic coils, 3 electrostatic deflectors, 3 passive magnetic channels. The range of available beam currents: 2nA – 80nA (short term current 130nA).

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Experimental line - beam parameters: The experimental line (R1) is used for experimental isotope production and high dose irradiation of electronic components. High intensity beam parameters: Beam energy: 10 – 60 MeV; Field diameter for non-scattered beam: from 1 cm to 3 cm (in waist FWHM<1cm); Proton flux: 1x108 – 3x1011 p/cm2*s; beam intensity 0.5 – 40 Gy/s; Field diameter for scattered beam up to 12 cm; Uniformity better than 20% for 12 cm field diameter.
Small field horizontal line - beam parameters: Beam parameters: Beam energy: 0 - 60 MeV; Proton flux 5.5x105 – 1x109 p/cm2*s; Max field diameter 4 cm; Recommended field diameter 2.5 cm; Dose rate 0.01 – 1 Gy/s in pristine and Spread-Out Bragg Peak; Uniformity better than 2 %; Unmodulated and modulated beam available; Range up to 29 mm in water; Modulation 0- 29 mm; Dose delivered with precision better than 0.5%. Sample positioning system: Precision of positioning better than 0.1 mm; Laser system for checking sample positioning; X-ray positioning equipment with precision better than 0.1 mm.
Available dosimetry and beam control: Active dosimetry with ionization chambers (complies with IAEA TRS-398); silicon diodes, diamond detectors, water and solid-state phantoms; alanine dosimetry; TLD and 2D TLD dosimetry; CCD camera + and scintillation screen, Faraday cup.
Description of work
Modality of access under this proposal: AIC-144 provides for TA access about 800 hours of beam time per 4 years, which corresponds to about 8-10 experiments yearly, three 8-hour shifts per experiment. The access costs will be calculated on the basis of unit cost.
Support offered under this proposal: Technical assistance of all kinds is provided by the IFJ technical staff. Mechanical and electronic workshops are available for the users. We might help in setting up equipment for use in experiments. In house physicists assist and support the experimental teams in setup of experimental facilities and to perform measurements.
Outreach to new users: Information about AIC-144 facility (technical and scientific information, calls for proposals, European support) is available online: www.ifj.edu.pl
Review procedure under this proposal: At CCB there is an International Advisory Committee (IAC) to coordinate all activities related to the research programme. The AIC-144 experiments will be consulted with the IAC. Then the EURO-LABS WP4 User Selection Panel gets notified of the application and decides on the allocation of resources.
Description of the infrastructure
Name of the infrastructure: 4.3.5: UCLouvain Centre de Ressources du cyclotron (CRC)
Location (town, country): Louvain-la-Neuve, Belgium
Web site address: https://uclouvain.be/en/research-institutes/irmp/crc
Annual operating costs (excl. investment costs) of the infrastructure: 1.498.720 €
Description of the infrastructure: Cyclotron Research Centre (CRC) is a technology platform attached to the Research Institute in Mathematics and Physics (IRMP) at UCLouvain. The facility operates a cyclotron called CYCLONE110 able to accelerate charged ions to kinetic energies up to 110 times Q2/M (in MeV). Main activities of the centre are: research in Nuclear (Astro) Physics experiments, industrial applications (membrane production), irradiation of electronic components and detectors and radiobiology experiments. In total, around 2,500 effective hours of beam are delivered to users during 35 weeks of operations.
In this project three areas are offered for access:
Neutron Irradiation Facility (NIF). Neutrons obtained impinging a 50 MeV deuteron beam on a Be target giving a continuous neutron spectrum up to 50 MeV with a mean energy of 20 MeV. The intensity of the beam can reach a flux of 7.3x1010 ns-1 cm-2, providing a beam diameter ~4cm. Irradiation area can be maintained at constant temperature down to -20o C during irradiation.
Light Ion Irradiation Facility (LIF). Mono-energetic protons with energies between 10 and 62 MeV. Beam size of ~8cm diameter and maximum flux of 2x108 protons s-1 cm-2.
Heavy Ion Irradiation Facility (HIF). This facility provides a beam of up to 1.5x104 ions s-1 cm-2 monoenergetic heavy ions with well-known range and LET. Irradiation area is ~25 mm diameter with 10% homogeneity. Various “ion cocktails” can be accelerated allowing an easy and efficient way to change LET. The available cocktails, LET and ranges are described in the facility webpage. This facility is especially devoted to irradiating electronics. DUT are in vacuum and should not be encapsulated.
CRC delivers ~2,500 beam hours per year for both scientific and industrial applications. Most relevant activities are electronics irradiation (ESA, CNES, THALES...), membrane fabrication (IT4P...). ~10% of access is devoted to scientific applications, mainly nuclear physics experiments, detector irradiations, rad-hard electronic devices and biomedical.
Services currently offered by the infrastructure: CRC has a long experience in receiving external groups for material and electronics irradiation. Assistance from the CRC technical staff is assured along the experiment lifetime. CRC engineers contact users providing relevant information about experimental areas, as well as review the proposed set-up. CRC technicians help in placing and cabling the device under test (DUT). Cables and power supplies can be provided. The design office and mechanical workshops can be accessible for users. Irradiation areas are equipped with moving tables capable to place or remove DUT. Radiation monitors and dosimeters provide on-line information about irradiation. Offline analysis allows to study beam spot size and uniformity. All this information is provided to users after irradiations.

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NIF beam line provides a cryogenic box capable to cool DUT down to -20oC. Radiation monitoring is assured both to personnel and DUT. Handling, storage and transportation of irradiated samples are provided. Contact with the users, outreach activities and administrative follow up of the project are not covered by the TA and dedicated manpower is requested in the framework of the project.
Description of work
Modality of access under this proposal: Two types of access are envisaged: in the case of an active control of the irradiated sample, users are expected to be present during the irradiation; in case no active control is needed, users do not have to be present.
Support offered under this proposal: CRC personnel takes care of delivering the prescribed fluence and performs the quality control both of the fluence and of the beam energy. For NIF, irradiation and cool down process can be performed at controlled temperatures down to -20°C. In case of need the UCLouvain mechanical workshop will help with the supporting structures to position the samples in the beam.
Outreach to new users: International meetings and conference, web page and acknowledgements in publications.
Review procedure under this proposal: generic (see WP4 introduction)
Description of the infrastructure
Name of the infrastructure: 4.3.6: Birmingham MC40 Cyclotron
Location (town, country): Birmingham, UK
Web site address: http://www.birmingham.ac.uk/research/activity/nuclear/research-themes/nuclear-physics.aspx : http://www.ep.ph.bham.ac.uk/general/SiliconLab/irradiationfacility.html
Annual operating costs (excl. investment costs) of the infrastructure: 400,000 €
Description of the infrastructure: The infrastructure consists of a Scanditronix MC40 Cyclotron serving 8 (potentially 12) beamlines/target positions. The cyclotron accelerates beams of protons (3-40 MeV), deuterons (5.5-20 MeV), 3He (9-53 MeV) and 4He (11-40 MeV). Beam currents up to 50μA (hydrogen) or 20μA (helium) are routinely available; currents as low as 1 pA are used for some studies.
A high intensity irradiation line, access to which will be provided in this proposal, was constructed in 2012, on a beam line which run from the cyclotron vault into an adjoining beam room. It provides 27 MeV protons, beam currents from around 100 nA up to 2 μA. Samples can be scanned across the incident beam to obtain uniform irradiation, while being kept at -27C (temperature down to -40C possible) and at a relative humidity below 10%.
Services currently offered by the infrastructure: The cyclotron is regularly used for radioisotope production (including production of 81Rb for manufacture of 81mKr generators, which is performed 5 days per week, 50 weeks per year), Thin Layer Activation for wear measurement, radiation damage/effects studies, and nuclear physics experiments. In total it operates for almost 2000 hours per year. The radiation damage/effects studies use two beam lines which run from the cyclotron vault into an adjoining beam room. One of these is used for low dose studies, including radiobiology and testing electronics for space environments. The other one, the high intensity irradiation line, has served first as ATLAS facility irradiating over two hundred ATLAS-upgrade prototype sensors from the UK, Germany and the USA, as well as materials studies including samples of PCBs and optical cables. Under AIDA-2020, the facility was further developed and offered Transnational Access to 13 projects, more than 40 users and delivered around 300 hours of beam time to the wider High Energy Physics community. The facility typically irradiates samples of a few cm2 to doses expected at the LHC and upgrades (few 1x1015 1Mev neq/cm2) within one day of irradiation. An upgrade is planned to provide fluence up to 1x1017 1Mev neq/cm2 to match the needs of detector R&D for future facilities.
Description of work
Modality of access under this proposal: It is envisaged that samples for irradiation will be mounted in a generic holder and sent to Birmingham where they will be irradiated by Birmingham staff. The access units will be accounted on the basis of irradiation time.
Support offered under this proposal: Samples will be irradiated to the fluence requested by the user, initially up to a few 1x1015 1Mev neq/cm2 and later, following an upgrade of the scanning setup, up to 1x1017 1Mev neq/cm2. The actual fluence delivered is determined by irradiating nickel foils and subsequently measuring the foil activities by gamma-ray spectroscopy using an in-house HpGe detector. After irradiation, activity of the samples will be monitored via spectroscopy and they will be shipped back to the user when activation levels allow an exempt shipment.
Outreach to new users: The facility will be promoted mainly through the LHC and EIC collaborations and meetings at which they present their results. The EURO-LABS TA web page will serve as an additional portal for users outside these collaborations.
Review procedure under this proposal: generic (see WP4 introduction)

Task WP4.4 (Service improvements) is split across ten service improvements (sub-tasks):
The Service improvements are targeted at the RI(‘s) outlined in the bracket in the service improvement (sub-task) title
• 4.4.1: Data base handling of beam time and irradiation requests (4.1.1 CERN TB, 4.3.1 IRRAD & 4.3.2 GIF++)
The CERN Test Beam facility provides beam lines at the CERN PS and SPS accelerators covering a broad momentum range from 1 to 400 GeV/c. The facilities are accessible for users typically, 30 weeks per year, and CERN provides help

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in setting up the beam, transport and handling, access to beam instrumentation signals, guidance with respect to safety, and administrative support to the beam test participants. Several hundred of users participate every year to test beam activities at CERN. The requests for beam time are handled by a dedicated Coordinator who decides on allocations and scheduling of the experiments, including the dedicated irradiation facilities IRRAD/CHARM and GIF++, and acts as a link-person providing support based on the users' requests and needs. Currently, beam time requests are manually filled-in using template Word files which limits the flexibility in handling the provided information, as well as the follow-up, archiving and reporting of the data. This calls for a new software tool capable to cope with the new challenging user requirements and increasing number of proposed experiments. Moreover, this system could be also made available to similar infrastructures running in the EU. For enabling the users to find the most appropriate test beam line fulfilling their needs, an extensive database, including information about CERN and worldwide test beam facilities was developed in the framework of the EU project AIDA-2020 and it is operational on-line since 2020. This database could allow the Coordinator to specify the beam-line characteristics and make them available for the users in a new CERN PS/SPS beam-time request online platform. Natural Language Processing (NLP) techniques could be applied on the beam-time requests to extract key information and automatically propose relevant scientific publications about detector test beam, as well as for irradiation experiment results.

• 4.4.2: Precision motion stages for large detector setups (4.1.2 DESY test beams)

Precision stages are a key element for positioning a device under test (DUT) inside the EUDET-style pixel beam telescopes at DESY. With the rise of larger and larger cooling boxes needed e.g. for highly irradiated devices, the current infrastructure is not sufficient anymore. Both in terms of range and weight, updates are required. We propose to update this essential infrastructure with a new set of stages, which can accommodate these cooling boxes while maintaining the micrometre precision of the current setup and the very robust remote-control.

• 4.4.3: Beam monitor (4.1.3 PSI test beams)

In order to improve the beam diagnostics in the secondary beam lines PSI is developing a novel type of beam monitors. It is based on two orthogonal planes of 21 scintillating fibres each read out on both sides using in total 84 very fast silicon photo multipliers. In contrast to the presently used wire chambers, which integrate the signal over a certain time, these devices measure the position and exact time of each event. As the dipole magnets of the beam optics select a well-defined momentum, particles with a different mass have a noticeable different speed. The production of all secondary beam particles happens at the same time and is pulsed with the clock of the main accelerator. Different kinds of particles (protons, pions, muons, electrons) carrying the same momentum will give a signal at a characteristic time. This allows to measure the shape (profile) and composition (contamination) of the beam. The development and construction of the prototype will be funded by PSI. The resources applied for in this proposal will be used to build two copies of the device to assure simultaneous availability at two beam lines. The cost of the hardware for each device is roughly 60'000 €.

• 4.4.4: Ion beam focusing lens (4.2.1 RBI-AF)

RBI-AF features two ion microprobes, the new comprises two separate beamlines, one connected to the 1 MV Tandetron accelerator, and the other one that is connected to the EN Tandem accelerator. This second beam line is currently not equipped with the ion beam focusing capability (ion beams can only be collimated). The proposal is to equip this second beam line with a stand-alone Electrostatic Microprobe Quadrupole Quadruplet Lens Assembly to enable ion beam focusing with light and heavy ions from both beam lines, even simultaneously. RBI is already in the process of procurement of such a lens system; the EURO-LABS project is expected to fund 6 PM of manpower needed to install and commission the beam line.

• 4.4.5: Cooling System and Graphical User Interface for EMC test station (4.2.2 ITAinnova)

A Python-based data acquisition and control system is currently being developed to operate the EMC susceptibility test bench at ITAINNOVA. These improvements will make it possible to automate this type of testing, so that we will be able to characterise the electronics of the detectors faster and without the need for human intervention. However, the current development has two important limitations. On the one hand, the test bench does not allow to control the temperature of the EUT (equipment under test) and the current software to control the test unit is not ready to be operated by any researcher. Therefore, upgrading the current designs to include these two options will increase the number of accesses and types of tests to be performed in the EMCLab for detector characterisation and allow users to perform such tests at low temperature with detailed control of the operating temperature. The objective of this task is to develop two activities:

- A user interface (GUI) that will serve as a link to the control software programmed in Python. The GUI will allow to configure and run the tests in a fast and easy way, as well as to display the most interesting results in a visual way from the obtained data.
- A programmable liquid cooling system for the electronic modules will be developed. The control and monitoring of this unit will also be implemented in the GUI of the EMC test system.

• 4.4.6: Beam profile monitor (4.3.1 CERN IRRAD)

Beam quality is the most important parameter in the operation of an irradiation facility. For the operation of the IRRAD facility at CERN, a dedicated Beam Profile Monitor (BPM) sensor was developed and recently significantly improved thanks to a new manufacturing technology based on microfabrication of metal nano-layers. In particular, the new BPM sensor feature a minimal particle interaction (non-invasive) and an improved radiation hardness (lifetime reliability).

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Today, to be able to exploit all features of these new BPMs, the DAQ technology, the handling and display of the BPM data need also to be substantially improved with the innovative idea of applying Machine Learning (ML) techniques. Moreover, the existing DAQ technology employed for the BPM sensors readout need to be upgraded in order to cope with increasing sensitivity, timing performance and to enable the final users to profit of new and advanced features. Both the data handling techniques and the improvement in the readout electronic for the BPM instrument could be later adopted by the other EU irradiation facilities for the monitoring of their various (in type and energy) particle beams and, in particular, the most challenging low-energy one.

• 4.4.7: Cadmium shielding in the tangential channel (4.3.3 JSI TRIGA)

The proposal aims to utilize the tangential irradiation channel of the TRIGA reactor by installing a device that will be used for irradiation of large samples shielded from thermal neutrons by usage of a cadmium foil. Cadmium will reduce the activation of samples and hence make manipulation after irradiation easier. As the cadmium foil will get activated, a device for safe handling and storage of the cadmium shield needs to be installed.

The tangential beam port has an aluminium liner (open tube) inserted with an inner diameter of 15 cm. In the project, a cadmium foil section (open cylinder at both ends) will be designed and installed inside this liner, to the closest location to the reactor core. Cadmium foil will have a thickness of 1 mm, which is sufficient to substantially reduce the dominant activation of irradiated samples by thermal neutrons. Samples will be placed inside the cadmium foil section for irradiations.

• 4.4.8: 2-D scanning table for irradiation (4.3.4 IFJ PAN AIC-144)

The X-Y automatic scanning table equipped with mounting arms that allows mounting and scanning of samples in the stable proton beam will be offered to extend the experimental capabilities. The table will allow to move the samples by 400 mm in the horizontal and 300 mm in the vertical directions, with sub-millimetre relative accuracy. The table will be equipped with handles allowing for easy assembly of the irradiated components. The table will be accompanied with collimators limiting the size of the radiation field and the system of laser markers facilitating the positioning of samples. The irradiation station will be connected to the local control room by Ethernet to control the samples during the irradiation process and can also be operated remotely.

• 4.4.9: Test chamber for the heavy ions irradiation facility (4.3.5 UCL CRC)

CRC is one of the reference centres for ESA radiation hardness tests. The actual heavy ions test chamber has been designed and built between 2000 and 2005.

A new test chamber is under development and has been designed for these reasons:

– a shorter beam transport line allows increasing beam quality and transport efficiency,

– pumping time in the chamber will be reduced,

– the positioning system of the components will be automated, in order to obtain more precision,

– the chamber will accept larger boards,

– ergonomics and accessibility around the chamber will be improved,

– more space available to users around the chamber and for preparation of the setup.

Even if most of the beam transport elements can be transferred from the actual beamline, some new equipment is needed for this new project, mainly around the chamber for the control, pumping and quality control of the beam.

• 4.4.10: Scanning system upgrade for high fluence delivery (4.3.6 UoB MC40)

The proposal aims to upgrade the experimental setup for irradiation at the MC40 high intensity irradiation line at the University of Birmingham to reach the irradiation target of up to 1 x 1017 1 MeV neq/cm2 envisaged by the EURO-LABS project. This will consist in replacing the experimental setup used to scan samples in the beam with one that can provide faster scanning speed. The setup will be a copy of what is implemented at the at irradiation facilities at KIT and at the University of Bonn. The faster scanning speed, combined the beam current and cooling capabilities of the facility, will allow to reach a fluence of 1 x 1017 1 MeV neq/cm2 within one day of irradiation on small size prototype sensors. The upgrade will include mechanical support for installation at the facility, environmental box, scanning stages, a secondary beam monitor (SEM) for better current monitoring, control electronics for stages and SEM.

Work package WP5 – Open, Diverse and Inclusive Science

Work Package Number	WP5	**Lead Beneficiary**	24. CSIC
Work Package Name	Open, Diverse and Inclusive Science		
Start Month	1	**End Month**	48

Objectives
EURO-LABS through its WP5 will enhance the users diversity (Task 5.1), bring the nuclear physics community

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into the EOSC (European Open Science Cloud) framework, develop services to enhance FAIR (Findable, Accessible, Interoperable and Reusable) data principles (Task 5.2), promote the use of machine learning (ML) methods to improve beam quality, transport efficiency and accelerator reproducibility (Task 5.3), and train young generations to make the European facilities more performing and more competitive (Task 5.4). The EURO-LABS consortium aims to reinforce common efforts on Knowledge and Technology Transfer network by joining the recent RI-Open Innovation Coordination Group and the RI-Innovation Knowledge and Technology Transfer Network consortia formed by I.FAST, AIDAinnova, and LEAPS-INNOV.

Description

Task 5.1: Diversity and dissemination
Participants: INFN
EURO-LABS will ensure large diversity, through a strong effort in engaging people of different nationality, gender, age, and level of professional expertise. We also plan to address other type of diversity, promoting that the RI facilitate the access for disabled people. EURO-LABS activities and results will be disseminated using several key communication tools:
• Project public website
• Intranet and collaboration workspaces
• EURO-LABS newsletter circulated to project members and to a wider community
• Modern media channels, like social media, YouTube
• Project mailing lists
• Videos of the various RI
Through the collaborative Intranet of the EURO-LABS website, the members will be able to contribute and participate to discussions and information exchange. Mailing list for exchanges between partners and labs will be available, with the possibility to include past users of the facility so they can be informed on new possibilities and developments in the facilities. We also plan to issue periodically a newsletter to advertise the work done, the usage of the facilities such to enhance the flow of information among the different RI and the progress in the project. Short videos will be prepared for every facility to illustrate the main features available at the RIs. Our goal remains to reinforce the collaboration between large-scale and small-scale facilities that will favor their development and allow all to be in contact with frontier-research and the testing of high-level equipment. Our training program, elaborated below in Task 5.4 will be visible through our web site to young engineers and physicist and researchers. Last but not least, our Service Improvement and Open Data program outlined in other sections of this proposal covering work planned in various RIs will be widely advertised and communicated to the consortium members and our user community which will stimulate complementarity, ensure a broad dissemination of results and multidisciplinary and application-oriented research. Through presentations to conferences and workshops we will communicate the TNA program of EURO-LABS and inform potential users to visit our Web site that will be “single-access point” portal and to the enlarged portfolio of RIs participating in EURO-LABS, thus enhancing the relationship between scientific communities, the European research infrastructure and possibly industry to leading research, development and innovation in our fields.
To reach out to young researchers in the field as well as the interested public, social media channels will be used. Outreach activities will be supported with generic outreach/educational materials collected on a dedicated area of the project website. To assess the effectiveness of the dissemination activities we plan to have accountability of the different initiatives related to outreach activities and training. In particular, we foresee to regularly keep track of the school talks given all over Europe by the members of the project.

Task 5.2: Open Science and Data Management
Participants: CSIC, GANIL (Leading partners), INFN, CNRS, GSI
This task has two objectives. First to develop a data management plan for EURO-LABS with the goal to promote the existence of data management plan in all facilities involved in EUROLABS. This plan will establish the policy on the ownership of, and access to experimental data collected and/or stored at the different facilities. The layout of the project data management plan will be coordinated by IEM-CSIC with the help of INFN.
The second objective is to create a portal for nuclear physics data tools. This task will focus on opening new opportunities for the nuclear physics community to improve the management and further the use of the large data-sets produced at the nuclear physics facilities. It will build on the work already done at national nuclear labs and the IAEA, and the HEP community.
The aim of this subtask is the development of data-workflow to be shared among the EURO-LABS facilities working towards Open Science. The catalogue of dataset produced during the project will follow the FAIR principles to ensure long term storage to allow for the possible future use of the data. EURO-LABS will create a portal of services allowing simple and efficient interaction between the different actors of the data life cycle: Data Producing Institution (DPI),

Technical Resources Developers (Engineers and technician), Scientific Collaborations (researchers) and End Users. It will be achieved through the following sub-tasks;

• Development of an Open NP catalogue of Datasets and associated tools and associated Open Science Desk. Representatives of all the RI for nuclear physics of EURO-LABS will be part of this task coordinated by LPC Caen and GANIL. The latter will finance a 12 months post-doc for this subtask.

• Integration of the Nuclear Physics community to existing infrastructures/services of EOSC environment - using present experience from ESCAPE/HEP physics community. It will be led and coordinated by GSI-FAIR, that will provide 6 months post-doc, and have contributions from CNRS-IJCLab. Many of these tools are shared with other communities e.g., high-energy physics, astro-particle physics, hadron physics, atomic physics. This set of tools and methods shall be used and adopted to the special challenges of the broad physics program with stable and radioactive beams at EURO-LABS.

The use of the common catalogue of digital objects OpenNP (Experimental and Theoretical Datasets, digital logbooks, data format standard libraries, data analysis softwares, Data Management Plans), following FAIR principles, at the different RI is proposed here for the first time. The digital objects will be uniquely identified and can then be properly referred to, thus fostering possibilities to exchange well identified datasets and associated analysis tools. This in turn will enhance the usage of the data produced in the RI. This will follow similar approach as developed for High Energy Physics community, benefitting from the latest advances in HEP and accounting for specificity of the Nuclear Physics community (e.g. heterogeneity of the research installations and setups, smaller scale collaborations). The catalogue will also contribute to promote the application of FAIR data principle at every stage of data production and reduction in the various facilities beyond what is presently done in heterogeneous manner. A promotion of the establishment of a data management plan requiring FAIR data principle in each data producing facilities is planned.

In addition to this catalogue, we propose the development of a digital environment that will allow RIs and their users to connect to the EOSC ecosystem. This environment, to be deployed in the various facilities, will include an Authentication and Authorization Infrastructure for the Nuclear Physics community to get access to the datasets, but also standardized tools to register datasets to the OPEN NP catalogue. This represents the first step to shift from the present “site by site” strategy towards a coordinated storage and management of digital objects in the Nuclear Physics community (where the main challenge resides in large datasets produced in the involved facilities and the large number of small size collaborations).

These activities will federate the RIs to improve and enhance the FAIRness of their data practices. In this respect, findability of dataset will be enhanced by the development of the common Catalogue for the involved RI. Accessibility will be improved by the development of Access and Authentication Infrastructure in coordinated manner (Catalogue, Common environment) but also by the portal that should allow users (identified) to access datasets in an uniformised manners. Inter-operability will be improved by the development of the portal that should be based on open-source solutions and properly documented. We will promote good practices for Reproducibility, fostering the release by the RIs of pertinent metadata with the dataset (Data format and setup description...).

Task 5.3: Machine Learning

Participants: GSI (Leading partner), CEA

This subtask will use Machine Learning (ML) methods to improve beam quality, transport efficiency and accelerator reproducibility, which will reduce the tuning time. The challenges of applying ML algorithms to the accelerator world are common to several facilities. The project will focus on open tools and platforms. The plan is to develop a virtual accessible beam diagnostic data base and an optimizer toolkit for accelerator experts and users.

The first objective is dedicated to the beam control and optimization. Beam delivery systems are complex systems with a large parameter space, requiring skilled machine supervisors to achieve the optimum beam parameters as required by the user. To date, the majority of the tuning is performed manually by machine supervisors. There are many different aspects of the matching with different parameter sets, which may also be operated by different teams involved, e.g. beam delivery to experiments. Automatic highly specific tuning software has been developed at different accelerator facilities. Coordinated by GSI-FAIR, a ML optimizer toolkit will be developed which shall allow integration of actors and sensors through modules. As GSI and CERN share an important communication layer between hardware and software, it is planned to develop the toolkit first for these two facilities, taking advantage of the in-kind contribution from CERN, to gain experience and get user feedback from the beam line operators. Here we propose to develop the CERN prototype further into a toolkit (using for instance, a python package) that can easily be deployed in other facilities in the Consortium. Due its modularity (algorithms/ user interface / communication) the toolkit can be easily adapted. For laser-driven accelerators, the CEA group will apply ML mainly for the source part. Open-source hosting will prevent dual efforts in implementation of common features or modules of the software. In a further stage, the toolkit will be extended to the facility’s users and their experimental beamlines. In a final step, the optimizer toolkit may be applied to other fields., such as medical physics.

Task 5.4: Training

Participants: IFIN-HH (Leading partner), CSIC
In order to enhance the competitiveness of our research infrastructures and its technical capabilities, this subtask will hearth a coherent, stable, and predictable system of training schools and events. We propose annual schools in experimental nuclear and high energy physics:
• Four events of “basic training” at smaller facilities that allows hands-on activities: INCT, CERN-CLEAR, IFIN-HH, Catania, HIL Warsaw, etc and coordinated by IFIN-HH.
• Four schools of “advanced training” at larger, state-of-the-art facilities including those dedicated to the technical and engineering staff. Training focused on accelerator techniques, technology and industrial applications with hands-on experience will be provided in selected facilities at CERN, INCT and possibly others. This activity will be coordinated by IEM-CSIC.
To coordinate this task a Training Scientific Board (TSB) will be selected in the first 6 months of the EURO-LABS project. Activities will be selected based on the following criteria:
- Target the new generations of researchers, as well as the specialized training of the technical and engineering staff.
- Address the need of cooperation between fundamental research and applications.
- Use the complementarity between larger and smaller facilities.
The need for “cross-disciplinary fertilisations and a sharing of information, knowledge and technologies across scientific fields” will be particularly addressed strengthening also the existing traditions of topical schools, regional schools, open internationally, etc. to avoid unnecessary duplications. For e.g. students will be sent to successful hands-on school such as the EDIT (Excellence in Detectors and Instrumentation Technologies) school that moves in Europe, Asia and North America (related to activities in WP4).

Work package WP6 – Ethics requirements

Work Package Number	WP6	**Lead Beneficiary**	1. INFN
Work Package Name	Ethics requirements		
Start Month	1	**End Month**	48

Objectives
The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description
This work package sets out the 'ethics requirements' that the project must comply with.

STAFF EFFORT

Staff effort per participant

Grant Preparation (Work packages - Effort screen) — Enter the info.

Participant	WP1	WP2	WP3	WP4	WP5	WP6	Total Person-Months
1 - INFN	48.00	45.50	21.00		48.00		162.50
2 - GANIL		12.00			24.00		36.00
3 - CERN	24.00		16.50	82.00			122.50
4 - JSI				18.00			18.00
5 - IFJ PAN		72.00		11.00			83.00
6 - DESY				16.00			16.00
7 - UCL				3.00			3.00
8 - RBI				8.00			8.00
9 - CNRS		10.00	13.00		18.00		41.00
11 - ITAINNOVA				17.00			17.00
12 - UNIWARSAW		24.00					24.00
13 - GSI		43.00			54.00		97.00
14 - IFIN-HH		4.00					4.00
15 - USE		52.80					52.80
17 - Atomki		8.00					8.00
18 - JYU		12.50					12.50
19 - UU			20.00				20.00
20 - CEA			20.00		12.50		32.50
22 - UMCG		12.00					12.00

Staff effort per participant

Grant Preparation (Work packages - Effort screen) — Enter the info.

Participant	WP1	WP2	WP3	WP4	WP5	WP6	Total Person-Months
23 - INCT			16.00				16.00
24 - CSIC					2.50		2.50
25 - UMIL		40.80					40.80
26 - PSI		3.00					3.00
32 - UoB				18.10			18.10
33 - UKRI			6.00				6.00
Total Person-Months	72.00	339.60	112.50	173.10	159.00	0.00	856.20

LIST OF DELIVERABLES

Deliverables

Grant Preparation (Deliverables screen) — Enter the info.

The labels used mean:

Public — fully open (⚠ automatically posted online)
Sensitive — limited under the conditions of the Grant Agreement
EU classified —RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision 2015/444

Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D1.1	EURO-LABS website ready	WP1	1 - INFN	R — Document, report	PU - Public	6
D2.1	Report on Access to Stable Beam Facilities	WP2	18 - JYU	R — Document, report	PU - Public	46
D2.2	Report on Access to Radioactive-ion Beam Facilities	WP2	9 - CNRS	R — Document, report	PU - Public	46
D2.3	Report on the research activities and the main results obtained in each of the RI providing neutron beams	WP2	3 - CERN	R — Document, report	PU - Public	46
D2.4	Report on access to the Theory for Experiments facilities	WP2	10 - FBK	R — Document, report	PU - Public	46
D2.5	Report on the Service Improvements	WP2	13 - GSI	R — Document, report	PU - Public	36
D3.1	Report on the progress of TA for Material Testing RIs	WP3	3 - CERN	R — Document, report	PU - Public	42
D3.2	Report on the progress of TA for Technology Infrastructure RIs	WP3	20 - CEA	R — Document, report	PU - Public	42
D3.3	Report on the progress of TA for Electron and Plasma Beam RIs	WP3	1 - INFN	R — Document, report	PU - Public	42
D3.4	Report on the progress of TA for Application oriented RIs	WP3	23 - INCT	R — Document, report	PU - Public	42

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D3.5	Report on the service improvement for material testing RIs	WP3	3 - CERN	R — Document, report	PU - Public	36
D3.6	Report on the service improvements for Technology Infrastructures	WP3	20 - CEA	R — Document, report	PU - Public	36
D3.7	Report on the service improvement for electron and plasma beams	WP3	1 - INFN	R — Document, report	PU - Public	36
D4.1	Report on the usage of Access Units for HEP detector R&D	WP4	4 - JSI	R — Document, report	PU - Public	46
D4.2	Report on the service improvements in WP4.4	WP4	4 - JSI	R — Document, report	PU - Public	46
D4.3	Report on the usage of Access Units for Irradiations	WP4	4 - JSI	R — Document, report	PU - Public	46
D4.4	Report on the service improvements in RI's for Detectors	WP4	4 - JSI	R — Document, report	PU - Public	46
D5.1	All research infrastructures videos completed	WP5	1 - INFN	R — Document, report	PU - Public	18
D5.2	EURO-LABS users' diversity final report	WP5	1 - INFN	R — Document, report	PU - Public	36
D5.3	Release of the first functional version of the Open NP and data access tools	WP5	2 - GANIL	R — Document, report	SEN - Sensitive	36

Deliverables

Grant Preparation (Deliverables screen) — Enter the info.

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Deliverable No	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month)
D5.4	The new toolkit deployed at least two facilities and been used optimization	WP5	2 - GANIL	R — Document, report	PU - Public	24
D5.5	Report on activities after 2 years, including follow-up from participants	WP5	14 - IFIN-HH	R — Document, report	PU - Public	24
D5.6	Final report on Open Science	WP5	24 - CSIC	R — Document, report	PU - Public	46
D5.7	Data Management Plan	WP5	24 - CSIC	OTHER	PU - Public	6
D6.1	OEI - Requirement No. 1	WP6	1 - INFN	ETHICS	SEN - Sensitive	6

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Deliverable – EURO-LABS website ready

Deliverable Number	D1.1	Lead Beneficiary	1. INFN
Deliverable Name	EURO-LABS website ready		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	6	Work Package No	WP1

Description
Website of the project ready

Deliverable – Report on Access to Stable Beam Facilities

Deliverable Number	D2.1	Lead Beneficiary	18. JYU
Deliverable Name	Report on Access to Stable Beam Facilities		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP2

Description
Report on Access to Stable Beam Facilities

Deliverable – Report on Access to Radioactive-ion Beam Facilities

Deliverable Number	D2.2	Lead Beneficiary	9. CNRS
Deliverable Name	Report on Access to Radioactive-ion Beam Facilities		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP2

Description
Report on Access to Radioactive-ion Beam Facilities

Deliverable – Report on the research activities and the main results obtained in each of the RI providing neutron beams

Deliverable Number	D2.3	Lead Beneficiary	3. CERN
Deliverable Name	Report on the research activities and the main results obtained in each of the RI providing neutron beams		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP2

Description
Report on the research activities and the main results obtained in each of the RI providing neutron beams

Deliverable – Report on access to the Theory for Experiments facilities

Deliverable Number	D2.4	**Lead Beneficiary**	10. FBK
Deliverable Name	Report on access to the Theory for Experiments facilities		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	46	**Work Package No**	WP2

Description
Report on access to the Theory for Experiments facilities

Deliverable – Report on the Service Improvements

Deliverable Number	D2.5	**Lead Beneficiary**	13. GSI
Deliverable Name	Report on the Service Improvements		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	36	**Work Package No**	WP2

Description
Report on the Service Improvements

Deliverable – Report on the progress of TA for Material Testing RIs

Deliverable Number	D3.1	**Lead Beneficiary**	3. CERN
Deliverable Name	Report on the progress of TA for Material Testing RIs		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	42	**Work Package No**	WP3

Description
Report on the progress of TA for Material Testing RIs

Deliverable – Report on the progress of TA for Technology Infrastructure RIs

Deliverable Number	D3.2	**Lead Beneficiary**	20. CEA
Deliverable Name	Report on the progress of TA for Technology Infrastructure RIs		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	42	**Work Package No**	WP3

Description
Report on the progress of TA for Technology Infrastructure RIs

Associated with document Ref. Ares(2022)4410236 - 15/06/2022

Deliverable – Report on the progress of TA for Electron and Plasma Beam RIs

Deliverable Number	D3.3	**Lead Beneficiary**	1. INFN
Deliverable Name	Report on the progress of TA for Electron and Plasma Beam RIs		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	42	**Work Package No**	WP3

Description
Report on the progress of TA for Electron and Plasma Beam RIs

Deliverable – Report on the progress of TA for Application oriented RIs

Deliverable Number	D3.4	**Lead Beneficiary**	23. INCT
Deliverable Name	Report on the progress of TA for Application oriented RIs		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	42	**Work Package No**	WP3

Description
Report on the progress of TA for Application oriented RIs

Deliverable – Report on the service improvement for material testing RIs

Deliverable Number	D3.5	**Lead Beneficiary**	3. CERN
Deliverable Name	Report on the service improvement for material testing RIs		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	36	**Work Package No**	WP3

Description
Report on the service improvement for material testing RIs

Deliverable – Report on the service improvements for Technology Infrastructures

Deliverable Number	D3.6	**Lead Beneficiary**	20. CEA
Deliverable Name	Report on the service improvements for Technology Infrastructures		
Type	R — Document, report	**Dissemination Level**	PU - Public
Due Date (month)	36	**Work Package No**	WP3

Description
Report on the service improvements for Technology Infrastructures

Deliverable – Report on the service improvement for electron and plasma beams

Deliverable Number	D3.7	Lead Beneficiary	1. INFN
Deliverable Name	Report on the service improvement for electron and plasma beams		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP3

Description
Report on the service improvement for electron and plasma beams

Deliverable – Report on the usage of Access Units for HEP detector R&D

Deliverable Number	D4.1	Lead Beneficiary	4. JSI
Deliverable Name	Report on the usage of Access Units for HEP detector R&D		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP4

Description
Report on the usage of Access Units for HEP detector R&D

Deliverable – Report on the service improvements in WP4.4

Deliverable Number	D4.2	Lead Beneficiary	4. JSI
Deliverable Name	Report on the service improvements in WP4.4		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP4

Description
Report on the service improvements in WP4.4

Deliverable – Report on the usage of Access Units for Irradiations

Deliverable Number	D4.3	Lead Beneficiary	4. JSI
Deliverable Name	Report on the usage of Access Units for Irradiations		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP4

Description
Report on the usage of Access Units for Irradiations

Deliverable – Report on the service improvements in RI's for Detectors

Deliverable Number	D4.4	Lead Beneficiary	4. JSI
Deliverable Name	Report on the service improvements in RI's for Detectors		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP4

Description
Report on the service improvements in RI’s for Detectors

Deliverable – All research infrastructures videos completed

Deliverable Number	D5.1	Lead Beneficiary	1. INFN
Deliverable Name	All research infrastructures videos completed		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	18	Work Package No	WP5

Description
All research infrastructures videos completed

Deliverable – EURO-LABS users' diversity final report

Deliverable Number	D5.2	Lead Beneficiary	1. INFN
Deliverable Name	EURO-LABS users' diversity final report		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	36	Work Package No	WP5

Description
EURO-LABS users’ diversity final report

Deliverable – Release of the first functional version of the Open NP and data access tools

Deliverable Number	D5.3	Lead Beneficiary	2. GANIL
Deliverable Name	Release of the first functional version of the Open NP and data access tools		
Type	R — Document, report	Dissemination Level	SEN - Sensitive
Due Date (month)	36	Work Package No	WP5

Description
Release of the first functional version of the Open NP and data access tools

Deliverable – The new toolkit deployed at least two facilities and been used optimization

Deliverable Number	D5.4	Lead Beneficiary	2. GANIL
Deliverable Name	The new toolkit deployed at least two facilities and been used optimization		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	24	Work Package No	WP5

Description
The new toolkit deployed at least two facilities and been used optimization

Deliverable – Report on activities after 2 years, including follow-up from participants

Deliverable Number	D5.5	Lead Beneficiary	14. IFIN-HH
Deliverable Name	Report on activities after 2 years, including follow-up from participants		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	24	Work Package No	WP5

Description
Report on activities after 2 years, including follow-up from participants

Deliverable – Final report on Open Science

Deliverable Number	D5.6	Lead Beneficiary	24. CSIC
Deliverable Name	Final report on Open Science		
Type	R — Document, report	Dissemination Level	PU - Public
Due Date (month)	46	Work Package No	WP5

Description
Final report on Open Science

Deliverable – Data Management Plan

Deliverable Number	D5.7	Lead Beneficiary	24. CSIC
Deliverable Name	Data Management Plan		
Type	OTHER	Dissemination Level	PU - Public
Due Date (month)	6	Work Package No	WP5

Description
Data Management Plan

Deliverable – OEI - Requirement No. 1

Deliverable Number	D6.1	**Lead Beneficiary**	1. INFN
Deliverable Name	OEI - Requirement No. 1		
Type	ETHICS	**Dissemination Level**	SEN - Sensitive
Due Date (month)	6	**Work Package No**	WP6

Description
The applicants have not flagged any ethics issues in Part A of the proposal and the self-assessment section has not been filled in. The applicants seem not to be aware of the ethical implications of the proposal with regard to: 1) Health and safety during experiments and training activities 2) The development of machine-learning methods to improve beam quality Furthermore, the experimental work is yet to be defined. Hence, an External Ethics Advisor is requested to oversee the project.

LIST OF MILESTONES

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
1	Consortium Agreement signed	WP1	1-INFN	Final version released	1
2	Preparation of calls for submission of proposals to stable beam access facilities completed	WP2	5-IFJ PAN	Survey / questionnaire to stable beam access facilities	6
3	All provision of access offered completed	WP2	5-IFJ PAN	Survey / questionnaire to stable beam access facilities.	46
4	Preparation of the call for submission of projects to access each of the RIs providing radioactive-ion beams	WP2	5-IFJ PAN	Survey / questionnaire to radioactive-ion beam access facilities	6
5	a) Completion of all the experiments proposed	WP2	5-IFJ PAN	Survey / questionnaire to radioactive-ion beam access facilities	46
6	Preparation of the call for submission of projects to access each of the RIs providing neutron beams	WP2	5-IFJ PAN	Survey / questionnaire to neutron beam access facilities	6
7	b) Completion of all the experiments proposed	WP2	5-IFJ PAN	Survey / questionnaire to neutron beam access facilities	46
8	Calls for proposals to be hosted at ECT*	WP2	5-IFJ PAN	ECT* web page	18
9	EURO-LABS-related workshops carried out at ECT*	WP2	5-IFJ PAN	Workshop programs at ECT* web page	42
10	Contracted personnel for Theo4Exp VA in place and first codes available for users in the virtual facility	WP2	5-IFJ PAN	Available software validated by the IRP	18
11	All codes installed at Theo4Exp VA	WP2	5-IFJ PAN	All software released and validated by IRP	42

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
	and interoperability among different nodes established				
12	Completed database containing selected features of remote-access toolkit	WP2	5-IFJ PAN	Database validated and web-interface released	18
13	Production of a report to define the state of the art in the field (targets for NP) and collect the requests from the community	WP2	5-IFJ PAN	Report complete and available	3
14	Reports on FLASH detectors for different facilities	WP2	5-IFJ PAN	Report complete and available	18
15	Conceptual plan for online monitoring of long-term operation beam stability	WP2	5-IFJ PAN	Conceptual plan for online monitoring of long-term operation beam stability	12
16	Organisation of hands-on workshops & training schools	WP2	5-IFJ PAN	Website for training events available	30
17	RIs ready for Tas	WP3	3-CERN	Web pages available, access procedures defined, TAs advertised, and first applications received	6
18	Majority of TAs attributed	WP3	3-CERN	TAs allocated as planned (about 70%)	36
19	Work on service improvements started	WP3	3-CERN	Detailed schedule and budget for the planned SI provided	6
20	Service improvements to RIs implemented	WP3	3-CERN	Planned service improvements installed and in operation for the last year of the project	36
21	a) More than 30% of AU delivered	WP4	4-JSI	AU usage report	24
22	b) More than 30% of AU delivered	WP4	4-JSI	AU usage report	24
23	c) More than 30% of AU delivered	WP4	4-JSI	AU usage report	24
24	Development and test of the first prototype of the system	WP4	4-JSI	Report on prototype functionality	12

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
25	Prototype and software ready for lab tests	WP4	4-JSI	Documentation on software and prototype	14
26	Electrostatic Microprobe Quadrupole Quadruplet Lens Assembly installed and tested	WP4	4-JSI	Installation report	16
27	Cooling system developed	WP4	4-JSI	Documentation on cooling system	18
28	Upgrade BPM DAQ	WP4	4-JSI	Demonstration of BPM DAQ	12
29	ML-based classification and evaluation of the beam profile patterns	WP4	4-JSI	Report on ML classification results	24
30	Design of the shielding system including safety related aspects	WP4	4-JSI	Design and safety documentation	14
31	Design of the XY table and purchase of materials and equipment for the device	WP4	4-JSI	Design documentation	18
32	Design and commissioning of the beam line (vacuum and test chamber)	WP4	4-JSI	Report on design and commissioning	12
33	Mechanics of the setup adapted to fit into the experimental area	WP4	4-JSI	Design documentation	24
34	One third of the research infrastructures videos ready	WP5	24-CSIC	Videos edited	12
35	Definition of the catalogue perimeter, architecture, and standards. Release of terms of reference	WP5	24-CSIC	Database validated and web-interface released	12
36	Identification of existing solutions in the EOSC ecosystem and integration of the Nuclear Physics Ecosystem	WP5	24-CSIC	Remote-access tools ‘up and running’ at user facilities	36

Milestones

Grant Preparation (Milestones screen) — Enter the info.

Milestone No	Milestone Name	Work Package No	Lead Beneficiary	Means of Verification	Due Date (month)
37	The source code of the ML toolkit prototype is available on a shared platform	WP5	24-CSIC	ML toolkit finished	8
38	Selection of the Training Scientific Board	WP5	24-CSIC	Training Scientific Board defined	6

LIST OF CRITICAL RISKS

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
1	Covid-19 or other pandemic-related risks: travel constraints, confinement, recurrence of pandemic (low-medium likelihood, medium severity)	WP2, WP1, WP5, WP3, WP4	Measures to ensure safe working conditions under confinement situation, have been realized and already adopted in the past. Possibility to follow-up and intervene in experiments and their preparation from off-site locations thus limiting the travel requirements. More local involvement to mitigate the reduced number of participants on-site
2	Breakdown of specific components of accelerators (very low likelihood, impact could be medium/high)	WP2	The planned activities (and the related allocated budget) could be shifted to other facilities in the consortium.
3	Closure of ECT*: i) low, ii) high	WP2	Maintain relations with local and international funding agencies, nuclear physics community and other stakeholders
4	Reduced availability of RIs due to longer shutdowns or unforeseen technical stops (Medium/Medium)	WP2, WP3, WP4	Reschedule TAs for later times if possible, otherwise rearrange tests to accommodate more in parallel. If not possible to resolve within the RI, shift access units to other RIs starting from within the same Task, then same WP, and eventually in other WPs.
5	Allocated user fails to realize the planned experiment/test and TAs (Medium/Medium)	WP2, WP3, WP4	Establish confirmation milestone for each user for the TA allocation. Reschedule for a later time slot in the facility. Propose the allocated slot to other users.

Critical risks & risk management strategy

Grant Preparation (Critical Risks screen) — Enter the info.

Risk number	Description	Work Package No(s)	Proposed Mitigation Measures
6	Failure to attract the foreseen number of users to the TA facilities (Low/High)	WP2, WP3, WP4	Regular monitoring of TA allocation within WP/Task. Effort for better publicity of the access opportunities offered by the RIs, promote success stories among target user community for the RI. Use dynamic allocation of access units (i.e. shift of EC funds to other RIs) within the WP/Task.
7	Failure to complete the planned service improvements (Low/Medium)	WP2, WP3, WP4	Regular reporting of the progress and accomplishment of milestones. Investigate of possible alternative service improvements having similar positive impact for the users.
8	Change of management team or WP coordinators or FC during the project (Medium/Medium)	WP2, WP1, WP5, WP3, WP4	Anticipate potential staff changed in the project management and WP/FC coordination and select suitable replacements within the participating scientists of the RI and the consortium for higher management positions as early as possible
9	Prolonged accelerator breakdown caused by major malfunctions (Medium/Low)	WP2	Because of accelerators variety in EURO-LABS, major accidents in one machine will not expected to jeopardize the programs that can be carried out in other accelerator facilities.
10	Due to variations in the needs of the participating facilities, the scope of the remote operations toolkit may be too large to be reasonably included in the database within the given time frame (Medium/ Low)	WP2	A manageable subset of the most critical items that would allow all participating facilities to carry out remote operation at an acceptable level would then be selected and implemented in the database.
11	Delay in the recruitment of the post-doc researchers (Low/Low)	WP2	The post-doc positions are required in three different institutions, one 12-month position for each. So, a delay in some of the institutions will not affect the recruitment of the other institutions. The request for the recruitment will be submitted at the beginning of the project so the planned activity can be completed within the three-year project.

PROJECT REVIEWS

Project Reviews

Grant Preparation (Reviews screen) — Enter the info.

Review No	Timing (month)	Location	Comments
RV1	15	tbc	
RV2	33	tbc	

RESEARCH INFRASTRUCTURE

Transnational/virtual access to research infrastructure

Grant Preparation (Research Infrastructure screen) — Enter the info.
The labels used mean:

Access provider short name — Short name of the beneficiary, affiliated entity or associated partner. It can be the infrastructure owner or, if the owner of the infrastructure is another third party contributing resources, the beneficiary/affiliated entity who they are provided to (and who coordinates access to them).
Installation number — Number progressively the installations of a same infrastructure. An installation is a part or a service of an infrastructure that can be used independently from the rest.
Country — Enter the code of the country where the installation is located (or INT if access is provided by an international organisation, ERIC, or similar legal entity with international membership. For mobile installations (e.g. a research vessel), give the country of its usual location (e.g. the homeport).
Type of access — Use the following access codes:

- *'TA-UC' or 'VA-UC' for transnational/virtual access with access costs declared on the basis of unit cost*
- *'TA-AC' or 'VA-AC' for transnational/virtual access with access costs declared as actual costs*
- *'TA-CB' or 'VA-CB' for transnational/virtual access with access costs declared as a combination of actual costs and unit cost.*

Associated partners must indicate actual cost (TA-AC or VA-AC) and put 0 in the actual cost column.
Amount per unit — To be filled in only if you have installations for which you use unit costs (or a combination of actual costs and unit costs) (VA-UC,TA-UC, TA-CB or VA-CB).
Access costs — Cost of the access provided under the project. For access costs on the basis of unit costs, multiply the amount per unit by the quantity of access to be provided.
*Columns with * should be filled only for transnational access, not for virtual access.*

Access Provider Short Name	Infrastructure Short Name	Installation		Country	Type of Access	Unit of Access	Estimated Quantity of Access	Amount per Unit (€)	Access Costs		Estimated Number of Users	Estimated Number of User Projects *
		Number	Short Name						as Unit Costs	as Actual Costs		
1 - INFN	LNF	1	SPARCLAB	IT	TA - AC	1h	1680.0			212 940.00	20	10
1 - INFN	LNF	2	BTF(1,2)	IT	TA - AC	1h	1176.0			212 562.00	14	7
1 - INFN	LNL/LNS	1	NSDBF+AIPF	IT	TA - UC	1h	4400.0	70.00	308 000.00		200	50
1 - INFN	MI	1	LASA	IT	TA - AC	1h	6400.0			440 000.00	120	80
1 - INFN	Salerno	1	THOR	IT	TA - AC	1h	272.0			87 500.00	8	8
2 - GANIL	GANIL-SPIRAL2	1	GANIL-SPIRAL2	FR	TA - UC	1h	3254.0	108.00	351 403.00		275	35
3 - CERN	CLEAR	1	CLEAR	INT	TA - AC	1h	1200.0		11	634 000.00	90	30
3 - CERN	GIF++	1	GIF++	INT	TA - UC	1h	4000.0	0.00	0.00		74	14
3 - CERN	HiRadMat	1	HiRadMat	INT	TA - UC	1h	4800.0	0.00	0.00		60	20
3 - CERN	IRRAD	1	IRRAD	INT	TA - UC	1h	4000.0	0.00	0.00		65	16
3 - CERN	ISOLDE	1	ISOLDE	INT	TA - UC	1h	4500.0	70.00	315 000.00		500	100
3 - CERN	n_TOF	1	N_TOF	INT	TA - UC	1h	504.0	153.00	77 112.00		130	6
3 - CERN	PS & SPS	1	PS & SPS	INT	TA - UC	1h	8736.0	0.00	0.00		504	56
3 - CERN	XBOX	1	XBOX	INT	TA - AC	1h	400.0			45 510.00	32	8
4 - JSI	TRIGA	1	TRIGA	SI	TA - UC	1h	700.0	250.00	175 000.00		150	50
5 - IFJ PAN	AIC	1	AIC-144	PL	TA - UC	1h	800.0	150.00	120 000.00		140	28
5 - IFJ PAN	NLC	1	CCB	PL	TA - UC	1h	550.0	104.00	57 200.00		20	5
5 - IFJ PAN	Theo4Exp	1	MeanField4Exp	PL	VA - AC	1h	360.0			270 000.00	40	
6 - DESY	TESTBEAM	1	TESTBEAM	DE	TA - UC	1h	8640.0	0.00	0.00		120	30
7 - UCL	CRC	1	HIF-LIF-NIF	BE	TA - UC	1h	100.0	720.00	72 000.00		20	10
8 - RBI	RBI-AF	1	RBI-AF	HR	TA - UC	1h	504.0	130.00	65 520.00		24	12

Access Provider Short Name	Infrastructure Short Name	Installation		Country	Type of Access	Unit of Access	Estimated Quantity of Access	Amount per Unit (€)	Access Costs		Estimated Number of Users	Estimated Number of User Projects *
		Number	Short Name						as Unit Costs	as Actual Costs		
9 - CNRS	IJCLAB	1	SUPRATECH	FR	TA - AC	1h	672.0			81 850.00	4	4
9 - CNRS	IJCLAB	2	ALTO	FR	TA - UC	1h	1860.0	100.00	186 000.00		76	30
10 - FBK	ECT*	1	ECT*	IT	TA - UC	Day	1280.0	94.00	120 320.00		256	18
11 - ITAINNOVA	EMCLab	1	EMCLab	ES	TA - AC	1h	800.0			82 500.00	56	14
12 - UNIWARSAW	NLC_SLCJ	1	SLCJ	PL	TA - UC	1h	1000.0	103.50	103 500.00		40	8
13 - GSI	GSI-FAIR	1	GSI-FAIR	DE	TA - UC	1h	2150.0	150.00	322 500.00		300	36
14 - IFIN-HH	TANDEM	1	TANDEM	RO	TA - UC	1h	4100.0	35.00	143 500.00		100	40
15 - USE	CLEAR_CNA	1	CNA	ES	TA - UC	1h	640.0	35.00	22 400.00		36	16
15 - USE	Theo4Exp	2	Reac4Exp	ES	VA - AC	1h	400.0			292 506.00	80	
16 - IST	CLEAR_Lisboa	1	IST	PT	TA - UC	1h	640.0	35.00	22 400.00		36	16
17 - Atomki	CLEAR_ATOMKI	1	ATOMKI	HU	TA - UC	1h	640.0	35.00	22 400.00		36	16
18 - JYU	JYFL	1	JYFL	FI	TA - UC	1h	3500.0	75.00	262 500.00		300	60
19 - UU	FREIA	1	GERSEMI, HNOSS	SE	TA - AC	1h	960.0			191 491.00	8	4
20 - CEA	IRFU	1	SYNERGIUM	FR	TA - AC	1h	640.0			236 155.00	20	20
20 - CEA	LIDYL	1	UHI100	FR	TA - UC	1h	640.0	117.00	74 899.00		12	4
21 - KIT	ALFA	1	FLUTE	DE	TA - UC	1h	330.0	49.28	16 261.94		15	3
21 - KIT	ALFA	2	KARA	DE	TA - UC	1h	880.0	382.88	336 930.62		40	8
23 - INCT	RAPID	1	RAPID	PL	TA - AC	1h	600.0			78 000.00	60	24
25 - UMIL	Theo4Exp	3	Structure4Exp	IT	VA - AC	1h	160.0			189 000.00	20	
26 - PSI	PiM1 & UCN	1	PiM1 & UCN	CH	TA - AC	1h	5376.0			0.00	136	32
32 - UoB	MC40	1	MC40	UK	TA - AC	1h	300.0			0.00	36	12

Access Provider Short Name	Infrastructure Short Name	Installation		Country	Type of Access	Unit of Access	Estimated Quantity of Access	Amount per Unit (€)	Access Costs		Estimated Number of Users	Estimated Number of User Projects *
		Number	Short Name						as Unit Costs	as Actual Costs		
33 - UKRI	CLARA	1	CLARA	UK	TA - AC	1h	150.0			0.00	16	8

HISTORY OF CHANGES

Part A		
date	**Page/section**	**Nature of change/ justification**
06.04.22	Work packages	Added the effort provide by UKRI, 6PM in WP3, and UoB, 18.1PM in WP4
06.04.22	Financial information	Subtracted 260692.8€ from INFN's budget in WP1 "Other goods, works and services". This was the UKRI and UoB total budget. This budget will be provided by a UK grant of the same amount.
17.03.2022	Annex 2B	Updated information
17.03.2022	Financial information	Corrected the costs that were all under Travel and subsistence and separated parts that have been placed under Other goods, works and services
17.03.2022	Infrastructures tab	Corrected a few infrastructure's data following also Table 3.1h
14.03.2022	Deliverables	Changed the type of the Data Management Plan deliverable to "DMP"
01.03.2022		Removed all references to the original Russian partner
01.03.2022	Associated partners	Remove JINR as partner of the project
01.03.2022	Beneficiaries, Associated partners	Moved UKRI and UoB to partners. All of their budgets have been moved to INFN under WP1 in "Other goods, works and services"
8.2.2022	Financial information	Corrected a mistake in WP1 for INFN. 50k€ had been placed into "Other goods, works and service" while they should have been under Personnel costs.
8.2.2022	Financial information	Transferred personnel costs from GANIL to CNRS in WP2 (12 PMs) and WP5 (24 PMs). CNRS will do all the hiring previously assigned to GANIL
8.2.2022	Financial information	Corrected KIT's budget by 2€
8.2.2022	Financial information	Corrected rounding problems with a couple of fractional numbers
6.2.2022	Participants	Substitute UKRI as beneficiary name in place of STFC
7.2.2022	Critical risks for implementation	Added a few more possible risks following comments from evaluators
6.2.2022	WPs description, Table 3.1f	Changed n. of participant for UMIL and partners, corrected PMs
5.2.2022	Participants	Corrected UMIL to be a beneficiary (was listed as partner before).
5.2.2022	Researchers	Added 6 researchers for INFN
5.2.2022	Researchers	Completed the researchers' information
5.2.2022	Infrastructures	Corrected data for Installations ALTO and SUPRATECH
4.2.2022	Deliverables	Corrected beneficiary for deliverables D2.4, D3.3 and D3.7
3.2.2022	General information	Defined the starting date of EURO-LABS. Added the justification.
Part B→A		

date	Page/section	Nature of change/ justification
15.03.2022	Description of WP2	Modified the sentence concerning the Swedish contribution CRYRING to FAIR
15.03.2022	Description of WP2	Modified the sentence related to FIUS, Univ. of Seville's third party
9.2.2022	WP1 description	Corrected the amount of funding kept as reserve to 220k
9.2.2022	WP2 description	Added ECR Ion Source to ATOMKI's accelerator complexes
8.2.2022	Participants, WPs descriptions	Corrected beneficiary name IFIN to IFIN-HH
8.2.2022	WP5 description, Table 3.1f	Added 2.5 person months to CSIC for effort in WP5
6.2.2022	Table 3.1a	Corrected the number of PMs for WP3 and the Total
6.2.2022	WP3 description	Corrected the number of PMs for many beneficiaries
6.2.2022	WP1 description	Corrected the number of PMs for the three beneficiaries
6.2.2022	WPs description, Table 3.1c	Specify beneficiary FBK for the ECT* RI
6.2.2022	Participants, WPs descriptions	Substitute UKRI as beneficiary name in place of STFC
7.2.2022	Critical risks for implementation	Added a few more possible risks following comments from evaluators
6.02.2022	WP1 description	Additions/modifications based on the reviewers comments:
6.02.2022	WP2 description	Additions/modifications based on the reviewers comments:
6.02.2022	WP5 description	Additions/modifications based on the reviewers comments:
6.02.2022	WP5 description	Additions/modifications based on the reviewers comments:
6.02.2022	Critical risks for implementation	Additions/modifications based on the reviewers comments:

Part B		
date	**Page/section**	**Nature of change/ justification**
08.04.22	Table 3.1k	Corrected the total actual costs of infrastructure CLEAR from CERN beneficiary
08.04.22	Table 3.1j	Updated by removing the costs of partners PSI, UKRI and UoB
08.04.22	Table 3.1h	Updated INFN removing the funding of UK partners that had been moved to WP1 under INFN
06.04.22	Comment on Table 3.1f	Updated total staff effort including effort provided by UKRI and UoB partners
06.04.22	Table 3.1j	Added in-kind contributions from UKRI and UoB partners
17.02.2022	Infrastructure Cost calculations sheets	Appended all the infrastructure cost (Actual or Unit costs) calculation sheets for TA/VA
17.03.2022	Table 3.1h	New format for Table 3.1h
14.03.2022	Headings of Table 3.1f	Specified that the 276 additional PMs are offered without cost
14.03.2022	Headings of Table 3.1f	Corrected the total number of PMs of the project to 832.1
14.03.2022	Headings of Table 3.1f	Specified that the PMs of GANIL (36) and CSIC (2.5) are provided without cost
01.03.2022		Remove JINR as partner of the project
01.03.2022	Tables 3.1h, 3.1k	Moved UKRI and UoB to partners
8.2.2022	Tables 3.1h, 3.1k	Corrected beneficiary name IFIN to IFIN-HH

7.2.2022	Tables 3.1h, 3.1k	Added the data for four missing beneficiaries, UU, KIT, UKRI and INCT. Corrected several numbers
6.2.2022	p. 7	Specify beneficiary FBK for the ECT* RI
6.2.2022	p. 20, Tables 3.1h, 3.1k	Substitute UKRI as beneficiary name in place of STFC
6.02.2-22	p. 17-18 (Measures to maximize impact)	Additions/modifications based on the reviewers comments:
6.02.2022	p. 22 (Work plan and resources)	Additions/modifications based on the reviewers comments:
6.02.2022	p. 29-31 (Project management and coordination)	Additions/modifications based on the reviewers comments:

Contents

1. Excellence

Nuclear and Particle Physics are driven by fundamental investigations of the origin and evolution of the universe, along with the exploration of its elementary constituents. Throughout science, researchers advance their understanding of core principles by studying extremes in nature. In the low and high energy domains, this is done by creating and probing systems under controlled conditions and by studying scenarios in the lab, that exist only in unimaginably vast bodies (10^{25} m) like stars and galaxies and connecting their properties to the physics of the very small ($<10^{-15}$ m) down to the ultimate constituents. These investigations need powerful microscopes (accelerators), eyes (detectors) and the nurturing of young talent along with experienced researchers. In the last decade, the Large Hadron Collider (LHC) at CERN through collisions of high-energy protons, allowed to test the predictions and validate the Standard Model (SM) that describes the fundamental structure of matter starting from fundamental particles and forces. Collisions of accelerated nuclei at LHC or other high-energy accelerators re-create the first moments after the Big Bang that gave rise to the building blocks of matter and subsequently to the formation of heavier elements, iron to uranium. But the SM describes only a small fraction of the known universe, and many of the mysteries about the universe, such as the nature of dark matter, and the preponderance of matter over antimatter, still need to be explained! High energy and smaller distance scales are required to study, e.g., Higgs pair production at hadron colliders and the diverse interactions of the Higgs boson with other particles, and to explore the flavour puzzle and the neutrino sector. The recent discoveries of gravitational waves and neutron star mergers have given us clues on element formation, pointing to the need of detailed studies of nuclear collisions at low energy physics facilities.

Today, we are at an evolutionary stage in Europe both in Nuclear and Particle Physics. The recent advances are thanks to the highly performant accelerators and detection systems constructed in the past decade and are presently in operation. At the same time there is need to design and construct the next generation of particle accelerators and detectors to make a smooth transition into the future. It is of paramount importance to simultaneously optimize the use of Research Infrastructures in Europe constructed and developed in leading laboratories over years representing the acquired expertise in the field and new facilities, to conduct curiosity-driven research to address fundamental questions. Their efficient use will be a key element in this endeavour, that will maximise the investment put in by the EC. Innovations are needed to identify and develop new sustainable accelerators and advanced detector technologies capable of reaching the required high performance. Novel accelerator techniques that push the frontier of technology and materials, along with experiments and new detectors/upgrades are essential. Continued progress in development of new or refined theoretical approaches is necessary to go hand in hand with experimental efforts to take our understanding to the next frontier. The management of big data and the strong coupling between experimental and theoretical frameworks to make substantial progress in unravelling the secrets in nature are the challenges ahead. Open data and data preservation of all these investigations are a key to optimize the output of the various facilities, including the training of the next generation, in the years to come. Besides the advancement in the strict scientific domains, it is of paramount importance to simultaneously open the Research and Technology Infrastructures to other disciplines, applications and industry. A continuous improvement of the tools and their wide usage is critical for Europe to maintain its leadership in this field. These improvements require various facilities to test and characterize accelerator and detector components both for proof of principle and for their performances and thus to improve the selectivity and sensitivity of our scientific efforts.

1.1 Objectives and ambition

Key objectives This proposal responds to the call for Research Infrastructure (**RI**) services advancing frontier knowledge and is driven by the European strategy for Nuclear Physics (**NP**) and High-Energy Physics (**HEP**). The goal is to provide transnational access to a major fraction of the state-of-the-art **EURO**pean **L**aboratories for **A**ccelerator **B**ased **S**ciences (**EURO-LABS**), part of a network of leading laboratories across Europe, to users for conducting state-of-art-research. This access will enable research at the technological frontiers in accelerator and detector development and for exploring new physics ideas. It will also complement a focused project-driven approach, thus bringing together the three extended communities engaged in nuclear physics, and accelerator and HEP detector technology.

To achieve this goal EURO-LABS sets objectives that underline the setting up of an overarching integrated RI service, based on the complementary nature of the access provision at the participating RIs, the sharing of

information and good practices and the implementation of targeted synergic activities, relating to service improvement, data management and training. The aims that will be pursued are fully consistent with the expected outcomes of the present call. Thus, the high-level objectives of EURO-LABS are:

1. Setup simplified and more efficient access procedures to an **enlarged and diverse portfolio** of leading RIs and installations located across Europe, to offer **dedicated beam-time** attributed to EURO-LABS, at no cost to the users, primarily for conducting research in Nuclear and High-Energy Physics. These RIs, potentially also attractive to related disciplines are expected to fertilize synergies and activities related to applications via a wider sharing of information, knowledge and technologies across scientific fields.
2. Organize and facilitate the effective use of the RIs by providing **expert help** to visiting teams, to optimally plan and exploit the full capabilities of the facilities for cutting-edge research. Create **reference documentation** and publicise the specifications and features of each RI along with examples of some key experiments or tests that can be conducted. This will allow research teams to choose the best RI (RIs) for their investigations
3. Additionally conduct **collaborative targeted improvements** for the existing services that will lead to an increase of the scientific and technical opportunities at various RIs.
4. Make the results from the tests conducted at the RIs of EURO-LABS during the period of the project **freely available** to the scientific community and manage the experimental data, when relevant, through a Data Management Plan (DMP) in line with the FAIR principles (Findable, Accessible, Interoperable, Reusable).
5. Organize the **training of the new generation** of researchers and young technical staff to best exploit the RIs, through workshops and hands-on experience at specifically chosen RIs.

The objectives described above are both measurable and verifiable. The access provision of EURO-LABS, attributed through a well-defined selection procedure, will be quantified and monitored during the lifetime of the proposal. The large number of facilities involved in EURO-LABS covers a wide panorama of RIs throughout Europe, and strategical non-European facilities will join the project as associated members, to complement the EURO-LABS offer. The improvement of service activities foreseen in EURO-LABS has well defined goals and will be instrumental in improving the quality and the variety of the experimental and technological offers at various RIs, including automated tools and remote/online access, and are planned to have an impact already during the first half of the project execution. Pointed feedback from the users about the services provided will serve as an indicator to follow up and improve deficiencies. A dedicated DMP fostering the implementation of FAIR principles for the flow of data generated at the RIs, will be delivered and updated throughout the project execution. A number of well-defined workshops and hands-on training activities with targeted goals, covering various topics, will be organised both for starting researchers and technical staff. This will be widely advertised.

Ambition

EURO-LABS will provide researchers a wide panorama of facilities to address a broad range of topics. It represents a pioneering step in bringing together, at the European level, the nuclear physics and the high-energy accelerator and detector communities. This will result in a cross-fertilization of these disciplines by providing access to a wide range of accelerator facilities to do frontline science. This proposal will unite 39 Research infrastructures in Nuclear and Particle Physics, 15 closely related to Nuclear, and 24 in HEP research, spread over 12 countries across Europe. Each RI offers a unique feature allowing to conduct state-of-the-art research over a wide range of topics. These widely distributed advanced RIs constitute a grid of facilities having a variety of beams ranging from electrons and protons to heavy hadron beams, from low to high energy, and secondary beams ranging from neutrons to radioactive ions for breakthrough and leading-edge research. The three communities integrated in this proposal are highly complementary, given their diverse nature in terms of energy scale, type of the beams and experimental facilities.

A majority of the facilities have already participated in previous trans-national access projects, such as EUCARD2, ARIES, AIDA-2020 and ENSAR2. Within those collaboration schemes, they have provided to a broad community of users a large panorama of tools and opportunities, necessary for major advances in science and the related technology, with a good track record of service to the community. An important novelty of this proposal is the bringing together of these three communities for the first time, to form a new super-community of sub-atomic physicists and technologists in Europe. This already represents an implementation at the grass root level of the very recent initiative for increasing the interaction between ECFA and NuPECC. On the longer perspective, EURO-LABS will set the example and contribute to develop a roadmap for complementary usage of leading RIs, ranging from the relatively small to large scale facilities (including ESFRI facilities), enhancing existing synergies and collaborations,

in the pursuit of excellent science in the nuclear and HEP domains, including their important role in applications and technology.

The synergies, in addition to natural ones, include usage of common facilities and gaining from each other's expertise for tasks of common interest, e.g., machine learning, data management, training, etc. ... and also the coordinated use of the RIs for diverse activities, e.g., at GSI, CERN, IFJ PAN Krakow, etc. For example, teams conducting R&D in HEP detectors can acquire access to irradiation facilities for studying in-beam pre or post irradiations effects. Small units of HEP detectors can be tested at nuclear physics RIs, before going to the large facilities such as DESY or CERN.

EURO-LABS will organize hands-on training programs for young and more experienced researchers and technical staff, to develop skills and experience through involvement in running experiments, especially exploiting the smaller facilities, profiting from relatively easier beam time availability. The ambition is to establish a coordinated effort, among the participating RIs, to prepare young researchers, for the challenges related to the use of the large/ESFRI facilities, for producing the best output for science/technology. Corresponding schools for the relevant scientific and technological background common to various RIs will also be held.

The DMP defined in EURO-LABS will foster the improvement of the present landscape, as far as Open Science practices are concerned. This will ensure that the data generated in experiments during the course of this project can be further analysed by other research groups, thus increasing the scientific productivity of the RIs. A dedicated task is foreseen for Open Data in EURO-LABS to maximize the usage of research data and naturally implement the FAIR principles.

Targeted actions to improve the "services" available for the users are aimed at providing better opportunities for curiosity-driven research, to benefit a wide user community. These improvements of harmonized services, implemented at transnational access facilities, will combine the expertise of various centres and benefit more than one RI. Planned developments in improving remote access to the facilities will increase the access and involvement in experiments at an international level.

EURO-LABS also aim at further simplifying and streamlining the access. To this purpose, a comprehensive set of information on the grand panorama of opportunities available at EURO-LABS facilities for potential users will be available on the dedicated website of EURO-LABS. A higher degree of standardization of the application procedures for exploiting these facilities is also envisaged. This single-entry point will allow more efficient access and utilization of the research infrastructure by the users.

Finally, the involvement, compared to previous programs, of new facilities in EURO-LABS will open wider avenues in both basic and applied research in diverse topics ranging from optimal running of reactors to mimicking reactions in the stars. Along with these new opportunities, sharing good practices and maximizing the knowledge exchange, as well as a stronger collaboration between the three communities, will allow to address new challenges in the coming decades.

1.2 Methodology

a) Concept

EURO-LABS in the European landscape

NP and HEP advance fundamental science at the smallest distances and the highest interaction energies. New discoveries are strongly correlated with ground-breaking experiments, improvements in accelerator technology for reaching higher beam energies and intensities, and more sensitive detector systems.

The field of accelerators for HEP is presently focussing on the operation of LHC and its upgrade HL-LHC, and in parallel working to identify and develop **new and sustainable accelerator technologies** capable of reaching the **highest performances** required by HEP, and also of crucial importance for future colliders like FCC or a Muon Collider presently under consideration. These new machines require substantial efforts and new developments, e.g., in optical design, long-term stability of operation and tuning and beam dynamics studies in order to maximize the potential luminosity and variety of beam-to-material effects. In addition, breakthrough ideas are necessary to ensure the long-term sustainability of accelerator operation, in terms of cost-reducing technologies, reducing power consumption and taking into account effects on the environment. The development in the accelerator field goes hand in hand with the core endeavour of the detector community currently occupied in the operation of the large LHC detectors and in their upgrade for operation at the HL-LHC, in line with the stipulations of the 2020 European Strategy for Particle Physics (ESPP) report in its recent update – "*The successful completion of the high-luminosity upgrade of the machine and detectors should remain the focal point of European particle physics, together with continued innovation in experimental techniques. The full physics potential of the LHC and the HL-LHC, including the study*

of flavour physics and the quark-gluon plasma, should be exploited." and *"The particle physics community must further strengthen the unique ecosystem of research centres in Europe. In particular, cooperative programmes between CERN and these research centres should be expanded and sustained with adequate resources in order to address the objectives set out in the Strategy update."* In this context and the outlined R&D directions for particle accelerators and detectors, to access to Research and Technology (**TI**) Infrastructures is a key ingredient, allowing the testing and validation of new ideas and concepts.

While HEP accelerators, and associated detector technology, are being improved and are moving to the next generation, several installations devoted to Nuclear Physics, and their recent upgrades, are in operation and are delivering beams to address open questions on the physics of the atomic nucleus and the origin of the chemical elements. These questions imply the understanding of the many facets of nuclear structure and reactions, to scrutinize how nuclear phenomena emerge from the underlying in-medium nucleon-nucleon interactions. This requires exclusive data on different observables (ranging from masses, lifetimes, electric and magnetic moments of ground and excited states to reaction cross sections, etc.), including features of nuclei which do not exist on Earth, some of them relevant to the nucleosynthesis processes. Often only a subset of important observables can be measured at any one facility, hence to obtain a complete picture naturally requires a network of complementary facilities to produce nuclei and understand the uncharted regions of extreme values of excitation energy, angular momentum and isospin. This is crucial to deepen our present knowledge of the nuclear interaction and test the unified theoretical descriptions for all nuclei. To meet these ambitious goals, several facilities are performing important upgrades: GSI in Darmstadt is currently undergoing a major extension with the construction of the FAIR facility, with a focus on new elements and isotopes; the SPES facility in Legnaro with reaccelerated short-lived beams will initially focus on nuclear ground state properties, while in the new SPIRAL2 facility in Caen the high-intensity stable beams facility is now starting its exploitation phase and will initially deliver neutrons to study fission and some key reactions relevant for nuclear data.

The role of EURO-LABS

This proposal addresses the call INFRA-2021-SERV-01-07 for the Nuclear and High Energy Physics community. It aims at facilitating access (transnational and/or virtual access) and providing optimum services to a very large pool of users, at state-of-the-art RIs, to conduct the best possible research in these and associated fields. The major goal of EURO-LABS is to create and federate a wide integrated structure, encompassing RIs distributed all over Europe that serve both nuclear and particle physics. This will allow the sharing of competences, expertise and experience, creating and promoting links, formulating common directions and strategies. EURO-LABS builds on the earlier experience of successful Integrating Activities for Nuclear Physics and HEP Accelerators and Detectors: ENSAR2 (2017-21), EuCARD-2 (2013-17), ARIES (2017-20) and AIDA-2020 (2015-2020). The funding obtained for transnational access (TA) and R&D activities within these programmes played a very important role in increasing the impact for these fields and in achieving the strategic goals of Europe. The present proposal exploits the successful tradition, initiated in these previous projects, and the synergies with on-going programmes, with the ambition of further broadening the access to advanced RIs and fostering cross-disciplinary fertilisations and a wider sharing of information, knowledge and technologies across these communities. EURO-LABS reflects a large and diverse community, adhering to the core principles of open access, diversity and equal opportunity. The RIs participating in EURO-LABS allow to address a broad spectrum of research activities, ranging primarily from probing the nucleus at low energies to testing and characterizing accelerator and detector technology to face the ongoing and upcoming challenges in subatomic physics. They have been selected in such a way as to ensure the complementarity and high-quality services to the users, for research activities in nuclear and HEP accelerators and detectors.

The EURO-LABS Consortium will create connections at three different levels:

- within each of the three involved communities (Nuclear Physics, High Energy Accelerators and Detectors),
- across these communities,
- across countries and regions.

This integration process among the different RIs of EURO-LABS will be strengthened through an improved harmonization of the access procedures (including for interdisciplinary research), and transverse activities aimed at improving the quality and the breadth of the technical services provided by the current infrastructures (such as beam quality, remote access, optimization procedures based on Machine Learning, training of young researchers). The sharing of a common open Science policy will also be another aspect. The EURO-LABS Consortium, with common objectives and complementary facilities, will open a new path for facing the challenges in the nuclear and HEP research for the coming decades, increasing the impact of European science at the subatomic level. Further, EURO-LABS aims at strengthening and facilitating complementary international collaborations, which can pave the path toward a global integration of RIs.

b) Methodology

The facilities participating in EURO-LABS have been classified in three thematic pillars:

1. **RIs for Nuclear Physics**: This activity aims at providing TA to various RIs providing stable ions, radioactive ions and neutrons at various energies, combined with state-of-the-art equipment to explore nuclei under extreme conditions. Virtual access (VA) to a theoretical repository will also be provided, to access model calculations, both for planning and interpretation of experiments conducted at the TA facilities (**WP2**).
2. **RIs for High Energy Accelerator R&D:** This activity aims at providing TA to a broad spectrum of installations, to test concepts for future accelerators, based on improving the present facilities, and for R&D studies for future colliders like CERN/FCC or the Muon Collider. These facilities will provide beam lines for testing advanced accelerator materials, superconducting or normal Radio-Frequency cavities, magnets and acceleration schemes. These tests use different particles and energies (low-energy protons, low-energy electrons, ultra-soft electron bunches and high-intensity high-energy electrons and could also have connections to industrial applications (**WP3**).
3. **RIs for HEP detector R&D**: This activity aims at providing TA to various facilities having energetic beams (protons, mesons, muons, electrons) and irradiation facilities in mixed hadron and γ fields. These measurements are necessary to study the effect of detectors and associated equipment in-beam, required for the detectors upgrades for operation at the HL-LHC and construction of new detectors for the future (**WP4**).

In addition to these WPs, EURO-LABS includes two transverse WPs, devoted to i) management and coordination (**WP1**); and ii) training, services to enhance FAIR data principles, common technologies (based on Machine Learning) and external/internal communication and outreach (**WP5**). A brief description of the methodology adopted to define the three WPs devoted to TA/VA activities is given below.

RIs for Nuclear Physics

The network of RIs for Nuclear Physics (WP2) was based on the recommendations of a scientific Steering Committee, formed by the representatives (including NuPECC) of the RIs participating in the Horizon 2020 ENSAR2 programme, towards the creation of a more comprehensive portfolio, thus ensuring a larger and complementary variety of access offered to the users. This selection process also took into account the alignment with the goals of the latest Long Range Plan for Nuclear Physics (released at the end of 2017). A bottom-up approach was favoured for the definition of the service improvement contributions, incorporating the suggestions from the users.

The infrastructures in WP2 of EURO-LABS will provide not only European but worldwide users with the highest intensities for stable ion beams (in certain cases ~pmA), for isotopes of hydrogen to Uranium (Task 2.1), high-energy short-lived radioactive ion beams (~10^4 p/sec) using in-flight fragmentation techniques and the largest variety of post-accelerated radioactive ion beams (up to ~10^7 p/s) using ISOL (Isotope Separation On Line) techniques (Task 2.2). In addition, EURO-LABS will also provide access to facilities delivering neutron beams (Task 2.3), to the European Center for Theoretical studies ECT* (through the FBK beneficiary) and, through the establishment of a Virtual Access facility, to theoretical support to experiments, for the first time (Task 2.4). The approach of WP2 is to offer access to those RIs which in a complementary way span opportunity for investigation of important nuclear physics phenomena that are pertinent to answer questions like*: how does the complexity of nuclear structure arise from the interaction between nucleons? What are the limits of nuclear stability?* WP2 offers access to the beams at 13 RIs and access to 2 RIs offering Virtual access for theoretical support. The offered services in all of the facilities partially overlap (making it possible to verify correctness of a new breakthrough), and partly are truly complementary – each of the facility offers certain unique opportunities (type of the beam, its energy range, associated instrumentation) which are not available in other RIs. For example, unique features for some of the facilities are the heavy-ion beams at relativistic energies at GSI/FAIR, the high intensity stable and reaccelerated beams at GANIL, the protons in the unique range of 70-230 MeV at NLC-CCB, all coupled to dedicated instrumentation. Many of the RIs are interconnected, for example through the possibility to host novel travelling detectors, such as AGATA, PARIS, FAZIA, NEDA. A unique TA support will be offered, for the first time, to a multi-national joint facility consisting of three infrastructures, one located at the University of Sevilla (Spain), another at ATOMKI in Debrecen (Hungary) and the third at IST in Lisbon (Portugal), all having scientific and technical development programs in relevant research areas. This action is in the spirit of enlarging the European research areas and facilitating complementary connections between this joint facility and the larger scale TAs of EURO-LABS. EURO-LABS will also foster the exchange of expertise and users to and from different complementary facilities outside Europe, in particular RIKEN (Japan) and FRIB (USA). The latter RIs join the proposal as associated partners. The breadth of this offer will be extremely attractive, to undertake advanced

programs for fundamental research aimed at unveiling yet unknown features of nuclei and their impact on interdisciplinary aspects connected to astrophysics and neutrino physics.

RIs for High Energy Accelerator

For the HEP Accelerator Research in building the EURO-LABS consortium, RIs that participated in ARIES were contacted, for their interest to participate, In consultation of the community and in agreement with TIARA (Test Infrastructure and Accelerator Research Area). The expected TA budget envelop in EURO-LABS, allowed to accommodate all the RIs that confirmed interest. Furthermore, the call was enlarged to include facilities with potential users involved in applications outside the particle and accelerator environment and possibly with industry. This step is considered to be very important and demonstrates the role and impact of the RIs for accelerator R&D, and the associated key technologies, to a wide and multidisciplinary community to push new technologies to applications, and inversely feed back and motivate further innovative research in the field of accelerators. In the end, 13 complementary top-class European Research Infrastructures willing be open to Transnational Access were identified that form WP3 of EURO-LABS. These facilities are of known quality and are highly attractive outside their national boundaries, and some of them to industry. TA to Accelerator infrastructures is known from past programs like EuCARD-2 and ARIES, with very positive and useful participation.

The EURO-LABS TA project has been structured in a complementary fashion to exploiting synergies and cover needs with respect to other ongoing projects and programs for particle accelerators in Europe and worldwide. The 2020 ESPP established the roadmap for the accelerator sector in two flavours: first on technology R&D as "t*he particle physics community should ramp up its R&D effort focused on advanced accelerator technologies, in particular that for high-field superconducting magnets, including high-temperature superconductors"* and second as a future collider project in two stages "*a future hadron collider at CERN with a centre-of-mass energy of at least 100 TeV and with an electron-positron Higgs and electroweak factory as a possible first stage"* labelled as the FCC-ee and FCC-hh projects respectively. Accelerator physics studies and R&D are only possible through the availability of a wide range of particle beams, including protons at high-intensity, low-energy electrons, high-intensity electron beams from storage rings and ultra-soft electron bunches in different configurations. The facilities offering TA in EURO-LABS will provide the platform to cover, test and evaluate R&D efforts in the various ongoing accelerator initiatives and thus contribute to the global effort for establishing new directions and identifying synergies between projects. The WP3 includes RIs offering access to test-stands for material tests with intense pulsed beams (Task 3.1) , or intense electron beams (Task 3.3). Access to large Technology Infrastructures (**TI**) from the AMICI collaboration (Task 3.2) will cover the needs for validation of the performance of novel techniques or full production assemblies of superconducting RF cavities, magnets, associated materials or mechanical designs. In all activities the link with ongoing projects like IFAST will be maintained. Finally, versatile facilities with electron beams (grouped in Task 3.4) will make in addition to basic research, the bridge to multidisciplinary research using accelerators and make connections with applications and industry.

The 13 Research and Technology Infrastructures of WP3 are modern and unique testing facilities, representing the state-of-the-art in European Accelerator science, based on long-term investments and expertise built up in the field. With few exceptions are in operation since the last few years and the majority is based in well-established world-class laboratories that have a tradition of providing high-quality service to the users. Four facilities are based in high-level universities hosting international research. The facilities provide a complete set of TA options covering accelerator physics studies, and tests and validation of all types of critical components for scientific and industrial applications. The facilities are fully complementary and offer a diverse range for testing conditions and equipment ranging from small prototypes and samples to full assemblies ready for installation in accelerators. This wide and structured access supplements the large amount of free access already established in the particle physics accelerator community, which is managed, to a large extent, by bilateral collaboration agreements.

RIs for HEP detector R&D

The RI's for the high-energy detector community were selected along three different tasks required by the community for efficient and reliable detector development: a) Access to high-energy particle beams (Task 4.1) at CERN, DESY and PSI. The usage of test beams is free-of-charge, with the main goal being to enable more researchers to actively participate in beam tests. Emphasis will be on supporting PhD students and postdoctoral researchers to carry out detector beam tests, as this constitutes a very effective S&T training in the instrumentation domain; b) Access to detector characterization RI's (Task 4.2). Semi-conductor detectors will be one of the main challenges at the Higgs factories and FCC-hh. Studying their behaviour also with micro-ion beams at RBI will enhance the understanding of these detectors. Electromagnetic Compatibility (EMC) is a key issue when detectors must be integrated in an experiment, and prior tests in a dedicated facility such as ITAINNOVA can make the commissioning of the detectors

more efficient. c) Access to irradiation RI's (Task 4.3). The goal is to cover the wide range of identified particle sources needed for detector development for later stages of HL-LHC upgrades and enable initial research on detectors for FCC-hh. These RI's include proton, neutron or mixed field sources as well as gamma irradiation. Some can provide extreme fluences beyond 10^{17} n_{eq}/cm^2 (JSI, IFJ PAN, UoB) for smaller samples, while others deliver lower fluences of ~10^{15} n_{eq}/cm^2 on larger (10x10 cm^2) objects. GIF++ covers irradiation of large-scale objects like muon chambers, while the Heavy-Ion Irradiation Facility (HIF) at UCL is widely used for Single-Event Effect tests of electronics. The facilities listed are complementary and the majority of them have provided reliable user access in previous projects like AIDA and AIDA-2020.

For detector R&D the two goals of ESPP (Higgs factory, FCC-hh) are supported at the EC level by the AIDAinnova project that encompasses the detector R&D communities in Europe and beyond. Other focal points include CERN RD collaborations, and developments within (large) experiments. The development cycle towards the use of a new technology in detectors spans over 10 to 20 years starting from prospective detector R&D, and proceeds via R&D, guided by the known needs of future projects, to focussed R&D of approved experiments. These detector development phases (with increasing Technology Readiness Levels) need the access to the RI's of EURO-LABS. The major support of EURO-LABS for the Higgs factory detectors is through the Detector Characterization and Test Beam tasks. The radiation load is relatively small; still testing at low levels of radiation and checking for single-event effects is indicated. The opposite is true for detector studies aimed at FCC-hh. Detectors at FCC-hh must achieve unprecedented radiation hardness. The highest levels are reached in the forward calorimeters where the total ionizing dose and the 1-MeV equivalent neutron fluence rise to values of 5000 MGy and $5x10^{18}$ n_{eq}/cm^2. In the innermost layer of the barrel vertex detectors, the fluences approach $1x10^{18}$ n_{eq}/cm^2after an integrated luminosity of 30/ab. Fluences in excess of at least $1x10^{18}$ n_{eq}/cm^2, a benchmark for a yearly exchange of the inner layers, need to be available for these studies. EURO-LABS intends to provide access to these conditions, even up to 10^{18} n_{eq}/cm^2, by RIs in the Irradiations Task. The RI's of EURO-LABS will also be used for testing the few remaining parts of late R&D for HL-LHC, like Low Gain Avalanche Detectors, (LGAD), Si PhotoMultipliers (SiPM) in ATLAS, CMS and LHCb. The users are expected to originate from the detector development community all around the globe, working on the remaining upgrade projects of the HL-LHC experiments (ATLAS, CMS and LHC-b), upgrades of the precision frontier experiments (e.g., Belle2), Higgs factory detectors and R&D collaborations aimed at detectors at the FCC-hh (e.g., CERN RD50, RD42…). This list is not exclusive, there are detector developments in related scientific fields like nuclear fusion (e.g., ITER) that face similar, or even more compelling challenges as FCC-hh.

General features

The infrastructures for which EURO-LABS are requesting TA are located over a vast area of Europe, going from east to west (Romania to Portugal) and from north to south (Finland to Italy), and address Nuclear and HEP related research programs. In addition to representing a broad and comprehensive offer in each of the three main fields, the selected facilities complement each other globally. The natural sharing of the knowhow between the three fields will lead to cross pollination as they are interconnected. The ever-increasing accelerator capabilities determine the constraints on the detectors, both these improvements will also feed the nuclear physics community. The consortium will have a wide spectrum of potential users and all the TA WPs will treat requests from both nuclear and HEP research teams, independent of their WP affiliation. Due to the strong demand and oversubscription for beam time at the large facilities, users will have the possibility to carry out tests and development of instrumentation beforehand at smaller facilities, in order to maximise the probability of success at large scale facilities. The cluster of small-scale facilities now involved in EURO-LABS will offer beam time for complementary scientific and technical activities, that will also support of the large scale facilities, thus widening the possibilities for applied physics and technological research.

The broad spectrum of RIs in EURO-LABS will actively solicit users not only from academia, but also from industry and other stakeholders. A wealth of accelerators in EURO-LABS is now in use for medicine and industry, with European companies maintaining an edge in the use of accelerators for radioisotope production, cancer treatment, and environmental applications. In particular, accelerators can play a strategic role in the fight against cancer, one of the main current societal challenges, for which new accelerator-based tools are rapidly growing. This varies from the recent use of FLASH therapy as a less-invasive radiotherapy technique, to the increasing interest in isotopes for combined imaging and cancer therapy ("theranostics"), to the growing use of heavy ion beams for cancer treatment with a minimum impact on surrounding tissues. The environmental sector is another promising field, where accelerators can be used for e.g. nuclear waste management. Moreover, the realization of application-specific tools, necessary for forefront research, often leads to new cutting-edge developments, which allow technological innovations to be transferred to industry and other potential user communities, such as for radiation safety and security. Tools and instrumentation developed for basic research drive associated developments for applied research requiring the use of accelerated ions and/or Radioactive ion beams. Examples are Atomic Mass Spectrometry used

for trace elements and dating analysis in geology, archaeology and cultural heritage applications, rare (new) isotope production schemes for radiotracers and cancer treatment, improved detectors and detection methods for PET scans (e.g., the TOF-PET scanning method), and many more. EURO-LABS, is also expected to arouse increased interest, triggered by the availability of new Radioactive Ion Beams, within the growing community involved in material science and quantum technology research.

c) Challenges

Transverse activities

The European RIs participating in EURO-LABS have fostered a culture of cooperation among themselves (within a WP) at different levels through activities in earlier EC framework programmes. Building on the previous important and positive experience, EURO-LABS aims at furthering this integration process, promoting synergies at a more comprehensive level, within the whole community involved in this consortium. To achieve this challenging goal, a number of targeted actions will be put in place, as part of the activities of WP5.

1. *Dissemination and Streamlined access procedures*: The proposed strategy to ease and improve the access to such a wide network of RIs for accelerator-based science will be driven by three main objectives:
   - Streamlined access procedures: Simplified and uniform access formalities will be adopted, in the directions of improving the facilities compliance with the European Charter for Access to RIs. The procedures to be adhered to, along with the relevant documentation, will be accessible through a common online portal.
   - Harmonised user management and exploitation of common best practices: The large number of users that are expected to apply for TA requires a proper management of their data among the facilities, in compliance with General Data Protection Regulations. A database to manage the information provided and the feedback by the users (including beam conditions, sample characteristics, dose, fluence, other environmental information, etc.) will be established to achieve standardisation and to improve the level of quality assurance.
   - Improved dissemination of scientific and facility characteristics for users: In order to improve the dissemination about facilities characteristics and the grand panorama of opportunities available in EURO-LABS for potential users, information will be gathered in a structured manner through surveys and interviews to the experimental teams, taking into account users needs and suggestions, then organized and presented in a comprehensive online portal. A search-and-compare functionality will allow users to find the best match for their proposal and the facility to exploit, including lead time estimates to run the experiment and/or the access services requested. This will ensure an optimal exploitation of the network of facilities and also attract new users.
2. *Sharing data and knowledge*: Further integration within the consortium will be reached also at the level of the sharing of data, produced in particular in physics experiments made during this period. The quest for Open Science will represent an opportunity, within EURO-LABS, to improve the management and use of the large data sets produced in the participating facilities. The development of a suited data workflow that could be shared among the European facilities represents a major step forward in EURO-LABS. The data produced will follow the FAIR principles. With this goal, a joint network/council will take care of the standardization of data, meta-data and associated software.
3. *Online services and Machine Learning*: A better harmonisation of the access conditions offered by the current research infrastructures will be achieved through the implementation of (common) activities aimed at improving the quality and breadth of the services at the RIs and addressing questions related to a long-term sustainable perspective of the facilities resources. Relevant examples are technological research programs devoted to promote remote access so as to enhance the capability to run the experiments from the users home institution and machine learning procedures primarily applied to optimized accelerator control and reliability (see also WP2.5).
4. *Training*: All developments in fundamental science and applied research go hand-in-hand with education and training of young physicists. Within EURO-LABS the goal will be to organise bridging actions across communities, training a new generation of European physicists ready to an optimised exploitation of the current RIs and to welcome a new generation of machines. EURO-LABS will include an enhanced training program combining lectures and courses with hand-on experience at the RIs, primarily to attract young researchers in the field to learn experimental techniques, with a possible extension to university students to stimulate interest in basic science and accelerators/detectors. Based on the strong technological implications of the various RIs research programs, targeted actions will also include training of engineers and scientists (with possible impact also on industry), with a strong impact on employment of highly-qualified and skilled personnel.

Trans-national and Virtual Access in EURO-LABS

The broad access offer provided to users of EURO-LABS is expected to provide a crucial support to address emerging new challenges in the fields of nuclear and HEP. Prominent examples are given below for the three WPs concerned:

WP2: New challenging directions of nuclear physics research require the integrated access offered in EURO-LABS. In particular, EURO-LABS will play a crucial role to promote and/or facilitate:

- the access to stable beams with extremely high intensity and the matching target technology, that is essential to investigate extremely small production cross-sections, e.g. for the synthesis of new chemical elements and specific isotopes.
- the access to an extremely wide spectrum of radioactive ion beams, including the use of the new facilities at SPES and S^3 at SPIRAL2, for path breaking research on nuclei far from stability.
- measurements of high-resolution neutron-induced reactions in an extremely wide range of kinetic energies (from sub-meV up to GeV), for the modelling of processes taking place in astrophysical sites and for applications in advanced nuclear technology developments.
- a stronger synergy between theory and experiments, through the opening of virtual access to well-established computing codes and theoretical tools for planning and analysing experiments performed at the TA RIs and for the community at large.
- exploring the use of ion beams for innovative isotopes for nuclear medicine and for quantum technology.

WP3: To face the challenges of the next generation of accelerators, a rigorous R&D effort is ongoing promoted by several projects like ARIES and more recently IFAST. EURO-LABS will play a vital supporting role in this transition effort to new accelerators by hosting tests and evaluation studies towards:

- ensuring sustainability of accelerator research through TIARA, the coordinating body for joint accelerator S&T, and collaboration and links with ongoing projects within Horizon2020 like IFAST.
- the development of new technologies that overcome present barriers in terms of performance or use of advanced materials.
- offering a structured and integrated support to test efforts for accelerator upgrade projects assuring the optimal use of existing facilities and investments.
- introducing new accelerator designs and applications aimed at using the present facilities especially for medical and industrial applications.

WP4: EURO-LABS will play a crucial supporting the detector development for the future colliders, coordinated by the AIDAinnova project, by providing accompanying TA at EURO-LABS RI's in all phases from detector conception to QA/QC of complete systems. The identified challenges that stretch beyond current capabilities of the RI's are connected to:

- the quest for detectors operable at extreme fluences faced in the FCC-hh detector core, which have to be replicated in the R&D phase. Irradiation can result in activation levels that effectively preclude detector release for a substantial period, to be followed by the exposure doses still requiring radiation worker handling and monitoring in all subsequent phases of testing. This can be partially mitigated by careful selection of detector materials and irradiation beams, within the wide EURO-LABS offer.
- due to the large irradiation flux necessary to reach the ultimate fluence, self-heating of sensors due to TID (low-energy protons) or KERMA (neutrons) might lead to unacceptable temperature rise that renders the results ambiguous or even permanently damages the DUT. To mitigate, the rather obvious temperature control techniques (cooling, spreading, scanning) will be employed; their implementation is, however not trivial due to space constraints and the hostile environment at the irradiation sites.
- irradiation induced leakage currents represent a problem for test-beam evaluation, especially since most of the detectors require a rather substantial operational bias voltage. The resulting heat, due to positive temperature feedback into the current, can lead to thermal runaway. Mitigation strategies include cooling of the set-up well below freezing point, requiring both sophisticated custom-built refrigerators and strict humidity control to prevent condensation.
- tracking detectors for the Higgs factory feature very fine granularity combined with thinnest possible detectors. The signals are therefore minute; most concepts therefore rely on the monolithic paradigm, combining sensor and FE electronics on the same substrate. The challenge for test-beam evaluation is to provide tracking telescopes with sufficient resolution to map out the complicated sensor behaviour, and to prevent any EM interference with the small signal.

In case of unexpected availabilities, the broad EURO-LABS offer will allow rescheduling or reassignment of TAs within the same task, according to needs.

d) National and international links, Interdisciplinary aspects

Strategies are implemented at the European level to ensure coordinated efforts for the scientific goals of Nuclear and High Energy Physics. For nuclear physics, NuPECC formulates strategic Long Range Plans that give a clear vision on the focus of the field, the associated development of facilities and instrumentation, and the strategy for the future. For the Accelerator sector, strategies are formulated by the CERN Council and EFCA. WG9 of IUPAP coordinates the international cooperation of Nuclear Physics. Similarly, the European Strategy for Particle Physics is the cornerstone of Europe's decision-making process for the long-term future of the field. It developed in close synergy with similar processes in the US and Japan, in order to ensure coordination between regions and optimal use of global resources.

EURO-LABS is a consortium of facilities which have participated in earlier integration activities. As a result, these have led to innovative R&D and physics breakthroughs on which the present proposal is built on. AIDA-2020 advanced detector technologies beyond previous limits, by offering well-equipped test beam and irradiation facilities for testing detector systems under its TA programme. Common software tools, microelectronics chips and data-acquisition systems were also provided. These shared high-quality RIs and standards ensured a coherent development of expertise across Europe. The enhanced coordination within the European detector community helped in leveraging EU and national resources and contributed to maintaining Europe's leadership in the field. As far as accelerator R&D is concerned, the RIs participating in EURO-LABS that offer electron beams would provide the basic test bed for testing of components and concepts proposed for future high-energy accelerators like the CERN/FCC-ee. This includes tests of materials in vacuum systems exposed to high-fields due to synchrotron radiation from the circulating beams or near-beam devices (collimators or masks) that will be used as equipment protection devices. Furthermore, the technology infrastructure RIs will be used to test new magnet systems or RF cavities for future installations like the MYRRHA LINAC presently in construction at the CRC of UC Louvain.

Nuclear and HEP research is pioneer in setting-up collaborations between countries and multicultural research teams. The EURO-LABS RIs are open to these exchanges; this often implies visits to new sites and the need to conduct the experiment or test in a new environment and country. The support of the local teams in accessing and guiding the visiting researchers to successfully complete their tests and experiments within the available time is crucial, indirectly involving the need of openness and understanding of cultural and language differences. Experience from the past projects on TA is very positive. For nuclear physics, these international links, which mainly come from research collaborations executing joint experimental programs, are with Japan (RIKEN, Tokyo & RCNP, Osaka), China (IMP, Lanzhou), the United States (NSCL, East Lansing, MI & ANL, Argonne, IL), Canada (TRIUMF, Vancouver) and South Africa (iThemba, Cape Town). These worldwide collaborations are bilaterally advantageous and again highlight the complementary nature of the facilities. Sometimes they have involved the temporary relocation of significant instrumentation (detector arrays and other instrumentation) and knowledgeable personnel from Europe to these international infrastructures and vice versa. The approach of global cooperation will be organised case-by-case and will be based on the user requests and plans for developments of available beams and intensities. In this way Europe will have larger impact on nuclear and high energy physics internationally.

EURO-LABS is built on the complementary and interdisciplinary nature of the activities carried out at the participating RIs. The need of expertise from various fields is a key factor for the success of the planned research program and tests. As an example, the successful test and validation of new superconducting RF cavities requires synergies between the engineering teams that construct the cavities and experts in cryogenics, power supplies available at the RIs. The realisation of nuclear physics experiments has a close synergy with R&D activities relating to accelerators and detectors. Data analysis and simulations use the object-oriented programs and libraries. For instance, ROOT is shared and developed by each of the communities.

The Nuclear Physics and HEP community has a proven track record on very extensive and broad appraoch with respect to equality issues. Besides gender, it also embraces multicultural, multinational, racial and disability dimensions of equality. We intend to adopt this pro-active policy in EURO-LABS. All WP coordinators, Task Leaders and Facility coordinators will continue to follow these general guidelines and in particular take care of gender equality and diversity in the course of this project. This will be monitored by the EURO-LABS Steering Committee and also as part of a task of WP5.

The present project deals with providing access for conducting scientific experiments and developing and using state-of-the-art detectors and accelerators for a large scientific community. Hence, the integration of social sciences and humanities is not relevant in EURO-LABS.

Data Management in EURO-LABS

A natural output of the research activities carried out at EURO-LABS typically includes scientific publications and reports. The participants will be encouraged to publish in open-access journals and to deposit their papers in open-access archives or local institutional repositories. This practice is already well established for the majority of the EURO-LABS partners. In accelerator and detector developments, for the case of prototype testing and small-scale experiments as those typically expected in the TA activities of EURO-LABS, normally the results are published in scientific journals and/or conference proceedings or as reports and are easily accessible. This practice covers the need and interest of the community, as often the collected data during the test are highly customised and linked to the exact conditions of the test known only to the participating research teams. As in previous TNA projects, a list of reports from the tests will be available for consultation and will provide a valuable background to new R&D, for example in the case of irradiation or material tests for detectors. For certain important publications that deserve immediate dissemination, the management of EURO-LABS may consider in addition using the "gold" open access, by supporting the publication costs.

The community of EURO-LABS recognizes the importance of Open Science and the necessity for coherent and consistent open data management policy and principles throughout the community, and the benefits such policies bring. Open data practices have been embedded in HEP research for quite some time. In the case of HEP Accelerator and Detector R&D tests, all the research teams are committed to the openness of data from their tests. This is typically organized per type of activity with the data openly available to all relevant and collaborating teams. Typically, a team collects data through highly customised acquisition systems, that register the conditions of the test, and images data from monitoring and devices under test. The analysis and extraction of the results, being typically on prototypes, require particular expertise thus making them of little interest and usefulness to external members. The key results are published and available to the community and depending on the type of experiment can be available in repositories including metadata to guide their use by external teams. In the HEP community, large centres like CERN provide solutions for long-term data storage and online accessibility (http://opendata.cern.ch), often used by the researchers. Within EURO-LABS we will maintain links to such data structures for the experiments performed. Moreover, this project represents an opportunity, in particular for the nuclear physics community, to improve the management and use of the data from the nuclear physics facilities and foster new collaborations. As a goal towards Open Science in nuclear physics, the setup of a suited data workflow, to be shared among the Nuclear Physics European RIs, would represent a major step forward, moving towards long-term data storage according to FAIR principles, which also implies a commitment to open data. Tasks connected to DM will be tackled through the creation of a portal of services allowing simple and efficient interaction between the different actors of the data life cycles: Data Producing Institution, Technical Resources developing and maintaining new technologies (developers, engineers and technicians), Scientific Collaborations (groups of physicists) and end Users (ranging from active physicist in the field to any interested citizen). A detailed DMP will be delivered by month 6.

The data generated/collected at the EURO-LABS infrastructures mainly consists of a multi-parameter list or event-mode data generated from the digitized electronic signals originating from radiation detectors and other instrumentation of widely varying complexity, which is often built "in-house" for a specific application. Due to the nature of the nuclear physics field in carrying out complementary experiments at several different facilities, to date, the community has not fully developed common data management practices. Many facilities have taken initial steps, but this should be completed, and EURO-LABS will be delivering a definition of data management for TA and VA facilities. The priority given to this can be gauged from the fact that a dedicated task has been included among the synergic activities of WP5.

One of the first deliverables of the DM task will be to produce a DMP document outlining the procedures to be implemented at the TA and VA facilities in order to foster proper handling of data according to FAIR principles and provide corresponding DMP templates. This will be instrumental for the deployment of Data Management good practices and tools, such as ownership of data, definition of responsibilities with respect to short- and long-term storage, compliance with European General Data Protection Regulations, possible embargo periods, use of standardized and automatized metadata, data packaging (required content and documentation) and use of global and persistent identifiers for the data.

The majority of data produced by the EURO-LABS community has well-documented formats which allow for the data to be read and interpreted by users and third parties, but as yet standardized data formats have not been widely implemented. The use of harmonised formats will be pursued within EURO-LABS, greatly aiding the subsequent analysis of data and sharing of analysis codes for users. The long-term data storage policies of the TAs are often similar but not fully coherent. This often makes the sharing of data with a wider community outside of the experimental collaborations more difficult, and sometimes even remote access to the data within the same collaboration is not possible. Some examples of more advanced centralized data management and access exist, for example data generated using the AGATA tracking array is stored and analysed using the GRID infrastructure. One

of the goals of the DM task will be the setup of a Catalogue of Data and Tools, where the data from EURO-LABS facilities will be stored in a centralized repository, findable and accessible by the collaborations and the wider community. Taking inspiration from the experience of the ESCAPE/HEP physics community, efforts will go to the integration of the Nuclear Physics community to existing infrastructures/services of the EOSC environment, federating many scientific communities for Open Science. This will imply the identification of existing solutions in the EOSC ecosystem of Authentication and Authorization Infrastructures (AAI) and Data Storage infrastructures (DataLakes, National Level Facilities) and the adaptation and integration of the solutions implemented into the portal and tools deployed for the Nuclear Physics RIs to access the data.

2. Impact

The RIs for experimentation and R&D play an essential role for Nuclear and HEP physics research. Measurements of observables in nuclear collisions are essential to understand new phenomena and test and validate the underlying theories and models. Similarly, tests of components of detectors and accelerators validate the design and optimal functioning of prototypes so as be able to scale up and have ready-to-use assemblies that can be used at large scale RIs. The challenges in new experiments or developmental projects are primarily faced and addressed while working in such RIs, starting from first prototypes to validation of full assemblies. With the increased complexity of the projects in the NP and HEP research, the related infrastructures participating in EURO-LABS, have increased in complexity and sophistication, at the same time remaining versatile and flexible so as to adopt the new requests and needs. They also represent the outcome of years of development and expertise, combined with large, long-term investments in the field. In addition, the RIs remain a unique source for training of students and young researchers, acquiring valuable hands-on experience from senior colleagues.

The EURO-LABS project represents a unique and substantial contribution toward a big direct impact in both fronts: increased TA to leading RIs for frontline experiments and R&D, and training of young researchers. This will enhance and strengthen the scientific impact of European research teams at a global level, securing the future of the research in nuclear and particle physics.

2.1 Project's pathways towards impact

EURO-LABS aims for an ambitious TA program in 43 RIs across Europe, building on the experience from previous projects. It will offer a wide spectrum of leading Research and Technological Infrastructures which will welcome and support numerous teams from Europe and Worldwide. In total ~31000 access units (typically beam hours) will be offered in the area of Nuclear Physics, ~21000 access units for Accelerator development and ~34000 access units for HEP Detector development corresponding to ~450, ~250 and ~275 projects, respectively. The results obtained will span an enormously broad spectrum and will have major impact in basically all ongoing R&D in the field by validating concepts and design options and on the achievement of breakthrough scientific results.

From discussions and contacts made during the preparation of this proposal, the interest of the communities was confirmed. A large number of research teams in Europe have experience in TA programmes and are eager to participate in EURO-LABS. EURO-LABS will setup from the start of the project an efficient scheme for receiving the requests for TAs and establish a system to monitor them. The TA funds will be streamlined in the participating RIs via the evaluation and prioritization by the USPs to targeted topics in unison with the ongoing projects in NP and HEP. Scheduling difficulties as well as unanticipated unavailability of the RIs would require flexibility in the execution of the schedule to succeed. The management of EURO-LABS at the WP and Task level will monitor the progress and assist in the rescheduling or reassignment of TAs according to needs.

In parallel, part of the planned service improvements will help to increase the availability and capacity of the RIs to accommodate users, through hardware upgrades, software developments easing the user access and additional instrumentation to match the user needs. Moreover, EURO-LABS will foster coordinated efforts towards improved conditions for remote access to experiments and automated (machine learning) tools for accelerator control, thus contributing to enhance the future sustainability of the participating RIs. The results obtained are expected to have a direct impact on the associated projects and the training of the young researchers that will provide the seeds for the future developments in the field. Increased scientific impact is expected also from the management of the continuous flow of data and results produced at the RIs through the creation of a common repository, promoting FAIR principles (see Task 5.2 in WP5). Moreover, the EURO-LABS project will pioneer the concept of Open Research Infrastructures (ORI). For R&D activities, ORI possesses much of the same functionality as Open Access to publications does to the general scientific endeavour - it provides to the users free access to resources that are a prerequisite to their research. Access to ORI is evaluated solely on the scientific merit of the proposal, which is especially favourable for prospective R&D ("blue-sky"). Institutional funding of RIs access tends to be driven to higher Technology Readiness

Level phases of development (guided, and especially focused research), where the role of the funding laboratory is more visible. ORI will certainly bridge the gap between different R&D phases and allow for fresh ideas to be injected.

A summary of the kind of access possibilities offered by EURO-LABS, with corresponding target user groups, is given in the Tales below, for WP2, WP3 and WP4. A detailed description of the access goals and of the participating RIs will be given in Section 3.1. A detailed description of the access goals and of the participating RIs will be given in Section 3.1. For WP3, the service improvements, directly assigned to specific facilities, have as prime goal to improve the installations making them more versatile and general-purpose, and increase key parameters of the beams or available equipment (details in WP3 Table 3.1b).

Table 1 - Summary of access goals and target user groups in WP2, WP3 and WP4.

Task	Title	Objective	RIs	User group
WP2.1	Stable ion beams	Extremely high intensity required to search rare events and the production of new chemical elements. R&D for detector materials, electronics and medical applications.	8	NP community, hadron-therapy groups, NP and HEP Accelerator & Detector community.
WP2.2	Radioactive ion beams	Experiments to explore the borders of the nuclear stability, studies of fundamental interactions and BSM physics. Research in biophysics.	6	NP community, Groups applying nuclear technique to solid-state and biophysics, nuclear astrophysicists.
WP2.3	Neutron beams	Wide energy range for the investigation of nuclear processes occurring in astrophysical scenarios. Applications in advanced nuclear technology.	5	NP community, nuclear astrophysicists, waste management technologists.
WP2.4	Theoretical support	NP community, nuclear astrophysicists, waste management technologists.	2	NP community, including NP theorists.
WP2.5	Service Improvements	Toolkit to improve remote access, improved access for biomedical applications, efficient sharing of traveling detectors, improved ion beam variety and stability, targets for high intense beams. As well applications of FAIR principles	10	All potential EURO-LABS users (NP + HEP)
WP3.1	Material testing	Test of materials with high-intensity proton and ion beams	1	Teams doing R&D for near beam devices (collimators, beam windows), targetry, vacuum
WP3.2	Technology Infrastructures	Testing of superconducting magnets, superconducting and normal RF cavities, and associated material and mechanics	6	Teams from the AMICI collaboration, validation of new RF cavities and magnet designs for FCC, MYRRHA, US/PIP-II, R&D on materials
WP3.3	Electron and plasma beams	Testing of instrumentation, beam optics, RF equipment, accelerator components with low-medium energy proton and electron beams. Testing of new acceleration concepts and instrumentation in electron beamlines driven by PW and TW-lasers.	4	Wide spectrum of research teams in accelerator R&D, like FEL, design of compact electron LINACs, work with ultra-short bunches, accelerator-based photon sources.
WP3.4	Applications	Test of developments for applications, relation to industry	2	Community doing R&D on the use of pulsed electron beams for medical

				applications or industrial processes.
WP4.1	Test Beams	Position-resolved tests of detectors	3	Teams involved in detector R&D, QC, related fields
WP4.2	Detector Characterization	Assessment of detector structure and evaluation of EM characteristics	2	Teams involved in Detector RD, QC
WP4.3	Irradiations	Irradiation of detectors and electronics	6	Teams involved in Detector RD, QA, related fields
WP4.4	Service Improvements	Improvement of infrastructure to face challenges of EURO-LABS	11	All users of WP4

The TA offered by EURO-LABS, bringing together a new super-community for the first time, will be crucial to strengthen and create synergies in basic research and associated accelerator and detector technology, covering low to high energy physics. By construction, EURO-LABS will have a strong impact on a fruitful sharing of knowledge and technologies across scientific fields: the ever-increasing accelerator capabilities progress closely with corresponding advanced detector technologies. Clearly, these improvements will also benefit the nuclear physics community, with a considerable impact for performing new ambitious experiments. Moreover, the access at the EURO-LABS RIs will also include a wider community that will foster new research in solid-state physics, biophysics and medical applications.

Advances and efficient steps towards the future need such a distributed approach, involving the European continent as a whole rather than at a national level. No single European country has the RIs that provide the full palette of beams required to address the "whole picture" of scientific questions and goals, nor the wide spectrum of accelerator and detector technological research that is vital to face the new challenges of high energy physics. In addition, the uniqueness of some of the instrumentation available at EURO-LABS infrastructures gives these an edge in comparison to infrastructures elsewhere in the world. For many, especially the smaller, RIs their inclusion in the EURO-LABS slate of RIs represents a substantial recognition of their capabilities at the international level. The leverage, resulting from this, is two-fold; First, their esteem towards their core users gets boosted, and second the local funding authorities are more likely to provide additional funding for the operation of the RI. The return of the RIs to EURO-LABS is the significant discount offered even with respect to the eligible operational cost, which tends to disregard many of the true costs associated with the RIs. Clearly, by having such a broad and excellent network of research infrastructures that is unparalleled in the world, the users will also have a competitive edge on a global scale. Moreover, in the spirit of healthy competition between European centres of research and international labs, fruitful collaborations will also be fostered, where joint trans-continental efforts will benefit from complementarity of the excellent facilities worldwide.

On the long-term perspective, EURO-LABS will lay the foundations for a significantly reinforced capacity for excellent research in the area of nuclear and HEP. It will allow an optimised usage of beam time and resources available for nuclear physics experiments, favouring coordinated efforts to investigate challenging fundamental questions, e.g., various aspects of the nuclear interaction and nuclear systems formed in astrophysical environments. Moreover, the access offered for research on superconducting magnets or RF cavities and on the effects of increased beam power will be crucial for the use in future accelerators, to pave the way to frontier research in high energy physics. Similarly, the establishment and/or validation of new detector technologies at the EURO-LABS facilities will be of vital importance for the developments required for FCC-hh. The improved and coordinated access offered in EURO-LABS, also including synergic activities across the NP and HEP communities, will have a significant impact on the discoveries in the coming decades in the field of sub-atomic physics.

The impact will be measurable in terms of key performance indicators, such as availability of access units, variety of beams available, number of users supported, number of peer-reviewed articles, publications and degrees produced, etc. The new ESFRI facilities (GANIL-SPIRAL2, and FAIR) approaching operation in various phases, as well as the new consortium of small facilities in CLEAR, distributed among three countries, will certainly attract more users thanks to EURO-LABS.

The coordinated access to the EURO-LABS RIs is expected to lead also to a very large number of theses and training activities. As already mentioned, one of the major expected impacts is the strong role that the RIs will play in the training of young researchers, leading to a pool of highly-competent young physicists, and attracting younger students to science. The training will mainly be based on hands-on experience. For young students, this will be done through open days and a short stay for a "discovery course" where a small group of students from high school spend time with staff to have a very wide perspective of an accelerator facility and the mysteries behind it. EURO-LABS will

setup a coherent, shared system of training schools and events, across the scientific communities involved in the project, including hands-on activities in experimental nuclear and high energy physics, both at basic and advanced levels (see Task 5.4 in WP5). The impact of our science and technology for a more general public will be done, e.g., through open days at the RIs (see Task 5.1 in WP5).

Beyond the direct scientific users and projects, several participating RIs will offer access towards applications expanding the use of accelerators and technology to other disciplines and to industry. The precise and accurate measurements that are required for new physics need the development of new detectors and associated electronics. Just to take an example, the advances in high-purity semiconductors or scintillator detectors for high resolution γ□ray spectroscopy will go into reducing the dose given for a full-body scan. Another application of nuclear science of strong impact is the use of radioactive isotopes such as those produced at the EURO-LABS laboratories. In particular, the use of on-line isotope separation at, e.g., ISOLDE-CERN, IGISOL at JYFL-JYU and GANIL-SPIRAL2, has demonstrated the great potential of nuclear probes for solid-state physics research and in biophysics research. Access for applications is also directly foreseen as a Task of WP3. Provision of ion beams for commercial customers is often time-critical and the reliable operation brought about by fundamental research is extremely beneficial to other communities. Hence, the promotion of such initiatives, enhanced through EURO-LABS would have a direct impact to the society. By granting access free of charge to communities of other scientific disciplines or at partial operational cost to industrial users, the facilities are contributing to industrial R&D and to product development through provision of services.

The EURO-LABS RIs play an important role in invigorating high-tech activities in the regions where they are located, and from a wider perspective, enhancing the availability of engineers, scientists and highly-qualified and skilled technical personnel for industry. Indeed, the environment of a research infrastructure provides a much wider range of skills than in a normal academic environment. The facilities also collaborate with local industry and companies in increasing their capacity to compete at the national and international level. The available infrastructures and in-house expertise are breeding grounds for spin-off businesses and industries. The EURO-LABS infrastructures participate, with local research institutions and industries, in consortia whose aim is to promote the transfer of knowledge, technological innovation and, more in general, the development of the regions. Moreover, the EURO-LABS consortium will join the recent RI-Open Innovation Coordination Group and the RI-Innovation Knowledge and Technology Transfer Network consortia formed by I.FAST, AIDAinnova, and LEAPS-INNOV. As the infrastructures are physical and the user base dominated by travelling researchers, the users contribute significantly to the local economy through travel, hotels, restaurants and shops, resulting ultimately in job creation.

2.2 Measures to maximize impact - Dissemination, exploitation and communication

Dissemination will be handled at the project level, i.e., for all RIs, through the activities planned in WP5 (Task 5.1). The exploitation of scientific results will be enhanced by the improved coordination between RIs envisaged within EURO-LABS. The use of a common EURO-LABS website will ensure an efficient diffusion of information on the services offered by the RIs of the consortium and their main research activities. The dissemination of knowledge within the community will take place also via specific workshops when required and a yearly town meeting that will be organised (as described in WP1). In these meetings, the achievements and highlights of each work package will be presented and discussed. These workshops and meetings will be very useful for the diverse user community, in particular the large number of PhD students and young researchers, who will benefit of EURO-LABS, keeping them informed about the improvements of the services and on the achieved results. For external communication, EURO-LABS physicists and users with granted access will be strongly encouraged to advertise the consortium in various international conferences. Advertisement in major scientific conferences and other events will be the main forum for interactions with the community and European Industry. Interactions and contacts with ongoing projects in the field (IFAST, AIDAInnova) and overall coordinating bodies (TIARA, NuPECC) will be established at the beginning of the project with the aim: a) to disseminate information on the RIs potential and capabilities for users and illustrative cases, b) to disseminate results and technologies developed in the framework of the project, and c) to gather information that may be used to motivate and to encourage industries to develop innovative products, using the RIs. For HEP, due to the increased complexity, and challenges of the next generation of particle accelerator projects (colliders and experiments) the role of the RIs would become essential not only for the R&D but also for industries to validate production methods and technologies.

EURO-LABS being a TA service program does not produce directly results but only through the user teams accessing the participating RIs. The beneficiaries of EURO-LABS will assure that the teams timely publish any scientific results in conference proceedings and scientific journals as appropriate, making them available in open-access

archives. All work done and presented will acknowledge the project. For a broader impact, the EURO-LABS website will communicate about all scientific events and publications, also those reaching out to society and industry.

In Nuclear and HEPs there is a substantial experience in managing the Intellectual Property Rights (IPR) of the scientific results from the exploitation of the relevant facilities. Specific developments and results related to possible applications will be handled by an experienced person in Task 5.1 of WP5, in collaboration with the Knowledge Transfer Group and legal advisors for EC affairs available at the coordinating Institution (INFN) and at CERN. The Consortium Agreement will define in detail the procedures for publication which will take into account the potential for commercial exploitation and/or the need for protection of IPR of the results concerned, with due consideration of the IP.

Dissemination will be also accomplished through training activities. Education and training of young nuclear physicists is foreseen at several institutions, and in particular, hands-on experience is planned to be made at the relatively smaller-scale facilities, where more beam time will be available. Additionally, at university-based labs, teaching and research go hand in hand. These activities will enhance the opportunity for young people to work on cutting-edge science in international and multidisciplinary teams. We also plan to count regularly the internships to increase early-career research opportunities.

Communication towards the general public

Outreach activities to society in general are also planned in EURO-LABS (see Task 5.1 of WP5). Outreach to the general public, highlighting the importance of research, is an effective tool to transmit and generate the passion for science. Engagement with schools and teachers is of particular importance. The curiosity of the general public about the structure of matter, how it is generated and its connection with astrophysical processes will be kindled and kept burning.
The excellent European science relating to nuclear and HEP and its positive application aspects will be emphasized, especially applications dedicated to health and environment (such as cancer treatment and nuclear waste management) and innovations resulting from research, through dedicated areas in the project website for reaching out to society and industry. EURO-LABS will also benefit from institutional outreach activities at the different RIs, with great attention at the coordinating institution (INFN) and at CERN.
Moreover, in order to promote and communicate about the project, targeted activities to reach a wide audience of students, and general public in European countries will be planned within the EURO-LABS consortium, e.g., open days organized at the various RIs, public talks at local science societies, school talks, participation in local Science fairs, web-based resources for high school teaching and intensive campaigns to offer internships at the different RI. We plan to promote women as presenters in the high school talks, to foster women in STEM.
Outreach activities of project members will be supported with outreach/educational materials in a dedicated area of the project website. To reach out to young scientists in the field, as well as the interested public, modern media channels (update of Wikipedia sections, social media, YouTube…) will be used to inform and highlight the activities and outcomes of the project. The project will also effectively use existing websites, at CERN and NuPECC for instance, built for a general audience.

1.3 Summary

EURO-LABS is motivated by the need to support research teams using available state-of-the-art RIs to conduct physics experiments, tests and validation of prototype R&D components. It is also motivated by the need to improve the available services in terms of beam availability, quality and support to the users.

KEY ELEMENT OF THE IMPACT SECTION

Example 1: General for RIs participating in TA/VA in the framework of EURO-LABS

Specific Needs	D & E & C Measures	Expected Results	Target Groups	Outcomes	Impacts
Well-coordinated TA to a large number and broad variety of the state-of-the-art RIs to address key questions in Nuclear Physics and technological challenges in detector and accelerator technology for HEP.	**Dissemination towards the scientific community**: Efficient communication through a one stop gateway, at the project website, about the scientific opportunities and access to the various RIs of EURO-LABS so as to allow the user community to choose the most optimum RI/RIs. Organisation of topical meetings to discuss more in detail the various opportunities. **Communication towards citizens:** through social media, non-specialized aspects of the project website, open days and visits to RIs. Visit by researchers to schools.	Fostering cutting-edge research in nuclear and HEP, including applications. Facing new challenges in the field. Contributions to reports conference and referred journals about the results of the discoveries made during this project. Training of young researchers, including providing data for PhD theses.	The scientific community belonging to the area of Nuclear and HEP. Society, through results of societal and environmental oriented research. Industrial users and groups from the nuclear medicine.	Increased coordination and targeted efforts to best exploit the RIs for advancing frontier knowledge. Enhanced sustainability of the RIs. Enhanced collaborations and cross-disciplinary exchanges.	**Scientific:** Breakthrough scientific results in the area of nuclear and HEP. Training of a new generation of researchers to exploit the RIs optimally. **Economic:** Invigorating high-technology activities and start-ups. **Societal:** Enhancing the availability of highly-qualified and skilled personnel for employment in research as well as in industry. Application of nuclear science for medicine and multidisciplinary purposes.

Example 2: Specific examples for TAs for Nuclear Physics

Specific Needs	D & E & C Measures	Expected Results	Target Groups	Outcomes	Impacts
A variety of stable and short-lived beams, with selective and sensitive detectors. The NP community aims at answering fundamental questions in the field, such as: *-how does the complexity of nuclear structure arise from the interaction between nucleons?*	**Towards the scientific community:** Dissemination of the scientific results through the project website and at international conferences. Collection of results and data in common repositories with open access, for future exploitation for more detailed and new results.	New discoveries in nuclear physics. Publications in leading international journals and PhD theses.	Mainly European and worldwide nuclear physics community. Committees defining the NP strategy for the future.	Enhanced synergy between NP theory and experiments. Up-take of results. Coordinated efforts, within the community, to optimize access	**Scientific/societal:** breakthrough results in the field of nuclear physics. Training the next generations.

-*What are the limits of nuclear stability?*	Preprints published in open access archives. **Communication towards citizens:** through social media, science exhibitions and open days.		the NP strategy for future experiments.	resources to RIs for top-level research and new advances.	

Example 3: Specific example for TAs for Accelerator R&D

Specific Needs	D & E & C Measures	Expected Results	Target Groups	Outcomes	Impacts
With the expected increase in beam power in future accelerators, the need for testing of materials for near-beam equipment (collimators, beam windows) becomes vital. Supporting such tests at the RIs can thus make a big impact on design choices.	**Exploitation of the new technique:** validation data of materials and equipment. **Dissemination towards the scientific community**: Scientific publication with the results of the large-scale demonstration in field-specific journals; develop a platform with performance data on materials to serve as reference for future applications and research.	Publication of scientific results on proposed materials and assemblies. **New component:** equipment validated for use in future installations. **Training** of user teams in exploiting the RIs for testing. Scientific publications of the research teams.	Research teams in Universities and Laboratories involved in near beam devices for accelerators: CERN, UKRI, USA-FermiLab. **Wider scientific community**: field of high-power targetry, collimators, beam windows R&D.	Up-take by research teams: research teams profit from the findings and use these in the design for future installations Trigger use of the tested material for other applications.	**Scientific:** New breakthrough scientific discovery on radiation resistant materials. **Technological:** A new candidate material for new designs, on accelerator components, opening pathways to new installations with use of increased beam power. **Strategic/Physics research:** Open path to construct components capable of sustaining high beam powers, thus increasing the discovery potential of future installations.

Example 4: R&D projects participating in TAs

Specific Needs	D & E & C Measures	Expected Results	Target Groups	Outcomes	Impacts
Presently there is ongoing R&D for new components like superconducting magnets or RF cavities for the use in future accelerators. Facilitating the testing and evaluation of such components would be of key importance for these projects.	**Exploitation:** validation of the new construction techniques or methods. **Dissemination towards the scientific community**: Scientific publications of the results obtained at the large-scale RIs in field-specific journals. **Communication towards wider audience and industry:** Presentation and publication of results in large Scientific Conferences; contacts with industry for large-scale or series production in future installations.	**Successful testing**: the assembled prototypes pass the validation tests according to specifications. **Testing protocol and operation:** Customized protocol for equipment testing experience in operation. Publications in journals and proceedings on achieved scientific and technical results.	Research teams in Universities and Laboratories involved in SC magnet and RF cavities: CEA, INFN, CERN. The European and world-wide community in SC magnet and RF cavities development. HEP Strategy for future installations. Industry and groups interested societal/medical applications.	Up-take by research teams: research teams profit from the findings and use it in the design for future installations	**Scientific:** New breakthrough scientific advancement in SC magnets and RF cavities. **Technological/Strategic:** Availability of a new design for future projects.

Example 5: Detector R&D in TA's

Specific Needs	D & E & C Measures	Expected Results	Target Groups	Outcomes	Impacts
Detector development for FCC-hh faces unprecedented specifications in matters of granularity, material budget and radiation hardness. Timescale for development likely > 20 years.	**Exploitation:** Blue-sky research on most promising detector materials. **Dissemination towards the scientific community**: Regular reports in detector R&D, specific workshops, conferences and publications. **Communication towards wider audience and industry:** Several future installations (e.g. ITER) face similar requirements; presentations to their communities.	**Establishment and/or validation of new detector technologies:** Offer tools to test new detector materials and ideas to meet the requirements.	**Research teams in Universities and Laboratories involved**: FCC community, CERN RD-50, RD-42, current HL-LHC experiments.	First exploratory steps towards detectors applicable at FCC-hh.	**Scientific:** First attempts at detector technologies meeting FCC-hh requirements. **Technological/Strategic:** involvement of European industry in early stages of novel detector development.

3. Quality and efficiency of the implementation

3.1 Work plan and resources

The implementation of work is organised in five Work Packages. WP1 is dedicated to project management and coordination. EURO-LABS has as main objective the provision of access (TA or VA) to RIs in Europe and three comprehensive WPs (WP2, WP3 and WP4) will be dedicated to these activities. The access offer also includes service improvements, both highly focussed technical improvements and easier procedures for access to the RIs. Many activities/facilities span WP2-4, including sharing the same facilities and the development of novel techniques, like machine learning to improve beam control and availability. Another important common focus is sharing of data under FAIR principles, as well as training, including hands-on experience for the young researchers, and actions towards diversity. The management of the TA WPs at the task level will assure the smooth communication flow, exchange of results, experience, and methods. It will also streamline and guide the access requests by the users among the RIs. Coordination at the WP level will assure the communication follow and exchange of information between all the RIs. Finally, the management at the project level will unify and optimize all the activities.

The programme and TA/VA support provided at the participating RI's will be publicised on the **EURO-LABS Web page**. To enhance the level of collaboration between the three EURO-LABS communities, establishing a more diverse user community and engaging new users, a streamlined access to those facilities will be implemented (Tasks 1.1, 2.5.1 and 5.1) via the EURO-LABS Website. The latter will deliver comprehensive information on available research tools in a unified and compact form to help potential users, especially the users from new communities, to apply with a proposal to the best facility in a proper time. It will provide a guide for users, starting from a concept of experiment, through a proposal submission to a chosen PAC, ending with the application for the TA support, submitted via an on-line form. Thus, the web page will be the single-entry point for all information regarding: a) all available EURO-LABS facilities, b) beams and their characteristics, c) detectors and their performances, d) planned campaigns, e) calendar of calls for proposals and PACs meetings, f) proposal submission procedures, g) outcomes of the PAC decisions. Highlights of the research projects executed within the WPs 2-4, collected and presented in the webpage, will help the potential user in the selection of the proper facility. In addition, information about the TA support and assisting tools will be available: a) TA support provided by each facility and rules to apply for it, b) a TNA support form, c) a tool to send the application to the appropriate selection panel, d) information about supported projects, e) a form for the users' feedback about facility and support will be available. The same web page will be used also for the dissemination of the EURO_LABS results (see WP5.1).

An introduction to the activities planned in the various WPs is given below:

WP2 (TA/VA): Access to Research Infrastructures for Nuclear Physics: The participating RIs will provide the necessary opportunities for cutting edge research in various fields covering, but not limited to: Fundamental Nuclear Science, Nuclear Astrophysics, Neutron Physics, Physics beyond the Standard Model, Atomic Physics, Biophysics, Medical Physics and Materials Science. WP2 builds on the experience gained in previous EU programmes (ENSAR/ENSAR2), expanding the access offer through the involvement of smaller facilities and neutron beam facilities. WP2 will provide more than 30000 access units (hours) in ca. 450 projects and for the benefit of more than 2400 users. This activity includes 15 RIs and more than 15 facilities/installations, for nuclear (fundamental and applied) physics experiments and the related theoretical support. The participating RIs provide access to an extremely broad range of services, delivering a myriad of ion beams covering a huge range of elements, masses, energies and intensities. The access is provided also to the interdisciplinary users, for example, offering beams of atomic clusters. Theoretical support will be provided by the strong nuclear physics theory teams at several RIs. In addition, **access is** provided to two RIs targeted to offer theoretical support for experiments (TA + VA). The RIs participating in WP2 are grouped into four tasks. All the facilities will sustainably undertake improvement and extension of their service provision in the coming years, in many cases working together to maximise synergies between them (see Task 2.5.).

Task 2.1: TA to RIs delivering Stable Ion Beams. The stable beam facilities of WP2 provide ions from protons up to uranium, from low energies up to the level of GeV per nucleon. The facilities range in scale from small laboratories hosting electrostatic accelerators up to large cyclotron and synchrotron facilities hosting an array of accelerators. A common theme through the facilities is the possibility to provide beams with high intensities that are required for instance in the case of extremely small production cross-sections, e.g. to create new isotopes and elements. R&D activities into detector materials, accelerator components and electronics are also carried out, also covering some of the needs of WP3 and WP4.

Task 2.2: TA to RIs delivering Radioactive Ion Beams (RIB). The Radioactive Ion-Beam (RIB) Facilities of WP2 are dedicated to the production, with different techniques, and study of nuclei not found in nature. The scientific program varies from *frontier physics* topics, such as reaching the borders of the nuclear chart, to *precision physics*

topics, such as high precision studies of long-lived states in radioactive nuclei. The facilities will give access to about a thousand of different RIB produced with a wide energy spectrum, necessary for studies of Nuclear Structure, Nuclear Reactions, Fundamental Interactions and BSM physics, Solid State and Biophysics, Nuclear Astrophysics or Optical Spectroscopy studies.

Task 2.3: TA to RIs delivering Neutron Beams. This task brings together state-of-the-art European laboratories in which neutron beams are produced by a wide range of generators, such as high-energy proton synchrotrons as well as by small Van de Graaff accelerators, in an extremely wide range of neutron kinetic energies (from sub-meV up to GeV), for measurements of high-resolution neutron-induced reactions Neutron beams are especially required among others for the investigations of processes taking place in astrophysical scenarios and for applications in advanced nuclear technology developments (nuclear fusion and emerging fields of medicine).

Task 2.4: RIs for theoretical support. Experimental research carried out at the laboratory facilities is underpinned by theory, both for interpreting the measured outcomes and for predicting new phenomena, yet to be discovered. This task develops theory for experiments, building on two pillars. The first pillar is ECT*, the *European Centre for Theoretical Studies in Nuclear Physics and Related Areas* in Trento (Italy), which provides TA to a dedicated facility to deliver scientific activities via workshops and training programmes. The second pillar (Theo4Exp) provides virtual access to well-established computing codes and possible upgrades, based on the principle of Open Access, making them available to the community at large.

WP3 (TA): Access to Research Infrastructures for Accelerator R&D: This TA activity includes 13 RIs accessing 15 installations, including 5 large Technology Infrastructures (TIs), in the area of Accelerator R&D, offered at no cost to the community. WP3 builds on the experience gained in previous EU programmes (EUCARD-2, ARIES) through the participation of six facilities. Nine facilities will participate for a first time in a TA program. The RIs participating in WP3 form a complete and competitive set that covers the full spectrum of R&D and testing needed in the area of high-energy accelerators from the presently operating ones (LHC and its upgrade HL-LHC), to the new generation of accelerators being considered (FCC-ee/hh, CLIC, Muon Collider). The offered infrastructures include beam lines, test stands for technological studies, and installations where applications of accelerators with links to industry can be developed. The RIs of WP3 will play a key role to cover the testing needs emerging from the IFAST activities and from other R&D projects that may emerge in the duration of the project following the recent European Strategy for Particle Physics (ESPP) roadmap. Part of the accelerator R&D access needs, like irradiations or tests with high-intensity medium-energy electron beams will be provided via RIs belonging to WP2.

The RIs participating in WP3 are grouped into four tasks providing complementary testing environments. The classification is based on the prime characteristic of the facility target user group.

Task 3.1: (TA) Material testing. This TA task refers to a specially designed beamline at CERN, for the testing of advanced accelerator materials, with high-intensity pulsed proton or heavy-ion beams. It offers a unique test bed for R&D on materials used for beam intercepting devices like collimators and beam windows.
Task 3.2: (TA) Technology infrastructures. This TA task groups 6 RIs proposing 6 installations, devoted to testing of superconducting magnets and related instrumentation, as well as Radio-Frequency cavities operating at cryogenic temperature and at X-band frequencies. It also includes test stands for specialized R&D on materials used in superconducting cavities and for mechanical tests made available to industry.
Task 3.3: (TA) Electron and plasma beams. This TA task groups 4 RIs with 6 installations, devoted to the testing of instrumentation, components and acceleration schemes and principles with different particles and energies: low-energy protons, low-energy electrons, ultra-short electron bunches, and high-intensity high-energy electrons, as well as electron beamlines driven by different types of lasers for testing plasma wakefield accelerating cells.
Task 3.4: (TA) Applications. This TA task groups 2 RIs with 2 installations, devoted to testing of R&D ideas for applications using powerful electron beams for medical applications or ultra-low energy electron beams for industrial applications and chemistry.

WP4 (TA): Access to RI for Detectors R&D: This work package provides access to world-class research infrastructures needed to carry out research and development of innovative HEP detectors required in the next generations of HEP experiments. The EC support for detector R&D is established through the H2020 AIDAinnova project. The associated support for access to the research infrastructures (RI) needed for detector R&D is the aim of EURO-LABS WP4. A typical detector R&D path requires ample testing during all phases of research and development. Tests usually start with detector parts like sensors or ASIC's to finally culminate in the test of the complete detector module or even larger assemblies. The most relevant data are obtained in test beams utilizing adequate particle beams in a position resolved measurement. Micro-beams enable characterization of detector structures, while electromagnetic noise characteristics of detectors can be evaluated by specialized equipment.

Finally, detectors need to be irradiated to the required levels, preferably with adequate particle species and energies. According to this scheme, the RIs participating in WP4 are grouped in three tasks:

Task 4.1 (TA): Test beams. This task will provide transnational access to the test beams, along with well-equipped beam lines to the users with high resolution pixel beam telescopes and high field magnets, at CERN, DESY and PSI, necessary for detector development in particle physics. The CERN test beams provide access to protons, electrons, pions and muons ranging from 1 to about 350 GeV. The DESY-II test beam facility provides an electron beam with energies between 1 and 6 GeV, high intensity pion beam at ~ 200 MeV and a UCN ultracold neutrons beam line.

Task 4.2 (TA): Detector characterizations. This task will provide transnational access for detector and system characterization to a) the multi-MeV ion micro-beam and the associated expertise at RBI for characterisation of semiconductor sensors and ASIC chips; b) the Electromagnetic Compatibility Laboratory of ITAINNOVA with tools and methodologies to address Electromagnetic-Compatibility (EMC) issues in detector commissioning and operation.

Task 4.3 (TA): Irradiations. This task will provide transnational access to several leading irradiation facilities in Europe with proton, neutron or mixed field sources, as well as with gamma rays. The facilities cover the actual radiation fields in high energy hadron collisions in a representative manner. In addition, some are offering single event effect testing opportunity for electronics. These facilities are located at Birmingham (UK), CERN (IRRAD and GIF++), JSI (Slovenia), IFJ PAN (Poland) and UCLouvain (Belgium). Main users originate from the hadron collider community, with the emerging R&D for FCC-hh requiring extremely high fluences in excess of 10^{17} $n_{eq}cm^2$.

Service improvements

Besides the provision of access, a fraction of the EURO-LABS resources (~20%) will be used to improve the services the RIs presently being provided. These service improvements are targeted at the needs of the project but will be exploited also beyond its duration. Improvements can be specific or mutually beneficial to several RIs. A flavour for various WPs is given below.

For WP2, service improvement includes a development of a toolkit to ease off-site accessibility to European accelerator facilities. Connected to this service are streamlined access procedures via a single, web-based, access point, and those for travelling detectors (INTRANS). Other aspects of service improvements address improved ion sources (ECRIS/EBIS) and target availability and activities for biomedical applications (FLASH@EURO-LABS).

For WP3, such improvements include upgrades to the beam or equipment control systems of the facilities to improved availability and reliability, or design and installation of additional instrumentation to match the needs of the expected requests by the users.

For WP4, improvements for services at the RIs are targeted at optimizing the specific usage to each RI of EURO-LABS, e.g. improvements include minor hardware upgrades at RI's or software developments easing the user access.

WP5 Open, diverse and inclusive Science

Activities in training, innovation, open data, and outreach, that will scan across fields, will be included in WP5. The installations offered in EURO-LABS are unique, at the frontier of research and technology in the field. They represent an important asset in the formation of young researchers. In several RIs training sessions will be organized that will combine courses and lectures passing theoretical knowledge with hands-on experience. Local experts will explain the operation of the complex infrastructures and how experiments and tests can be realized to optimally exploit the capabilities of the facilities. The ambition is to create a pool of trained and well-informed researchers in the area of nuclear science and accelerator/detector science and technology. By extending the scope and adjusting the level of the program to undergraduate students, these activities will offer a unique opportunity to expose them to the basic knowledge on the concepts of these areas.

3.2 Capacity of participants and consortium as a whole

EURO-LABS is a consortium of 43 Research Infrastructures (RIs) from twelve countries in Europe spanning Finland in the north and Italy to south to Romania in the east and Portugal in the west. It gathers the main **EURO**pean Nuclear and Particle Physics **L**aboratories for **A**ccelerator-**B**ased **S**cience (See Fig. 1). A good fraction of European RIs for Nuclear and High Energy Physics, thanks to earlier EC framework programmes, have successfully developed a culture of cooperation. This permitted thematic networking, joint research and transnational access activities benefiting the users for these communities independently.

Building on this thematically focussed positive interaction, EURO-LABS aims at an avant-garde integration of the best RIs *between* the nuclear and high energy communities, including increasing the number of RIs *within* each of them. This dynamic integration of these diverse, but naturally linked, communities of this consortium will lead to a better awareness of the expertise and working cultures and thus to cross-fertilization and can be seen as unity in diversity. Such a super community, created for the first time in Europe, will allow a wider sharing of information, knowledge and technologies across the scientific fields in sub-atomic physics. The large integration of these communities will play a critical role in further advancing the scientific and technical aspirations of Europe and preserve its global leadership in the science and technology of this field.

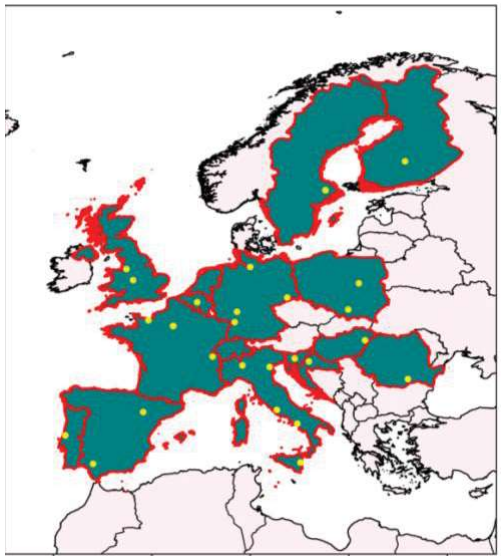

Figure 1 - Map of participating RIs in EURO-LABS

EURO-LAB with its judicious choice of RIs, in addition to certain obvious overlaps among any accelerator lab, was made taking into their specificities for various subfields of interest. These specificities go beyond the available instrumentation and could also be related to, e.g., available beam times at a certain facility or the possibility of highly focussed studies of the systematic error/stability of a dedicated setup and for rare searches. Given the large and varied RIs covered by this project, the capabilities required for any given investigation will be found at one of these facilities. However, an exhaustive study of various observables, necessary for a complete picture of a given phenomenon, will need a network of facilities. Such an approach will allow the observation in various channels thus confirming, e.g., a discovery of a new phenomenon. These RIs vary from CERN, which includes facilities for all the three communities, ranging from high energy particles to radioactive ion beams, the two ESFRI facilities GSI/FAIR, GANIL/SPIRAL2 giving stable and radioactive ions, to the multi-country based CLEAR facility providing stable and neutrons beams. The available expertise varies from building and testing accelerators components, like at CERN, GSI, GANIL-SPIRAL2 (CEA, CNRS), INFN labs, to detector building and testing like at CERN, ALTO and Krakow. Additionally, e.g., at CERN, Italy, France, and Germany, in certain labs both nuclear and high energy physics activities are carried out, highlighting the complementarity. RIs belonging to major scientific organizations of Europe like Helmholtz Association, BMBF, CEA, CNRS, INFN, Polish Academy of Sciences, etc. are part of EURO-LABS ensuring a strong collaboration even at the political level. As a result of the consortium of EURO-LABS, further joint use of such facilities is expected. A logical extension would be the building of additionally mutually beneficial common programmes that could be related, e.g., to wear and tear of superconducting cavities, design of new cyclotrons, transfer of technology for high field fast switching magnets, improved performance on the clock frequency for time stamping, and studies of high radiation on various components. In this project along with increasing the number, new types of facilities have also been added which will provide new opportunities that were unavailable in earlier related EU projects, thus widening further the already available comprehensive list of the best RIs. The various facilities and instruments are described elsewhere in the text. Certain focussed services improvements, either through collaborative work among RIs and/or across various work packages or focussed service improvements that are of common interest for a group of facilities or for a given facility, have been envisaged.

For the conception and interpretation of the experiments done at the RIs and beyond, a Virtual Infrastructure for software and theoretical tools, which will galvanize synergies with nuclear theory, will be created. This tool for nuclear physics will further increase the impact of the scientific results of the field in general. The results and data produced during the duration of the project will follow the FAIR principles of data management to maximize its usage.

The RIs will provide access to key and complementary facilities/services to promote top-level research and technology relating to sub-atomic physics, and the associated expertise for their successful exploitation. A majority of RIs have committed to cover ~85% of the running cost of facility with non-EU funds for the access being provided to EURO-LABS, thus ensuring that adequate resources are available, including staff, to secure the feasibility of the project.

In order that the large and diverse user community of EURO-LABS is aware and can easily take advantage of this comprehensive portfolio of RIs, specific action to make the access smoother and more uniform to the various facilities will be implemented. A "one stop" entry point through the dedicated website of EURO-LABS will be implemented.

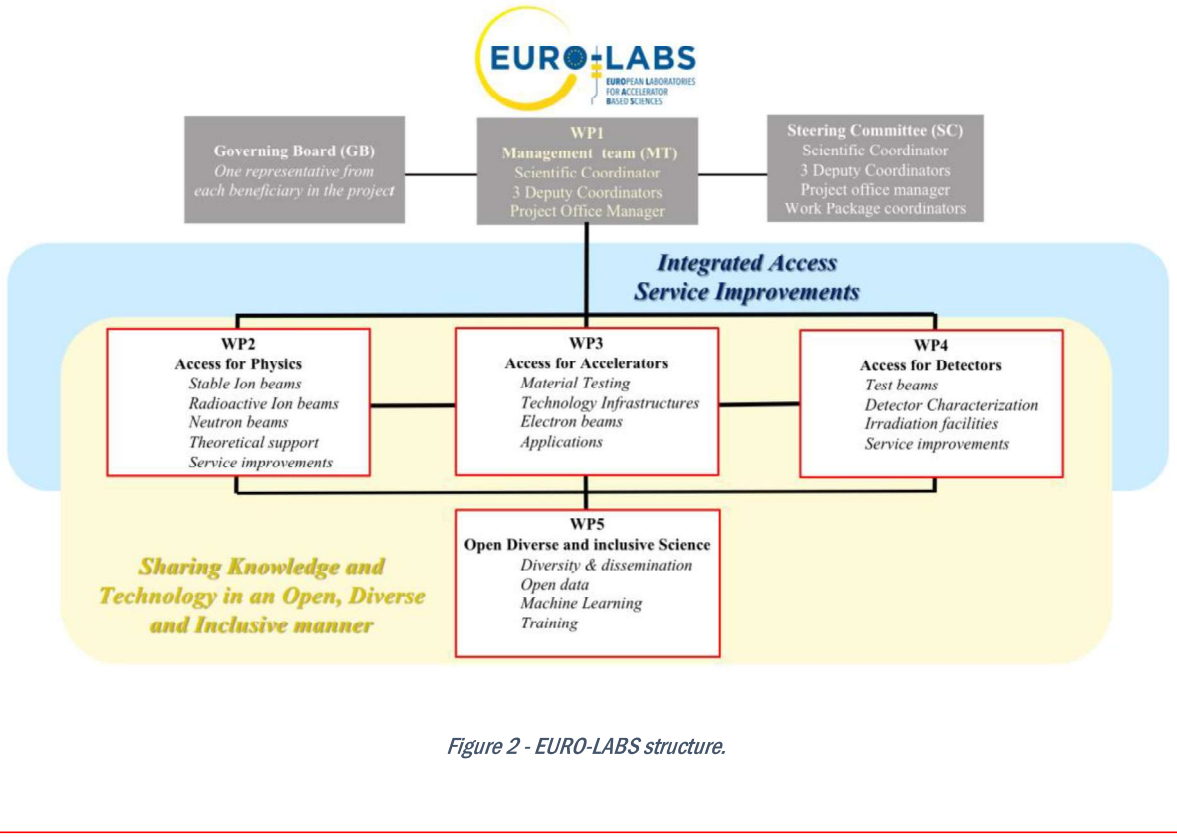

Figure 2 - EURO-LABS structure.

This will give a complete panorama of all the available facilities and the potential of these RIs to conduct curiosity-driven programmes at anyone (or more) of them, in any of the 12 countries. This will provide opportunities to undertake cutting-edge research in basic and applied research and technology in various key topics of relevance to the strategic plans of Europe. Additionally, for nuclear physics, one laboratory each in Europe (not in EU), Asia and America, having facilities not yet available (under construction) in Europe, have been included as associate members to complement the available resource in EURO-LABS.

Educating the present and next generation of researchers to exploit and upgrade the present facilities and lead the genesis of the next generation ones will be done through unique hands-on training in all key aspects of planning and running fully (beam delivery, vacuum, electronics, DAQ to ...), suitable experiments in smaller facilities. This will be the basis for becoming a useful skilled team member of a larger collaboration or for enriching any group of researchers with common goals at a RI. This will be complemented with schools common to the three communities of this project. Such schools will create long-term relationships leading to effective scientific collaborations.

In the case of nuclear physics activities, additional associated partners are included both for expertise in topics being treated in EURO-LABS within Europe or for complementary facilities not available presently in Europe.

Within the former context, activities connected to target developments, crucial to run experiments with the new high intense beams and/or with radioactive targets, will benefit from the support of two associated partners: a) PSI (Switzerland) is specialized in manufacturing radioactive targets not possible elsewhere. PSI will also contribute to the target characterization procedures especially using Inductively Coupled Plasma-Mass Spectroscopy; b) LIP (Coimbra, Portugal) will join the network of target producers in Europe by contributing to the production and characterization (via different low-energy nuclear methods) of thin targets necessary for experiments at EURO-LABS RIs.

It should be noted that PSI is also involved in activities relating to test beams for HEP detector R&D, as described in detail in WP4.

Activities aimed at fostering off-site participation to experiments through remote access will include the contribution of the associated partner TU Dresden, that has a long experience in the conduction of partly remotely performed experiments across different institutions and communities.

The available neutron beams facilities will be complemented by the associated partner ENEA-FNG (Frascati Neutron Generator) (FNG). FNG will provide, in the framework of EURO-LABS, absolutely calibrated, high-intensity monoenergetic (14 and 2.5 MeV) beams with a large experimental hall with a low background.

Two non-EU associated laboratories, namel RIKEN-Japan and MSU/FRIB – USA will offer facilities and services that complement the yet available resources in EURO-LABS to European users. These include, e.g. RIKEN, the SAMURAI spectrometer at RIKEN and the high-resolution GRETA detector coupled with high energy radioactive beams for nuclear spectroscopy at MSU. As a result, users of EURO-LABS will increase the possible scientific opportunities and form/strengthen new collaborations.

All the above strategies will be put in place and monitored by the **Project management and coordination** team as shown in Fig. 2. Thus EURO- LABS will be able to address the various aspects of the call in a coherent and logical manner in *developing, consolidating and optimizing European RIs landscape and maintaining global leadership.*

Tables for section 3.1

		Year 1												Year 2												Year 3												Year 4													
Tasks	Description	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
WP1	Project management and coordination																																																		
1.1	Project management and coordination	MS1					D1.2												D1.1																	D1.1													D1.1		
WP2	Access to Research Infrastructures for Nuclear Physics																																																	
2.1	TA to RIs delivering Stable Ion Beams						MS2																																							D2.1 MS3					
2.2	TA to RIs delivering Radioactive Ion Beams (RIB)						MS4																																							D2.2 MS5					
2.3	TA to RIs delivering Neutron Beams						MS6																																							D2.3 MS7					
2.4	RIs for theoretical support																		MS8 MS10																										MS9 MS11				D2.4				
2.5	Service improvements			MS13									MS15						MS12 MS14												MS16					D2.5																
WP3	Access to Research Infrastructures for Accelerator R&D																																																	
3.1	Material testing																																			D3.5								D3.1							
3.2	Technology infrastructures						MS17 MS19																													D3.6 MS18 MS20								D3.2							
3.3	Electron and plasma beams																																			D3.7								D3.3							
3.4	Applications						MS17 MS19																													D3.7 MS18 MS20								D3.4							
WP4	Access to Research Infrastructures for Detector R&D																																																	
4.1	Test beams																								MS21																								D4.1			
4.2	Detector characterizations																								MS22																								D4.1			
4.3	Irradiations																								MS23																								D4.1 D4.3			
4.4	Service improvements												MS24 MS28 MS32		MS25 MS30		MS26		MS27 MS31						MS29 MS33																								D4.1 D4.2 D4.4			
WP5	Open Diverse and Inclusive Science																																																	
5.1	Diversity and dissemination												MS34						D5.1																	D5.2															
5.2	Open Science and Data Management						D5.7						MS35												D5.4											D5.3 MS36												D5.6			
5.3	Machine Learning								MS37																																										
5.4	Training						MS38																		D5.5																											

Gantt chart of the project

Table 3.1f: Summary of staff effort

In addition to the 856.2 person/months declared in the WP summary effort table, 276 person/months are offered as contribution without cost by the Consortium: 40 for WP1, 80 for WP2, 46 for WP3, 80 for WP4 and 30 for WP5. GANIL and CSIC, for example, provide respectively 36 and 2.5 PMs as contribution without cost.

Table 3.1g: 'Subcontracting costs' items

The project has no sub-contracting cost items identified.

Participant Number/Short Name		
	Cost (€)	Description of tasks and justification
Subcontracting		

Table 3.1h: 'Purchase costs' items (travel and subsistence, equipment and other goods, works and services)

Participant No. 1 Short name: INFN	Cost (€)	Justification
Travel & subsistence	847 280,00	WP1: Travel support for management: 160k€ WP1: User travel support to RI access: 220k€ WP2: User travel support for TA: 220k€ WP3: User travel support for RI access, small travel budget for TA management to project annual meetings: 247,3k€
Equipment	100 000,00	WP3: Equipment for improvements to the control system for the magnetic field measurements
Other goods, works and services	342 971,00	WP1: Annual meetings costs: 80k€ WP2, SI: Technical support and consumables for travelling detectors: 16k€ WP2: SI (remote access, target service, beam service): 71,5k€ WP3: Technical support to the users for their experiment – shipment and RP related costs: 151,5k€ WP5, Task 1: Support to produce the videos of the facilities: 24k€ *For information, to complement the costs declared above, part of the actual costs to access infrastructure are offered as contribution without cost by the Consortium. Here are the full estimated actual access costs:* *WP3: LNF infrastructure, SPARCLAB installation, actual costs: 47k€* *WP3: LNF infrastructure, BTF(1,2) installation, actual costs: 83,7k€* *WP3: MI infrastructure, LASA installation, actual costs: 150k€* *WP3: Salerno infrastructure, THOR installation, actual costs: 22k€*
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	1 290 251,00	

Participant No. 2 Short name: GANIL	Cost (€)	Justification
Travel & subsistence	250 000,00	WP2: User travel support for TA
Other goods, works and services	92 567,00	WP2: SI (target service, beam service)
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	342 567,00	

Participant No. 3	Cost (€)	Justification

Short name: CERN		
Travel & subsistence	1 009 664,00	WP2: User travel support for TA: 430,9k€ WP3: User travel support for RI access, small travel budget for TA management to project annual meetings: 275,2k€ WP4: User travel support for RI access, small travel budget for TA management to project annual meetings: 303,6k€
Equipment	70 000,00	WP3: Contribution to the instrumentation of an additional beam line for the users: 30k€ WP4: Contribution to the instrumentation of a beam line: 40k€
Other goods, works and services	143 000,00	WP3: Technical support to the users for their experiment – shipment and RP related costs: 131k€ WP4: Technical support and consumables for the installation and removal of experiments. Participation to shipment cost of activated materials: 12k€ *For information, to complement the costs declared above, part of the actual costs to access infrastructure are offered as contribution without cost by the Consortium. Here are the full estimated actual access costs:* *WP3: CLEAR infrastructure actual costs: 9 307,2k€* *WP3: XBOX infrastructure actual costs: 17,4k€*
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	1 222 664,00	

Participant No. 4 Short name: JSI	Cost (€)	Justification
Equipment	61 000,00	WP4: Cd shield for service improvement.
Other goods, works and services	25 000,00	WP4: Sample shipment costs to remote access users.
Remaining purchase costs (<15% of pers. Costs)	4 000,00	
Total	90 000,00	

Participant No. 5 Short name: IJF-PAN	Cost (€)	Justification
Travel & subsistence	78 460,00	WP2: User travel support for TA: 22,8k€ WP4: User travel support for RI access, small travel budget for TA management to annual meetings: 55,7k€
Equipment	15 940,00	WP4: 2-D scanning table for service improvement.
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	94 400,00	

Participant No. 6 Short name: DESY	Cost (€)	Justification
Travel & subsistence	151 456,00	WP4: User travel support for RI access, small travel budget for TA management to annual meetings
Equipment	45 000,00	WP4: Micrometer stages for the service improvement
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	196 456,00	

Participant No. 7 Short name: UCL	Cost (€)	Justification
Travel & subsistence	12 000,00	WP4: User travel support for RI access, small travel budget for TA management to annual meetings.
Equipment	58 000,00	WP4: HIF-chamber service improvement (50 %).
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	70 000,00	

Participant No. 8 Short name: RBI	Cost (€)	Justification
Travel & subsistence	23 920,00	WP4: User travel support for RI access, small travel budget for TA management to project annual meetings.
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	23 920,00	

Participant No. 9 Short name: CNRS	Cost (€)	Justification
Travel & subsistence	112 220,00	WP2: User travel support for TA: 100k€ WP3: User travel support for RI access, small travel budget for TA management to project annual meetings: 12,2k€
Other goods, works and services	55 600,00	WP2: Technical support and consumables for travelling detectors: 16k€ WP2: SI (target service, beam service, travelling detectors): 39,6k€
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	167 820,00	

Participant No. 10 Short name: FBK	Cost (€)	Justification
Travel & subsistence	121 344,00	WP2: User travel support for TA
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	121 344,00	

Participant No. 11 Short name: ITAINNOVA	Cost (€)	Justification
Travel & subsistence	20 800,00	WP4: User travel support for RI access, small travel budget for TA management to annual meetings
Other goods, works and services	18 000,00	WP4: SI (EMCLab infrastructure and remote access) *For information, to complement the costs declared above, part of the actual costs to access infrastructure are offered as contribution without cost by the Consortium. Here are the full estimated actual access costs:* *WP4: EMCLab infrastructure actual costs: 16k€*
Remaining purchase costs (<15% of pers. Costs)	4 000,00	
Total	42 800,00	

Participant No. 12 Short name: UNIWARSAW	Cost (€)	Justification
Travel & subsistence	40 000,00	WP2: User travel support for TA
Other goods, works and services	16 700,00	WP2: SI (remote access and target service)
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	56 700,00	

Participant No. 13 Short name: GSI	Cost (€)	Justification
Travel & subsistence	220 000,00	WP2: User travel support for TA
Other goods, works and services	79 600,00	WP2: Technical support and consumables for travelling detectors: 16k€ WP2: SI (remote access, target service, beam service, biomedical applications): 63,6k€
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	299 600,00	

Participant No. 14 Short name: IFIN-HH	Cost (€)	Justification
Travel & subsistence	244 000,00	WP2: User travel support for TA: 100k€ WP5, Task 4: Travel for training activities: 144k€
Other goods, works and services	40 500,00	WP2: SI (remote access, target service): 40,5k€
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	284 500,00	

Participant No. 15 Short name: USE	Cost (€)	Justification
Travel & subsistence	34 080,00	WP2: User travel support for TA
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	34 080,00	

Participant No. 16 Short name: IST	Cost (€)	Justification
Travel & subsistence	34 080,00	WP2: User travel support for TA
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	34 080,00	

Participant No. 17 Short name: ATOMKI	Cost (€)	Justification
Travel & subsistence	30 000,00	WP2: User travel support for TA
Other goods, works and services	7 080,00	WP2: SI (beam service)
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	37 080,00	

Participant No. 18 Short name: JYU	Cost (€)	Justification
Travel & subsistence	180 000,00	WP2: User support for TA
Other goods, works and services	62 000,00	WP2: SI (beam service)
Remaining purchase costs (<15% of pers. Costs)	0,00	

Total	242 000,00

Participant No. 19 **Short name: UU**	**Cost (€)**	**Justification**
Travel & subsistence	13 200,00	WP3: User travel support for RI access, small travel budget for TA management to project annual meetings
Equipment	160 000,00	WP3: Equipment for improvements to RF cavity voltage and magnetic field measurement
Other goods, works and services	21 500,00	WP3: Technical support to the users for their experiment – shipment and RP related costs *For information, to complement the costs declared above, part of the actual costs to access infrastructure are offered as contribution without cost by the Consortium. Here are the full estimated actual access costs:* *WP3: FREIA infrastructure, GERSEMI and HNOSS installation, actual costs: 21k€*
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	194 700,00	

Participant No. 20 **Short name: CEA**	**Cost (€)**	**Justification**
Travel & subsistence	44 000,00	WP3: User travel support for RI access, small travel budget for TA management to project annual meetings
Equipment	40 000,00	WP3: Improvements to magnetometer MACHAFILM and CRYOMECH system sensors, improvements to the electron beam source
Other goods, works and services	31 000,00	WP2: SI (target service): 4k€ WP3: Technical support to the users for their experiment – shipment costs: 27k€ *For information, to complement the costs declared above, part of the actual costs to access infrastructure are offered as contribution without cost by the Consortium. Here are the full estimated actual access costs:* *WP3: IRFU infrastructure, SYNERGIUM installation, actual costs: 5,4k€*
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	115 000,00	

Participant No. 21 **Short name: KIT**	**Cost (€)**	**Justification**
Travel & subsistence	23 100,00	WP3: User travel support for RI access, small travel budget for TA management to project annual meetings

Other goods, works and services	150 400,00	WP3: Technical support to the users for their experiment – shipment and RP related costs
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	173 500,00	

Participant No. 22 **Short name: UMCG**	**Cost (€)**	**Justification**
Other goods, works and services	15 000,00	WP2: SI (remote access and beam service)
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	15 000,00	

Participant No. 23 **Short name: INCT**	**Cost (€)**	**Justification**
Travel & subsistence	76 000,00	WP3: User travel support for RI access, small travel budget for TA management to project annual meetings: 76k€
Other goods, works and services	21 600,00	WP3: Technical support to the users for their experiment – shipment and RP related costs: 21,6k€ *For information, to complement the costs declared above, part of the actual costs to access infrastructure are offered as contribution without cost by the Consortium. Here are the full estimated actual access costs:* *WP3: RAPID infrastructure actual costs: 31,2k€*
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	97 600,00	

Participant No. 24 **Short name: CSIC**	**Cost (€)**	**Justification**
Travel & subsistence	144 000,00	WP5, Task 4: Travel for training activities
Remaining purchase costs (<15% of pers. Costs)	0,00	
Total	144 000,00	

Table 3.1i: 'Other costs categories' items (e.g. internally invoiced goods and services)

Participant Number/Short Name		
	Cost (€)	**Justification**
Internally invoiced goods and services		
…		

Table 3.1j: 'In-kind contributions' provided by third parties

Participant Number/Short Name			
Third party name	**Category**	**Cost (€)**	**Justification**

Table 3.1k: Summary of trans-national/virtual access provision

Access provider short name[2]	*Short name of infrastructure*	*Installation*		*Installation Country code*[3]	*Type of access*[4]	*Unit of access*	*Estimated quantity of access to be provided*	*Unit cost (UC) (€)*[5]	*Access costs*[6]		*Estimated number of users*	*Estimated number of applications**
		Nr[7]	*Short name*						*On the basis of UC*	*As actual costs*		
CERN	HiRadMat			CH	TA-uc	1h	4800	0	0		60	20
UU	FREIA	1	2	GERSEMI, HNOSS	TA-ac	1h	960			191191	8	4
INFN	MI	4	LASA	IT	TA-ac	1h	6400			440000	120	80
INFN	Salerno	1	THOR	IT	TA-ac	1h	272			87500	8	8
CNRS	IJCLAB	4	SUPRATECH	FR	VA-ac	1h	672			81850	4	4
CEA	IRFU	2	SYNERGIUM	FR	TA-ac	1h	640			236155	20	20
CERN	XBOX	1		CH	TA-ac	1h	400			45510	32	8
KIT	ALFA	2	FLUTE, KARA	GE	TA-uc	1h	330 880	49.3 383	16261 336930		15 40	3 8
UKRI	CLARA	1		UK	TA-ac	1h	150			0	16	8
INFN	LNF	3	BTF(1,2) SPARCLAB	IT	TA-ac	1h	1176 1680			212562 212940	14 20	7 10

2 Short name of the beneficiary, affiliated entity or associated partner. It can be the infrastructure owner or, if the owner of the infrastructure is another third party contributing resources, the beneficiary/affiliated entity to whom the infrastructure owner provide resources in Annex I and who coordinates access to the service of this research infrastructure.

3 Give the ISO two-letter code of the country where the installation is located, or 'IO' if the access provider (the beneficiary or linked third party) is an international organization, an ERIC, or a similar legal entity. When the installation is mobile (e.g. a research vessel) give the country of its usual location (e.g. the home port).

4 "TA-uc" for trans-national access with access costs declared on the basis of unit costs, TA-ac for trans-national access with access costs declared as actual costs, or "TA-cb" for trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit costs. "VA-uc" for virtual access with access costs declared on the basis of unit costs, VA-ac for virtual access with access costs declared as actual costs, or "VA-cb" for virtual access with access costs declared as a combination of actual costs and costs on the basis of unit costs. Associate partners, as they cannot charge costs, must indicate actual cost (TA-ac or VA-ac) and put 0 in the actual cost column.

5 To be filled in only for installations providing trans-national access or virtual access declaring access costs either on the basis of unit costs (TA-uc or VA-uc) or as a combination of actual costs and costs on the basis of unit costs (TA-cb or VA-uc). The unit cost must be calculated through the specific excel table provided in the submission system. Leave blank in case of or trans-national access with access costs declared as actual costs (TA-ac), or virtual access with access costs declared as actual costs (VA-ac).

6 Cost of the access provided under the project. For trans-national access and virtual access fill in one of the two columns or both according to the way access costs are declared. The trans-national and virtual access cost on the basis of unit costs must be computed by multiplying the unit cost by the quantity of access to be provided.

7 Number the installations of the same infrastructure consecutively. An *installation* is a part or a service of an *infrastructure* that could be used independently from the rest.

CEA	LIDYL	1	UHI100	FR	TA-uc	1h	640	117	74899		12	4
INCT	RAPID	3	RAPID	PL	TA-ac	1h	600			78000	60	24
CERN	CLEAR	1		CH	TA-ac	1h	1200			11634000	90	30
INFN	LNL/LNS	1	NSDBF+AIPF	IT	TA-uc	Beam hour	4400	70	308000		200	50
GANIL	GANIL-SPIRAL2	1	GANIL-SPIRAL2	FR	TA-uc	Beam hour	3256	108	351403		275	35
CNRS	IJCLab	1	ALTO	FR	TA-uc	Beam hour	1 860	100	186000		76	30
GSI	GSI-FAIR	1	GSI-FAIR	DE	TA-uc	Beam hour	3350	150	322500		300	36
CERN	ISOLDE	1	ISOLDE	IO	TA-uc	Beam hour	4500	70	315000		500	100
CERN	n_TOF	1	N_TOF	IO	TA-uc	Beam hour	504	153	77112		130	6
JYU	JYFL	1	JYFL	FI	TA-uc	Beam hour	3500	75	262500		300	60
UNIWARSAW	NLC_SLCJ	1	SLCJ	PL	TA-uc	Beam hour	1000	103.5	103500		40	8
IFJ PAN	NLC_CCB	1	CCB	PL	TA-uc	Beam hour	550	103.5	57200		20	5
IFIN-HH	TANDEM	1	TANDEM	RO	TA-uc	Beam hour	4100	35	143500		100	40
USE	CLEAR_CNA	1	CNA	ES	TA-uc	Beam hour	640	35	22400		36	16
ATOMKI	CLEAR_ATOMKI	1	ATOMKI	HU	TA-uc	Beam hour	640	35	22400		36	16
IST	CLEAR_Lisboa	1	IST	PT	TA-uc	Beam hour	640	35	22400		36	16
FBK	ECT*	1	ECT*	IT	TA-uc	Visitor day	1280	94	120320		256	18
IFJ PAN	Theo4Exp	1	MeanField4Exp	PL	VA-ac	Hour	360			270000	40	
USE	Theo4Exp	2	Reaction4Exp	ES	VA-ac	Hour	400			292506	80	
UMIL	Theo4Exp	3	Structure4Exo	IT	VA-ac	Hour	160			189000	20	
CERN	PS & SPS			IO	TA-uc	Beam hour	8736	0	0		504	56
DESY	TESTBEAM			GE	TA-uc	Beam hour	8640	0	0		120	30
PSI	PiM1 & UCN			CH	TA-uc	Beam hour	5376	0		0	136	32
RBI	RBI-AF			HR	TA-uc	Beam hour	504	130	65520		24	12
ITAINNOVA	EMCLab			ES	TA-ac	Test hour	800			82500	56	14
CERN	IRRAD			IO	TA-uc	Beam hour	4000	0	0		65	16
CERN	GIF++			IO	TA-uc	Beam hour	4060	0	0		74	14

JSI	TRIGA			SI	TA-uc	Beam hour	700	250	175000		150	50
IFJ PAN	AIC-144			PL	TA-uc	Beam hour	800	140	120000		140	28
UCL	HIF-LIF-NIF			BE	TA-uc	Beam hour	100	720	72000		20	10
UoB	MC40			UK	TA-uc	Beam hour	300	0		0	36	12

* *Column to be mandatorily filled in for trans-national access only. Not to be filled in for virtual access*

ANNEX 2

ESTIMATED BUDGET FOR THE ACTION

	Estimated eligible[1] costs (per budget category)												Estimated EU contribution[2]			
	Direct costs										Indirect costs	Total costs	EU contribution to eligible costs			Maximum grant amount[6]
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories			E. Indirect costs[3]		Funding rate %[4]	Maximum EU contribution[5]	Requested EU contribution	
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons		A.4 SME owners and natural person beneficiaries	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	D.2 Internally invoiced goods and services	D.3 Transnational access to research infrastructure unit costs	D.4 Virtual access to research infrastructure unit costs	E. Indirect costs					
Forms of funding	Actual costs	Unit costs (usual accounting practices)	Unit costs[7]	Actual costs	Actual costs	Actual costs	Actual costs	Unit costs (usual accounting practices)	Unit costs[7]	Unit costs[7]	Flat-rate costs[8]					
	a1	a2	a3	b	c1	c2	c3	d2	d3	d4	e = 0,25 * (a1 + a2 + a3 + c1 + c2 + c3)	f = a + b + c + d + e	U	g = f * U%	h	m
1 - INFN	522 903.00	0.00	0.00	0.00	847 280.00	100 000.00	342 971.00	0.00	308 000.00	0.00	453 288.50	2 574 442.50	100	2 574 442.50	2 573 880.00	2 573 880.00
2 - GANIL	0.00	0.00	0.00	0.00	250 000.00	0.00	92 567.00	0.00	351 403.00	0.00	85 641.75	779 611.75	100	779 611.75	779 611.00	779 611.00
3 - CERN	890 800.00	0.00	0.00	0.00	1 009 664.00	70 000.00	143 000.00	0.00	392 112.00	0.00	528 366.00	3 033 942.00	100	3 033 942.00	3 033 942.00	3 033 942.00
4 - JSI	89 500.00	0.00	0.00	0.00	4 000.00	61 000.00	25 000.00	0.00	175 000.00	0.00	44 875.00	399 375.00	100	399 375.00	399 375.00	399 375.00
5 - IFJ PAN	242 400.00	0.00	0.00	0.00	78 460.00	15 940.00	0.00	0.00	177 200.00	0.00	84 200.00	598 200.00	100	598 200.00	418 200.00	418 200.00
6 - DESY	89 000.00	0.00	0.00	0.00	151 456.00	45 000.00	0.00	0.00	0.00	0.00	71 364.00	356 820.00	100	356 820.00	356 820.00	356 820.00
7 - UCL	32 850.00	0.00	0.00	0.00	12 000.00	58 000.00	0.00	0.00	72 000.00	0.00	25 712.50	200 562.50	100	200 562.50	200 562.00	200 562.00
8 - RBI	24 600.00	0.00	0.00	0.00	23 920.00	0.00	0.00	0.00	65 520.00	0.00	12 130.00	126 170.00	100	126 170.00	126 170.00	126 170.00
9 - CNRS	318 980.00	0.00	0.00	0.00	112 220.00	0.00	55 600.00	0.00	186 000.00	0.00	121 700.00	794 500.00	100	794 500.00	794 500.00	794 500.00
10 - FBK	0.00	0.00	0.00	0.00	121 344.00	0.00	0.00	0.00	120 320.00	0.00	30 336.00	272 000.00	100	272 000.00	272 000.00	272 000.00
11 - ITAINNOVA	85 000.00	0.00	0.00	0.00	20 800.00	4 000.00	18 000.00	0.00	0.00	0.00	31 950.00	159 750.00	100	159 750.00	159 750.00	159 750.00
12 - UNIWARSAW	72 000.00	0.00	0.00	0.00	40 000.00	0.00	16 700.00	0.00	103 500.00	0.00	32 175.00	264 375.00	100	264 375.00	264 375.00	264 375.00
13 - GSI	592 065.00	0.00	0.00	0.00	220 000.00	0.00	79 600.00	0.00	322 500.00	0.00	222 916.25	1 437 081.25	100	1 437 081.25	1 437 081.00	1 437 081.00
14 - IFIN-HH	10 634.00	0.00	0.00	0.00	244 000.00	0.00	40 500.00	0.00	143 500.00	0.00	73 783.50	512 417.50	100	512 417.50	512 417.00	512 417.00
15 - USE	234 005.00	0.00	0.00	0.00	34 080.00	0.00	0.00	0.00	22 400.00	0.00	67 021.25	357 506.25	100	357 506.25	155 000.00	155 000.00
16 - IST	0.00	0.00	0.00	0.00	34 080.00	0.00	0.00	0.00	22 400.00	0.00	8 520.00	65 000.00	100	65 000.00	65 000.00	65 000.00
17 - Atomki	19 500.00	0.00	0.00	0.00	30 000.00	0.00	7 080.00	0.00	22 400.00	0.00	14 145.00	93 125.00	100	93 125.00	93 125.00	93 125.00
18 - JYU	0.00	56 500.00	0.00	0.00	180 000.00	0.00	62 000.00	0.00	262 500.00	0.00	74 625.00	635 625.00	100	635 625.00	635 625.00	635 625.00
19 - UU	125 240.00	0.00	0.00	0.00	13 200.00	160 000.00	21 500.00	0.00	0.00	0.00	79 985.00	399 925.00	100	399 925.00	399 925.00	399 925.00
20 - CEA	0.00	178 493.00	0.00	0.00	44 000.00	40 000.00	31 000.00	0.00	74 899.00	0.00	73 373.25	441 765.25	100	441 765.25	438 780.00	438 780.00
21 - KIT	0.00	0.00	0.00	0.00	23 100.00	0.00	150 400.00	0.00	353 192.56	0.00	43 375.00	570 067.56	100	570 067.56	570 067.00	570 067.00
22 - UMCG	75 324.00	0.00	0.00	0.00	0.00	0.00	15 000.00	0.00	0.00	0.00	22 581.00	112 905.00	100	112 905.00	112 905.00	112 905.00
23 - INCT	22 400.00	0.00	0.00	0.00	76 000.00	0.00	21 600.00	0.00	0.00	0.00	30 000.00	150 000.00	100	150 000.00	150 000.00	150 000.00
24 - CSIC	0.00	0.00	0.00	0.00	144 000.00	0.00	0.00	0.00	0.00	0.00	36 000.00	180 000.00	100	180 000.00	180 000.00	180 000.00
25 - UMIL	151 200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37 800.00	189 000.00	100	189 000.00	45 000.00	45 000.00
26 - PSI																
27 - RIKEN																
28 - MSU																
29 - TUD																
30 - LIP																

	Estimated eligible[1] costs (per budget category)												Estimated EU contribution[2]			
	Direct costs										Indirect costs	Total costs	EU contribution to eligible costs			Maximum grant amount[6]
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories			E. Indirect costs[3]		Funding rate %[4]	Maximum EU contribution[5]	Requested EU contribution	
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons		A.4 SME owners and natural person beneficiaries	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	D.2 Internally invoiced goods and services	D.3 Transnational access to research infrastructure unit costs	D.4 Virtual access to research infrastructure unit costs	E. Indirect costs					
Forms of funding	Actual costs	Unit costs (usual accounting practices)	Unit costs[7]	Actual costs	Actual costs	Actual costs	Actual costs	Unit costs (usual accounting practices)	Unit costs[7]	Unit costs[7]	Flat-rate costs[8]					
	a1	a2	a3	b	c1	c2	c3	d2	d3	d4	e = 0,25 * (a1 + a2 + a3 + c1 + c2 + c3)	f = a + b + c + d + e	U	g = f * U%	h	m
31 - ENEA																
32 - UoB																
33 - UKRI																
Σ consortium	3 598 401.00	234 993.00	0.00	0.00	3 713 604.00	553 940.00	1 122 518.00	0.00	3 174 846.56	0.00	2 305 864.00	14 704 166.56		14 704 166.56	14 174 110.00	14 174 110.00

[1] See Article 6 for the eligibility conditions. All amounts must be expressed in EUR (see Article 21 for the conversion rules).
[2] The consortium remains free to decide on a different internal distribution of the EU funding (via the consortium agreement; see Article 7).
[3] Indirect costs already covered by an operating grant (received under any EU funding programme) are ineligible (see Article 6.3). Therefore, a beneficiary/affiliated entity that receives an operating grant during the action duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant, unless they can demonstrate that the operating grant does not cover any costs of the action. This requires specific accounting tools. Please immediately contact us via the EU Funding & Tenders Portal for details.
[4] See Data Sheet for the funding rate(s).
[5] This is the theoretical amount of the EU contribution to costs, if the reimbursement rate is applied to all the budgeted costs. This theoretical amount is then capped by the 'maximum grant amount'.
[6] The 'maximum grant amount' is the maximum grant amount decided by the EU. It normally corresponds to the requested grant, but may be lower.
[7] See Annex 2a 'Additional information on the estimated budget' for the details (units, cost per unit).
[8] See Data Sheet for the flat-rate.

ANNEX 2a

ADDITIONAL INFORMATION ON UNIT COSTS AND CONTRIBUTIONS

SME owners/natural person beneficiaries without salary (Decision C(2020) 7115[1])

Type: unit costs

Units: days spent working on the action (rounded up or down to the nearest half-day)

Amount per unit (daily rate): calculated according to the following formula:

{EUR 5 080 / 18 days = **282,22**}
multiplied by
{country-specific correction coefficient of the country where the beneficiary is established}

The country-specific correction coefficients used are those set out in the Horizon Europe Work Programme (section Marie Skłodowska-Curie actions) in force at the time of the call (see Portal Reference Documents).

HE and Euratom Research Infrastructure actions[2]

Type: unit costs

Units[3]: see (for each access provider and installation) the unit cost table in Annex 2b

Amount per unit*: see (for each access provider and installation) the unit cost table in Annex 2b

* Amount calculated as follows:

For trans-national access:

$$\frac{\text{average annual total trans-national access costs to the installation (over past two years[4])}}{\text{average annual total quantity of trans-national access to the installation (over past two years[5])}}$$

For virtual access:

$$\frac{\text{total virtual access costs to the installation (over the last year[6])}}{\text{total quantity of virtual access to the installation (over the last year[7])}}$$

Euratom staff mobility costs[8]

Monthly living allowance

Type: unit costs

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1 Commission Decision of 20 October 2020 authorising the use of unit costs for the personnel costs of the owners of small and medium-sized enterprises and beneficiaries that are natural persons not receiving a salary for the work carried out by themselves under an action or work programme (C(2020)7715).

2 Decision of 19 April 2021 authorising the use of unit costs for the costs of providing trans-national and virtual access in Research Infrastructure actions under the Horizon Europe Programme (2021-2027) and the Research and Training Programme of the European Atomic Energy Community (2021-2025).

3 Unit of access (e.g. beam hours, weeks of access, sample analysis) fixed by the access provider in proposal.

4 In exceptional and duly justified cases, the granting authority may agree to a different reference period.

5 In exceptional and duly justified cases, the granting authority may agree to a different reference period.

6 In exceptional and duly justified cases, the granting authority may agree to a different reference period.

7 In exceptional and duly justified cases, the granting authority may agree to a different reference period.

8 Decision of 15 March 2021 authorising the use of unit costs for mobility in co-fund actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025).

Units: months spent by the seconded staff member(s) on research and training in fission and fusion activities (person-month)

Amount per unit*: see (for each beneficiary/affiliated entity and secondment) the unit cost table in Annex 2b

* Amount calculated as follows from 1 January 2021:
{**EUR 4 300** multiplied by
country-specific correction coefficient** of the country where the staff member is seconded}[9]

**Country-specific correction coefficients as from 1 January 2021[10]

EU-Member States[11]

Country / Place	Coefficient (%)
Bulgaria	59,1
Czech Rep.	85,2
Denmark	131,3
Germany Bonn Karlsruhe Munich	101,9 95,8 98 113,9
Estonia	82,3
Ireland	129
Greece	81,4
Spain	94,2
France	120,5
Croatia	75,8
Italy Varese	95 90,7
Cyprus	78,2
Latvia	77,5
Lithuania	76,6
Hungary	71,9
Malta	94,7
Netherlands	113,9
Austria	107,9
Poland	70,9
Portugal	91,1
Romania	66,6
Slovenia	86,1

[9] Unit costs for living allowances are calculated by using a method of calculation similar to that applied for the secondment to the European Commission of seconded national experts (SNEs).

[10] ⚠ For the financial statements, the amount must be adjusted according to the actual place of secondment.
The revised coefficients were adopted in the Decision authorising the use of unit costs for the Fusion Programme co-fund action under the Research and training Programme of the European Atomic Energy Community 2021-2025. They are based on the 2020 Annual update of the remuneration and pensions of the officials and other servants of the European Union and the correction coefficients applied thereto (OJ C 428, 11.12.2020) to ensure purchasing power parity. The revised coefficient are applied as from 1 January 2021 through an amendment to the grant agreement.

[11] No correction coefficient shall be applicable in Belgium and Luxembourg.

Slovakia	80,6
Finland	118,4
Sweden	124,3

Third countries

Country/place	Coefficient (%)
China	82,2
India	72,3
Japan	111,8
Russia	92,7
South Korea	92,3
Switzerland	129.2
Ukraine	82.3
United Kingdom	97.6
United States	101,4 (New-York) 90,5 (Washington)

Mobility allowance

Type: Unit costs

Units: months spent by the seconded staff member(s) on research and training in fission and fusion activities (person-month)

Amount per unit: **EUR 600** per person-month; see (for each beneficiary/affiliated entity and secondment) the unit cost table in Annex 2b

Family allowance

Type: unit costs

Units: months spent by the seconded staff member(s) on research and training in fission and fusion activities (person-month)

Amount per unit: **EUR 660** per person-month; see (for each beneficiary/affiliated entity and secondment) the unit cost table in Annex 2b

Education allowance

Type: Unit costs

Units: months spent by the seconded staff member(s) on research and training in fission and fusion activities (person-month)

Amount per unit*: see (for each beneficiary/affiliated entity and secondment) the unit cost table in Annex 2b

*Amount calculated as follows from 1 January 2021:
{EUR 283.82 x number of dependent children[12]**}**

[12] For the estimated budget (Annex 2): an average should be used. (⚠ For the financial statements, the number of children (and months) must be adjusted according to the actual family status at the moment the secondment starts.)

ANNEX 2b

ADDITIONAL INFORMATION ON CUSTOMISED UNIT COSTS AND CONTRIBUTIONS

HE and Euratom Research Infrastructure actions[1]

Unit cost table (Transnational access to research infrastructure unit cost and virtual access to research infrastructure unit cost)[2]

Short name access provider*	Short name infrastructure	Installation		Unit of access	Amount per unit	Estimated No of units	Total unit cost (cost per unit x estimated no of units)
		No	Short name				
FBK	ECT*	1	ECT*	Visitor day	94.0	1,280	120,320.00
INFN	LNL/LNS	1	NSDBF+AIPF	Beam hour	70.0	4,400	308,000.00
UNIWARSAW	NLC_SLCJ	1	SLCJ	Beam hour	103.5	1,000	103,500.00
GSI	GSI-FAIR	1	GSI-FAIR	Beam hour	150.0	2,150	322,500.00
IFIN-HH	TANDEM	1	TANDEM	Beam hour	35.0	4,100	143,500.00
USE	CLEAR_CNA	1	CNA	Beam hour	35.0	640	22,400.00
IST	CLEAR_Lisboa	1	IST	Beam hour	35.0	640	22,400.00
ATOMKI	CLEAR_ATOMKI	1	ATOMKI	Beam hour	35.0	640	22,400.00
JYU	JYFL	1	JYFL	Beam hour	75.0	3,500	262,500.00
CEA	LIDYL	1	UHI100	1h	117.0	640	74,899.00
GANIL	GANIL-SPIRAL2	1	GANIL-SPIRAL2	Beam hour	108.0	3,254	351,403.00
KIT	ALFA	1	FLUTE	1h	49.3	330	16,262.56
KIT	ALFA	2	KARA	1h	383.0	880	336,930.00
CERN	GIF++	1	GIF++	Beam hour	0.0	4,000	0.00
CERN	HiRadMat	1	HiRadMat	1h	0.0	4,800	0.00
CERN	IRRAD	1	IRRAD	Beam hour	0.0	4,000	0.00
CERN	ISOLDE	1	ISOLDE	Beam hour	70.0	4,500	315,000.00
CERN	PS & SPS	1	PS&SPS	Beam hour	0.0	8,736	0.00
CERN	n_TOF	1	N_TOF	Beam hour	153.0	504	77,112.00
JSI	TRIGA	1	TRIGA	Beam hour	250.0	700	175,000.00
IFJ PAN	AIC	1	AIC-144	Beam hour	150.0	800	120,000.00
IFJ PAN	NLC	1	CCB	Beam hour	104	550	57,200.00
DESY	TESTBEAM	1	Testbeam	Beam hour	0.0	8,640	0.00
UCL	CRC	1	HIF-LIF-NIF	Beam hour	720.0	100	72,000.00
RBI	RBI-AF	1	RBI-AF	Beam hour	130.0	504	65,520.00
CNRS	IJCLab	1	ALTO	Beam hour	100.0	1,860	186,000.00

* Beneficiary or affiliated entity. For installations of third parties indicate in this column the short name of the beneficiary/affiliated entity to which the third party is associated.

[1] Decision of 19 April 2021 authorising the use of unit costs for the costs of providing trans-national and virtual access in Research Infrastructure actions under the Horizon Europe Programme (2021-2027) and the Research and Training Programme of the European Atomic Energy Community (2021-2025).

[2] Data from the Table on estimated costs/quantity of access to be provided that is part of the proposal and Annex 1.

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

GRAND ACCELERATEUR NATIONAL D'IONS LOURDS (GANIL), PIC 999957481, established in Boulevard Henri Becquerel, CAEN 14076, France,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Patricia Roussel Chomaz with ECAS id n008rz0t signed in the Participant Portal on 16/06/2022 at 16:38:59 (transaction id SigId-115-zteOGqH910LkTaZYszRl8kuOIk4P4JFSu0CIu2ZkRq9gjzPVFCtew3RrTWO2wiTlwbpk4zlDoGtzzMZdiUTwmNOG-rS0vSrmBGYC5A0GYws8iKq-xzhDXJksdvzVjcOthLo02zPDNr6Q4TmBEG4tcuwc4V5pCkUH3E9cRmo1uybaKlAppWorX9TpFlzOrJQPEQgzpYj). Timestamp by third party at 2022.06.16 17:39:10 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE (CERN), PIC 999988133, established in ESPLANADE DES PARTICULES 1 PARCELLE 11482 DE MEYRIN BATIMENT CADASTRAL 1046, GENEVE 23 1211, Switzerland,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Mike Lamont with ECAS id n003m7pt signed in the Participant Portal on 17/06/2022 at 10:06:56 (transaction id SigId-6035-eQJh9pKRZHv1I5VejirAmO5o39Fj7ZkizbtKsoduTQB3B2q8AHzQyLGLOJjTMNVjgiZjQv3Mbj99xlyJnLklqj-rS0vSrmBGYC5A0GYws8iKq-AiY1zPbNSjAJxx9DME0602TdoQQgWvBpWLHzzazl2ljwzLwL0zVQsQizO5yF83zeUSJeRt9FboFEtJf5qO3GqsXZ). Timestamp by third party at 2022.06.17 11:07:13 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTITUT JOZEF STEFAN (JSI), PIC 999971837, established in Jamova 39, LJUBLJANA 1000, Slovenia,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Boštjan Zalar with ECAS id n005e0r1 signed in the Participant Portal on 16/06/2022 at 09:29:15 (transaction id SigId-173928-aRbtc5M0nVGrTzoaOQHBu8NWVllk7RgacqIubIXyXMzmZzgPPf4GzMECVvV6mpHzwhIgNmb7OWWalVgZyMPOztlG-yntOf97TTHq9QCab4GzIaj-rkwxifVflNxzzXjVSx5QA9nnBzLx0LeBYW3dVDSEPabwyznxCtKKzXpWptxC6a5VGZ3pXvTLgtpLttWp3Av06bj). Timestamp by third party at 2022.06.16 10:29:23 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

THE HENRYK NIEWODNICZANSKI INSTITUTE OF NUCLEAR PHYSICS, POLISH ACADEMY OF SCIENCES (IFJ PAN), PIC 999611579, established in RADZIKOWSKIEGO 152, KRAKOW 31 342, Poland,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Tadeusz LESIAK with ECAS id nlesiata signed in the Participant Portal on 15/06/2022 at 13:09:23 (transaction id SigId-163838-6Dw2kk9Gx3LJp7evW7HpTq2VK3Z1rRaVhdelROhzrOiuAI2Y7Ki1U1BQBh4sojDzNdmXSLqzmGqIszLxjSo7LlC-yntOf97TTHq9QCab4GzIaj-kTAgbG9NqOC8aywxLALiWSV3XiHT9SdP1okcNGpD3MMWTCm3XBljXbv5HNQzfEXLQeVKOwM1vZgsAzzWJzveecG). Timestamp by third party at 2022.06.15 14:09:31 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

DEUTSCHES ELEKTRONEN-SYNCHROTRON DESY (DESY), PIC 999986969, established in NOTKESTRASSE 85, HAMBURG 22607, Germany,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Ute KRELL with ECAS id nkrellut signed in the Participant Portal on 21/06/2022 at 08:52:59 (transaction id SigId-186832-tO38d5zi0KPpzuySCWxbHsYW7SKtJlPacipqQdIJvZ4RlORUCIsd555uf3Mg0RZPpkiYNJVpjDVNwDJocnwsFf-yntOf97TTHq9QCab4GzIaj-VWn5CcS3EA514QyO7aiH5B2M5mB3KGjev8pC1GjbwzUVI3kpfahv49hub5sp19sjzwCsrHzpWiugC2uB3gHx320). Timestamp by third party at 2022.06.21 09:53:08 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITE CATHOLIQUE DE LOUVAIN (UCL), PIC 999980664, established in PLACE DE L UNIVERSITE 1, LOUVAIN LA NEUVE 1348, Belgium,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Xavier Lepot with ECAS id n006p4hv signed in the Participant Portal on 17/06/2022 at 16:33:39 (transaction id SigId-13243-jqHKgLzzM3zwtQ6oXIxqrYj6XgiCi2XXMJkzuldtlAyyvgYajazUZom3HwqZq1nVcQmMStRBzVHoUoGx7U4yVnV0-rS0vSrmBGYC5A0GYws8iKq-Bn20UAnS7d14vuabCygIdXIgaFJzrbXlSFar35qeFGzZYipho3QpIhC8p2KKm4pCV11Qvd7uzRdN1Sx2JsumA2G). Timestamp by third party at 2022.06.17 17:34:01 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

RUDER BOSKOVIC INSTITUTE (RBI), PIC 999875031, established in Bijenicka cesta 54, ZAGREB 10000, Croatia,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

David SMITH with ECAS id nsmithcw signed in the Participant Portal on 15/06/2022 at 17:31:54 (transaction id SigId-169098-BS74RqfgHkaxZ3afRLzHhchX4pB3nWbCesGsKZIC37xAD1c7cZwGnLzvCqvMR23BxBFDJE2pms5jairDKsO2DN-yntOf97TTHq9QCab4GzIaj-jiWhUgDZCnIHgWAhLCNgGpxnoiomZfASxACyIWK3mzzzJYBxXxpzkx8JU7Je1zVFf67QKdXS5Kjzpfzeyu9ykZjq). Timestamp by third party at 2022.06.15 19:32:03 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (CNRS), PIC 999997930, established in RUE MICHEL ANGE 3, PARIS 75794, France,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Reynald PAIN with ECAS id npainrey signed in the Participant Portal on 23/06/2022 at 09:21:07 (transaction id SigId-213716-l4mxS5sdFgzXuYRmEgZ4LWm1RT4r6GJdhNv4XoXHyoPZ418N1FhuHFYCZKhcCgUgxbnCNzszliyvw73hBULY7U0-yntOf97TTHq9QCab4GzIaj-t7OyIYIs26Ml6Y8Gtp0Lqy8FCEyJm2Os4caUop06L00QMxVIzJRs5Z2EjhOc6x1GlNVpgk9Vy3sOGIHuv8tshK). Timestamp by third party at 2022.06.23 10:21:15 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FONDAZIONE BRUNO KESSLER (FBK), PIC 999625450, established in VIA SANTA CROCE 77, TRENTO 38122, Italy,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Gert Arnold Pieter Theo Aarts with ECAS id n0066tfn signed in the Participant Portal on 15/06/2022 at 13:48:29 (transaction id SigId-164666-8Db7sLhPZlWexQHck7QsFd7boZHBU0mMbsSFH0ZoEvrhOxZVa1crri1yHzaGOdApUOTGzGlyqDHY7ryQ2P6zLSW-yntOf97TTHq9QCab4GzIaj-1xpHLmYoS3oxQf733GUkwHNPizojyMLimn0zP952FMZBKohzRJ8zfCulKWjyztrMk4PblI410YZOzzOcy69tPoW4). Timestamp by third party at 2022.06.15 14:48:36 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTITUTO TECNOLOGICO DE ARAGON (ITAINNOVA), PIC 999509341, established in MARIA DE LUNA 8, ZARAGOZA 50018, Spain,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

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By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Esther Borao Moros with ECAS id n002xoy7 signed in the Participant Portal on 15/06/2022 at 11:59:24 (transaction id SigId-162718-B6osTJm7IcQf1hewNPNnW9QEuyHVCXK9RfMdjg7Sq2fYOTMJwsHQHuLbQbc12MBCUhUzPugawAsYKVyQpX9a0a-yntOf97TTHq9QCab4GzIaj-UzLs0Elo7nGHTjDIzjARrbxNzMVVdgHmHGCDDVuemyxOPo87zZmPxJsZqdCcmQwrslHeubuQ4j8G9wsNkhpwrle). Timestamp by third party at 2022.06.15 12:59:30 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIWERSYTET WARSZAWSKI (UNIWARSAW), PIC 999572294, established in KRAKOWSKIE PRZEDMIESCIE 26/28, WARSZAWA 00 927, Poland,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

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SIGNATURE

For the beneficiary

Zygmunt LALAK with ECAS id nlalakzy signed in the Participant Portal on 29/06/2022 at 10:19:34 (transaction id SigId-270511-InqpHtGlpjCnsJzPJgGPUxMERwzbywgOAD8fhqrhwRM9V2ozh2wMGeACtk9STyZrfmlf4dzgxXOytcsdpVZN3sW-yntOf97TTHq9QCab4GzIaj-0connBEzzgrapLkCRJq4V87RzZ5rYbwsf0qzGeOGZ26iLP4l0c01qmC3vLhvGbczfm7R7sYzqzRCAZ31CHEMjzxw). Timestamp by third party at 2022.06.29 11:19:44 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

GSI HELMHOLTZZENTRUM FUR SCHWERIONENFORSCHUNG GMBH (GSI), PIC 999995214, established in PLANCKSTRASSE 1, DARMSTADT 64291, Germany,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Paolo GIUBELLINO with ECAS id ngiubpol signed in the Participant Portal on 15/06/2022 at 17:31:45 (transaction id SigId-169096-MoT2WBwNtKY3XxzRas47zQW2ll5f25Y0Yd9qd3yzae0t8zVzJYqlyAEFwdmWVefqP9loRTjsrlyyvbzTdKArcY5G-yntOf97TTHq9QCab4GzIaj-F69zLSv57Rcj39DIyP7ER2JkBc3dut4lkLtkSEkLnNSzweeEluDMCnif8tWj3KS7NFXoDQzrPVTnhRWJnEe4DtG). Timestamp by third party at 2022.06.15 18:31:53 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTITUTUL NATIONAL DE CERCETARE-DEZVOLTARE PENTRU FIZICA SI INGINERIE NUCLEARA-HORIA HULUBEI (IFIN-HH), PIC 999488777, established in STRADA REACTORULUI 30, MAGURELE ILFOV 077125, Romania,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Nicolae Marius MARGINEAN with ECAS id nmarginn signed in the Participant Portal on 20/06/2022 at 10:04:25 (transaction id SigId-19191-CKyxTEzPBPbkFQU1izvyzUmmSzpbyZ5PDab7xzjDb8rsMmFp3TObX92YzhWj1Fg0VnCnSW3zu8GfMd4S96GCqd1G-rS0vSrmBGYC5A0GYws8iKq-xh9zWeGR9s6HosnrYsIN3NdKYzlQJL1F9JhOvoqWlW86gnbkFYXGZlIKQ9OWztZSMIkXeMV82yqwytQZAVil20m). Timestamp by third party at 2022.06.20 11:04:36 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSIDAD DE SEVILLA (USE), PIC 999862518, established in CALLE S. FERNANDO 4, SEVILLA 41004, Spain,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Julián MARTÍNEZ FERNÁNDEZ with ECAS id ngarcimw signed in the Participant Portal on 15/06/2022 at 15:30:26 (transaction id SigId-167163-LdOE91sA18ekNlzcj42rqtp8dn9WseeD9pnPXdD8gfsIp00oeyJGdG0fnaOMwzJw2QSeD9eyesN44VXmIMs8yO-yntOf97TTHq9QCab4GzIaj-xFZHn55pIf9h30euHlIk6zMqcl4Ed5MVzhnpSsm3lFUzS0ZAuzIYc5nxC17NTRFIY3DGcmoU7R7TIOVP5RDy57W). Timestamp by third party at 2022.06.15 16:30:37 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTITUTO SUPERIOR TECNICO (IST), PIC 999992983, established in AVENIDA ROVISCO PAIS 1, LISBOA 1049 001, Portugal,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Rogério COLAÇO with ECAS id ncolarog signed in the Participant Portal on 15/06/2022 at 12:59:33 (transaction id SigId-163638-JL9d CrxBUIazhU17GS9pApVQqwQzmIZrEetPrxKwkRf1y5AdiaWsrhOCQ Yo7KzxosZKAhpmsrM08iVJfqqBOwa0-yntOf97TTHq9QCab4GzIaj-z WMRYjBBt5br8ieNfZ2JLeKzVnkAvHyETiiCJDhnLMn7bzL9E6ICnyPzzl ZkxIkxoneYJ4Z2zl9ri3TGDzTzzKgzq). Timestamp by third party at 2022.06.15 13:59:41 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ATOMMAGKUTATO INTEZET (Atomki), PIC 999869890, established in BEM TER 18/C, DEBRECEN H4026, Hungary,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Zsolt DOMBRÁDI with ECAS id ndombrzs signed in the Participant Portal on 20/06/2022 at 13:36:27 (transaction id SigId-1384-2RQM4 5tLXIb2sI7C8cpAV4xKWa6YcoxJizOgWfv1PYtIskP9ZJLHNTtYxajh6Zx syL8uKzY9oMmJteemvzfzoRu-jpJZscgsw0KQmzTLomzww8m-3QZy EdOOotqTiHcZeheasYxYHa7TIYQDnHZTzTj8IcPO1L74UwctSNeUsd LfWYIenQ9fWYWhCJ0UaHaowCux0O). Timestamp by third party at 2022.06.20 14:36:38 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

JYVASKYLAN YLIOPISTO (JYU), PIC 999842245, established in SEMINAARINKATU 15, JYVASKYLA 40100, Finland,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Mikko MÖNKKÖNEN with ECAS id nmoenkmi signed in the Participant Portal on 15/06/2022 at 14:01:42 (transaction id SigId-164959-n4wcX3oluAXIny6qmj7aSVn4UOVH2h5zHZzV1QCQi8m9XyPiIuW4zeKiFOleNH0jMM5um7WzZ73HzM69THbBgdw-yntOf97TTHq9QCab4GzIaj-LfzZDtcNNmeclU7VdzhOhyuVjJKKGi8CA3uw8JzYkRZV8UVr4VepYmbHPOR20PKzejN2ZHo0wxrBKnvbqhHztkM). Timestamp by third party at 2022.06.15 15:01:52 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UPPSALA UNIVERSITET (UU), PIC 999985029, established in VON KRAEMERS ALLE 4, UPPSALA 751 05, Sweden,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Per ABRAHAMSSON with ECAS id nabrahap signed in the Participant Portal on 16/06/2022 at 12:17:18 (transaction id SigId-176789-7nfiaqioKgR1og3zvNNWS0An5VFzrOMakSpEs2EULypWDLxHzi6WpkJU4wwUZy7npOpa3Ut6yiKV2jIQlHdgl1m-yntOf97TTHq9QCab4GzIaj-fRM27zpi8zaZzzrn2IFB5FkhjIUpwnDeXzh2VCdczVgYw6zwkzgeIugnCtIxAEgEmxjlU1hv1hyBJoQ1jzznB7BQ8). Timestamp by third party at 2022.06.16 13:17:28 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (CEA), PIC 999992401, established in RUE LEBLANC 25, PARIS 15 75015, France,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Gaelle DECROIX with ECAS id ndecroga signed in the Participant Portal on 29/06/2022 at 13:08:10 (transaction id SigId-273529-cGNYgtyI82yDZU8ogEMPhijo08YMEM4nLLwGxshfhoaoXe5agPGh81JHpk2U5iMziiVl8VeqrXbf9tWzrksJ4c-yntOf97TTHq9QCab4GzIaj-NfUYp0ShRXIKy3jIeQ2tFAp7IUUSzmoUflQJZKemzMzr8lODB9rSFyppJCVlJWCn9v5P1aZFLPRZttvdDEWc7Vm). Timestamp by third party at 2022.06.29 14:08:21 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

KARLSRUHER INSTITUT FUER TECHNOLOGIE (KIT), PIC 990797674, established in KAISERSTRASSE 12, KARLSRUHE 76131, Germany,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Thomas Jaeger with ECAS id n0049dth signed in the Participant Portal on 20/06/2022 at 08:31:05 (transaction id SigId-17149-3IrcjzVfzsTf6GMTvsCk0a0o5yRs9zxF1Ast4NGvnbsNzgByosmgxVRIYpJq1e2jo5xfIKuWGXIZqehX2GzqvMp-rS0vSrmBGYC5A0GYws8iKq-AsySpvNzXrHC1ZM6NXVWxueosV1cbNkKMRURZo7DwsjYzvsRFt4srC4wsbmLsw9cOvzlbrDjHSrT0H33pdU2hDG). Timestamp by third party at 2022.06.20 10:11:59 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ACADEMISCH ZIEKENHUIS GRONINGEN (UMCG), PIC 999914801, established in HANZEPLEIN 1, GRONINGEN 9713 GZ, Netherlands,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

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SIGNATURE

For the beneficiary

Marian Joëls with ECAS id nlcrloke signed in the Participant Portal on 23/06/2022 at 13:06:49 (transaction id SigId-216773-XI2t3xqjf1nvKA36d0UzXXszG194Fkm54gzGAHuzzy9XHBcXQCPyzuOc8toCotTnko12JOKibx3KNuIvspMbArKG-yntOf97TTHq9QCab4GzIaj-gyOdUiCRXhlpmOJhQJ7a14eVWcoBAfC6FyYQzRJqq9zZc5OK4IaDnBYJtBzvDX9yHNy8v1tSLtrpcGA8tXJo9KW). Timestamp by third party at 2022.06.23 14:07:01 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INSTYTUT CHEMII I TECHNIKI JADROWEJ (INCT), PIC 999464915, established in ul. Dorodna 16, WARSZAWA 03-195, Poland,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

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SIGNATURE

For the beneficiary

Andrzej CHMIELEWSKI with ECAS id nchmiand signed in the Participant Portal on 16/06/2022 at 17:14:21 (transaction id SigId-494-e1GTwk5UWvZizZlS4dMfLIgFzzKX4IZgzq9aOkG9sJcgywf8kjUyzqgDECgzzUSW5N27ZLVmCMUx4wbKTrbuPMWy-rS0vSrmBGYC5A0GYws8iKq-FhNHCnQG1VLICPTxHUkNCOKGVzRWjLKFYMW3MdQWfeqCzjUraOuNNj0zzc4F7PnzXYzLyyzixeT208LKJddKroum). Timestamp by third party at 2022.06.16 18:14:31 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS (CSIC), PIC 999991722, established in CALLE SERRANO 117, MADRID 28006, Spain,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 39.

By signing this accession form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and terms and conditions it sets out.

SIGNATURE

For the beneficiary

Maria Angeles Gomez Borrego with ECAS id n002mz0g signed in the Participant Portal on 16/06/2022 at 11:50:51 (transaction id SigId-176412-akI2WddSTGNfwfMmrM469fshLP7lFuyGurgmjydZcSHYta4zTNP021MU63dkFLyScU2mjUhv0iXwCxUGAbBF2W-yntOf97TTHq9QCab4GzIaj-QJFu7sezxHt5qa0kVuZzKU4pjqlhe725gEa8qXeA9X9VRWVzkormuP4bQizt1iLMyNzsaySi3HAAT8OgEFtczS2m). Timestamp by third party at 2022.06.16 12:51:01 CEST

ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSITA DEGLI STUDI DI MILANO (UMIL), PIC 999995796, established in Via Festa Del Perdono 7, MILANO 20122, Italy,

hereby agrees

to become beneficiary

in Agreement No 101057511 — EURO-LABS ('the Agreement')

between ISTITUTO NAZIONALE DI FISICA NUCLEARE (INFN) **and** the **European Research Executive Agency (REA)** ('EU executive agency' or 'granting authority'), under the powers delegated by the European Commission ('European Commission'),

and mandates

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SIGNATURE

For the beneficiary

Elio FRANZINI with ECAS id nvagganl signed in the Participant Portal on 17/06/2022 at 10:21:08 (transaction id SigId-6359-k0cmwF LWaK1qwjgM0EBpemzvSzzm3gKvIWM424oi2uuVFNYnjAUaEb9P1v 8mNoOzPJ8qpZcMEzZ8IYG4dUxuzjLG-rS0vSrmBGYC5A0GYws8iKq-f 3CPVRqbPkKj4eWNdFi2l0KVwEmefFACjOLzR5n3Hl7jcfCh1k8skuKBn 8AMLk1s8zcvOrYoIya1oT4juXQoGg). Timestamp by third party at 2022.06.17 11:21:18 CEST

FINANCIAL STATEMENT FOR [PARTICIPANT NAME] FOR REPORTING PERIOD [NUMBER]

	Eligible[1] costs (per budget category)																	EU contribution[2]				Revenues
	Direct costs															Indirect costs	Total costs	EU contribution to eligible costs			Total requested EU contribution	Income generated by the action
	A. Personnel costs			B. Subcontracting costs	C. Purchase costs			D. Other cost categories								E. Indirect costs[2]		Funding rate %[3]	Maximum EU contribution[4]	Requested EU contribution		
	A.1 Employees (or equivalent) A.2 Natural persons under direct contract A.3 Seconded persons		A.4 SME owners and natural person beneficiaries	B. Subcontracting	C.1 Travel and subsistence	C.2 Equipment	C.3 Other goods, works and services	[D.1 Financial support to third parties]	D.2 Internally invoiced goods and services	[D.3 Transnational access to research infrastructure unit costs]	[D.4 Virtual access to research infrastructure unit costs]	*[OPTION for HE PCP/PPI:* D.5 PCP/PPI procurement costs*]*	*[OPTION for Euratom Programme Cofund Actions:* D.6 Euratom Cofund staff mobility costs*]*	*[OPTION for HE ERC Grants:* D.7 ERC additional funding*]*	*[OPTION for HE ERC Grants:* D.8 ERC additional funding (subcontracting, FSTP and internally invoiced goods and services)*]*	E. Indirect costs						
Forms of funding	Actual costs	Unit costs (usual accounting practices)	Unit costs[5]	Actual costs	Actual costs	Actual costs	Actual costs	[Actual costs]	Unit costs (usual accounting practices)	[Unit costs[5]]	[Unit costs[5]]	[Actual costs]	[Unit costs[5]]	[Actual costs]	[Actual costs]	Flat-rate costs[6]						
	a1	a2	a3	b	c1	c2	c3	[d1a]	d2	[d3]	[d4]	[d5]	[d6]	[d7]	[d8]	e = 0,25 * (a1 + a2 + a3 ~~+b+~~ c1 +c2 + c3 ~~+d1a + d2 + d3 + d4 [+ d5][+ d6]~~ [+d7] ~~[+ d8]~~)	f = a+b+c+d+e	U	g = f*U%	h	m	n
XX – [short name beneficiary/affiliated entity]																						

The beneficiary/affiliated entity hereby confirms that:

The information provided is complete, reliable and true.

The costs and contributions declared are eligible (see Article 6).

The costs and contributions can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 19, 20 and 25).

For the last reporting period: that all the revenues have been declared (see Article 22).

① Please declare all eligible costs and contributions, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace costs/contributions that are found to be ineligible.

[1] See Article 6 for the eligibility conditions. All amounts must be expressed in EUR (see Article 21 for the conversion rules).

[2] If you have also received an EU operating grant during this reporting period, you cannot claim indirect costs - unless you can demonstrate that the operating grant does not cover any costs of the action. This requires specific accounting tools. Please contact us immediately via the Funding & Tenders Portal for details.

[3] See Data Sheet for the reimbursement rate(s).

[4] This is the *theoretical* amount of EU contribution to costs that the system calculates automatically (by multiplying the reimbursement rates by the costs declared). The amount you request (in the column 'requested EU contribution') may be less.

[5] See Annex 2a 'Additional information on the estimated budget' for the details (units, cost per unit).

[6] See Data Sheet for the flat-rate.

ANNEX 5

SPECIFIC RULES

CONFIDENTIALITY AND SECURITY (— ARTICLE 13)

Sensitive information with security recommendation

Sensitive information with a security recommendation must comply with the additional requirements imposed by the granting authority.

Before starting the action tasks concerned, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task. The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary.

For requirements restricting disclosure or dissemination, the information must be handled in accordance with the recommendation and may be disclosed or disseminated only after written approval from the granting authority.

EU classified information

If EU classified information is used or generated by the action, it must be treated in accordance with the security classification guide (SCG) and security aspect letter (SAL) set out in Annex 1 and Decision 2015/444[1] and its implementing rules — until it is declassified.

Deliverables which contain EU classified information must be submitted according to special procedures agreed with the granting authority.

Action tasks involving EU classified information may be subcontracted only with prior explicit written approval from the granting authority and only to entities established in an EU Member State or in a non-EU country with a security of information agreement with the EU (or an administrative arrangement with the Commission).

EU classified information may not be disclosed to any third party (including participants involved in the action implementation) without prior explicit written approval from the granting authority.

ETHICS (— ARTICLE 14)

Ethics and research integrity

The beneficiaries must carry out the action in compliance with:

- ethical principles (including the highest standards of research integrity)

[1] Commission Decision 2015/444/EC, Euratom of 13 March 2015 on the security rules for protecting EU classified information (OJ L 72, 17.3.2015, p. 53).

and

- applicable EU, international and national law, including the EU Charter of Fundamental Rights and the European Convention for the Protection of Human Rights and Fundamental Freedoms and its Supplementary Protocols.

No funding can be granted, within or outside the EU, for activities that are prohibited in all Member States. No funding can be granted in a Member State for an activity which is forbidden in that Member State.

The beneficiaries must pay particular attention to the principle of proportionality, the right to privacy, the right to the protection of personal data, the right to the physical and mental integrity of persons, the right to non-discrimination, the need to ensure protection of the environment and high levels of human health protection.

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- aim at human cloning for reproductive purposes
- intend to modify the genetic heritage of human beings which could make such modifications heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed)
- intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer, or
- lead to the destruction of human embryos (for example, for obtaining stem cells).

Activities involving research on human embryos or human embryonic stem cells may be carried out only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the granting authority.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out in the European Code of Conduct for Research Integrity[2].

This implies compliance with the following principles:

- reliability in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources
- honesty in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way

[2] European Code of Conduct for Research Integrity of ALLEA (All European Academies).

- respect for colleagues, research participants, society, ecosystems, cultural heritage and the environment

- accountability for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices including ensuring, where possible, openness, reproducibility and traceability and refrain from the research integrity violations described in the Code.

Activities raising ethical issues must comply with the additional requirements formulated by the ethics panels (including after checks, reviews or audits; see Article 25).

Before starting an action task raising ethical issues, the beneficiaries must have obtained all approvals or other mandatory documents needed for implementing the task, notably from any (national or local) ethics committee or other bodies such as data protection authorities.

The documents must be kept on file and be submitted upon request by the coordinator to the granting authority. If they are not in English, they must be submitted together with an English summary, which shows that the documents cover the action tasks in question and includes the conclusions of the committee or authority concerned (if any).

VALUES (— ARTICLE 14)

Gender mainstreaming

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action and, where applicable, in line with the gender equality plan. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

INTELLECTUAL PROPERTY RIGHTS (IPR) — BACKGROUND AND RESULTS — ACCESS RIGHTS AND RIGHTS OF USE (— ARTICLE 16)

Definitions

Access rights — Rights to use results or background.

Dissemination — The public disclosure of the results by appropriate means, other than resulting from protecting or exploiting the results, including by scientific publications in any medium.

Exploit(ation) — The use of results in further research and innovation activities other than those covered by the action concerned, including among other things, commercial exploitation such as developing, creating, manufacturing and marketing a product or process, creating and providing a service, or in standardisation activities.

Fair and reasonable conditions — Appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

FAIR principles — ‘findability’, ‘accessibility’, ‘interoperability’ and ‘reusability’.

Open access — Online access to research outputs provided free of charge to the end-user.

Open science — An approach to the scientific process based on open cooperative work, tools and diffusing knowledge.

Research data management — The process within the research lifecycle that includes the organisation, storage, preservation, security, quality assurance, allocation of persistent identifiers (PIDs) and rules and procedures for sharing of data including licensing.

Research outputs — Results to which access can be given in the form of scientific publications, data or other engineered results and processes such as software, algorithms, protocols, models, workflows and electronic notebooks.

Scope of the obligations

For this section, references to ‘beneficiary’ or ‘beneficiaries’ do not include affiliated entities (if any).

Agreement on background

The beneficiaries must identify in a written agreement the background as needed for implementing the action or for exploiting its results.

Where the call conditions restrict control due to strategic interests reasons, background that is subject to control or other restrictions by a country (or entity from a country) which is not one of the eligible countries or target countries set out in the call conditions and that impact the exploitation of the results (i.e. would make the exploitation of the results subject to control or restrictions) must not be used and must be explicitly excluded from it in the agreement on background — unless otherwise agreed with the granting authority.

Ownership of results

Results are owned by the beneficiaries that generate them.

However, two or more beneficiaries own results jointly if:

- they have jointly generated them and
- it is not possible to:
    - establish the respective contribution of each beneficiary, or
    - separate them for the purpose of applying for, obtaining or maintaining their protection.

The joint owners must agree — in writing — on the allocation and terms of exercise of their joint ownership (‘**joint ownership agreement**’), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement or consortium agreement, each joint owner may grant non-exclusive licences to third parties to exploit the jointly-owned results (without any right to sub-license), if the other joint owners are given:

- at least 45 days advance notice and
- fair and reasonable compensation.

The joint owners may agree — in writing — to apply another regime than joint ownership.

If third parties (including employees and other personnel) may claim rights to the results, the beneficiary concerned must ensure that those rights can be exercised in a manner compatible with its obligations under the Agreement.

The beneficiaries must indicate the owner(s) of the results (results ownership list) in the final periodic report.

Protection of results

Beneficiaries which have received funding under the grant must adequately protect their results — for an appropriate period and with appropriate territorial coverage — if protection is possible and justified, taking into account all relevant considerations, including the prospects for commercial exploitation, the legitimate interests of the other beneficiaries and any other legitimate interests.

Exploitation of results

Beneficiaries which have received funding under the grant must — up to four years after the end of the action (see Data Sheet, Point 1) — use their best efforts to exploit their results directly or to have them exploited indirectly by another entity, in particular through transfer or licensing.

If, despite a beneficiary's best efforts, the results are not exploited within one year after the end of the action, the beneficiaries must (unless otherwise agreed in writing with the granting authority) use the Horizon Results Platform to find interested parties to exploit the results.

If results are incorporated in a standard, the beneficiaries must (unless otherwise agreed with the granting authority or unless it is impossible) ask the standardisation body to include the funding statement (see Article 17) in (information related to) the standard.

Additional exploitation obligations

Where the call conditions impose additional exploitation obligations (including obligations linked to the restriction of participation or control due to strategic assets, interests, autonomy or security reasons), the beneficiaries must comply with them — up to four years after the end of the action (see Data Sheet, Point 1).

Where the call conditions impose additional exploitation obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) grant for a limited period of time specified in the request, non-exclusive licences — under fair and reasonable conditions — to their results to legal entities that need the results to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Additional information obligation relating to standards

Where the call conditions impose additional information obligations relating to possible standardisation, the beneficiaries must — up to four years after the end of the action (see Data Sheet, Point 1) — inform the granting authority, if the results could reasonably be expected to contribute to European or international standards.

Transfer and licensing of results

Transfer of ownership

The beneficiaries may transfer ownership of their results, provided this does not affect compliance with their obligations under the Agreement.

The beneficiaries must ensure that their obligations under the Agreement regarding their results are passed on to the new owner and that this new owner has the obligation to pass them on in any subsequent transfer.

Moreover, they must inform the other beneficiaries with access rights of the transfer at least 45 days in advance (or less if agreed in writing), unless agreed otherwise in writing for specifically identified third parties including affiliated entities or unless impossible under the applicable law. This notification must include sufficient information on the new owner to enable the beneficiaries concerned to assess the effects on their access rights. The beneficiaries may object within 30 days of receiving notification (or less if agreed in writing), if they can show that the transfer would adversely affect their access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

Granting licences

The beneficiaries may grant licences to their results (or otherwise give the right to exploit them), including on an exclusive basis, provided this does not affect compliance with their obligations.

Exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights.

Granting authority right to object to transfers or licensing — Horizon Europe actions

Where the call conditions in Horizon Europe actions provide for the right to object to transfers or licensing, the granting authority may — up to four years after the end of the action (see Data Sheet, Point 1) — object to a transfer of ownership or the exclusive licensing of results, if:

- the beneficiaries which generated the results have received funding under the grant
- it is to a legal entity established in a non-EU country not associated with Horizon Europe, and
- the granting authority considers that the transfer or licence is not in line with EU interests.

Beneficiaries that intend to transfer ownership or grant an exclusive licence must formally notify the granting authority before the intended transfer or licensing takes place and:

- identify the specific results concerned
- describe in detail the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU interests, in particular regarding competitiveness as well as consistency with ethical principles and security considerations.

The granting authority may request additional information.

If the granting authority decides to object to a transfer or exclusive licence, it must formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information it has requested).

No transfer or licensing may take place in the following cases:

- pending the granting authority decision, within the period set out above
- if the granting authority objects
- until the conditions are complied with, if the granting authority objection comes with conditions.

A beneficiary may formally notify a request to waive the right to object regarding intended transfers or grants to a specifically identified third party, if measures safeguarding EU interests are in place. If the granting authority agrees, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

Granting authority right to object to transfers or licensing — Euratom actions

Where the call conditions in Euratom actions provide for the right to object to transfers or licensing, the granting authority may — up to four years after the end of the action (see Data Sheet, Point 1) — object to a transfer of ownership or the exclusive or non-exclusive licensing of results, if:

- the beneficiaries which generated the results have received funding under the grant
- it is to a legal entity established in a non-EU country not associated to the Euratom Research and Training Programme 2021-2025 and
- the granting authority considers that the transfer or licence is not in line with the EU interests.

Beneficiaries that intend to transfer ownership or grant a licence must formally notify the granting authority before the intended transfer or licensing takes place and:

- identify the specific results concerned
- describe in detail the results, the new owner or licensee and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or licence on EU interests, in particular regarding competitiveness as well as consistency with

ethical principles and security considerations (including the defence interests of the EU Member States under Article 24 of the Euratom Treaty).

The granting authority may request additional information.

If the granting authority decides to object to a transfer or licence, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

No transfer or licensing may take place in the following cases:

- pending the granting authority decision, within the period set out above
- if the granting authority objects
- until the conditions are complied with, if the granting authority objection comes with conditions.

A beneficiary may formally notify a request to waive the right to object regarding intended transfers or grants to a specifically identified third party, if measures safeguarding EU interests are in place. If the granting authority agrees, it will formally notify the beneficiary concerned within 60 days of receiving notification (or any additional information requested).

Limitations to transfers and licensing due to strategic assets, interests, autonomy or security reasons of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security reasons, the beneficiaries may not transfer ownership of their results or grant licences to third parties which are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless they have requested and received prior approval by the granting authority.

The request must:

- identify the specific results concerned
- describe in detail the new owner and the planned or potential exploitation of the results, and
- include a reasoned assessment of the likely impact of the transfer or license on the strategic assets, interests, autonomy or security of the EU and its Member States.

The granting authority may request additional information.

Access rights to results and background

Exercise of access rights — Waiving of access rights — No sub-licensing

Requests to exercise access rights and the waiver of access rights must be in writing.

Unless agreed otherwise in writing with the beneficiary granting access, access rights do not include the right to sub-license.

If a beneficiary is no longer involved in the action, this does not affect its obligations to grant access.

If a beneficiary defaults on its obligations, the beneficiaries may agree that that beneficiary no longer has access rights.

Access rights for implementing the action

The beneficiaries must grant each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- informed the other beneficiaries that access to its background is subject to restrictions, or

- agreed with the other beneficiaries that access would not be on a royalty-free basis.

The beneficiaries must grant each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

Access rights for exploiting the results

The beneficiaries must grant each other access — under fair and reasonable conditions — to results needed for exploiting their results.

The beneficiaries must grant each other access — under fair and reasonable conditions — to background needed for exploiting their results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to restrictions.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for entities under the same control

Unless agreed otherwise in writing by the beneficiaries, access to results and, subject to the restrictions referred to above (if any), background must also be granted — under fair and reasonable conditions — to entities that:

- are established in an EU Member State or Horizon Europe associated country

- are under the direct or indirect control of another beneficiary, or under the same direct or indirect control as that beneficiary, or directly or indirectly controlling that beneficiary and

- need the access to exploit the results of that beneficiary.

Unless agreed otherwise in writing, such requests for access must be made by the entity directly to the beneficiary concerned.

Requests for access must be made — unless agreed otherwise in writing — up to one year after the end of the action (see Data Sheet, Point 1).

Access rights for the granting authority, EU institutions, bodies, offices or agencies and national authorities to results for policy purposes — Horizon Europe actions

In Horizon Europe actions, the beneficiaries which have received funding under the grant must grant access to their results — on a royalty-free basis — to the granting authority, EU institutions, bodies, offices or agencies for developing, implementing and monitoring EU policies or programmes. Such access rights do not extend to beneficiaries' background.

Such access rights are limited to non-commercial and non-competitive use.

For actions under the cluster 'Civil Security for Society', such access rights also extend to national authorities of EU Member States for developing, implementing and monitoring their policies or programmes in this area. In this case, access is subject to a bilateral agreement to define specific conditions ensuring that:

- the access rights will be used only for the intended purpose and
- appropriate confidentiality obligations are in place.

Moreover, the requesting national authority or EU institution, body, office or agency (including the granting authority) must inform all other national authorities of such a request.

Access rights for the granting authority, Euratom institutions, funding bodies or the Joint Undertaking Fusion for Energy — Euratom actions

In Euratom actions, the beneficiaries which have received funding under the grant must grant access to their results — on a royalty-free basis — to the granting authority, Euratom institutions, funding bodies or the Joint Undertaking Fusion for Energy for developing, implementing and monitoring Euratom policies and programmes or for compliance with obligations assumed through international cooperation with non-EU countries and international organisations.

Such access rights include the right to authorise third parties to use the results in public procurement and the right to sub-license and are limited to non-commercial and non-competitive use.

Additional access rights

Where the call conditions impose additional access rights, the beneficiaries must comply with them.

COMMUNICATION, DISSEMINATION, OPEN SCIENCE AND VISIBILITY (— ARTICLE 17)

Dissemination

Dissemination of results

The beneficiaries must disseminate their results as soon as feasible, in a publicly available format, subject to any restrictions due to the protection of intellectual property, security rules or legitimate interests.

A beneficiary that intends to disseminate its results must give at least 15 days advance notice to the other beneficiaries (unless agreed otherwise), together with sufficient information on the results it will disseminate.

Any other beneficiary may object within (unless agreed otherwise) 15 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the results may not be disseminated unless appropriate steps are taken to safeguard those interests.

Additional dissemination obligations

Where the call conditions impose additional dissemination obligations, the beneficiaries must also comply with those.

Open Science

Open science: open access to scientific publications

The beneficiaries must ensure open access to peer-reviewed scientific publications relating to their results. In particular, they must ensure that:

- at the latest at the time of publication, a machine-readable electronic copy of the published version or the final peer-reviewed manuscript accepted for publication, is deposited in a trusted repository for scientific publications

- immediate open access is provided to the deposited publication via the repository, under the latest available version of the Creative Commons Attribution International Public Licence (CC BY) or a licence with equivalent rights; for monographs and other long-text formats, the licence may exclude commercial uses and derivative works (e.g. CC BY-NC, CC BY-ND) and

- information is given via the repository about any research output or any other tools and instruments needed to validate the conclusions of the scientific publication.

Beneficiaries (or authors) must retain sufficient intellectual property rights to comply with the open access requirements.

Metadata of deposited publications must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent, in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: publication (author(s), title, date of publication, publication venue); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the publication, the authors involved in the action and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for any research output or any other tools and instruments needed to validate the conclusions of the publication.

Only publication fees in full open access venues for peer-reviewed scientific publications are eligible for reimbursement.

Open science: research data management

The beneficiaries must manage the digital research data generated in the action ('data') responsibly, in line with the FAIR principles and by taking all of the following actions:

- establish a data management plan ('DMP') (and regularly update it)

- as soon as possible and within the deadlines set out in the DMP, deposit the data in a trusted repository; if required in the call conditions, this repository must be federated in the EOSC in compliance with EOSC requirements

- as soon as possible and within the deadlines set out in the DMP, ensure open access — via the repository — to the deposited data, under the latest available version of the Creative Commons Attribution International Public License (CC BY) or Creative Commons Public Domain Dedication (CC 0) or a licence with equivalent rights, following the principle 'as open as possible as closed as necessary', unless providing open access would in particular:

    - be against the beneficiary's legitimate interests, including regarding commercial exploitation, or

    - be contrary to any other constraints, in particular the EU competitive interests or the beneficiary's obligations under this Agreement; if open access is not provided (to some or all data), this must be justified in the DMP

- provide information via the repository about any research output or any other tools and instruments needed to re-use or validate the data.

Metadata of deposited data must be open under a Creative Common Public Domain Dedication (CC 0) or equivalent (to the extent legitimate interests or constraints are safeguarded), in line with the FAIR principles (in particular machine-actionable) and provide information at least about the following: datasets (description, date of deposit, author(s), venue and embargo); Horizon Europe or Euratom funding; grant project name, acronym and number; licensing terms; persistent identifiers for the dataset, the authors involved in the action, and, if possible, for their organisations and the grant. Where applicable, the metadata must include persistent identifiers for related publications and other research outputs.

Open science: additional practices

Where the call conditions impose additional obligations regarding open science practices, the beneficiaries must also comply with those.

Where the call conditions impose additional obligations regarding the validation of scientific publications, the beneficiaries must provide (digital or physical) access to data or other results needed for validation of the conclusions of scientific publications, to the extent that their legitimate interests or constraints are safeguarded (and unless they already provided the (open) access at publication).

Where the call conditions impose additional open science obligations in case of a public emergency, the beneficiaries must (if requested by the granting authority) immediately deposit any research output in a repository and provide open access to it under a CC BY licence, a Public Domain Dedication (CC 0) or equivalent. As an exception, if the access would be against the beneficiaries' legitimate interests, the beneficiaries must grant non-exclusive licenses — under fair and reasonable conditions — to legal entities that need the research output to address the public emergency and commit to rapidly and broadly exploit the resulting products and services at fair and reasonable conditions. This provision applies up to four years after the end of the action (see Data Sheet, Point 1).

Plan for the exploitation and dissemination of results including communication activities

Unless excluded by the call conditions, the beneficiaries must provide and regularly update a plan for the exploitation and dissemination of results including communication activities.

SPECIFIC RULES FOR CARRYING OUT THE ACTION (— ARTICLE 18)

Implementation in case of restrictions due to strategic assets, interests, autonomy or security of the EU and its Member States

Where the call conditions restrict participation or control due to strategic assets, interests, autonomy or security, the beneficiaries must ensure that none of the entities that participate as affiliated entities, associated partners, subcontractors or recipients of financial support to third parties are established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) — unless otherwise agreed with the granting authority.

The beneficiaries must moreover ensure that any cooperation with entities established in countries which are not eligible countries or target countries set out in the call conditions (or, if applicable, are controlled by such countries or entities from such countries) does not affect the strategic assets, interests, autonomy or security of the EU and its Member States.

Recruitment and working conditions for researchers

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers[3], in particular regarding:

- working conditions
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and all participants involved in the action are aware of them.

Specific rules for access to research infrastructure activities

Definitions

Research Infrastructures — Facilities that provide resources and services for the research communities to conduct research and foster innovation in their fields. This definition includes the associated human resources, and it covers major equipment or sets of instruments; knowledge-related facilities such as collections, archives or scientific data infrastructures; computing systems, communication networks, and any other infrastructure, of a unique nature and open to external users, essential to achieve excellence in research and innovation. Where relevant, they may be used beyond research, for example

[3] Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).

for education or public services, and they may be 'single-sited', 'virtual' or 'distributed'[4]:

When implementing access to research infrastructure activities, the beneficiaries must respect the following conditions:

- for transnational access:
  - access which must be provided:

    The access must be free of charge, transnational access to research infrastructure or installations for selected user-groups.

    The access must include the logistical, technological and scientific support and the specific training that is usually provided to external researchers using the infrastructure. Transnational access can be either in person (hands-on), provided to selected users that visit the installation to make use of it, or remote, through the provision to selected user-groups of remote scientific services (e.g. provision of reference materials or samples, remote access to a high-performance computing facility).

  - categories of users that may have access:

    Transnational access must be provided to selected user-groups, i.e. teams of one or more researchers (users).

    The majority of the users must work in a country other than the country(ies) where the installation is located (unless access is provided by an international organisation, the Joint Research Centre (JRC), an ERIC or similar legal entity).

    Only user groups that are allowed to disseminate the results they have generated under the action may benefit from the access (unless the users are working for SMEs).

    Access for user groups with a majority of users not working in a EU Member State or Horizon Europe associated country is limited to 20% of the total amount of units of access provided under the grant (unless a higher percentage is foreseen in Annex 1).

  - procedure and criteria for selecting user groups:

    The user groups must request access by submitting (in writing) a description of the work that they wish to carry out and the names, nationalities and home institutions of the users.

    The user groups must be selected by (one or more) selection panels set up by the consortium.

[4] See Article 2(1) of the Horizon Europe Framework Programme Regulation 2021/695.

The selection panels must be composed of international experts in the field, at least half of them independent from the consortium (unless otherwise specified in Annex 1).

The selection panels must assess all proposals received and recommend a short-list of the user groups that should benefit from access.

The selection panels must base their selection on scientific merit, taking into account that priority should be given to user groups composed of users who:

- have not previously used the installation and
- are working in countries where no equivalent research infrastructure exist.

It will apply the principles of transparency, fairness and impartiality.

Where the call conditions impose additional rules for the selection of user groups, the beneficiaries must also comply with those.

- other conditions:

The beneficiaries must request written approval from the granting authority for the selection of user groups requiring visits to the installations exceeding 3 months (unless such visits are foreseen in Annex 1).

In addition, the beneficiaries must:

- advertise widely, including on a their websites, the access offered under the Agreement
- promote equal opportunities in advertising the access and take into account the gender dimension when defining the support provided to users
- ensure that users comply with the terms and conditions of the Agreement
- ensure that its obligations under Articles 12, 13, 17 and 33 also apply to the users
- keep records of the names, nationalities, and home institutions of users, as well as the nature and quantity of access provided to them

- for virtual access:
  - access which must be provided:

The access must be free of charge, virtual access to research infrastructure or installations.

'Virtual access' means open and free access through communication networks to digital resources and services needed for research, without selecting the users to whom access is provided.

The access must include the support that is usually provided to external users.

Where allowed by the call conditions, beneficiaries may in justified cases define objective eligibility criteria (e.g. affiliation to a research or academic institution) for specific users.

- other conditions:

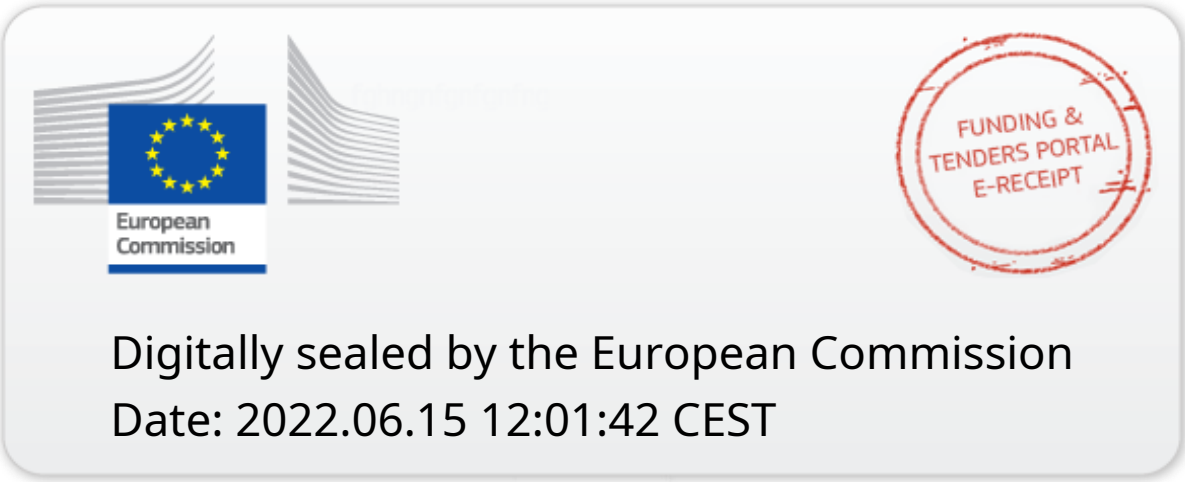
  The beneficiaries must have the virtual access services assessed periodically by a board composed of international experts in the field, at least half of whom must be independent from the consortium (unless otherwise specified in Annex 1). For this purpose, information and statistics on the users and the nature and quantity of the access provided, must be made available to the board.

  The beneficiaries must advertise widely, including on a dedicated website, the access offered under the grant and the eligibility criteria, if any.

  Where the call conditions impose additional traceability[5] obligations, information on the traceability of the users and the nature and quantity of access must be provided by the beneficiaries.

These obligations apply regardless of the form of funding or budget categories used to declare the costs (unit costs or actual costs or a combination of the two).

[5] According to the definition given in ISO 9000, i.e.: "Traceability is the ability to trace the history, application, use and location of an item or its characteristics through recorded identification data." The users can be traced, for example, by authentication and/or by authorization or by other means that allows for analysis of the type of users and the nature and quantity of access provided.



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