Concluding remarks

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CARE
Coordinated Accelerator Research in Europe

http://care.lal.in2p3.fr

This meeting has clearly demonstrated once again the outstanding achievements of CARE

…indeed

- **The large majority of the deliverables have been achieved**
- **For several of them we have done better than expected**
- **For the remaining deliverables the work is done and only the report is missing**

Why do we do all these efforts

For unraveling the fundamental mysteries of the universe,
it is necessary

- to "recreate" the initial conditions of the "Big Bang",
- to search for rare events,
- to observe the universe,
- to collect large datasets and carry sophisticated analysis

4 generic type of equipments are needed

- State of the art accelerators
- Large infrastructures (ground based, underground, underwater…)
- State of the art detector technologies
- Large data set management and analysis power

Each of these equipments can be useful (vital) to other disciplines …
… as well as for industrial developments

Elementary Particle Physics

"Discovering the Quantum Universe"™ (US-HEPAP)

I. Einstein's dream of unified forces:

1. **Are there undiscovered principles of nature: new forces, new symmetries, new physical laws ?**
2. **How can we solve the mystery of dark energy ?**
3. **Are there extra dimensions of space ?**
4. **Do all forces become one ?**

II. The particle world:

1. **Why are there so many kinds of particles ?**
2. **What is dark matter ? How can we make it in the laboratoy ?**
3. **What are neutrinos telling us ?**

III. The birth of the universe:

1. **How did the universe come to be ?**
2. **What happened to the anti-matter ?**

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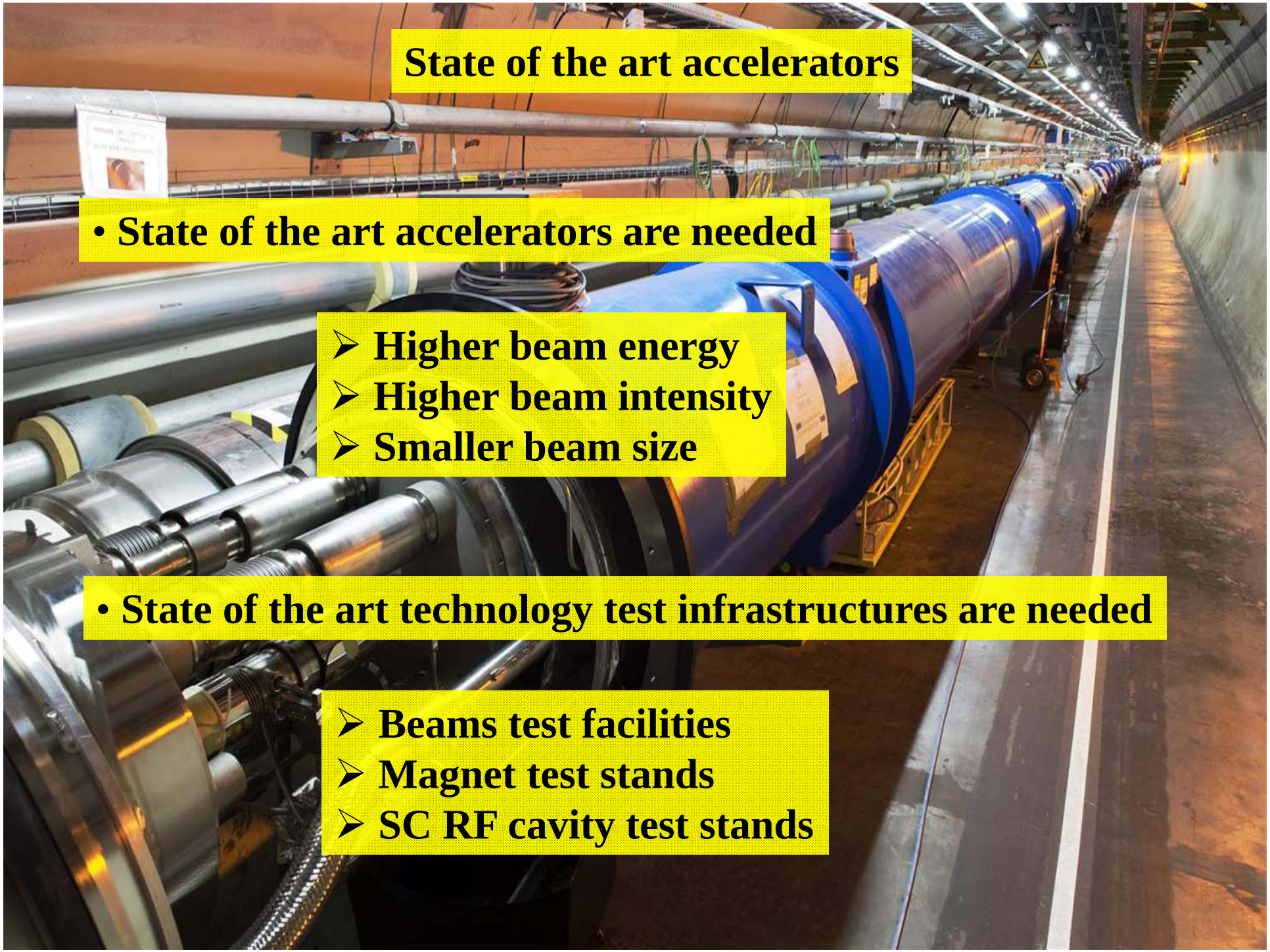
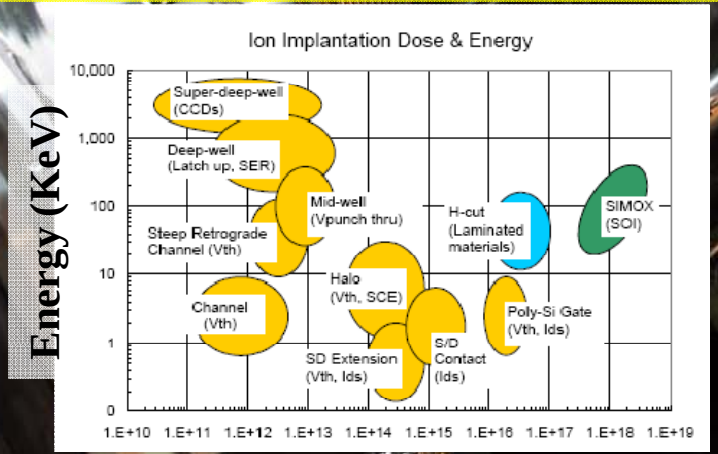

State of the art accelerators
• State of the art accelerators are needed
➢ Higher beam energy
➢ Higher beam intensity
➢ Smaller beam size
• State of the art technology test infrastructures are needed
➢ Beams test facilities
➢ Magnet test stands
➢ SC RF cavity test stands

Accelerator use

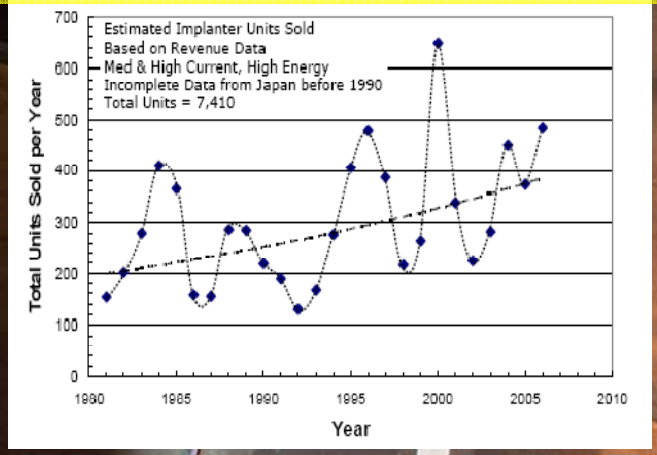
The development of state of the art accelerators for HEP has lead to

- **Research accelerators for other field of science (light source, spallation neutron sources…)**

- **Industrial accelerators (cancer therapy, ion implant., electron cutting&welding...)**



Ion Implatation accelerators



Industrial market for accelerators

Application	Total systems (2007) approx.	System sold/yr	Sales/yr ($M)	System price ($M)
Cancer Therapy	9100	500	1800	2.0 - 5.0
Ion Implantation	9500	500	1400	1.5 - 2.5
Electron cutting and welding	4500	100	150	0.5 - 2.5
Electron beam and X-ray irradiators	2000	75	130	0.2 - 8.0
Radioisotope production (incl. PET)	550	50	70	1.0 - 30
Non-destructive testing (incl. security)	650	100	70	0.3 - 2.0
Ion beam analysis (incl. AMS)	200	25	30	0.4 - 1.5
Neutron generators (incl. sealed tubes)	1000	50	30	0.1 - 3.0
Total	27500	1400	3680	

Total accelerators sales increasing more than 10% per year

Most, if not all, of the progress done in CARE are useful worldwide for the development of accelerators for

- ❑ **Basic research on the origin and the content of the universe**
- ❑ **many other scientific fields (basic and applied research),**
- ❑ **societal issues and industrial applications**

European Infrastructures benefiting from CARE (non-exhaustive)

Laboratory	Accelerator	Description
BESSY	BESSY	Synchrotron light source
CCLRC-RAL	ISIS, MICE	neutron and muon accelerator complex
CERN	LHC,SLHC CNGS ISOLDE CTF3 FRESCA	Proton accelerator complex Neutrino beam Ion acceleration Electron two-beam linac test facility Superconducting wire and cable test facility
DESY	FLASH, PITZ XFEL	SC electron linac and injector facilities FEL
FZ Rosendorf	ELBE	Electron linear accelerator
GSI Darmstadt	SIS, ESR,FAIR UNILAC	Heavy-ion and proton accelerator complex Accelerator for beam and diagnostics tests
INFN-Frascati	SPARC	FEL
LAL-Orsay	PHIL	Electron injector

…and many other European and worldwide infrastructures benefiting less directly

CARE
Coordinated Accelerator Research in Europe

Many studies and realizations have or will have important impact for Infrastructures

Some non-exhaustive examples:

- SC Cavity surface treatment
- BPM (XFEL…)
- Coupler development and conditioning (XFEL, ILC)
- Blades Tuners (Fermilab, Cornell, ILC…)
- LLRF (Flash, Fermilab, University test beds…)
- Photo-injectors (CTF3, SPARC, ELBE, BESSY…)
- Chopper (ISIS, LINAC4…)
- DTL, CCDTL, CHDTL, SCL… (LINAC4, ISIS, GSI-linac)
- SC cavities (elliptical, spoke) (SPL, ESS…)
- High Jc conductor (SLHC, ILC/CLIC…)
- Machine study and Code benchmarking (UNILAC, any future linacs…)
- …

The final report will highlight the impact of CARE for Research Infrastructures

Networking Activities

All networks have been very active and successful fostering collaborations for R&D

Also initiating, carrying and/or supporting very innovative studies, as well as R&D

ELAN

EuroTEV (DS), EuroLEAP(NEST), EuCARD (IA)

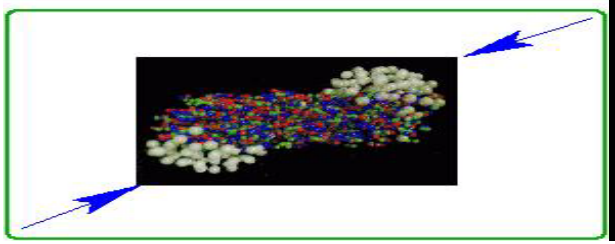
ILC studies, CLIC/CTF3 studies (HT-13)
New acceleration tech.

BENE

EURISOL-βbeam (DS), EuroNu (DS), EuCARD (IA)

Comparative studies for SuperBeam, βbeam, νFact.
MICE (HT-6), MERIT (HT-12). FFAG studies

SLHC (PP), EuCARD (IA)



SPL and PS2 studies, Crab cavities for LHC (HT-14),
Pulsed SC Magnet for FAIR (HT-5), Crystal coll. (HT-11)
Code benchmarking (HT-13), SC database…

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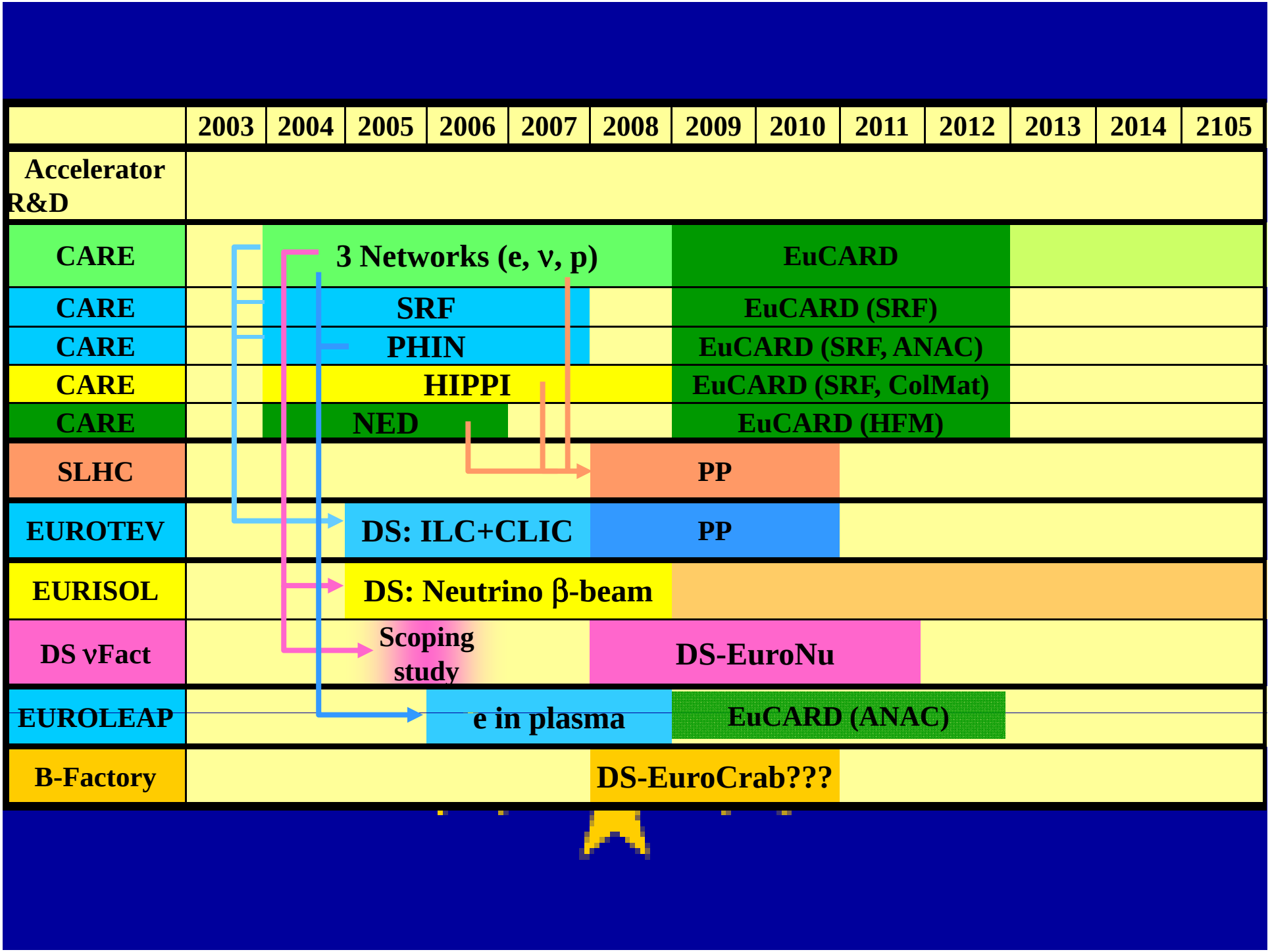

2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2105
Accelerator R&D
CARE
3 Networks (e, ν, p)
EuCARD
CARE
SRF
EuCARD (SRF)
CARE
PHIN
EuCARD (SRF, ANAC)
CARE
HIPPI
EuCARD (SRF, ColMat)
CARE
NED
EuCARD (HFM)
SLHC
PP
EUROTEV
DS: ILC+CLIC
PP
EURISOL
DS: Neutrino β-beam
DS νFact
Scoping study
DS-EuroNu
EUROLEAP
e in plasma
EuCARD (ANAC)
B-Factory
DS-EuroCrab???

This meeting has been successful in many ways

… thanks to the nice works carried out by the Collaboration

…but also thanks to our host

Many thanks to J.-P. Koutchouk and its CERN team

Paszkowska	Anna
Bosteels	Claudine
Laface	Emmanuele
Sterbini	Guido

Looking forward

With the end of CARE a great adventure is coming to its conclusion with outstanding results

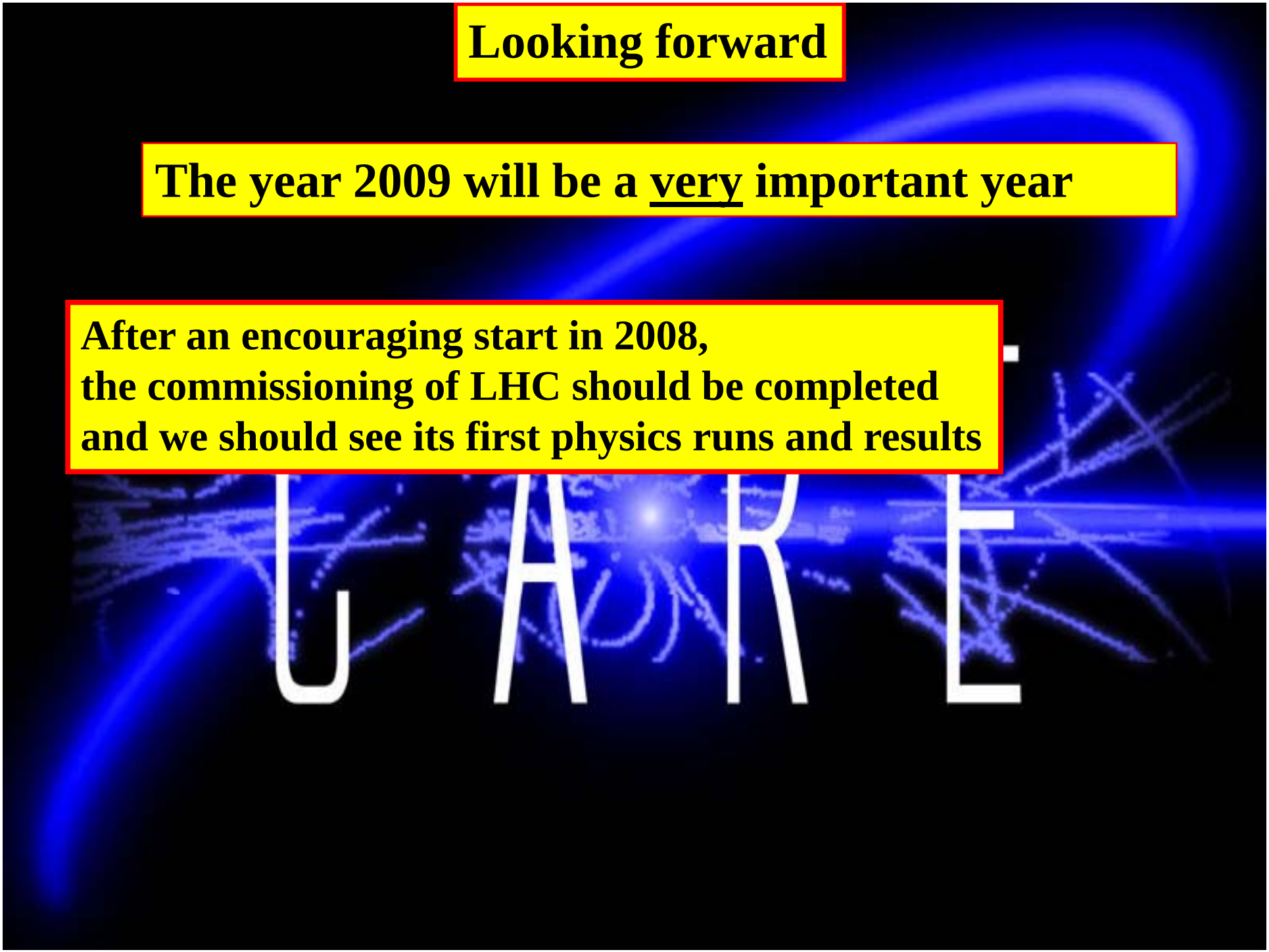
Congratulation to you for your fantastic work, which we can be proud of

It was an honor and a real pleasure to work with you all

Looking forward

The year 2009 will be a very important year

**After an encouraging start in 2008,
the commissioning of LHC should be completed
and we should see its first physics runs and results**



“Le roi CARE est mort…”

“…vive le roi”

Many new excitements are ahead of us

Thank you for your efforts to continue making the success
of the CARE endeavor and looking forward to see you very soon


C A R E