Accelerator R&D

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1. Introduction
2. Accelerator Science and Technology
3. Conclusion

Unraveling the fundamental mysteries of the universe requires

State of the art accelerators

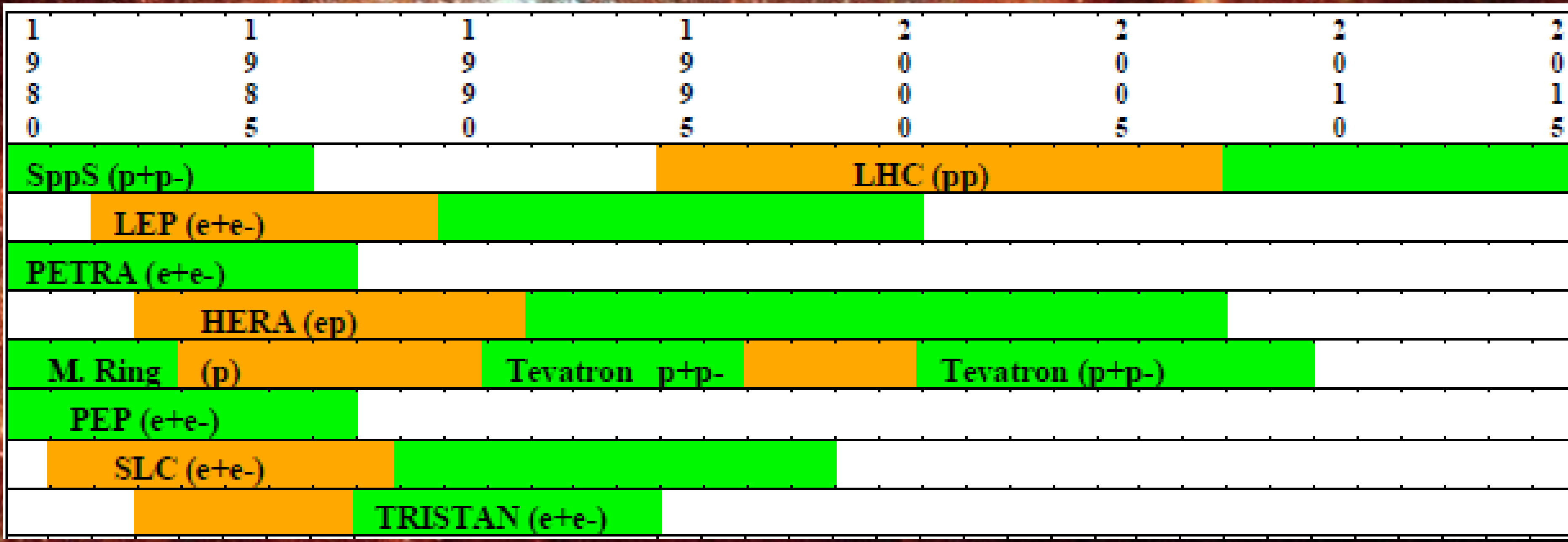
These accelerators have to address different challenges

- **"Energy Frontier" i.e. reaching ever higher energy**
- **"Intensity/Power Frontier" i.e. delivering ever higher luminosity**
- **"Probes Diversity" i.e. accelerating many different probes**

State of the art accelerator technology, instrumentation and test facilities are needed

Note: These infrastructures and technology can be useful (vital) to many research fields, as well as for industrial developments

Energy Frontier Accelerators



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

No planned facility exist

e.g. Plasma acceleration

Targeted R&D

Demonstration of the Technical feasibility of all critical components

Demonstration of the feasibility of fully engineered system

e.g. CTF3, 20T magnet

Industrialization R&D

Transfer of technology

Large scale production and cost optimization

Diversification of Applications

e.g. High Yield production of SC 35 MV/m cavities

Accelerator Science and Technology

Topic to be discussed in Accelerator Science and Technology section :

- ***Accelerator R&D and infrastructures needed***
  - ***for allowing one to realize the new (or upgrade of) accelerator facilities with their respective parameters required by Physics***
  - ***for developing new concepts/technologies***

Each of these specific facilities should be identified in the corresponding Physics section, including their main characteristics

<u>In AS&T section</u>:

For each discussed facilities and new concept/technology

- ***Identification of the Key Accelerator Research Area (KARA)***
- ***Identification of related needed major « sub-infrastructures », if relevant***
- ***Assessment of State of Development (possibly with a schedule)***
- ***Assessment of Remaining Major Issue***

Each of the specific facilities have to identify a contact person for " accelerator science and technology", in charge of corresponding subsection

Accelerator Science and Technology

<u>Proposed subsections</u>

- ***Energy Frontier Challenges***
- ***Intensity Frontier Challenges***
- ***Organization of Accelerator R&D for HEP in Europe***
  - ***Accelerator R&D coordination and collaborative programmes***
  - ***Education and Training***
  - ***Relation with industry***
  - ***Synergies with other fields of science***
  - ***Applications to societal Challenges***

Example for *Energy Frontier Challenges*

- ***Introduction***
- ***High Energy Hadron Colliders (incl. ions)***
  - ***LHC (14 TeV)***
  - ***HL-LHC***
  - ***HE-LHC (or VLHC?)***
- ***High Energy Lepton Colliders***
  - ***ILC***
  - ***CLIC***
  - ***Muon Collider***
  - ***Plasma accelerators***
- ***High Energy Hadron(ion)-Lepton Collider***
  - ***eRHIC?***
  - ***LHeC***

Example for *Intensity Frontier Challenges*

- ***Introduction***
- ***High Intensity ν facilities***
  - ***Super-beams***
  - ***β-Beams***
  - ***ν-Factories***
- ***High luminosity Flavor factories***
  - ***ϕ-Factories***
  - ***τ/c-factories***
  - ***B-Factories***
- ***High intensity single beams***
  - ***e, μ, K, p(pbar),n -beams***

Accelerator Science and Technology

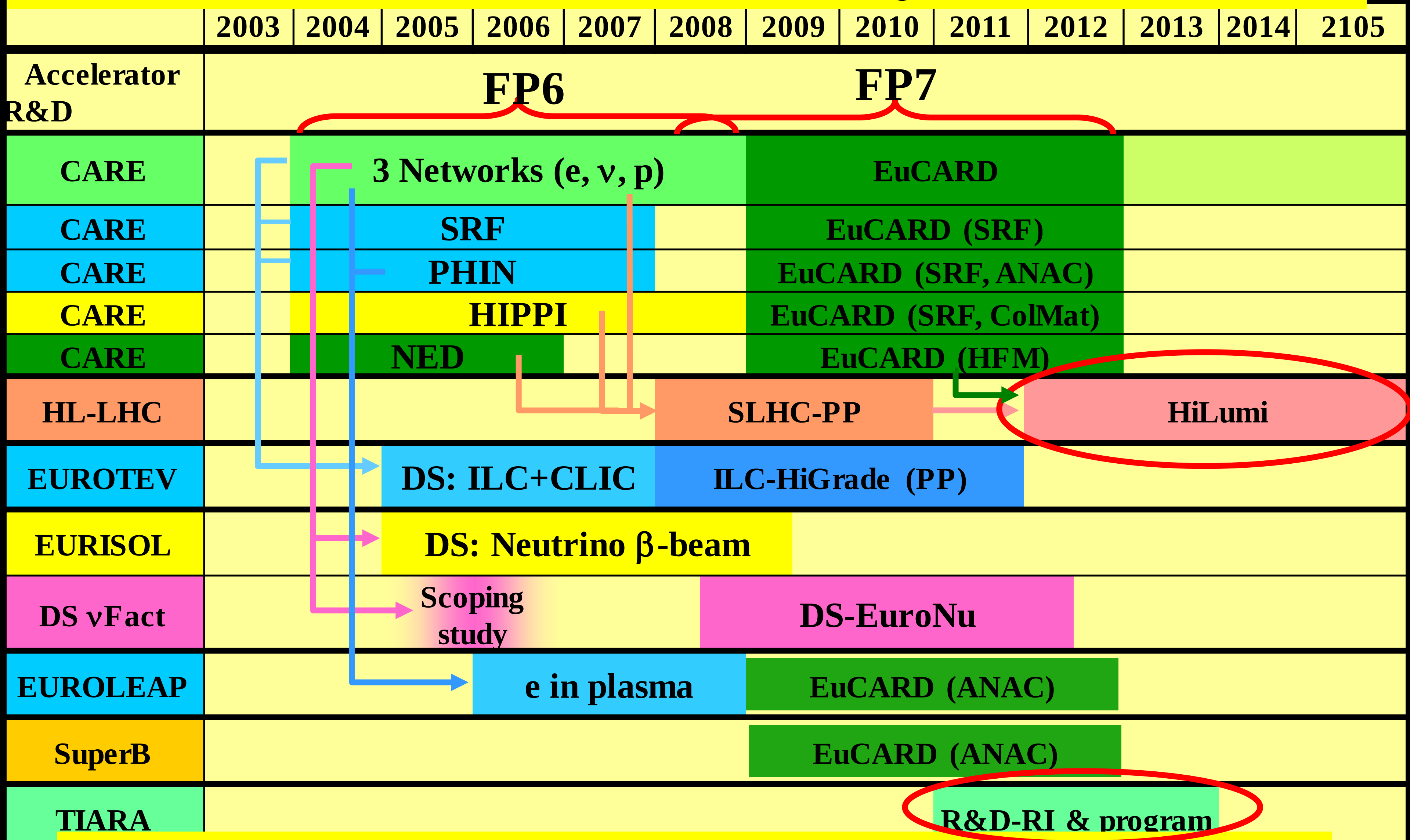
Other source of inputs (whenever not available from (or complementary to) organized facility projects)

- *ESGARD committee (i.e. EU Accelerator R&D projects…)*
- *TIARA :*
  - *general KARA document already exists*
  - *Several surveys to come*
    - *Education&Training in accelerator science and technology*
    - *Accelerator R&D infrastructures*
- *Interview of selected key people (could be done jointly with other sections)*
  - *From US (DoE(HEPAP)? and/or FNAL?)*
  - *From Asia (ACFA? and/or KEK?)*
- *Written contributions from the community*

Essential that

- *I am the NOT the only responsible person in the PG for AS&T section!*
- *We can form a committee with the contact people for editing the Briefing Book section on AS&T*

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)

The use of Accelerators: much beyond HEP

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