

# Physics Beyond Colliders

## Beyond Collider Physics study group

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# Three main scientific pillars

Full exploitation of the LHC → over the period of this MTP:

- ❑ successful Run 2, LS2, and Run 3 start-up
- ❑ construction and installation of LIU; on-track construction of HL-LHC

Scientific diversity programme serving a broad community:

- ❑ ongoing experiments and facilities at Booster, PS, SPS and their upgrades (ELENA, HIE-ISOLDE)
- ❑ participation in accelerator-based neutrino projects outside Europe (presently mainly LBNF in the US) through CERN Neutrino Platform

Preparation of CERN's future:

- ❑ vibrant accelerator R&D programme exploiting CERN's strengths and uniqueness (including superconducting high-field magnets, AWAKE, etc.)
- ❑ design studies for future accelerators: CLIC, FCC (includes HE-LHC)
- ❑ future opportunities of diversity programme (new): "Physics Beyond Colliders" Study Group

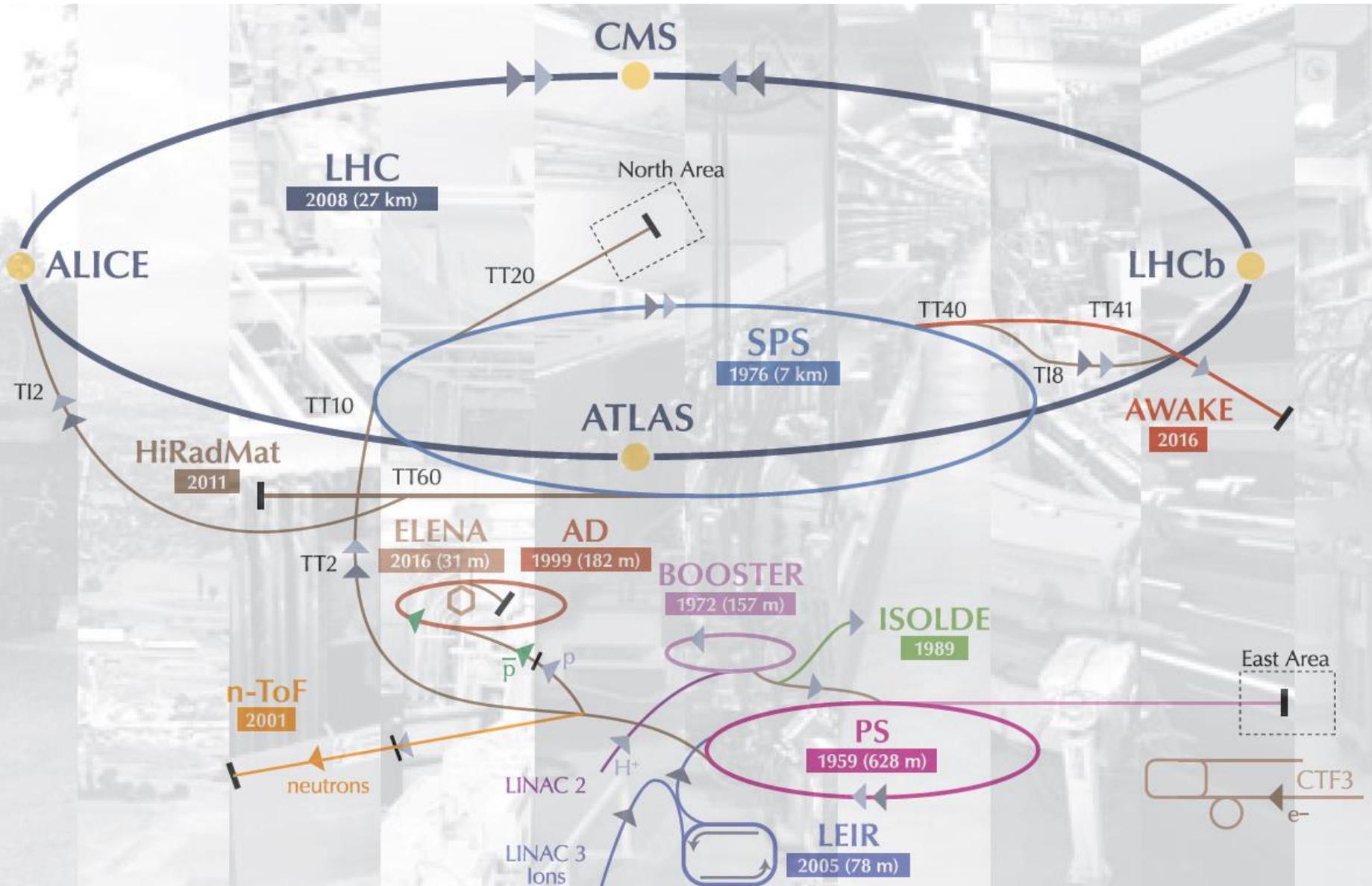
Important milestone: update of the European Strategy for Particle Physics (ESPP): ~ 2019-2020  
→ 10-year view has uncertainties beyond 2020 for part of programme other than LHC upgrade

**Fabiola Gianotti SPC May 2016**

# PBC - Scientific goal

- The main goal of the Study Group is to explore the opportunities offered by the CERN accelerator complex to address some of today's outstanding questions in particle physics through experiments complementary to high-energy colliders and other initiatives in the world.
- These experiments would typically:
  - enrich and diversify the CERN scientific program,
  - exploit the unique opportunities offered by CERN's accelerator complex and scientific infrastructure,
  - complement the laboratory's collider programme (LHC, HL-LHC and possible future colliders).
  - Examples of physics objectives include searches for rare processes and very-weakly interacting particles, measurements of electric dipole moments, etc.

This study should provide input for the future of CERN's scientific diversity programme, which today consists of several facilities and experiments at the Booster, PS and SPS, over the period until ~2040.



# What's not in

Medical applications
Beta beams
ADSR
Short baseline neutrino
Long baseline neutrino
g-2
Mu2e
AWAKE (as a project)
Neutrino platform
FCC era variations



# Physics Beyond Colliders

Kickoff workshop of the Physics Beyond Colliders study group to be held at CERN, Geneva, on 6-7 September, 2016.

The main goal of the Study Group is to explore the opportunities offered by the CERN accelerator complex and infrastructure to provide new insight into some of today's outstanding questions in particle physics through projects complementary to high-energy colliders and other initiatives in the world.

The focus is on fundamental questions that are similar in spirit to those addressed by high-energy colliders, but that may require different types of experiments. The kick-off workshop is intended to stimulate new ideas for such projects, for which we encourage submission of abstracts.

Details on the workshop programme, registration and abstract submission, as well as the mandate of the Study Group, can be found on the workshop web site: <https://indico.cern.ch/event/523655/>

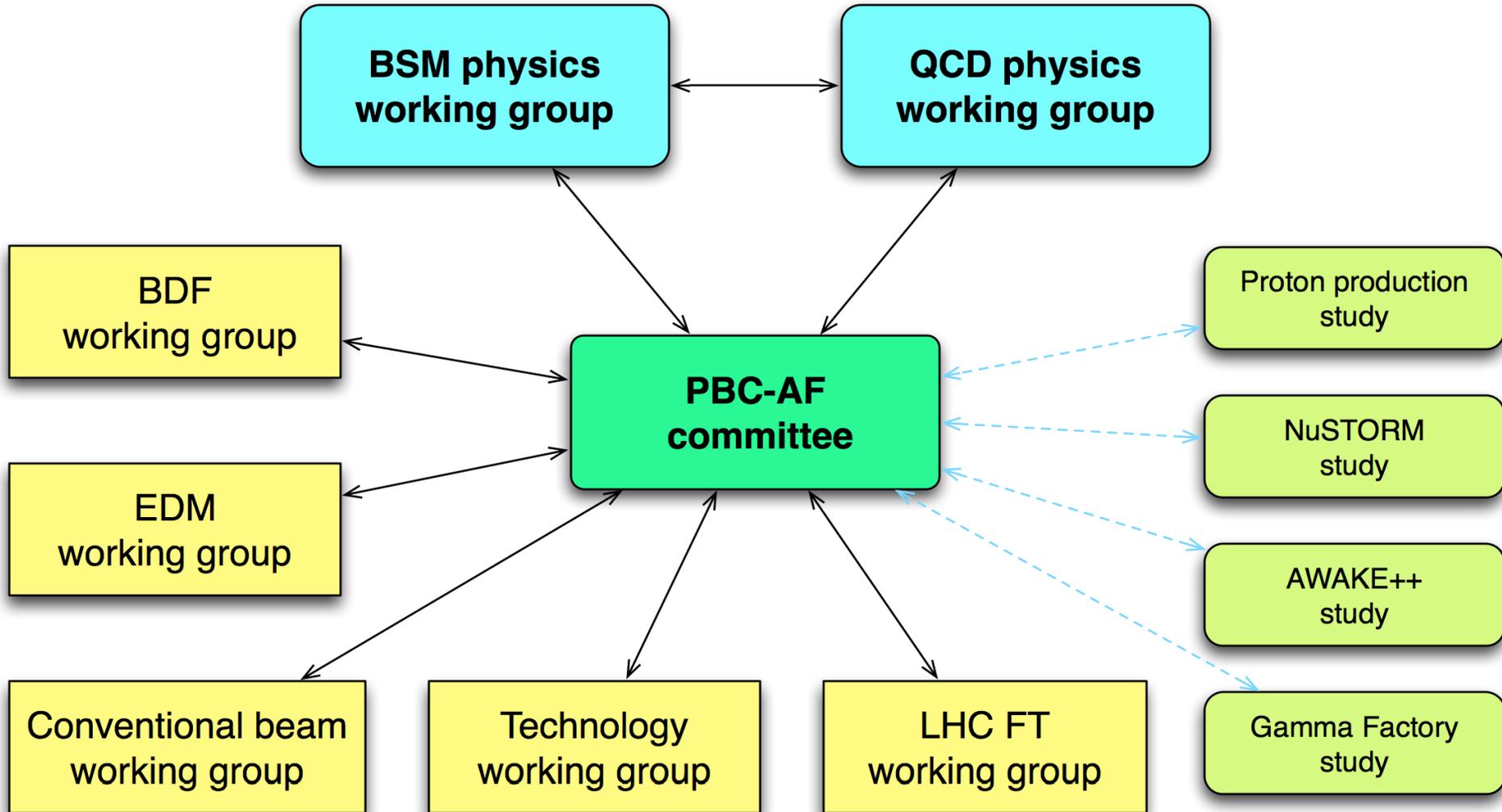
Organizing Committee: Joerg Jaeckel, Mike Lamont, Connie Potter, Claude Vallée.  
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# ONGOING

- **Working Groups are being set up to address:**
  - the physics case of the proposed projects in the worldwide landscape
  - their feasibility and possible implementation at CERN (or elsewhere)*... with involvement tuned to the level of maturity of the projects*
- **Follow-up PBC workshop foreseen in 2017.**
- **Final deliverable due end 2018:** summary document as input to the European Strategy Update process (2019-20).  
*Will gather facts on the projects (no ranking!)  
to facilitate future orientations from the ESU group.*

# Organization



# Physics domain

- For each proposed project deliverables will include:
  - evaluation of the physics case in the worldwide context;
  - possible further detector optimization;
  - and, for new projects, investigation of the uniqueness of the CERN accelerator complex for their realization.
  - The subgroup core members include theory and experimental experts of the corresponding domains as well as representatives of the projects.
- **Physics sub working groups:**
  - **BSM subgroup:** current projects: SHIP/NA64++/NA62++/KLEVER/IAXO/LSW/**EDM**
  - **QCD subgroup:** current projects: COMPASS++/ $\mu$ -e/LHC FT (gas target+crystal extraction) / DIRAC++/ NA60++/NA61++

# Deliverables

COMPLEX	Fully developed proton performance plan
BDF	Complete technical feasibility studies – input to SHIP CDS
EDM	Fully developed proposal including preliminary costing
SPS NA	Establish requirements, initiate feasibility studies
LHC FT	Preliminary conceptual design report
GAMMA	Exploratory study, initiate initial tests
AWAKE+	Exploratory study

Technology	<ul style="list-style-type: none"><li>• Explore possible technological contributions by CERN to externally hosted facilities</li><li>• Document actual use of CERN infrastructure</li><li>• Facilitate potential use of CERN infrastructure</li><li>• Study physics case and technical requirements as input to ESU</li></ul>
nuSTORM	<ul style="list-style-type: none"><li>• Exploratory study of implementation at CERN</li><li>• Review potential scientific impact</li></ul>

# Conclusions

- Physics Beyond Colliders study group to look at CERN's non-collider options out to 2040
  - Report to ESPP in 2019
- Kickoff meeting in September put a number of options on the table
- In the process of launching working groups and studies of appropriate depth
- Clearly a lot of support for an EDM initiative out there!

But please bear in mind the competition for resources.

