Structuring the particle accelerator community

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Industry Innovation Workshop

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Structuring the particle accelerator community

Outline

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2. Accelerator R&D and the EC
3. What is missing and what next
4. The Industry Innovation Workshop
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The use of Accelerators

The development of state of the art accelerators is essential for many fields of science (fundamental, applied or industrial)

Research accelerators

- **R&D, Education&Training and Innovation are fundamental pillars.**
- **Integration of international effort is essential.**

carried out with accelerators

This « market » represents ~15 000 M€ for the next 15 years, i.e. ~1 000M€/year

Clinical accelerators

- **radiotherapy, electron therapy, hadron (proton/ion)therapy…**

Industrial accelerators

- **ion implanters, electron beam and X-ray irradiators, radioisotope production…**

This market represents ~3 000M€/year and is increasing at a rate of ~10% /year

Accelerator R&D in Europe (History and today's Organization)

Established in 2002 from the initiative of several labs.

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http://esgard.lal.in2p3.fr

*** Representing consortium of Polish institutes**
**** Representing consortium of Nordic institutes**

ESGARD mandate: develop and implement a Strategy to optimize and enhance the outcome of the Research and Technical Development in the field of accelerator physics in Europe, by:

- ***promoting mutual coordination and facilitating the pooling of European resources***
- ***promoting a coherent and coordinated utilization and development of infrastructures***
- ***promoting inter-disciplinary collaboration including industry***

This developed strategy led to the preparation and implementation of a coherent set of collaborative projects using the incentive funding EC Framework Programme.

From ESGARD to TIARA

Strengthen the role of the European consortium and formalize it through a MoU

Established in 2015 and superseding ESGARD

CEA (FR), CERN (INO), CNRS (FR), CIEMAT(SP), DESY (DE) , GSI (DE), INFN (IT), PSI (CH), STFC (UK), Uppsala U (SW)*, IFJ-PAN (PL)**

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TIARA is a consortium, the purpose of which is to exchange expertise and to facilitate and support the setting-up of joint R&D programmes and education and training activities in the field of Accelerator Science and Technology in Europe.

Concerning TIARA activities, Key Words are:

- Collaborative projects for Accelerator Science and Technology
- Development of R&D infrastructure and access
- Innovation with industry
- Education and Training
- Dissemination and Outreach

To build future accelerators, a strong and sustainable effort is indispensable.

Step 1: *Design Studies (CDR level)*

First step to be visible at the EC level and to enter the strategic infrastructure Roadmap of the European Union

Be included in the ESFRI roadmap

Step 2 : *Preparatory Phase (TDR level)*

Technical, managerial and Political Preparation Phase for the construction of the infrastructure

Medium TRLs (3-5)

Step 3: *Implementation*

Launch of the construction including technology transfer and industry involvement

High TRLs (>5)

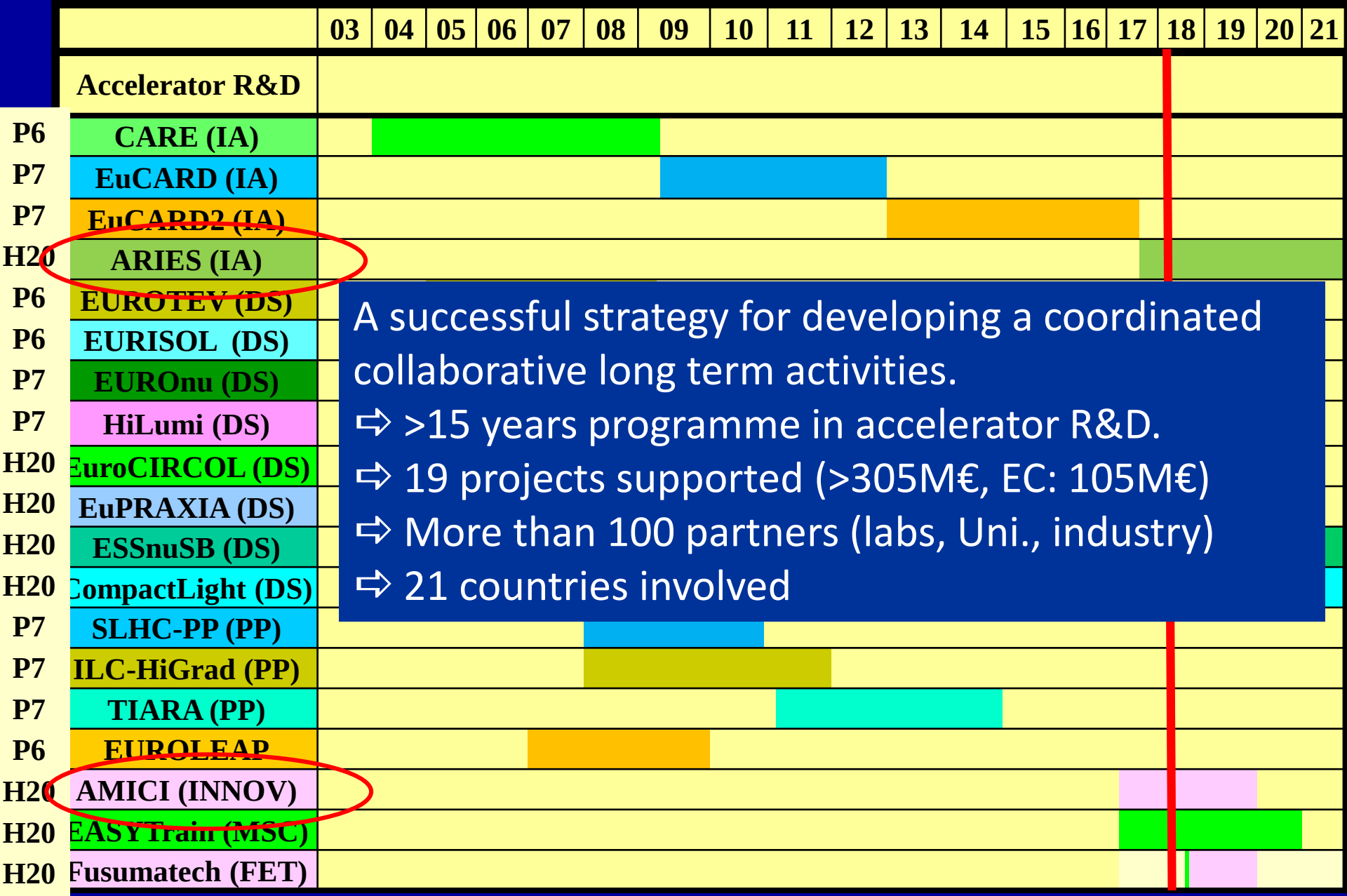
Step 0: Basic R&D, Assessment of new concepts

⇨Integrating activities

Low TRLs (<3)

For each of these steps, there are EC calls within European Framework Programmes that are useful incentives

Past and on-going projects supported by ESGARD/TIARA



Accelerator R&D for European Science and Society (IA)

- Europe leadership in particle accelerators by **developing novel concepts and technologies** to improve the performance of the present and next-generation accelerators.
- Provide European researchers and industry with **access to top-class accelerator research infrastructures** needed for the development of new technologies.
- Enlarge and advance the **integration of the European particle accelerator community** through new geographical and interdisciplinary connections between the operators of accelerator infrastructures, universities and **industries**.
- **Involving industry** in the setting up of co-innovation programmes and in the selection and promotion of innovative technologies, and by supporting the **societal applications of accelerators**.
- Ensure the long term **sustainability of particle accelerator research** by defining roadmaps for the future integration of accelerator facilities and for the scientific and technical training of young European researchers.

Management, dissemination, ensuring sustainability (MADISU)
Training, Communication and Outreach for Accelerator Science (TCO)
Industrial and Societal Applications (ISA)
Efficient Energy Management (EEM)
European Network for Novel Accelerators (EuroNNAAC)
Accelerator Performance and Concepts (APEC)
Rings with Ultra-Low Emittance (RULE)
Advanced Diagnostics at Accelerators (ADA)
Magnet Testing
Material Testing
Electron and proton beam testing
Radio Frequency Testing
Plasma beam testing
Promoting Innovation (PI)
Thin Film for Superconducting RF Cavities SRF (TF-SRF)
Intense, RF modulated E-beams (IRME)
Materials for extreme thermal management
Very High Gradient Acceleration Techniques (VHGAT)

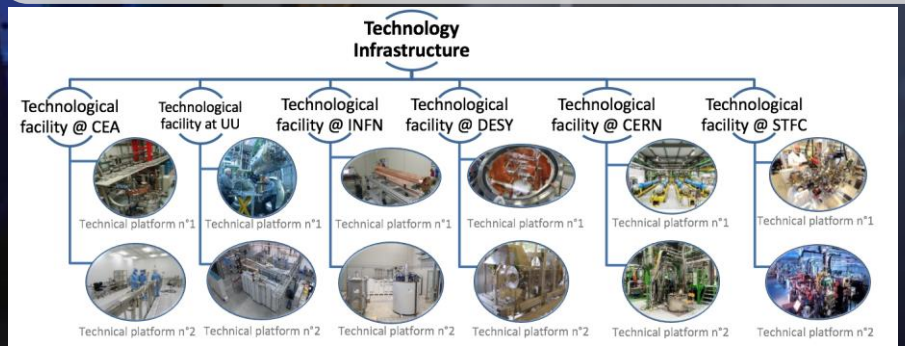
Accelerator and Magnet Infrastructure for Cooperation and Innovation (CSA)

Its general goal is to **propose a model for the profitability and sustainability of the Technological Facilities** dedicated to **Accelerators and Superconducting Magnets** in Europe, based on the engagement of the European Commission, the National Agencies and the Industry, and serving

Sustainability of particle **accelerator research** is the main objective of ARIES; sustainability of the **particle accelerator Technology Infrastructure** is the main goal of AMICI.

the global market, as qualified suppliers of components for accelerators and big superconductor magnets,

- and also **in the development of innovative applications in advanced sectors such as healthcare, energy, environment and space**.



These projects have been and are instrumental

For collaborating, integrating, knowledge building and innovating

For fostering the community to carry out Accelerator R&D in a collaborative and sustainable manner

For enabling smaller institutes/universities (>100 partners) to gain knowledge and experience by collaborating with large institutes and to access world class infrastructures

For enabling coordinated and efficient means for a regionally balanced scientific and technological development (21 countries).

For triggering new ideas and developing further novel concept, e.g. crab waist scheme, plasma acceleration

For allowing Europe to build expertise in domains where it was behind, e.g. Nb3Sn magnet, HTS links, PWFA…

These projects have been and are instrumental

For helping improving accelerator R&D infrastructures, e.g.

⇨ **CTF3, SLS, SPARC, ICTF…**

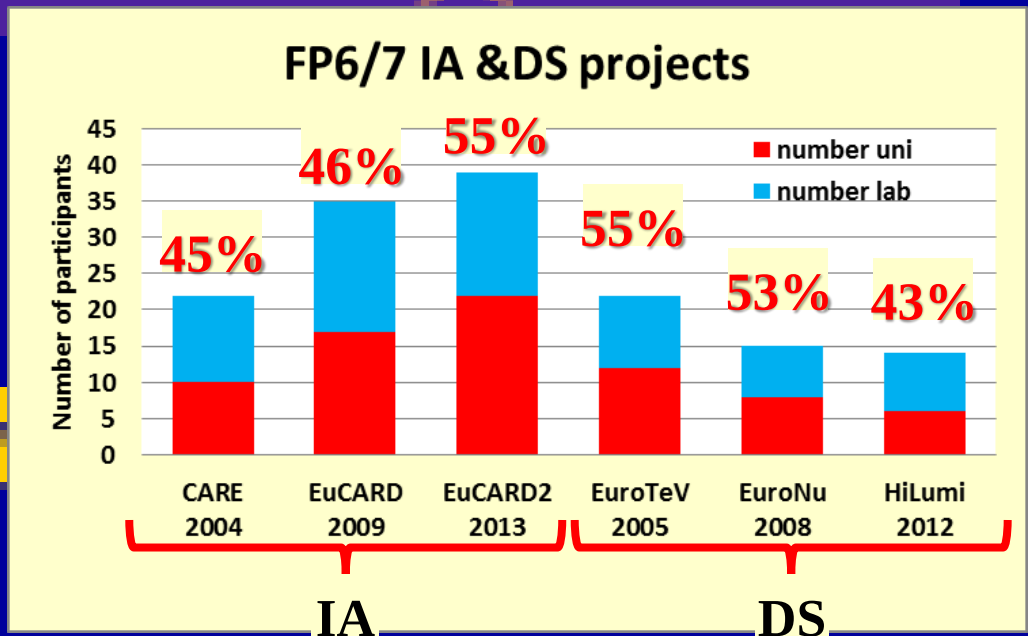
For helping enabling the improvement or launch of large infrastructure projects, e.g.

⇨ **Linac4, HL-LHC, FAIR, ESS**

⇨ **ELBE, FLASH, XFEL**

⇨ **…**

- **Projects have integrated both labs and Universities: All major actors are involved**
- **Same ratio for H2020 projects which also includes industrial partners**



Summary

The Accelerator Community in Europe is promoting and developing a consistent collaborative programme in the field of Accelerator Science and Technologies (19 projects granted). Strong and very advanced integrated community for R&D in AS&T is now very active and efficient.

It embraces most of the aspects, including:

- **Brainstorming of new ideas through Networking activities**
- **Generic R&D**
- **Dedicated R&D in Key Accelerator Research Areas**
- **Access to Test Infrastructures**
- **Design Studies toward new Accelerator-Based Research Infrastructures**
- **Education and Training**
- **Industrial Development of state-of-the-art components and co-innovation with Industry**

What is missing or should be improved

Involvement of Industry is essential for the realization of RI (hight TRL's)

But involving industry in R&D for low and medium TRL levels is also extremely important and needs to be significantly improved

- **Better integration of industrial sector in Accelerator Science & Technology**
  - **more effective R&D**
  - **better vision of the AS&T needs by industry**
  - **Better anticipation of industrialization of components**
- **Co-Innovation**
  - **Generate new ideas for innovative products**
  - **Joint R&D for new products**

First attempt and/or studies initiated (see later talks)

- **in ARIES for joint R&D with industry**
- **In AMICI for transferring know-how to industry and keeping industry at the forefront of the international competition**
- **In AMICI, ARIES and EASYTrain for Education&Training with/for industry**

What is missing or should be improved

All previous work carried out sets the foundation for a much more ambitious actions with a long term vision including the integration of the industry sector
However, there are still constraints to be taken into account

- ⇨ **Simplicity, flexibility and timely occurrence of actions**
- ⇨ **IP management**
- ⇨ **Funding**
- ⇨ **Access to infrastructures**
- ⇨ **…**

- ⇨ **New structures and instruments necessary to get industry associated at early stages and/or development of new products?**

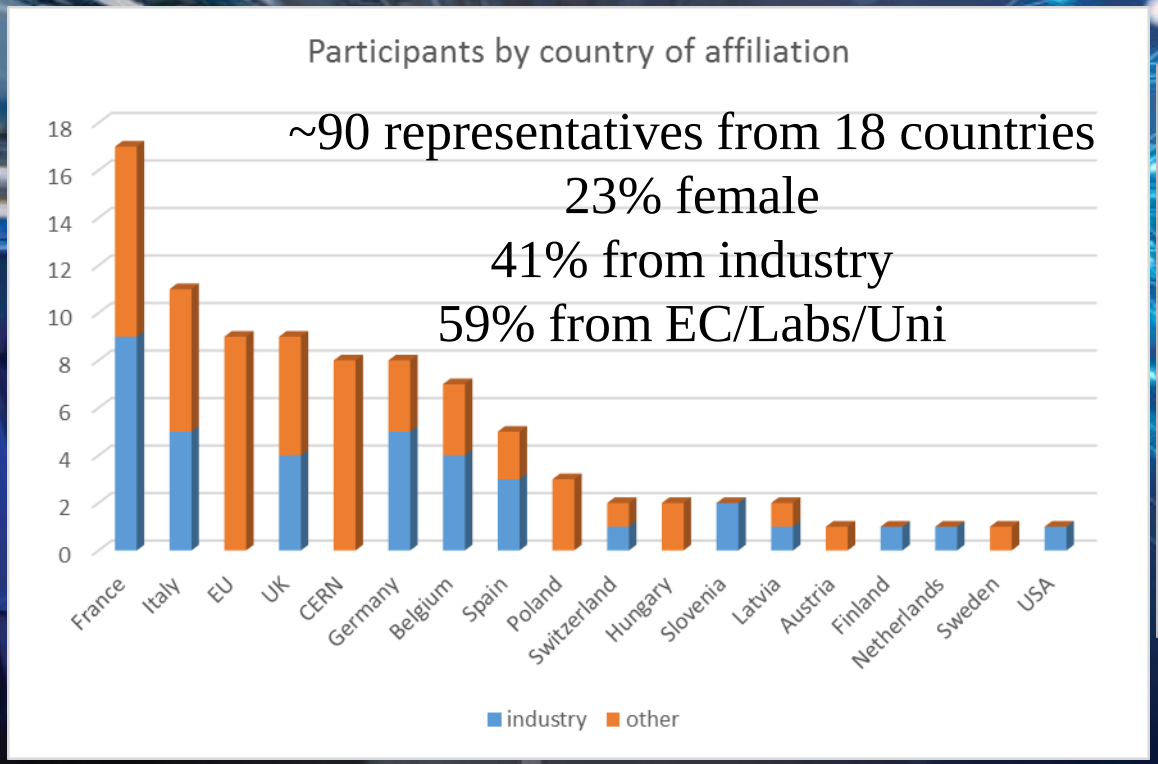
The objective of this workshop is

- **to reflect jointly with industry the issues above and on what should be done to improve the active collaboration with industry for Accelarator Science&Technology**
- **Propose new actions and instruments for the medium and long term, in case of needed**

What is missing or should be improved

The objective of this workshop is to reflect jointly with industry on what should be done to improve the active collaboration with industry for Accelarator Science&Technology

Excellent attendance (90 people) and well balance participation (countries/gender/affiliation) to this workshop



Final remarks

- **The implementation of an accelerator R&D strategy through many very successful projects in FP6, FP7 and H2020 has enabled to integrate the European expertise (Labs and universities) for collaborative Accelerator R&D.**
- **All aspects, from generic R&D (low TRL) to industrialization (high TRL) are covered by the projects launched in this coordinated frame.**
- **The European accelerator community continues to work toward a successful integration of all AS&T actors in Europe with the involvement of Industry in order to enhance further the impact of Accelerators in Science and Society.**

Accelerator science is a powerful mean towards scientific, technical and industrial breakthroughs. It´s the time to advance on an integral collaboration with industry

ARIES

TIARA
ACCELERATING KNOWLEDGE AND INNOVATION

QUIQI

Structuring the particle accelerator community

We wish you an excellent work and consensual outcomes

Accelerator science is a powerful mean towards scientific, technical and industrial breakthroughs. It´s the time to advance on an integral collaboration with industry