EPITA project proposal

Enabling Partnerships for Innovation & accelerator Technology Advancement

Toms Torims & Maurizio Vretenar

22.10.2025

EPITA

ἐπίτα – in Greek language

Enabling
Partnerships
for
Innovation
&
accelerator
Technology
Advancement

Meaning

EPI - ἐπί (epi) functions as an intensifying prefix

TA – τα (ta) strengthens the meaning of *ταχύνω* (tachýno), which means "to quicken" or **"to make swift."**

ἐπιταχύνω literarly means "to really quicken" or **"to accelerate"**

The Greek word "έπειτα" (épeita) means then, afterwards, or next. It's used to indicate a sequence of events or actions – **thereupon**

Specific requirements

1. Implement significant parts of a research infrastructure technology **roadmap** (ESPP, LEAPS, others) or develop new advanced applications.
2. Address **prototyping** of high-performance systems needed to upgrade the involved research infrastructures or construct their next generation.
3. Include **co-creation** with **industrial partners** from the earliest possible stage (as beneficiaries, subcontractors, PCP partners, or with letters of engagement) .
4. Respond to the needs of several research infrastructures, possibly of different types.
5. Build on results from previous projects and avoid overlaps with ongoing projects.
6. Consider resource efficiency and environmental impacts.

TIARA guidelines for the proposal

Different from previous projects, the EPITA required to have:

- A mixture of top-down and bottom-up topics: explore recognised critical R&D topics with appropriate funding, while keeping the creativity and innovation dimension of a bottom-up call to the community.
- Less partners than in I.FAST, avoiding beneficiaries with less that 100 kEUR EC funding (50 kEUR for industry).
- Rate of matching funds (was 50% for academia, 30% for industry) reduced to **1/3 (33%)** for research institutions, **20%** for industry.
- No more Networks, only in the frame of defining Strategies or Roadmaps – and more space to prototyping with industry.

Preparation

- Contacts between TIARA and the RI Unit of DG/RTD have started in 2022, with the goal of agreeing on the main features of a “pilot” call in the Work Programme 2025/27.
- TIARA meeting on January 10th enlarged to the accelerator user communities (with and without roadmaps but giving priority to ESPP and LEAPS).
- Selected 7 “enabling technologies” for the top-down part. Conveners identified, preliminary proposals submitted, analyzed by TIARA.

TIARA selected topics – top/down Priorities expressed by the communities

1. SC thin films for RF cavities
2. HTS magnets
3. Additive manufacturing
4. SCRF Surface treatments
5. Permanent magnets for accelerators
6. Laser driven acceleration
7. High brightness electron injectors

Preparation

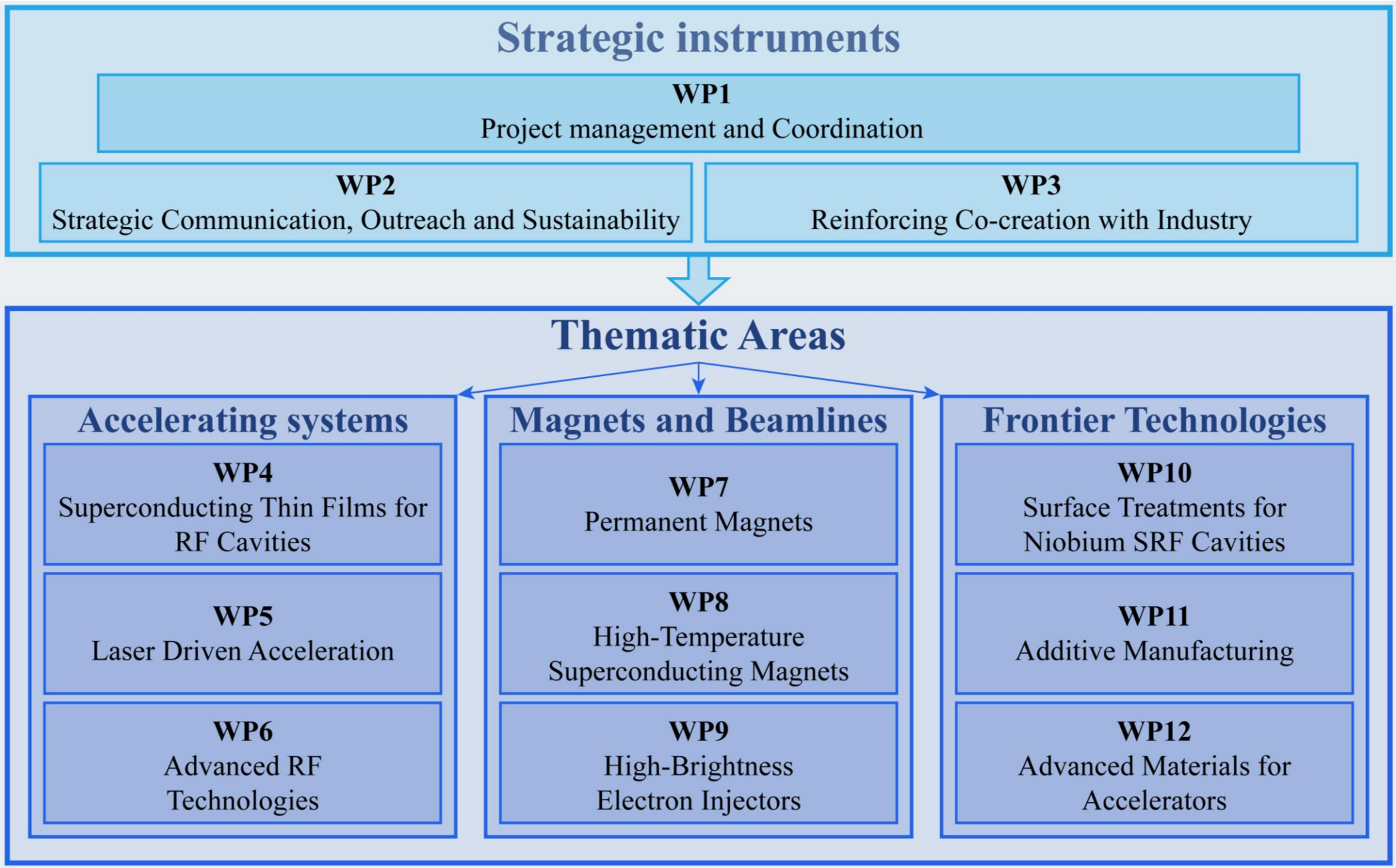
- Call for proposals for bottom-up part “emerging technologies” received **45 proposals (!)** for a total request of 17 MEUR – call oversubscribed by a factor 5.7 (in budget). Only 8 proposals can be accepted, 17.8% of the total.
- An evaluation committee set up by TIARA has ranked the proposals.
- The 8 selected proposals have been merged with existing Work Packages and formed 2 new Work Packages.
- All information available on https://ifast-project.eu/proposal-infra-tech-02

Selected by evaluation committee – bottom/up

1. Chromium-graphite development
2. Phase-locked magnetrons for SC-RF
3. Plasma-based bending
4. HTS for high gradient RF
5. Pulsed electron lens for space charge compensation
6. Fast tuning for beam loading compensation
7. Development new target materials
8. Laser and plasma acceleration, DLA structures

Work Packages

WP1	Project Management	Toms Torims	CERN	IEIO
WP2	Strategic Communication, Outreach and Sustainability	Philip Burrows	UOXF	UK
WP3	Reinforcing Co-creation with Industry	Carsten Welsch	ULIV	UK
WP4	Superconducting Thin Films for RF Cavities	Oleg Malyshev & Thomas Proslier	UKRI & CEA	UK & France
WP5	Laser Driven Acceleration	Andreas Maier	DESY	Germany
WP6	Advanced RF Technologies	Adolfo Velez	HZB	Germany
WP7	Permanent Magnets	Raffaella Geometrante	KYMA	Italy
WP8	High-Temperature Superconducting Magnets	Ernesto De Matteis	INFN	Italy
WP9	High-Brightness Electron Injectors	Paolo Craievich & Thomas Lucas	PSI	Switzerland
WP10	Surface Treatments for Niobium SRF Cavities	David Longuevergne	CNRS	France
WP11	Additive Manufacturing	Andris Ratkus	RTU	Latvia
WP12	Advanced Materials for Accelerators	Federico Carra	CERN	IEIO


Strategic instruments
WP1
Project management and Coordination
WP2
Strategic Communication, Outreach and Sustainability
WP3
Reinforcing Co-creation with Industry
Thematic Areas
Accelerating systems
WP4
Superconducting Thin Films for RF Cavities
WP5
Laser Driven Acceleration
WP6
Advanced RF Technologies
Magnets and Beamlines
WP7
Permanent Magnets
WP8
High-Temperature Superconducting Magnets
WP9
High-Brightness Electron Injectors
Frontier Technologies
WP10
Surface Treatments for Niobium SRF Cavities
WP11
Additive Manufacturing
WP12
Advanced Materials for Accelerators

Strategic Instruments

Work Package	Task		Leader
WP1 – Project Management Toms Torims CERN	1.1	Management, Coordination and Internal Communication	Toms Torims, CERN
	1.2	Dissemination and Impact Generation	Tobia Romano, PoliMi
	1.3	Ethics, Integrity and Diversity	Yiota Foka, GSI
	1.4	Roadmap Follow-up and Coordination with Other Technology Clusters	José Manuel Pérez, CIEMAT
WP2 – Strategic Communication, Outreach and Sustainability Philip Burrows, UOXF	2.1	Strategic Communication, Outreach and Public Value	Philip Burrows, UOXF
	2.2	Challenge-Based Innovation, Capacity Building in Accelerator Technology	Nicolas Delerue, CNRS
	2.3	Sustainability	Denise Völker, DESY
WP3 – Reinforcing Co-creation with Industry Carsten Welsch ULIV	3.1	Transfer of Knowledge and Technology to Industry	Carsten Welsch, ULIV
	3.2	Accelerator Industry Permanent Forum (AIPF)	Isabel Bejar Alonso, CERN
	3.3	Accelerators for Health and Societal Benefit	Alberto Degiovanni, RTU
	3.4	Future Accelerators	Frank Zimmermann, CERN

Accelerating Systems

Work Package	Task		Leader
WP4 – Superconducting Thin Films for RF Cavities Oleg Malyshev & Thomas Proslier UKRI & CEA	4.1	Strategy and Industrialisation	Reza Valizadeh, UKRI
	4.2	Horizontal Cavity Integration and RF Tests	Oliver Kugeler, HZB
	4.3	1.3 GHz Cavity Production and Coating	Cristian Pira, INFN
	4.4	Superconducting Thin Film Development	Thomas Proslier, CEA
WP5 – Laser Driven Acceleration Andreas Maier DESY	5.1	Fast Stabilisation	Kevin Casseau, CNRS
	5.2	Precision Beam Sampler	Leonida Gizzi, INO/CNR
	5.3	Autonomous Tuning	Andreas Maier, DESY
	5.4	Active Plasma For Bending	Riccardo Pompili, INFN
	5.5	Co-Propagating Dielectric Laser Accelerator Structures	Giuseppe Torrisi, INFN
WP6 – Advanced RF Technologies Adolfo Velez HZB	6.1	Locked Magnetron Sources for SRF Systems	Adolfo Velez, HZB
	6.2	FE-FRT Ultra High Rep-Rate Frequency Shifting Applications	Nicholas Shipman, HZB
	6.3	High-Temperature Superconductors for High-Gradient RF	Sergio Calatroni, CERN

Magnets and Beamlines

Work Package	Task		Leader
WP7 – Permanent Magnets Raffaella Geometrante Kyma	7.1	Performance Review and Accelerator Quadrupole Specification	Ben Shepherd, UKRI
	7.2	Modular ZEPTO Product Line Engineering	Raffaella Geometrante, Kyma
	7.3	Prototype High-Field Permanent Magnet Wiggler (PMW) for Damping Rings	Yannis Papaphilippou, CERN
WP8 – High Temperature Superconducting Magnets Ernesto De Matteis INFN	8.1	Coordination and HTS Strategy	Ernesto De Matteis, INFN
	8.2	HTS Conductor R&D at 20 K	Fernando Toral, CIEMAT
	8.3	Energy-Saving Split Coil at 20 K	Ernesto De Matteis, INFN
	8.4	HTS Cable for Fast Ramping Operation	Tiemo Winkler, GSI
WP9 – High-Brightness Electron Injectors Paolo Craievich PSI	9.1	Chirping Cavity	David Alesini, INFN
	9.2	Transverse Deflecting Structure and High-Power Validation of RF Devices	Thomas Lucas, PSI

Frontier Technologies

Work Package	Task		Leader
WP10 – Surface Treatments for Niobium SRF Cavities David Longuevergne CNRS	10.1	Surface Preparation for High-Q at High-G	Julia Goedecke, DESY
	10.2	HPR and Cleanroom Assembly Improvements	David Longuevegne, CNRS
	10.3	Performance Preservation and Recovery	Daniele Sertore, INFN
	10.4	Test and Diagnostics	Enrico Cenni, CEA
WP11 – Additive Manufacturing Andris Ratkus RTU	11.1	Development of AM for Accelerators	Pietro Rebesan, INFN
	11.2	Development and Testing of RFQ Prototype	Maurizio Vedani, PoliMi
	11.3	Development and Testing of an IH-DTL Prototype	Hendrik Hähnel, GUF
	11.4	Pulsed Space Charge Lens Demonstrator	Kathrin Schulte-Urlichs, GSI
WP12 – Advanced Materials for Accelerators Federico Carra CERN	12.1	Carbide-Carbon Materials with High Thermomechanical Properties	Federico Carra, CERN
	12.2	High-Entropy Alloys (HEAs) via Additive Manufacturing and FAST/SPS for Radiation-Resistant Components in High-Power Accelerator Systems	Marilena Tomut, GSI

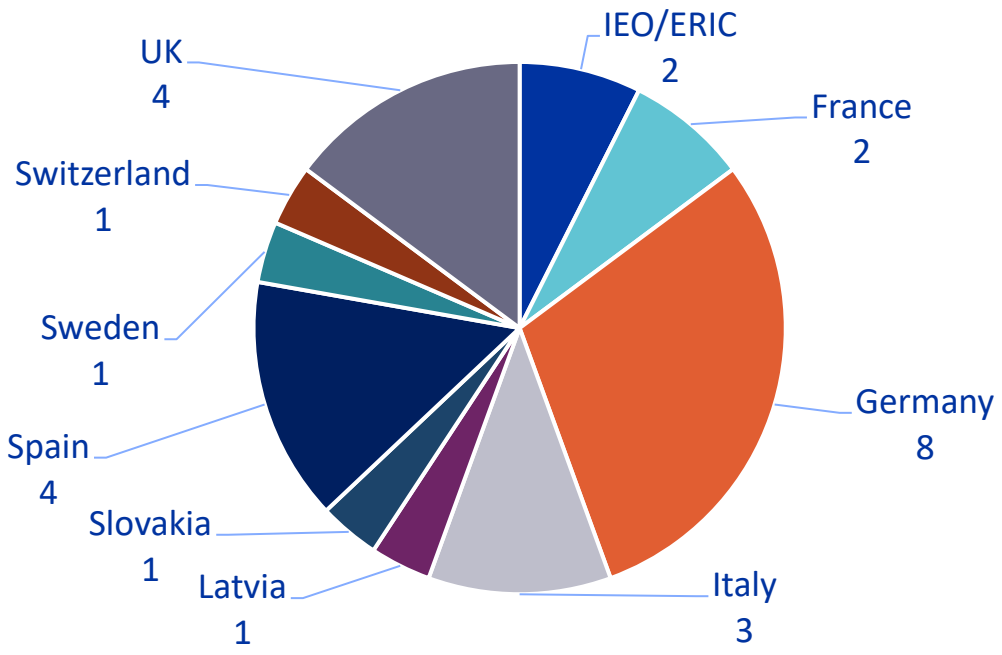
Composition of Consortium

- 43 beneficiaries (26 research institutions + 17 industries) from 16 countries
  + 3 Associated Partners; + numerous Collaborators
- **10M EUR** of EU contribution + **~11M EUR** of matching funds = **~21 M EUR** of **full costs**
- 13 WP coordinating organizations (11 research institutions + 1 industry) from 6 countries + CERN.
- 6 infrastructure operators (22%),10 research laboratories (37%),10 universities (41%)
- All technological WPs (25/31 technological tasks) involve beneficiary industries with a budget request of ~20% of total EC contribution.

Research Institutions

Infrastructure Operators

1. CERN
2. ESS
3. DESY
4. GSI
5. HZB
6. PSI



Research Laboratories

1. CNRS
2. CIEMAT
3. CEA
4. CNR
5. Fraunhofer IWS
6. IEE
7. CSIC-ICMAB
8. AIDIMME
9. INFN
10. UKRI

Universities

1. GUF
2. PoliMi
3. QMUL
4. RTU
5. FAU
6. ULIV
7. WWU
8. UOXF
9. UPV/EHU
10. UU

26 research institutions from 9 countries + CERN/ESS

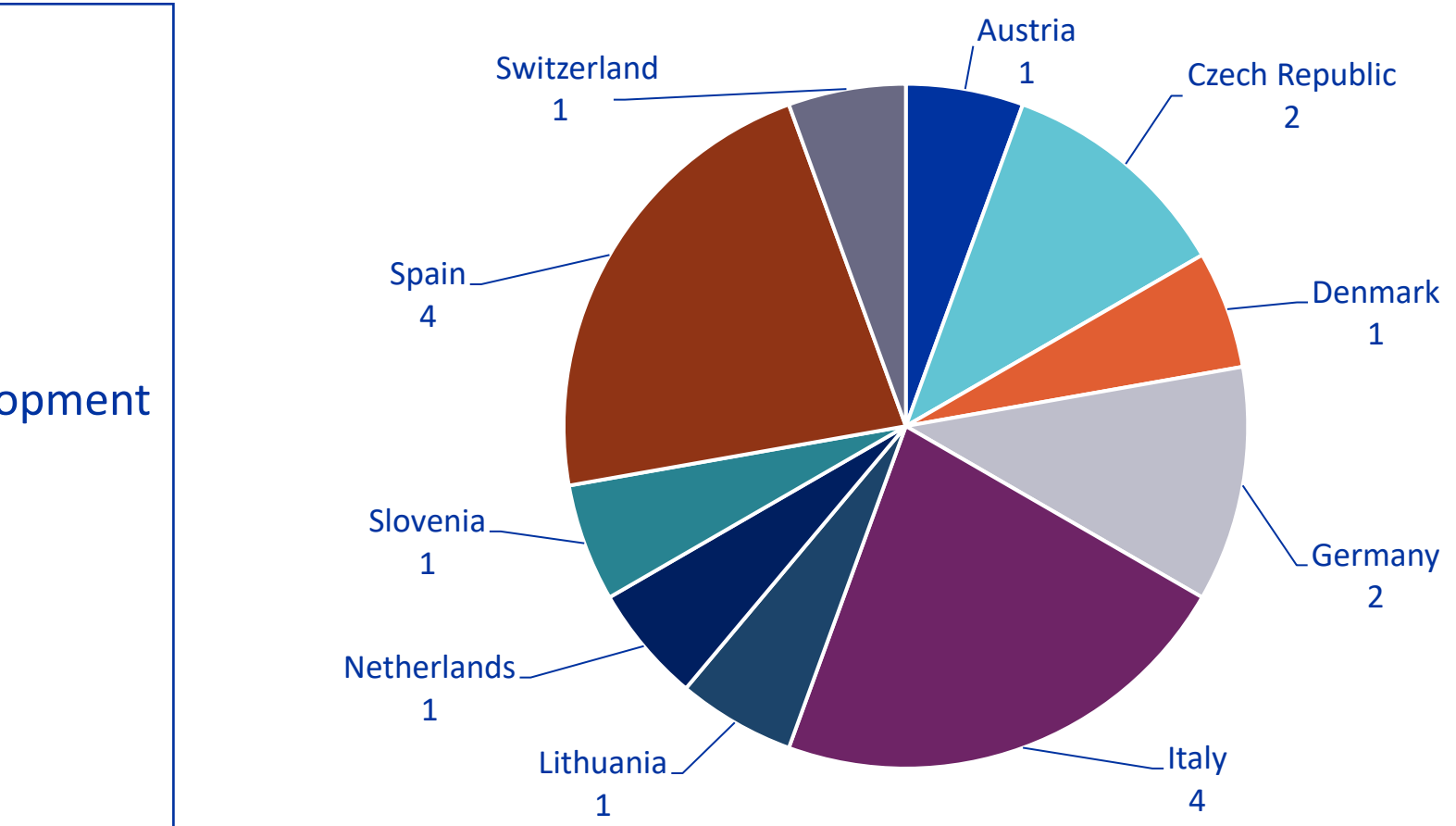
6 infrastructure operators - 22%

10 research laboratories - 37%

10 universities - 41%

Industrial Partners

1. Arquimea Research Center
2. Comeb S.R.L.
3. Instrumentation Technologies
4. KYMA SpA
5. Nanoker Research
6. OPTOMAN
7. Proactive Research and Development
8. Research Instruments
9. RHP Technology GmbH
10. Rösler Italiana S.R.L.
11. SAFINA, a.s.
12. SenSiC GmbH
13. Subra A/S
14. Tekniker
15. VDL Enabling Technologies Group
16. VITAVE Tech
17. Zanon

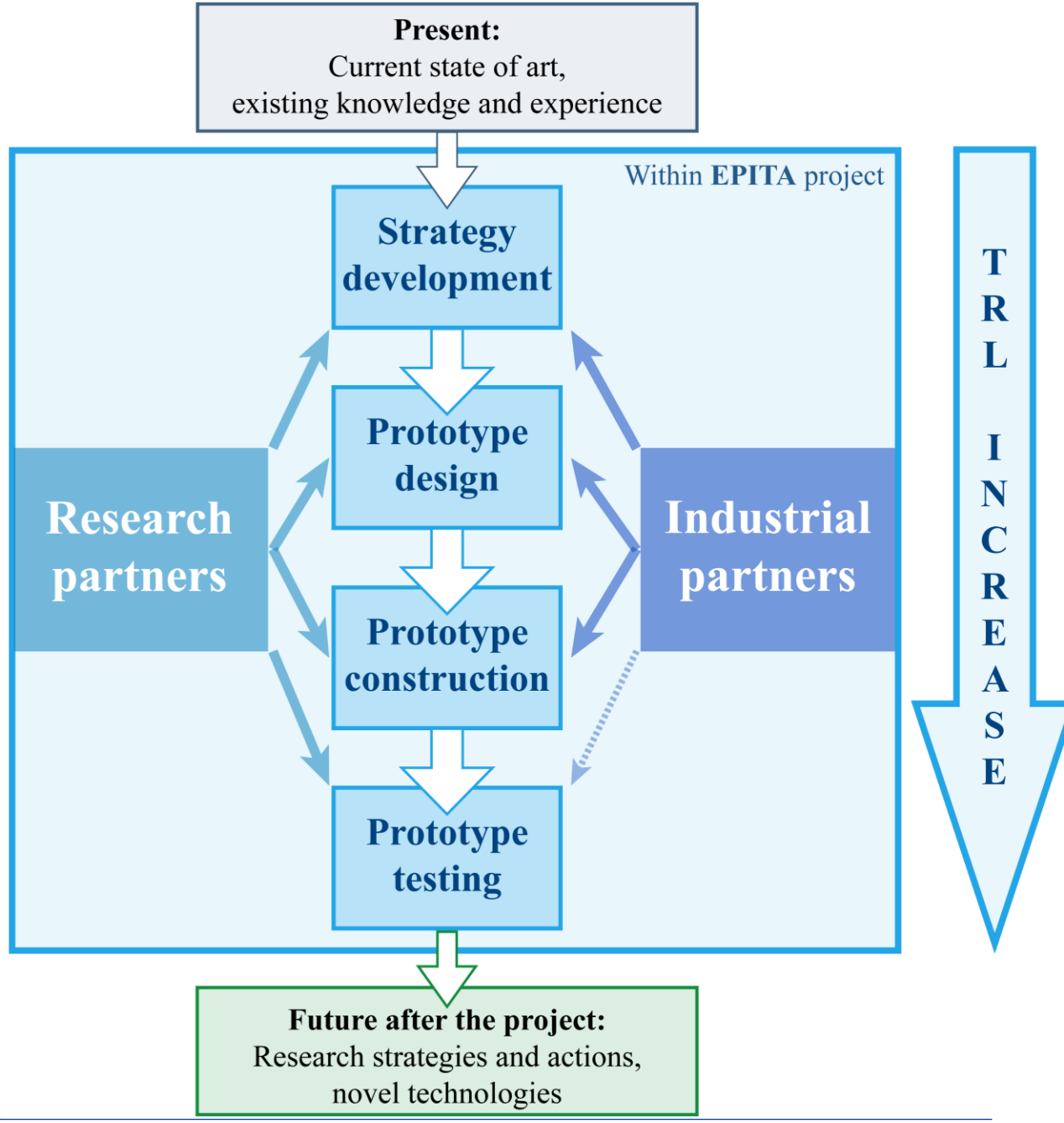


17 industries from 10 countries

All technological WPs (25/31 technological tasks) involve beneficiary industries

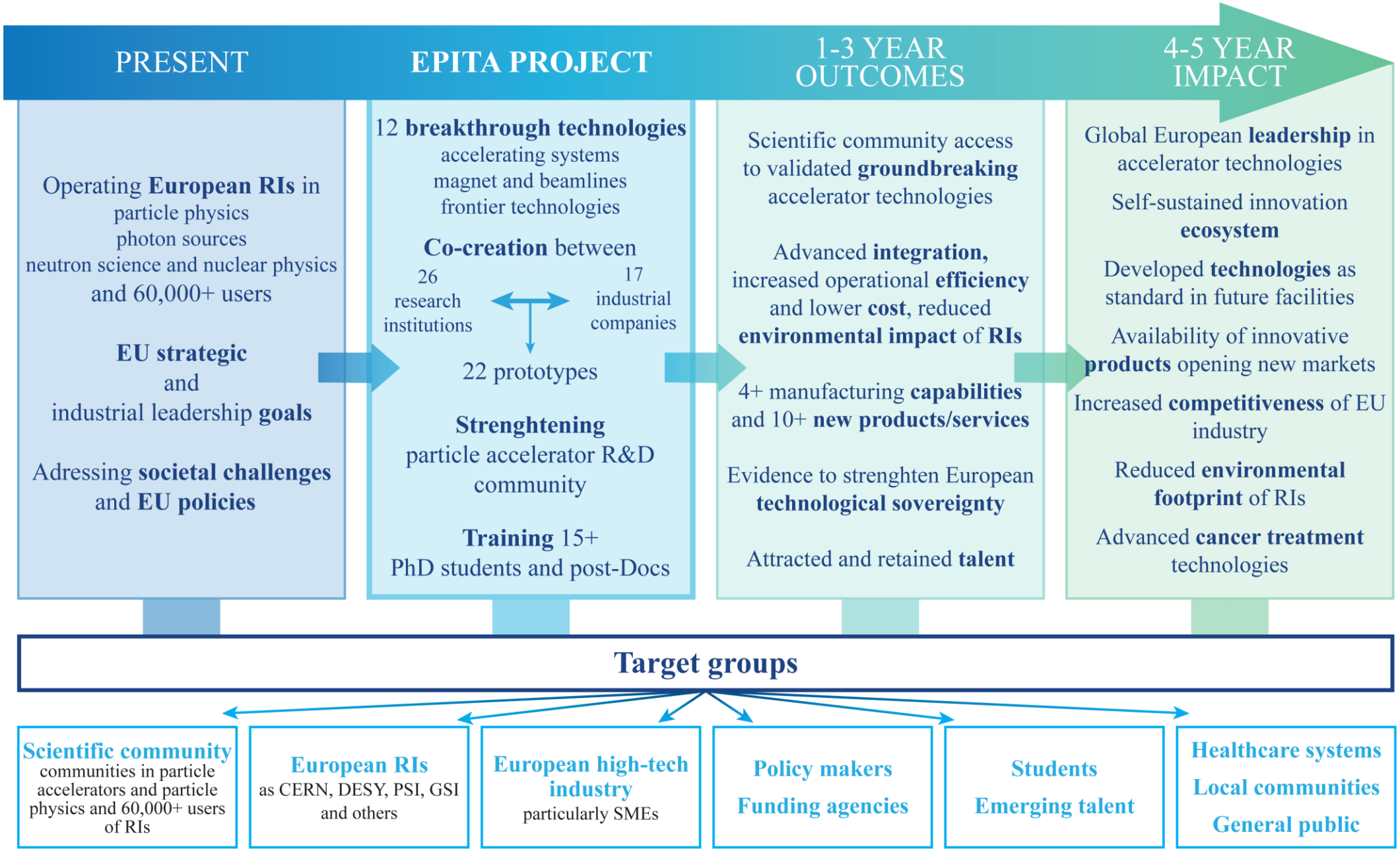
EPITA Collaborative R&D methodology

“This comprehensive pool of expertise and technical capacity shared across EPITA’s WP’s and Tasks, will allow to deliver the innovative technologies that will constitute the backbone of the next generation of particle accelerators.”



22 prototypes in co-creation with industry

1. SRF cryomodule with single-cell 1.3 GHz cavity
2. Single-cell 1.3-GHz Nb_3Sn coated copper cavities
3. Light-weight SiC laser mirror with stress-compensating coating
4. Plasma-based beam bending curved capillary
5. copropagating dielectric laser structure
6. High-efficiency 1.3 GHz magnetron
7. High repetition rate ferro-electric fast reactive tuner
8. High repetition rate high voltage pulser
9. Disc prototype with soldered wide HTS tapes
10. Tuneable permanent magnet quadrupole ZEPTO-PRO
11. Permanent magnet wiggler
12. HTS split coil magnet with integrated cryogen-free cooling system
13. Fast-ramping HTS cable
14. Chirping cavity (TW S-band structure with 8-10 cells)
15. Multi-cell S-band transverse deflecting structure
16. HPR set-up with cobot fully operational and qualified
17. High-Q high-G cavity prototype fully qualified
18. Additively manufactured RFQ linac structure
19. Additively manufactured interdigital IH-DTL structure
20. low-loss collector for electron guns
21. Carbide-Carbon beam absorbers
22. refractory high entropy alloy targets


PRESENT
EPITA PROJECT
1-3 YEAR OUTCOMES
4-5 YEAR IMPACT
Operating European RIs in particle physics photon sources neutron science and nuclear physics and 60,000+ users
EU strategic and industrial leadership goals
Adressing societal challenges and EU policies
12 breakthrough technologies accelerating systems magnet and beamlines frontier technologies
Co-creation between
26 research institutions
17 industrial companies
22 prototypes
Strenghtening particle accelerator R&D community
Training 15+ PhD students and post-Docs
Scientific community access to validated groundbreaking accelerator technologies
Advanced integration, increased operational efficiency and lower cost, reduced environmental impact of RIs
4+ manufacturing capabilities and 10+ new products/services
Evidence to strenghten European technological sovereignty
Attracted and retained talent
Global European leadership in accelerator technologies
Self-sustained innovation ecosystem
Developed technologies as standard in future facilities
Availability of innovative products opening new markets
Increased competitiveness of EU industry
Reduced environmental footprint of RIs
Advanced cancer treatment technologies
Target groups
Scientific community
communities in particle accelerators and particle physics and 60,000+ users of RIs
European RIs
as CERN, DESY, PSI, GSI and others
European high-tech industry
particularly SMEs
Policy makers
Funding agencies
Students
Emerging talent
Healthcare systems
Local communities
General public

home.cern

Research Institutions – Main activities

AIDIMME
- Development of AM for accelerators

CEA
- Design cryostat for testing of 1.3 GHz cavities at 4.2 K
- Superconducting thin film coating
- Nb_3Sn targets via Spark Plasma Sintering
- SRF cavity diagnostics

CIEMAT
- Review accelerator community roadmaps
- HTS conductor characterisation

CNRS
- Challenge-Based Innovation
- Cobots for cleanroom processes

Fraunhofer IWS
- Development of AM for accelerators

Uppsala University
- Field-emission properties of HTS tapes at low temperature

GSI
- Ethics and data protection
- Fast-ramping cable testing
- CrGr beam absorber irradiation tests

GUF
- Development of AM for accelerators

DESY
- Framework for sustainability in Ris
- Autonomous Tuning of laser systems

Research Institutions – Main activities

HZB

- Test Nb_3Sn-coated SRF cavity HoBiCaT facility
- TESLA-type cavity with ports for power coupler and pickup antenna
- Magnetron testing with SRF cavities
- Novel FE-FRTs

INFN

- Production of 1.3 GHz cavities
- Superconducting thin film coating
- Nb_3Sn targets via infusion
- Curved capillary for beam bending
- Co-propagating DLA structures
- 7 T split coil magnet operating at 20 K
- S-band chirping cavity

PoliMi

- Dissemination plan for project results
- Development of AM for accelerators

PSI

- Multi-cell S-band TDS

RTU

- Medical and societal applications of accelerator technologies
- Development of AM for accelerators

ULIV

- Knowledge and technology transfer to industry

UKRI

- Strategy to industrialize thin-film SRF technology
- Superconducting thin film coating
- Nb_3Sn targets via cold spray

UOXF

- Communication strategy and implementation plan

Research Institutions – Main activities

ESS
- Deployment and validation of surface-treated Nb SRF cavities on cryomodules
- Implementation of high-resolution diagnostic tools for SRF cavities

CNR
- Testing of beam samplers for active laser stabilization

IEE
- R&D on superconducting thin film deposition and post thermal treatments
- Manufacturing and characterization of HTS cable

CSIC-ICMAB
- RF characterization of large HTS tapes

QMUL
- Cathode design for 1.3 GHz magnetron

FAU
- Design co-propagating DLA structures and test with electron beams in sub-relativistic and relativistic regimens

University of Münster
- Pre-Irradiation structural and thermo-mechanical characterization of refractory high-entropy alloys

UPV/EHU
- Low-level RF testing of 1.3 GHz magnetron

CERN's main activities

WP1
- Project management, coordination and internal communication
- Dissemination plan for project results
- Ethics and data protection

WP2
- Accelerator Industry Permanent Forum
- Communication strategy and implementation plan
- Challenge-Based Innovation

WP3
- Knowledge and technology transfer to industry
- Accelerator Industry Permanent Forum
- Medical and societal applications of accelerator technologies
- Framework for collaborative R&D to advance novel accelerator designs

WP6
- Test HTS samples at 3 GHz

WP7
- Prototype high-field PMW for damping rings

WP8
- Cold testing of HTS conductors

WP11
- Testing of AM accelerator components

WP12
- CrGr beam absorbers
- Testing of refractory high-entropy alloys

Industries – Main activities

Arquimea
- Cryogenic testing of 7 T split coil magnet

COMEB
- Chirping cavity machining

Instrumentation Technologies
- High-resolution cavity beam position monitor

KYMA
- Challenge-Based Innovation
- Modular ZEPTO product line engineering

Nanoker
- CrGr beam absorber sintering
- Refractory high-entropy alloys

Optoman
- Optical stress-compensating coatings for SiC-based fast mirrors
- Coatings for 800 nm high-energy laser systems

ProactiveRD
- PMW design

Research Instruments
- High-power coupler integration in TESLA-type cavity

RHP
- CrGr beam absorber sintering
- Refractory high-entropy alloys

Rösler
- Surface finishing of AM accelerator components

SAFINA
- Pulsed space charge lens demonstrator

SenSic
- SiC for DLA structure manufacturing

SUBRA
- HTS tape production

Tekniker
- Anode for 1.3 GHz magnetron

VDL-ETG
- TDS precision machining

VITAVE
- FE-FRTs pulser design

Zanon
- Production of 1.3 GHz cavities