The EU R&D for Accelerators

HiLumi Kickoff
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November 18th, 2011

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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

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"

in 2002

R. Aleksan (Chair), M. Cerrada (CIEMAT),
R. Edgecock (CCLRC), E. Elsen (DESY) ,
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

In 2006, CERN Council, as the HEP European Strategy Body, had stressed further the needs to strengthen further accelerator R&D and included it as a high priority item in its Strategy Document.

The ESGARD Strategy

Use the incentive of the European Commission Framework Programmes (FP6, 7…) to implement a coherent set of accelerator R&D collaborative projects

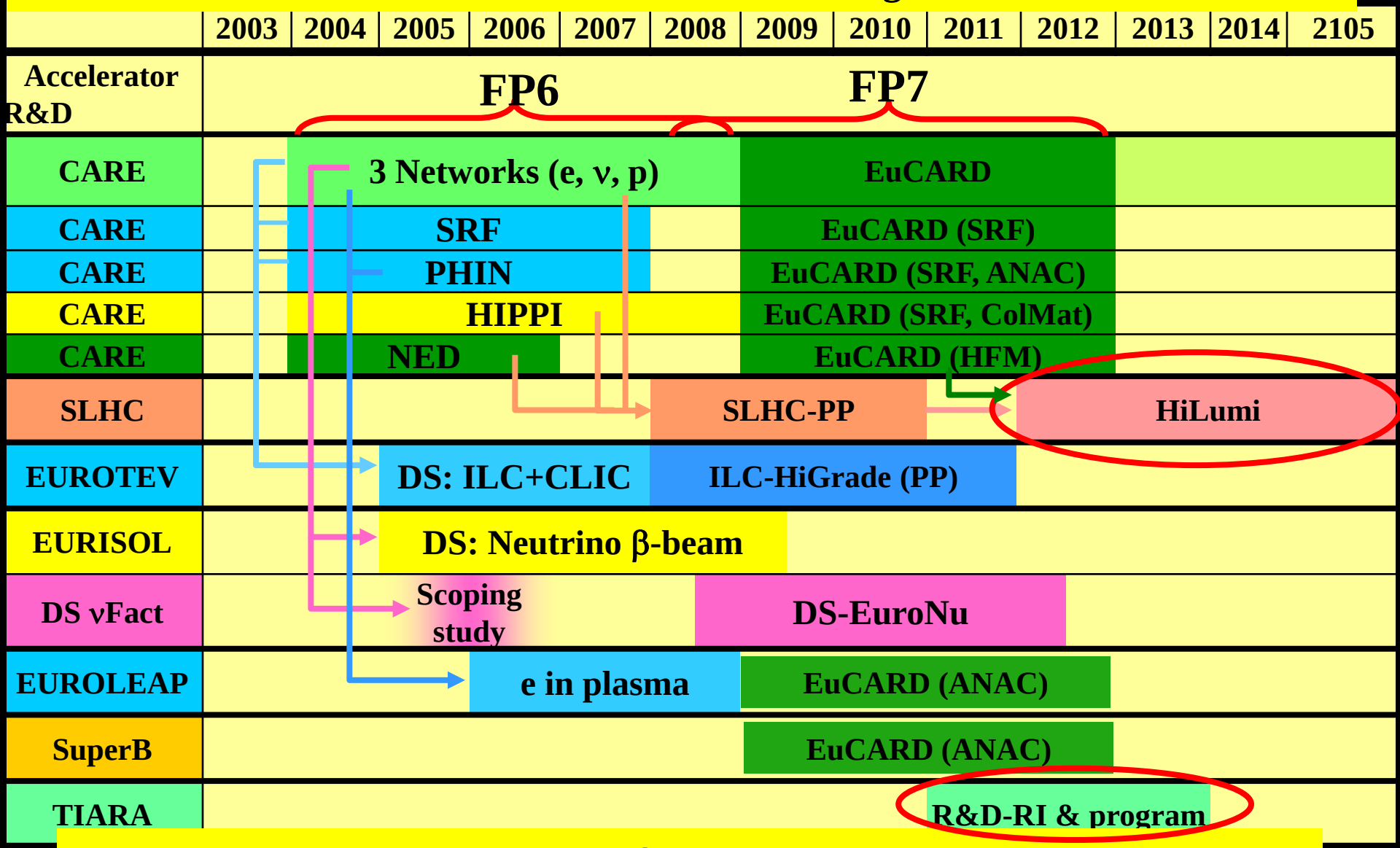
Including

- **Multipurpose R&D Projects (Integrating Activities: Incubators)**
- **Targeted Design Studies (DS) and R&D for specific Accelerator Projects**
- **Preparation Phase (PP) and final R&D projects for launching construction**

With the quantitative objective to augment significantly the EC contribution

- **For each euros from the EC,**
- **Get ~2 more euros from the partners (i.e. organizations/labs/universities/industries…)**

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



Altogether EC has partially financed projects in FP6 and FP7 with a total budget of ~197 M€ (60 M€ from EC)

R&D toward Energy and Intensity Frontier with *p*-colliders: a key driver in this strategy

Time →

IA

PP

DS

CARE

HHH p-Acc. Science
HIPPI (injectors)
NED (Nb_3Sn magnet)

EuCARD

AccNet: Acc. Science
HFM (Nb_3Sn magnet)
ColMat: Collimation

EuCARD2

In preparation toward HE-LHC
X-beams network
Future Magnet (20T)
Collimation

sLHC

~200fb^{-1}
/10-12 years

HiLumi

~3000fb^{-1}
/10-12 years

LHC: the most recent state-of-the-art *p*-accelerator

Summary: EU projects are helping paving the way toward Energy and Intensity Frontier with *p*-colliders

Thanks in particular to the fantastic Energy and Intensity of …

To be able to build future accelerators, a strong sustainable R&D program is indispensible

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 large and costly infrastructures

We have to think at the European level, at least

We have to think beyond

ESGARD is already carrying out a coordination leading to development of well organized European wide integrated R&D project for Particle Physics (see the high success rate of FP proposals).

Building on this experience, we can and need to go further

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

- **The integration of R&D infrastructures and offered services within a general framework (including industry)**
- **The development of a joint R&D program and the launching of a set of consistent integrated accelerator R&D projects**
- **The promotion of the education and training for accelerator sciences**
- **A model for financing all of the above**

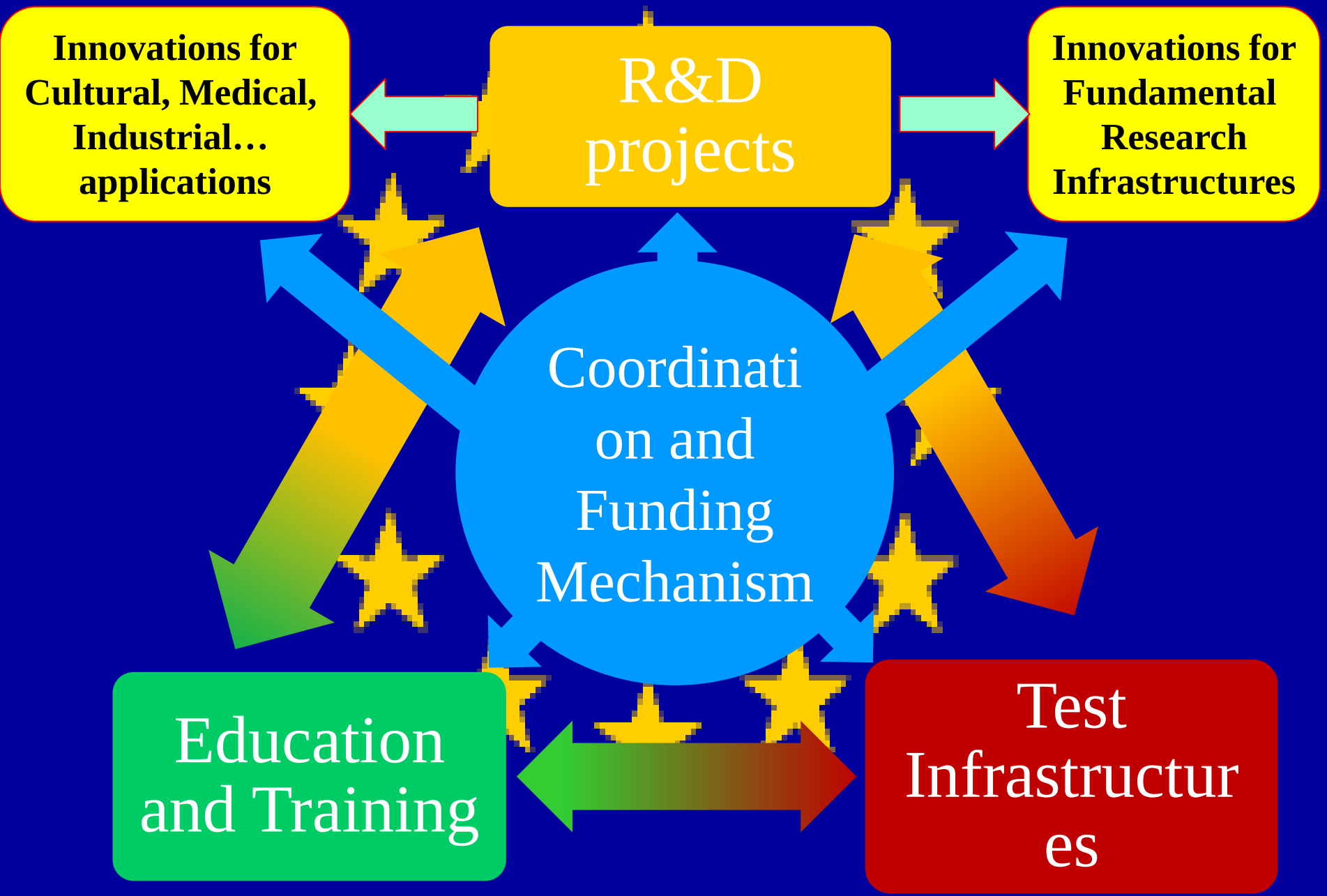
TIARA website: http://www.eu-tiara.eu

Test Infrastructure and Accelerator Research Area

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



Tiara

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**

11 participants (8 countries + 1 int. organisation)

Number	Organization Name	Country
1(coordinator)	**CEA**	France
2	**CERN**	International
3	**CNRS**	France
4	**CIEMAT**	Spain
5	**DESY**	Germany
6	**GSI**	Germany
7	**INFN**	Italy
8	**PSI**	Switzerland
9	**STFC**	UK
10	**Uppsala University (rep. Nordic Consortium)**	Sweden
11	**IPJ-PAN**	Poland

Tiara

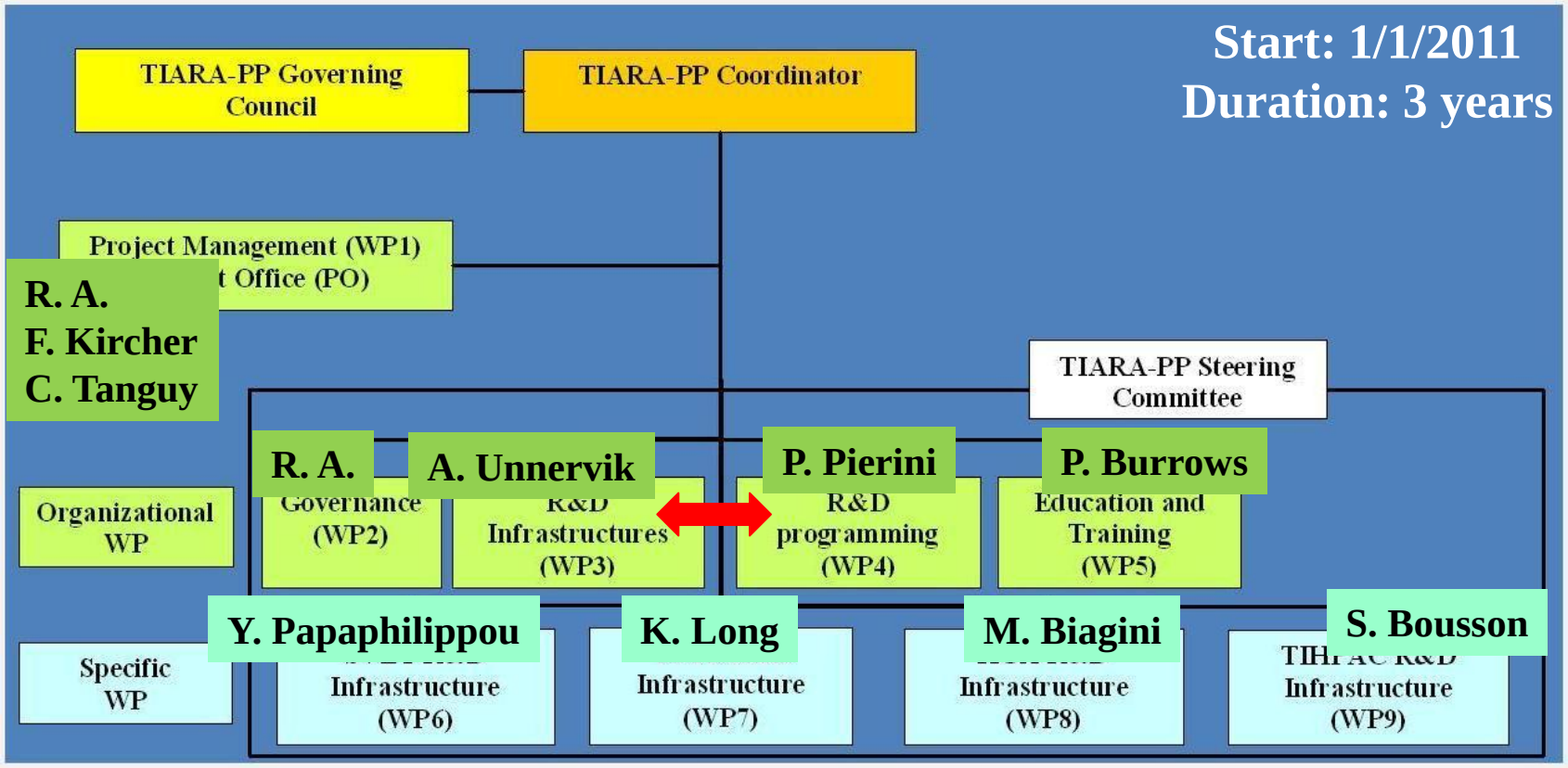
http://www.eu-tiara.eu

Test Infrastructure and Accelerator Research Area

September 18th **: TIARA has been presented and approved by the CERN Council at the European session of the Council**

TIARA proposed to the PP call in Dec. 2009 and accepted in 2010

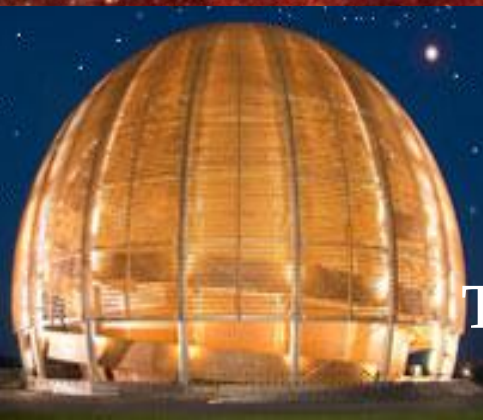
Start: 1/1/2011
Duration: 3 years



Total Cost: € 9 139 196 ***EC contribution: € 3 900 000***

Conclusions

- HiLumi is an important focal point in the European strategy for particles physics and well embedded in the European objective to strengthen accelerator R&D with the support of the EC.
- 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.
- TIARA will hopefully establish the groundbase for supporting sustainably Accelerator R&D and infrastructures in Europe through “program funding” in FP8



Accelerator science is a powerful mean toward scientific, technical and industrial breakthroughs and innovations…

TIARA will strengthen significantly this potential