

# Big Science Business Forum 2022

*BSBF, Granada  
Session D1.  
Affiliated Big Science Organizations (ABSOS)*

## **TIARA. Co-innovation of industry and the Accelerator Science and Technology community**



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on behalf of the TIARA Collaboration  
2022-10-06*



# Outline

## 1. Introduction

1. Accelerator Science and Technology

## 2. A picture of our community

1. A detailed view of our Science and Technology field
2. Who we are. Who we represent to
3. A snapshot of our coordination activity

## 3. The crucial role of the Industry on Acc. Science & Tech.

1. Co-innovation of industry and the Accelerator Science and Technology community.



# 1. Introduction

## 1. Accelerator Science and Technology

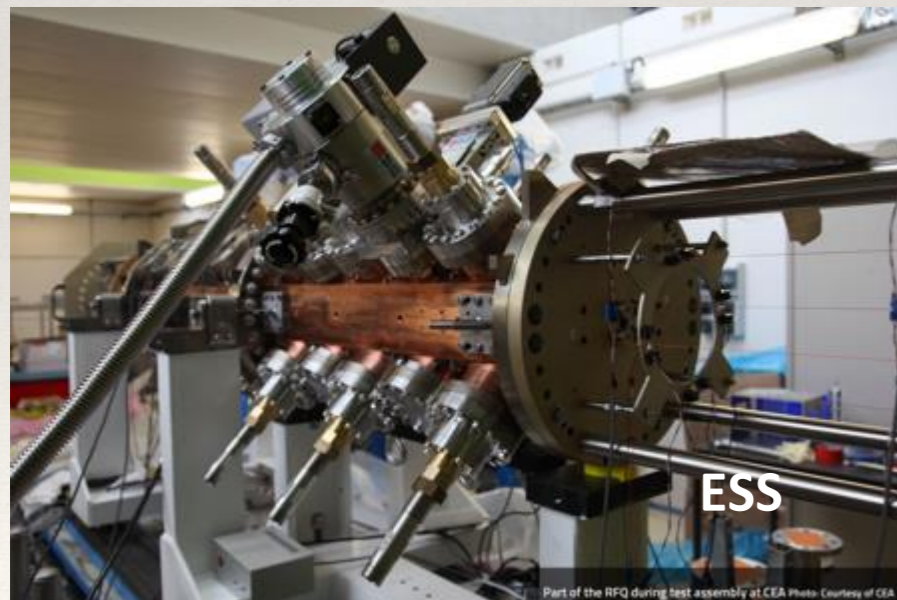
Accelerators are fundamental for Basic Science:



LINAC4



LHC



ESS



E-XFEL



IFMIF-EVEDA (Japan)

ESFRI Projects	
Energy	IFMIF-DONES
Phys S. & Eng	EuPRAXIA

ESFRI Landmarks (out of 41)	
	ELI ERIC
	ESRF
	ESS ERIC
	European XFEL
	FAIR
	HL-LHC
	ILL
	SPIRAL2

Acc Sc&T : technological components for key scientific instrumentation



# 1. Introduction

## 1. Accelerator Science and Technology

But accelerators are not only essential for Basic Sciences:

- Without accelerators, major advances in the biosciences of the past 50 years would not have happened,
- Accelerator technology stimulates a better understanding of living processes, leading to new medicines and therapies.
- Accelerated particle beams play a growing role of commercially important products, (next generation of electronics, advanced engineering, smart materials).
- Technology based on accelerators helps to solve environmental problems and
- Energy (example: new generation nuclear energy).

*Applications of Particle Accelerators in Europe. Eucard 2, 2017*

# The impact of accelerators on Society

Fundamental physics  
Materials science  
Solid state and condensed matter physics  
Biological and chemical science  
Research

Cleaning flue gases of thermal power plants  
Energy & Environment

Treating cancer  
Medical imaging  
Health & Medicine

Ion implantation for electronics  
Hardening surfaces & materials  
Welding and cutting  
Treating waste & medical material  
Food preservation  
Industrial applications

Cultural heritage  
Authentication  
Cargo scanning and security  
Material characterisation

Cleaner and safer nuclear power  
Technologies for fusion  
Replacing ageing research reactors  
Prospects



**Materials research**  
Beams of photons, neutrons and muons are essential tools to study materials at the atomic level.

**Protein modelling**  
Synchrotron light allows scientists to solve the 3D structure of proteins e.g. the Chikungunya virus.

**Controlling power plant gas emission**  
In some pilot plants, electron beams are used to control emission of sulphur and nitrogen oxides.

**Hadron therapy**  
Proton and ion beams are well suited for the treatment of deep seated tumours.

**Positron Emission Tomography (PET)**  
Radioisotopes used in PET-CT scanning are produced with accelerators.

**Ion implantation for electronics**  
Many digital electronics rely on ion implanters to build fast transistors and chips.

**Hardening materials**  
Replacing steel with X-ray cured carbon composites can reduce car energy consumption by 50%.

**Cultural heritage**  
Particle beams are used for non-destructive analysis of works of art and ancient relics.

**Energy**  
Accelerator technologies may bring the power of the sun "down to earth", treat nuclear waste and allow for safer operation of reactors.



## 2. A picture of our community

### 1. A detailed view of our Science and Technology field.

Application fields related to accelerator Sc&T

Accelerator Sc&T map and applications. A two dimensional relation

Field/ community	Identified body
Particle Physics	<a href="#">ECFA</a>
Nuclear physics	<a href="#">NuPECC</a>
Light sources and FELs	<a href="#">LEAPS</a>
Neutron sources	<a href="#">LENS</a>
Medical applications	<a href="#">ENLIGHT, PTCOG</a>
ADSR (nuclear reactors)	<a href="#">(MYRRHA)</a>
Fusion energy	<a href="#">F4E,</a> <a href="#">EUROFusion</a>

	Particle Physics	Nuclear physics	Light sources and FELs	Medical Applic.	Neutron sources	ADSR	Fusion energy
<b>ACCELERATOR COMPONENTS</b>							
Sources and Injectors	X	X	X	X	X	X	X
RF structures	X	X	X	X	X	X	X
RF systems	X	X	X	X	X	X	X
SC magnets	X	X	X	X	X	X	X
Conventional NC magnet systems		X	X	X	X		
Diagnostics and instrumentation	X	X	X	X	X	X	X
Targetry	X	X			X	X	X
Radiation issues	X	X	X	X	X	X	X
<b>ACCELERATOR TECHNOLOGIES</b>							
Electronics and Software	X	X	X	X	X	X	X
UHV	X	X	X	X	X	X	X
RF sources	X	X	X	X	X	X	X
Cryogenics	X	X	X	X	X	X	X
Alignment and Stabilization	X	X	X	X	X	X	X



## 2. A picture of our community

### 2. TIARA. Who we are, who we represent to

Instituion	Short name	Country
Commissariat à l'Énergie Atomique et aux Énergies Alternatives	CEA	France
European Organization for Nuclear Research	CERN	International
Centro de Investigaciones Energeticas, Medioambientales y Tecnológicas	CIEMAT	Spain
Centre National de la Recherche Scientifique	CNRS	France
Stiftung Deutsches Elektronen-Synchrotron	DESY	Germany
GSI Helmholtzzentrum für Schwerionenforschung GmbH	GSI	Germany
Istituto Nazionale di Fisica Nucleare	INFN	Italy
Paul Scherrer Institut	PSI	Switzerland
Science and Technology Facilities Council	STFC	UK
Uppsala Universitet	UU	Sweden → Nordic Region
Instytut Fizyki Jadrowej – Krakow	IFJ PAN	Poland
RIGA Technical University	RTU	Latvia → Baltic Region



Memorandum of Understanding  
for  
the establishment of TIARA, a European Consortium of Research Institutions in the Particle Accelerator Research Area.

Among

1 COMMISSARIAT À L'ÉNERGIE ATOMIQUE ET AUX ÉNERGIES ALTERNATIVES, a French state-owned research entity with a scientific, technical and industrial activity (EPIC), whose registered quarters are located at 25 rue Leblanc, 75015 Paris, France and declared at the Paris Trade and Companies Register (R.C.S) under the number PARIS B 775 685 019, duly represented by its Director of the Physical Sciences Division, Dr. Gabriele FIONI,

after referred to as "CEA",

2. EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, an Intergovernmental Organization whose seat is at Geneva, Switzerland, duly represented by its Director-General, Prof. Rolf-Dieter HEUER and/or its Director for Accelerators and Technology, Dr. Frederick BORDRY,

- Relevant actors on Acc Sc & Tech at Europe.
- An open list! Keen to accept new members.



## 2. A picture of our community

### 2. Who we are and who we represent to

TIARA supports and coordinates the complete scope of accelerator R&D activities.

◆ It addresses :

- Generic R&D projects on ASc&T
- Oriented R&D projects
- Design Studies and strategies
- Education & Training
- Development and Access to R&D infrastructures (AMICI)
- Innovation with Industry

◆ TIARA aims to cover **Trans-Field Activities (no only Particle Physics)** since R&D in ASc&T is transverse

◆ TIARA follows the **Roadmaps/Priorities of the involved communities** to guide its initiatives

◆ And provides support to the definition of these roadmaps



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## 2. A picture of our community

### 3. A snapshot of our coordination activity

A long term history of activity for developing a coordinated action in terms of projects:

Period (2003-2030) ▶			2003	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	2030								
Accelerator R&D Projects																																						
FP6		EUROLEAP						X	X	X																												
FP7	(PP)	SLHC-PP						X	X	X																												
FP7	(PP)	ILC-HiGrad						X	X	X	X																											
FP7	(PP)	TIARA										X	X	X	X																							
H2020	(FET)	Fusumatech																	X	X																		
H2020	(MSC)	EASYTrain																X	X	X	X																	
FP6	(IA)	CARE	X	X	X	X	X																															
FP7	(IA)	EuCARD							X	X	X	X																										
FP7	(IA)	EuCARD2											X	X	X	X	X																					
H2020	(IA)	ARIES																X	X	X	X																	
H2020	(IA)	HITRIplus																				X	X	X	X													
H2020	(INNOV)	IFAST																			X	X	X	X														
FP6	(DS)	EUROTEV		X	X	X	X																															
FP6	(DS)	EURISOL		X	X	X	X																															
FP7	(DS)	EUROnu						X	X	X	X																											
FP7	(DS)	HiLumi									X	X	X	X	X																							
H2020	(DS)	EuroCIRCOL														X	X	X	X																			
H2020	(DS)	EuPRAXIA														X	X	X	X																			
H2020	(DS)	ESSnuSB																X	X	X	X																	
H2020	(DS)	CompactLight																X	X	X	X																	
H2020	(DS)	FCC-IS																			X	X	X	X														
HE	(DS)	MuCol																					X	X	X	X												
HE	(DS)	ESSnuSB+																					X	X	X	X												
HE	(Infraserv)	EuroLABS																				X	X	X	X													

- ~20 years programme in accelerator R&D
- >22 projects supported: Total cost >333M€ (EC contribution 123M€). High rate of success,
- >100 partners (labs, Uni., industry) in >21 countries involved
- Some of the of highest relevance: LINAC4, ELBE, FLASH, XFEL, ESS, HL-LHC, FAIR, ARIES/IFAST... Others on the way



## 2. A picture of our community

### 3. A snapshot of our coordination activity

#### Technological Infrastructures. AMICI



**ACCELERATOR AND MAGNET  
INFRASTRUCTURE  
FOR COOPERATION AND INNOVATION**  
EUROPEAN  
TECHNOLOGY INFRASTRUCTURE

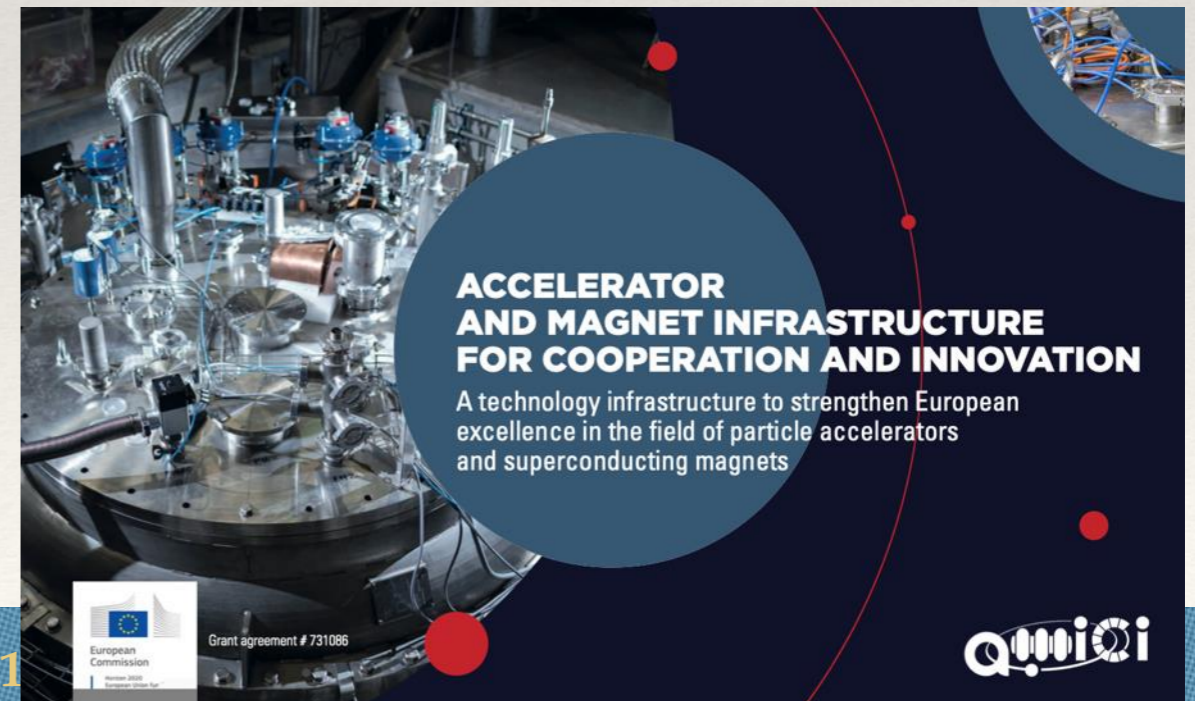
The objective of AMICI is to **engage the Technology Infrastructures** which is currently dedicated to European Science-based accelerators with a efficient and **sustainable cooperation and production model**.

Aims at keeping European industry at the forefront of the international competition, by fostering collaboration initiatives and opportunities between Industry and the TI

Gathers the main European laboratories operating Technical Platforms dedicated to the development, testing and production of accelerator components

Benefits for Industry:

- A clear view on the strategic roadmaps of the different scientific domains
- Better information and facilitated access to the Technical Platforms
- Harmonized and standardized procedures





### 3. The role of the Industry of Science on Accelerator Science & Tech.

#### Why TIARA in this Forum

##### Because of a strategic request:

For the period 2023-2026, we aim at consolidating a structured coordination of the Accelerator Science and Technology community, providing support to development of the R&I activities:

- In an integrated roadmap
- Encompassing the R&D needs on ASc&T of the different communities
- Not only for basic science, but translational: Energy, Environment, Medical
- Coordinating the needs of the research infrastructures and
- the needs of the Technological infrastructures at European level.

#### Contacts with CE advanced on this scope

In this strategy, a crucial need:

**To build this co-innovation strategy together with the industry**



### 3. The role of the Industry of

We start from a good position:

ASc&T has been historically co-ordinated by the industry at an acceptable level.

The relevance of engaging industry in Sc&T projects has increased and a representative example: IFAST

In FAST tasks (\*):

88% of the tasks involve industrial partners  
47% -> more than one industrial partner

## IFAST IAB

(\* ) See Session B1. EU policies supporting a new model of industry in the “big science” innovation ecosystem. M...

#### Who we are

The I.FAST Industry Advisory Board (IAB) is composed of representatives of European companies that have been successfully involved in the largest scientific undertakings carried out with particle accelerators and is chaired by a scientist with a large and consolidated experience in the interaction between industry and research institutions.

#### What we do

In I.FAST there are many R&D activities carried out in collaboration between research groups and companies and the main objective of the IAB is to help the project to make these interactions as effective and fruitful as possible.

The IAB has been established by the I.FAST governing board within the first six months of the project and is also expected to bring the vision of the companies in the implementation of some of the I.FAST initiatives in which companies play an important role, such as the Innovation fund, the industrial training program, the exploitation of the European technological infrastructures.



## IAB Members



**Spela Stres**  
IAB Chair - Director of the Center for Technology Transfer and Innovation (CTI)



**Miguel Angel Carrera**  
Founder and CEO of AVS



**Ronald Dekker**  
CEO - Demaco



**Francesco Fantini**  
Sales manager Big Science Division - Fantini Sud S.p.A.



**Pavel Hedbavny**  
CEO - Vakuum Praha



**Rok Hrovatin**  
Senior BD advisor - Cosylab



**Jean-Luc Lancelot**  
Sigmaphi President - Board member of Piges (French association of large scientific equipment suppliers)



**Charles Mangeot**  
Senior R&D Engineer, Product Specialist, Piezoelectric Actuators - CTS Corporation



**Ziad Melhem**  
Founder and CEO - Oxford Quantum Solutions Ltd



**Michael Peiniger**  
Managing Director - Research-Instruments



**François Sylla**  
Co-founder and CEO of SourceLAB



**Josef Troxler**  
Business Development Manager, Ampegon & OCEM Power Electronics



### 3. The role of the Industry of Science on Accelerator Science & Tech.

Our message to the industries in this Big Science Business Forum:

Your help will be requested in our next steps to build this co-innovation strategy

#### Added value

- Involving the industry at the possible earliest stages.
- Integrated strategy for R&D, design studies, E&T, Technological Infrastructures (AMICI), concept developments, **innovation**.
- Supporting the armonization of the roadmaps and stragies of different communities (in ASc&T, not colliding with their roles and development programs)
- Promoting the coordination with other Big Science fields.
- And thus: enlarging the **market dimension**, create critic mass. Increase the European industry competitiveness.

A coherent frame for innovation strategy on ASc&T fields.

#### Too ambitious?

Indeed, many difficult aspects. But

- stating from a good position
- we have the required background
- we will have the proper tools for such

**Added value: Could the industry be the common nexus of the several Big Science Communities?**



### 3. The role of the Industry of Science on Accelerator Science & Tech.

#### Final remark

**We need a more structured link with the Big Science Industry. We are working to create this link.**

**A specific request: We think that it is the time to create a permanent industrial body within the ASc&T coordination structures.**

**A point to address in line with the next calls of the the running EC FP.**

**Would you help us? It is the right time.**



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# Thank you very much