



Maurizio Vretenar, CERN

Coordinator of the I.FAST Innovation Pilot for particle accelerator R&D (H2020)

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Industry has changed...

We observe that around accelerators (and other Research Infrastructure systems) has grown a **network of companies**, most of them **SME's**, often run by scientists or by people with a scientific background, that are **creative, flexible, innovative**, continuously looking for new markets and new applications.

Research Infrastructures have a role to play in helping these companies to **grow and to compete in the global market**, to:

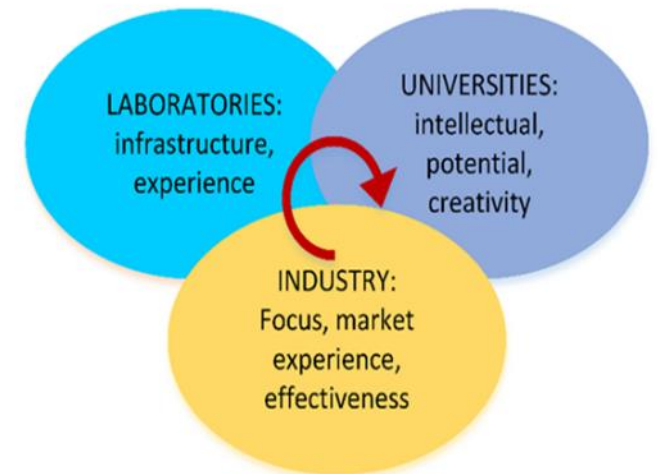
- a) sustain the **virtuous circle** of scientific innovation, and
- b) demonstrate the **social and economical impact** of research performed at RI's.



The virtuous circle of scientific innovation

... but the system did not evolve

- SME's have **potential and interest** to contribute to early R&D (**low TRL** activities), but the present schemes offer **limited opportunities**.
- In most cases, R&D is still taking place in the scientific institutions and the companies are associated **only in the final production phase**, after a competitive tender.
- How can we **involve industry from the initial low TRL** phase, when they can contribute with ideas, market focus and cost awareness?
- Cannot be done via usual tenders because requires **schemes to share risks** (and costs): some **structured public intervention is instrumental**, at EC, national or regional level.



The magic triangle of scientific innovation

Co-innovation with industry for accelerators

I.FAST: Innovation Fostering in Accelerator Science and Technology

Innovation Pilot of H2020/RI - pilot instrument of the last H2020 Research Infrastructure Work Programme, to demonstrate the role of Research Infrastructures in the translation of Open Science into Open Innovation.

- **48 beneficiaries** – 8 RI operators, 12 research centres, 12 universities, 16 industrial partners (1/3, including 11 SMEs) - from 15 EU countries, supported by 12 partner organisations and >20 collaborating institutions, jointly developing technologies for the next generation of accelerators
- **4 years**, starting 1 May 2021, **10 M€** EC contribution out of a total project cost of **19 M€**.

- ❑ **16** industrial partners (1/3 of consortium), **12** companies in the Industry Board
- ❑ R&D budget to industry **1.8 M€**, for a total cost of **3.2 M€** (**44%** industry **co-funding**)

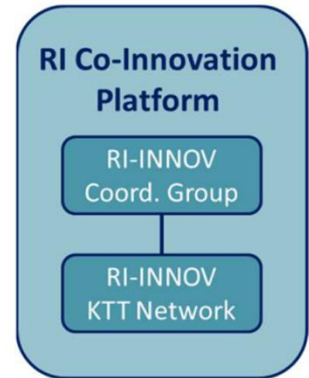


For the moment (after 17 months) I.FAST is extremely successful in the co-innovation part:

- One new company joining with its own funds: ~100 k€ to contribute with a prototype.
- Oversubscribed internal call for innovative projects with industry: 16 proposals received (on environment, high-efficiency technologies, new materials, etc.), but only ~50% can be funded within the allocated budget (1.2 M€).

3 Innovation Pilots, same goals

- ❑ **LEAPS-INNOV**: Innovation for accelerator-based light sources in Europe
- ❑ **AIDAinnova**: Advancement and Innovation for Detectors at Accelerators
- ❑ **I.FAST**: Innovation fostering in accelerator science and technology



LEAPS approach to involve industry in the innovation of SR & FELs in Europe on **three layers**

- Industry as supplier
- Industry as user
- Industry as trigger of science in European Partnerships

Tools

Open Innovation

- Knowledge Transfer (WP3, WPS, WP7)
- Technology Transfer (WP2, WPS, WP6)
- Inside out
- Industry Workshops (WP2-8)
- European User Summit (WP9)
- Industry Forums (WP8)
- LEAPS-INNOV Beneficiary (WP4)
- Subcontract (WP2, WPS)
- Procurement (WP2, WP3, WPS, WP6)
- Outside in
- Competitive & Early Dialogue (WP2, WPS, WP7)
- PCP (WP3)

Consortium
all 16 LEAPS members, 3 SMEs, 3 technology partners (ENEA, KIT, STFC) and > 50 European industrial partners (> 77% are SMEs)

Industrial partners

[CAEN SpA](#)

[Conpart AS](#)

[ELTOS SpA](#)

[Fyla Laser SL](#)

[Lithoz GMBH](#)

[PICOTECH](#)

[WEEROC](#)

[WORKSHAPE](#)



I.FAST: industry from suppliers to co-innovators

Fostering a new role of industry in Big Science.

Most of the I.FAST Tasks have one or more industrial partners that are fully “**co-innovators**”, participating from the early stage in the R&D, giving their contribution to the development of prototypes at different Technology Readiness Level.

Early participation of industry guarantees a faster feedback on the technological requirements, and an easier adoption of industrial standards and technologies, resulting in simpler and less expensive final products – and a consistent sharing of ideas!



Challenges:

- administration (on both sides!),
- corporate culture in large companies,
- Sharing of responsibilities and risks,
- IP management,
- Keeping competition for series production.

From Open Science to Open Innovation



Particle accelerator community entering the age of open innovation:

Sharing of ideas between scientific institutions and companies, to improve high technology products and to identify new products and markets.

Creation of an innovation ecosystem

(Keywords: community, trust, openness, creativity, connection to industry)

The long-term goal is to **create a common language and a common working ground** between academia and industry, to **favour exchanges** – in both directions!

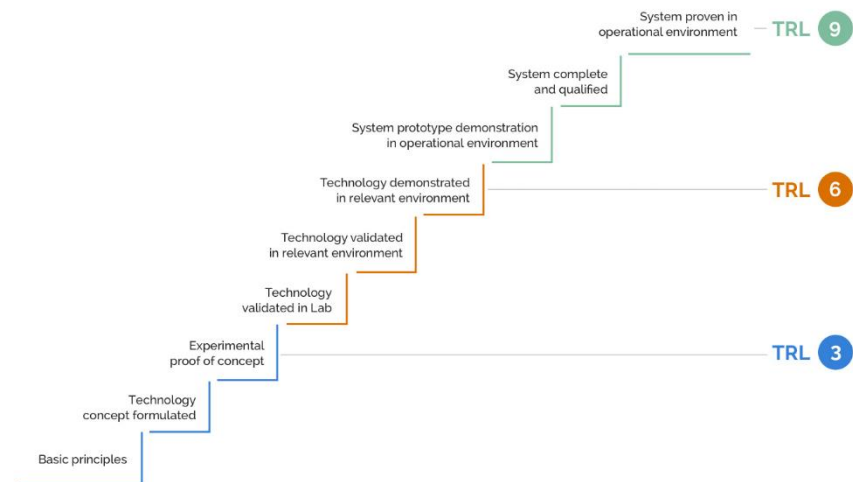
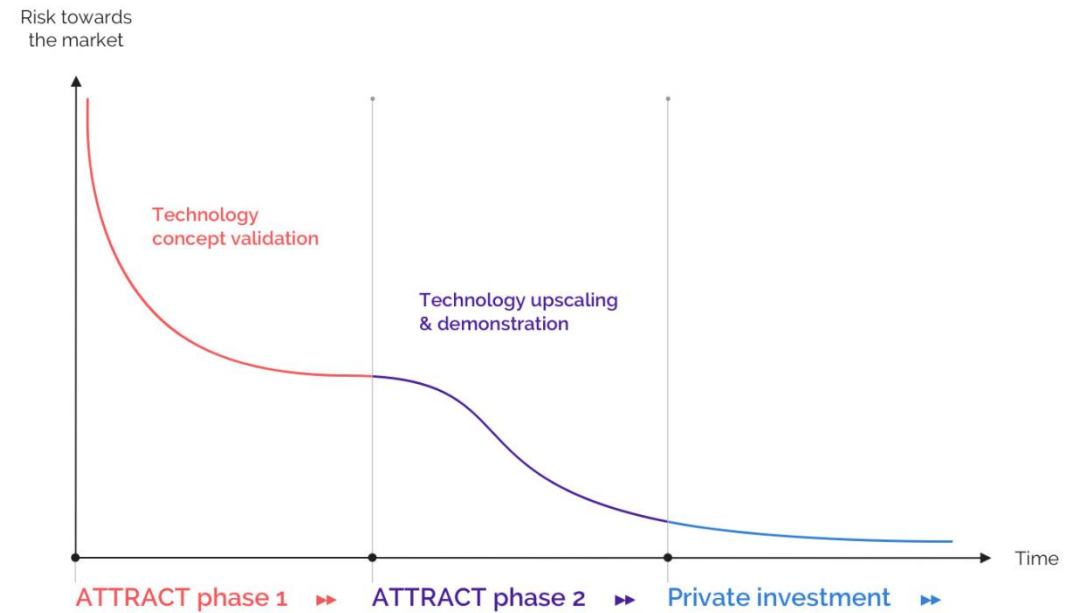
Open Innovation... what next?

- Innovation-oriented calls have disappeared from the new Horizon Europe RI Work-Programmes - focus is more on provision of **services** than on **innovation**.
- How can we keep the **momentum** and the **connections** that we have created between academia and industry, in particle accelerator and other advanced communities? Can we think to expand and to **integrate other communities** in a **common technological roadmap**?
- Times are mature for **more integration** industry/research and across Big Science communities. How can we develop it?
- **INFRA-TECH** projects for next generation instrumentation will include an innovation component but their focus is on the **instruments** and their budget is **limited** – when making choices, **innovation** and **integration** will become second priorities.



ATTRACT: another approach to co-innovation

- ATTRACT is an ongoing H2020 project completing its 2nd phase, for boosting breakthrough co-innovation on **detection and imaging technologies**.
- The overarching goals of ATTRACT are in line with the Innovation Pilots: **building bridges between research and industry** for undertaking research and development and innovation (R&D&I) – but on a totally different scale, **55 M€**.
- Can we expand this approach to **accelerators and other hardware-oriented technologies**? Is there any interest at the Commission level in **fostering the impact of Research Infrastructures on economy and society**, or are RI's becoming just **service providers (losing industry on the way)**?



An Open Innovation ecosystem for particle accelerator (and other) technologies

Making accelerator-based research **sustainable** over the long-term, increasing at the same time the benefits for **society** are the main challenges to the accelerator community in this XXIst century.

Other communities that share with us the same industrial basis are facing similar challenges.

- ❑ To address the critical issues for the future we need **innovation** developed in a collaborative environment, where **industry** is one of the key actors.
- ❑ Our network of innovative SME's is a crucial **asset** of our communities, but companies alone are often too **small** to have an impact at European level.
- ❑ To grow and expand our innovation ecosystem and to leverage its impact on society, more **co-innovation programmes** are needed at regional, national and European level, built around well-defined schemes to share the costs and the risks of innovation.



Image credit: University of Leicester

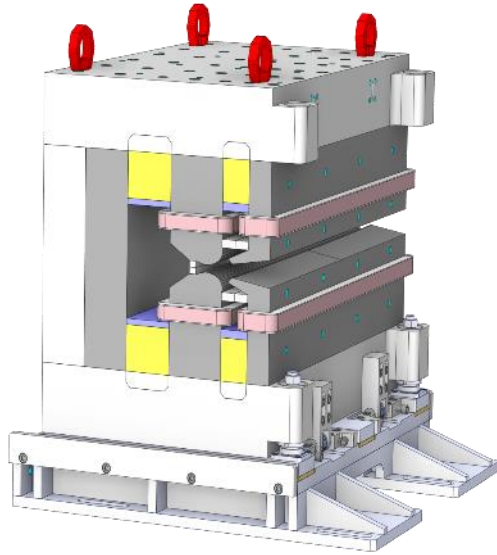
iFAST

Thank you for your attention!

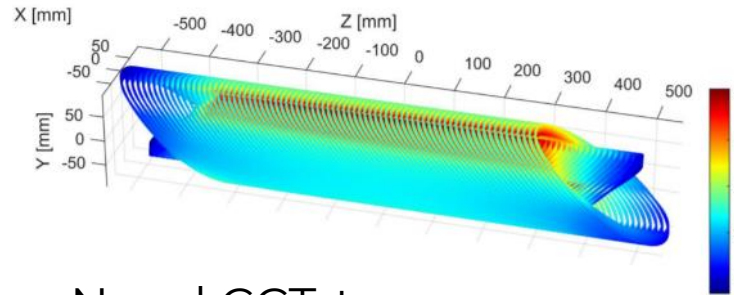


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Some examples of I.FAST technologies



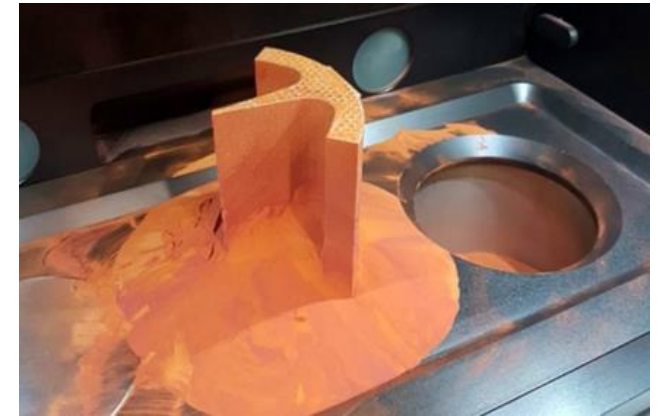
Permanent Magnet
Quadrupoles and
Combined Function
Magnets for Ultra-
Low Emittance
Storage Rings



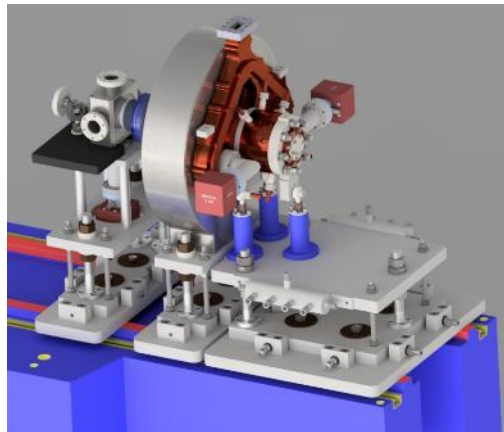
Novel CCT-type
superconducting magnets
for small synchrotrons and
medical applications



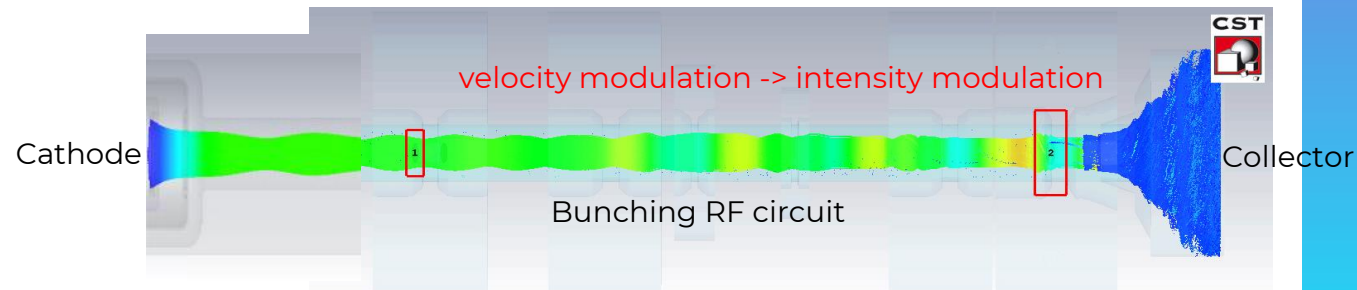
Internal source for
small cyclotrons



Additive-manufactured
samples of critical
accelerator components



Very high gradient electron guns
operating at high frequency



High efficiency klystron prototype

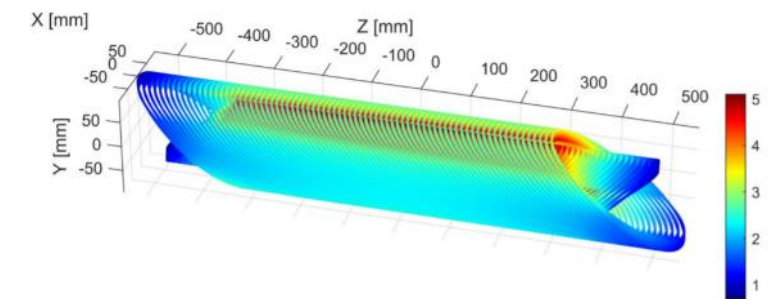
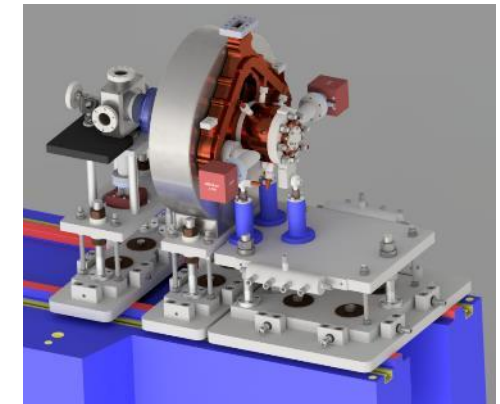
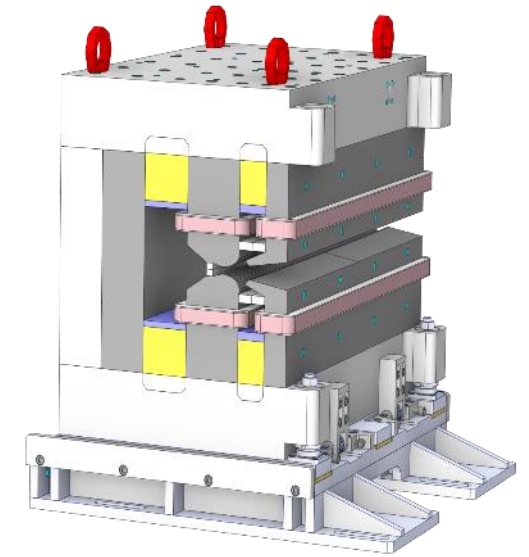
Particle accelerator R&D: challenges and opportunities

Opportunities:

- Strong demand for R&D: accelerators are crucial tools in the progress of modern science and technology (physics, biology, medicine, material science, etc.).
- Mature technology, with large industry involvement.
- Supported by a wide, motivated, and rapidly expanding scientific and technological community, spanning across continents.

Challenges:

- Presence of many actors, many projects, many technologies, with different priorities and time-scales.
- Long time scale and high cost of accelerator R&D, well beyond the capabilities of single EU projects.
- Strong dependence on post-ww2 technologies increasingly faraway from modern industry's focus.
- Needs coordination and sharing of resources.



Creating an Innovation Ecosystem

- Main strategic goals for EU accelerator projects:
 1. **Transverse approach** based on **synergies** between accelerators for different users: particle and nuclear physics, photon and neutron science, medicine and industry.
 2. **Collaborative schemes** involving laboratories, university and industry.
 3. Priority to **long-term R&D** topics, beyond the specific needs of approved projects and developments, starting from low TRL activities.

