


TIARA: Structuring further Accelerator R&D in Europe

**R. Aleksan
Industry Workshop
December 4-5th, 2012**

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- The background of the slide is a large, waving European Union flag, featuring a blue field with twelve golden stars arranged in a circle.
- 1. Introduction**
 - 2. General Context**
 - 3. Building TIARA**
 - 4. Conclusion**

The use of Accelerators

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

Research accelerators

- Particle Physics, Nuclear Physics, Research fields using light source, Research fields using spallation neutron sources, Study of material for fusion, Study of transmutation...

In past 50 years, about 1/3 of Physics Nobel Prizes are rewarding work based on or 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**

To be able to build future accelerators, a strong sustainable R&D programme is indispensable

It includes 3 levels of R&D



Exploratory R&D

Assessment of new ideas
Demonstration of conceptual feasibility of new and innovative principles



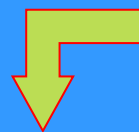
Targeted R&D

Demonstration of the Technical feasibility of all critical components
Demonstration of the feasibility of fully engineered system



Industrialization R&D

Transfer of technology
Large scale production and cost optimization
Diversification of Applications



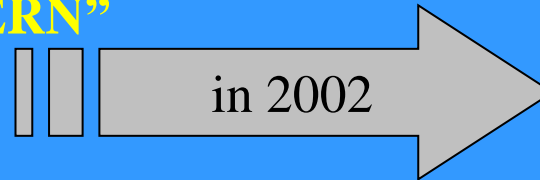
It requires sustainability and large (costly) infrastructures

We have to think at the European level, at least

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

1) ECFA 2001 Report “The Future of Accelerator-based Particle Physics in Europe”

“an improved educational programme in the field of accelerator physics and increased support for accelerator R&D activity in European universities, national facilities and CERN”



R. Aleksan (Chair), M. Cerrada (CIEMAT),
R. Edgecock (CCLRC), E. Elsen (DESY), O. Kester (GSI),
K. Osterberg (HIP), M. Jezabek (IFJ-PAN),
S. Guiducci (LNF), J.-P. Koutchouk (CERN),
F. Richard (IN2P3/Orsay), L. Rivkin (PSI)

<http://www.esgard.org>

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

2) Absence of HEP in the FP of the EU

This strategy led to the preparation and implementation of a coherent set of collaborative projects using the incentive funding of the 6th and 7th Framework Programme.

ESGARD developed and implemented a strategy to promote Accelerator R&D with the incentive of the EC Framework Programme within ERA

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2105
Accelerator R&D	FP6						FP7						
CARE		3 Networks (e, v, p)					EuCARD						
CARE		SRF					EuCARD (SRF)						
CARE		PHIN					EuCARD (SP)						
CARE		HIPPI					EuCARD						
CARE		NED											
SLHC													HiLumi
EUROTEV		DS: ILC+CLIC											
EURISOL		DS: M											
DS vFact							DS-EuroNu						
EUROLEAP		asma					EuCARD (ANAC)						
SuperB							EuCARD (ANAC)						
TIARA							R&D-RI & program						

1 euros from the EC has triggered 2 additional euros from the partners

Altogether EC has partially financed projects in FP6 and FP7 with a total budget of ~228 M€ (68 M€ from EC)

We have to think beyond

The Big Issues to be integrated within the next step

- ★ Coordinated wide scope sustainable programme
- ★ Enhanced Collaborative R&D projects
- ★ Integration and Access to broad variety of large infrastructures
- ★ Enhanced Partnership and Technology Transfer to Industry for boosting innovation
- ★ Strong Education & Training in Accelerator Science and Technology

A structure and mechanism that ensures **the sustainability of accelerator R&D useful for many fields**, which includes

Test Infrastructure and Accelerator Research Area

TIARA website: <http://www.eu-tiara.eu>



Accelerating Knowledge and Innovation

A multi-field, coordinated pan-European distributed infrastructure

*Joint particle accelerator R&D programming in Europe
and the integration of the required infrastructures*

The Virtuous Triangle

Innovations for
Cultural, Medical,
Industrial...
applications

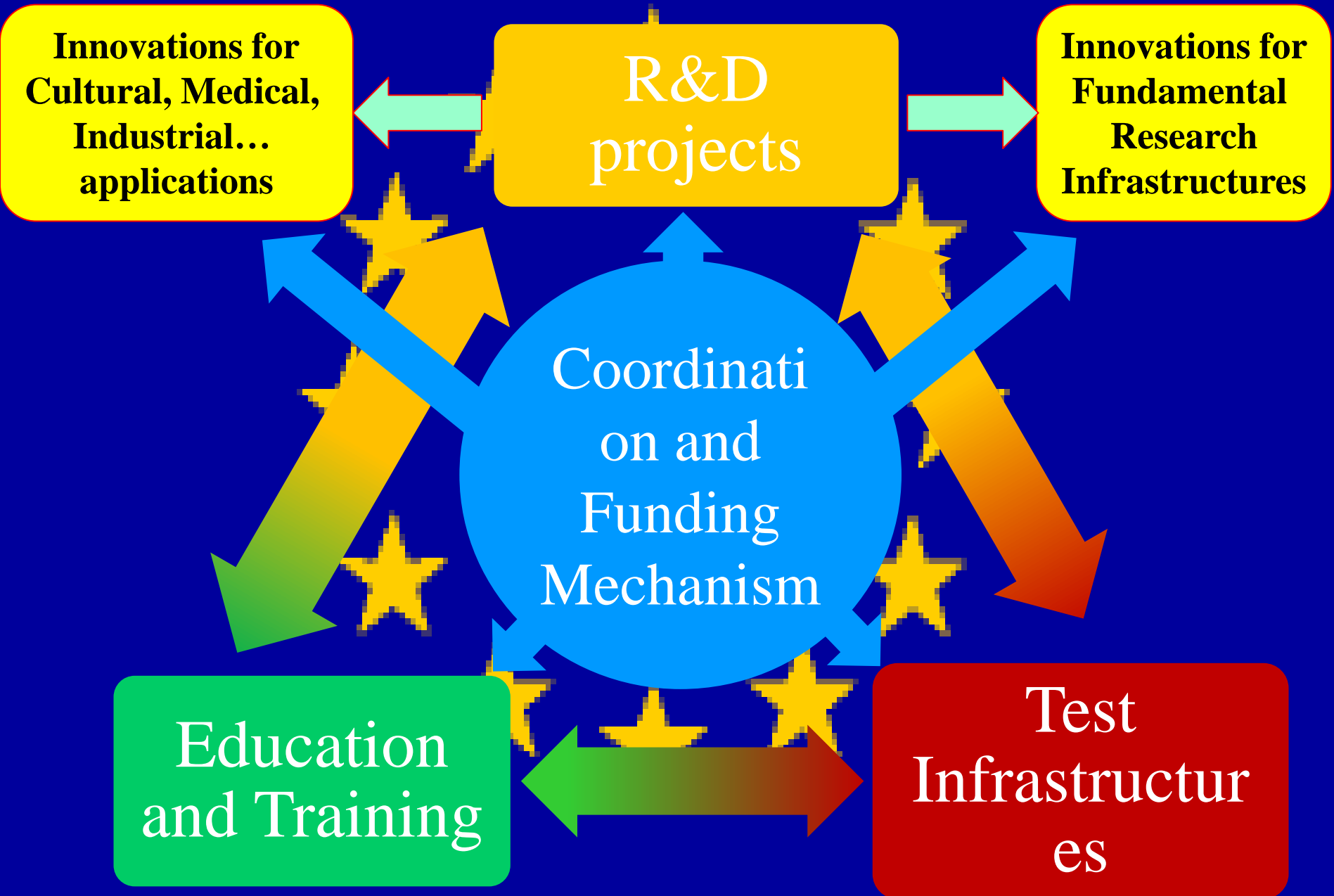
R&D
projects

Innovations for
Fundamental
Research
Infrastructures

Coordinati
on and
Funding
Mechanism

Education
and Training

Test
Infrastructur
es





*Test Infrastructure
and
Accelerator Research Area*



Creation of a coordinated panEuropean multi-purpose distributed Test Infrastructure



Joint Strategic Analysis of the accelerator needs and perspective for the development of R&D RI



Joint R&D programming and launching of a set of consistent integrated accelerator R&D projects



Promotion of the education and training for accelerator science



Strengthening the collaboration with the industry to boost innovation



Test Infrastructure and Accelerator Research Area

11 participants (8 countries + 1 int. organisation)

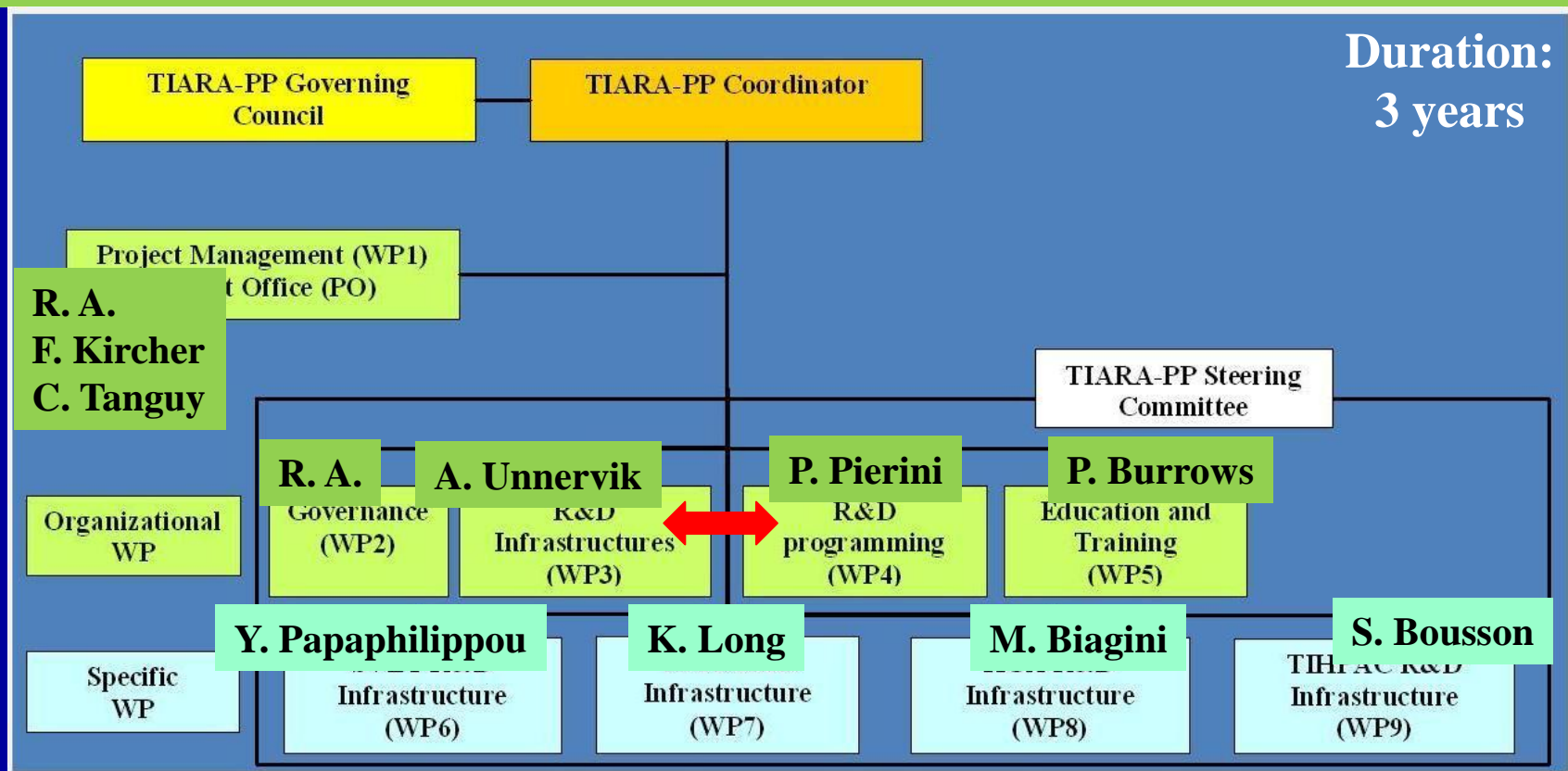
Number	Organization Name	Representative	Country
1(coord.)	CEA	R. Aleksan	France
2	CERN	S. Myers	Internat.
3	CNRS	A. Müller	France
4	CIEMAT	J. Perez-Morales	Spain
5	DESY	R. Brinkmann	Germany
6	GSI	H. Eickhoff	Germany
7	INFN	U. Dosselli	Italy
8	PSI	L. Rivkin	Switzerland
9	STFC	J. Womersley	UK
10	Uppsala University (for Nordic Consortium)	T. Ekelöf	Sweden
11	IPJ-PAN	M. Jezabek	Poland



Test Infrastructure and Accelerator Research Area

2009, Sept. 18th : TIARA has been presented and approved by the CERN Council at the European session of the Council

FP7-PP call in Dec. 2009, accepted in 2010 and started in 2011



Total Cost: € 9 139 196

EC contribution: € 3 900 000



WP1



➤ **WP1: Besides the maintenance of external and internal Websites <http://www.eu-tiara.eu> as well as the documentation database (38 documents so far), some other achievements for communication:**

Newsletter

<http://www.acceleratingnews.eu/>



Development of Brochure & Website « Accelerators for Society »

TIARA
accelerating innovation and knowledge

The impact of accelerators on Society

Particle accelerators were originally developed for investigating the fundamental laws of nature. These machines would do this by accelerating and colliding charged particles at extremely high energies. The resulting particles produced in these collisions would then be detected and analysed to reveal the structure of matter. However, today, accelerators also play an increasingly significant role in society and industry with an extremely important, but often unseen, impact on our everyday life.

Nevertheless the vast majority of accelerators are not used for fundamental science but for industrial processes and for applications relevant to society. Among these, the most noteworthy applications include electronics, electron beam cutting and welding, hardening materials, medical diagnosis, the treatment of cancer, monitoring of pollution and climate change, the examination and dating of works of art and ancient objects, screening food and medical goods and cargo scanning. Possible future applications towards alternative energy sources are also being developed.

To ensure that the technological benefits of science can be exploited for more efficient and effective applications that impact on the way we all live and work as a society, it is essential to provide ongoing support for accelerator research and development.

<p>Fundamental physics Biological & chemical sciences Materials science</p> <p>Research</p>	<p>Cleaning flue gases of thermal power plants</p> <p>Energy & Environment</p>	<p>Treating cancer Medical Imaging</p> <p>Health & Medicine</p>	<p>Ion implantation for electronics Hardening surfaces Hardening materials Welding and cutting Treating waste & medical material</p> <p>Industrial applications</p>	<p>Non-destructive testing Cultural heritage Authentication Cargo scanning</p> <p>Material identification</p>	<p>Safe nuclear power Replacing ageing research reactors</p> <p>Prospects</p>
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<p>Materials research Swarms of photons, neutrons and muons are essential tools to study materials at the atomic level.</p>	<p>Particle modelling Synchrotron light allows scientists to solve the 3D structure of proteins and the Chikungunya virus.</p>	<p>Controlling power plant gas emission In some pilot plants, electron beams are used to control emission of sulphur and nitrogen oxides.</p>	<p>Nuclear therapy Proton and ion beams are well suited for the treatment of deep seated tumours.</p>	<p>Positron Emission Tomography (PET) Radioisotopes used in PET-CT scanning are produced with accelerators.</p>	<p>Ion implantation for electronics Many digital electronics rely on ion implantation to build fast transistors and chips.</p>	<p>Hardening materials Refracting steel with X-ray cured carbon composite can include 50% energy consumption by 50%.</p>	<p>Cultural heritage Particle beams are used for non-destructive analysis of works of art and ancient texts.</p>	<p>Energy Accelerator technologies may bring the power of the sun down to earth. Test nuclear waste and show for safer energy.</p>
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<http://www.eu-tiara.eu/Communication/brochureAFS/index.htm#/2>





Interactions with concerned communities



★ Strong Interest for TIARA from many communities

- ESRF (visited on February 14th)
- ESS (see P. Carlson talk at TIARA Meeting)
- ITER/F4E (discussion with R. Heidinger on April 18th)
- PTCOG (discussion . A. Mazal ⇔ strong letter of interest and support)
- NuPPECC (TIARA presentation at NuPPECC meeting on June 16th ⇔ strong letter of interest and support)
- ECFA (TIARA presentation at RECFA meeting on November 22nd)
- TIARA presentation at ESLS meeting on November 20



Possible advantages for industry



Some (non exhaustive) items:

- Access to research infrastructures and associated expertise on state-of-the-art technologies will be made easier,
- Collaborative R&D activities and related funding will be more sustainable and adapted to needs of the context
 - TIARA aims to complete the calls for proposal managed by the European Commission with more appropriate scope and timely manner
- Access to TIARA's coordinated communication, dissemination and outreach activities.
 - Documentation, publication, newsletter, brochure...
 - Education and training programme
 - Specific events, Workshops...



TIARA activities related to Industry



One of the goals of TIARA is to strengthen relations with industry. Several aspects of TIARA concern industry

★ WP2:

- *How associate the industrial sector in TIARA's activities?*
- *How to interact with industry in most efficient way?*

★ WP3:

- *Study options for sharing R&D infrastructures and developing joint R&D Infrastructures with industry*
- *Define technology roadmap for the development of future accelerator components in industry.*
- *Develop an Industry workshop programme*

★ WP4:

- *Develop an accelerator R&D programme in Europe*

★ WP5:

- *Survey of the numbers of students, courses, and teaching resources*
- *Evaluation and Study of the development of the market for Accelerator Sciences*
- *Establish a plan of action for promoting Accelerator Science and Technology*

Conclusions

After having established an accelerator R&D strategy, implemented through several projects in FP6 & FP7, ESGARD proposed to go one step further with the TIARA Concept.

The EC has approved TIARA as a Preparatory Phase project with an EC funding of 3.9 M€.

The project has started on 1/1/2011 and is on track.

TIARA will hopefully establish the groundbase for supporting sustainably Accelerator R&D and infrastructures in Europe through “program funding” in Horizon2020

Accelerator science is a powerful mean toward scientific, technical and industrial breakthroughs and innovations...
TIARA will strengthen significantly this potential

