

Physics Beyond Colliders workshop

Introduction

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1st March 2017



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

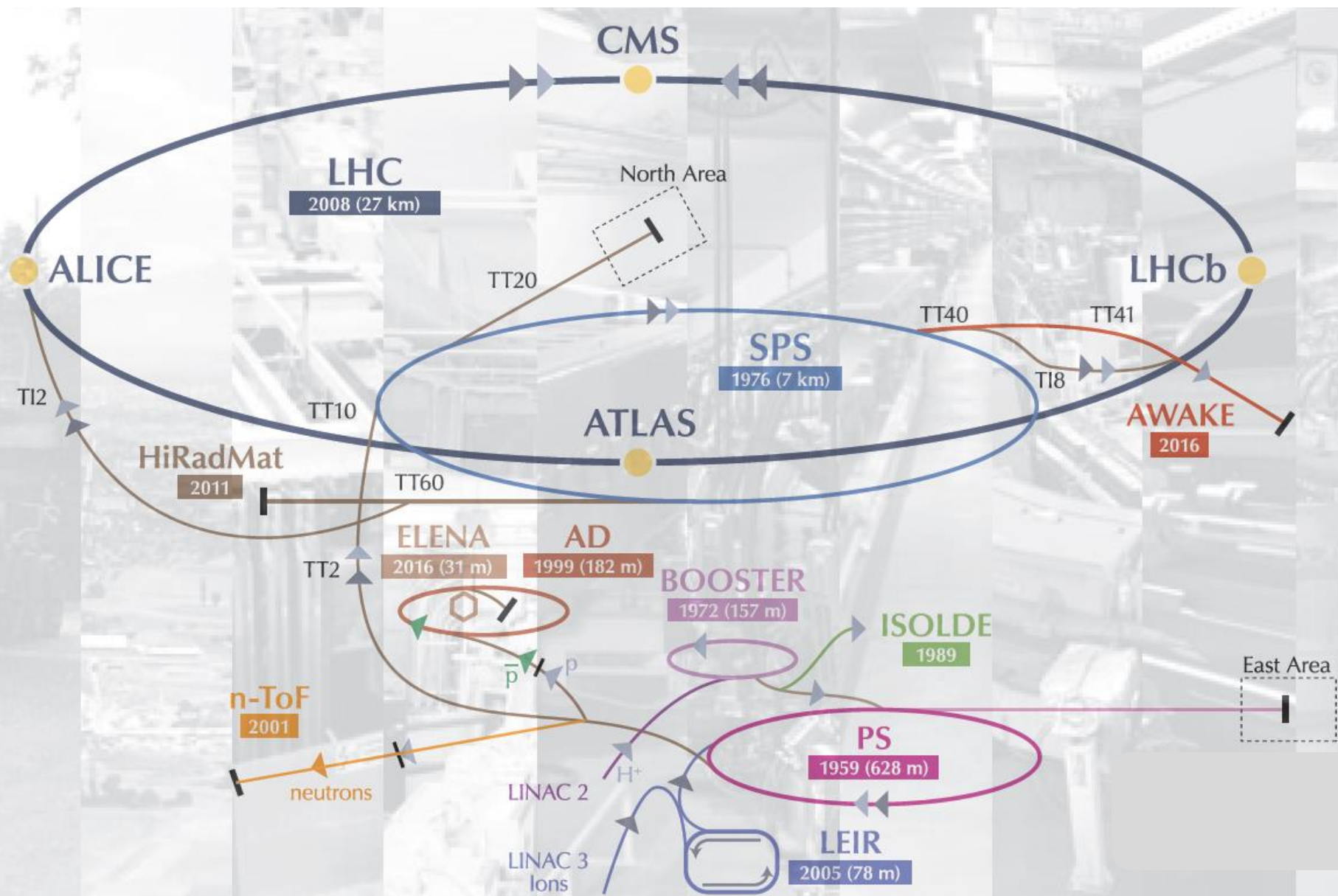
Important milestone: update of the European Strategy for Particle Physics (ESPP): ~ 2019-2020
→ 10-year view has uncertainties beyond 2020 for part of programme other than LHC upgrade

Fabiola Gianotti SPC May 2016

PBC - scientific goal

- Explore the opportunities offered by the CERN accelerator complex to address some of today's outstanding questions in particle physics
- 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
- 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!

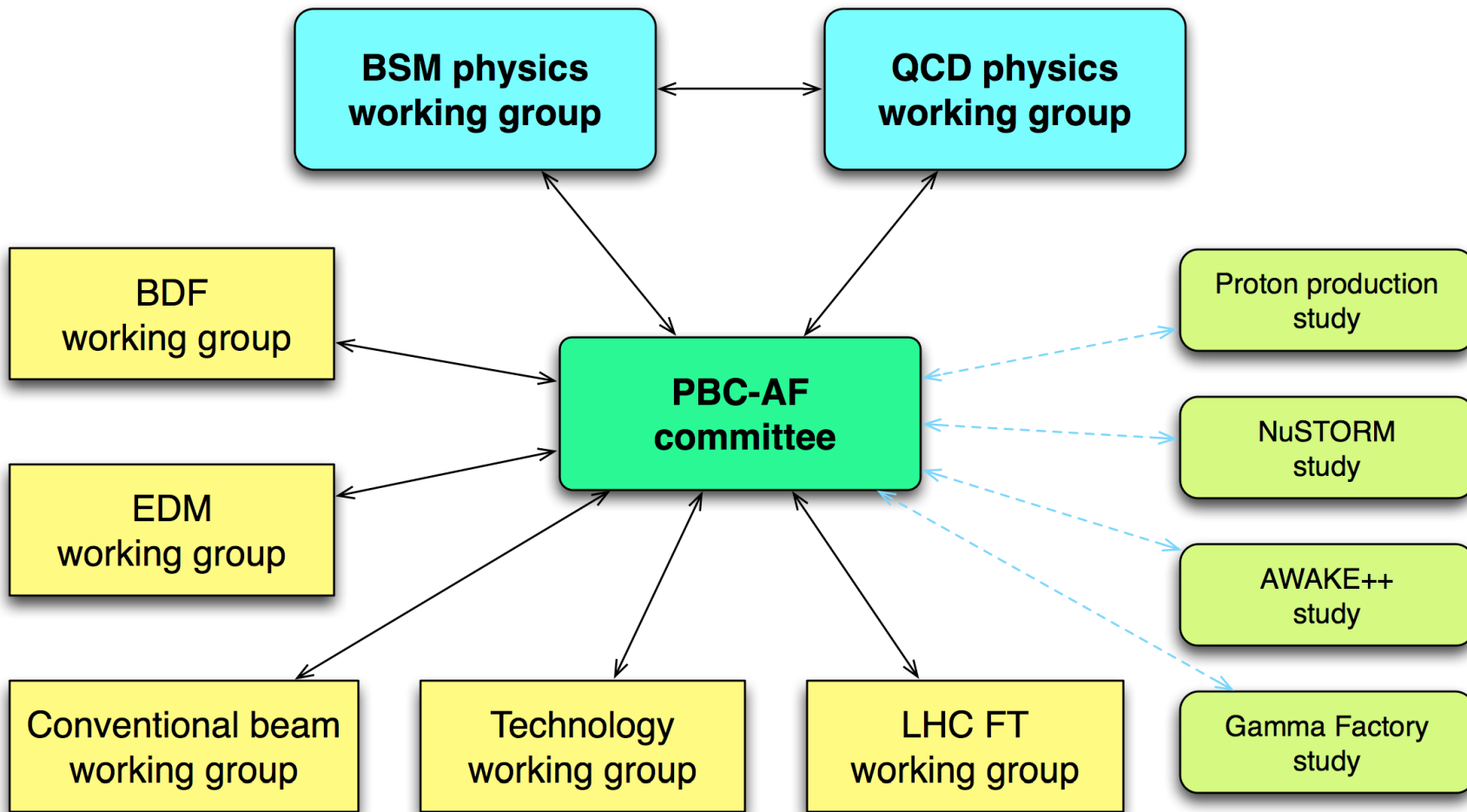
Medical applications
Beta beams
ADSR
Short baseline neutrino
Long baseline neutrino
g-2
Mu2e
AWAKE (as a project)
Neutrino platform
FCC era variations

Working groups

Collected input from the community mainly via the kick-off workshop

- Working Groups have been 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 deliverables being tuned to the level of maturity of the projects**
- First general working group meeting 1-2 March
 - Present plans, deliverables, timeline, resources
- Follow-up PBC workshop foreseen in autumn 2017.

Organization



Conveners have been nominated for each group – see [//cern.ch/psc](https://cern.ch/psc) for details

Physics sub-working groups

- **BSM subgroup:**

- current projects: SHIP; NA64++; NA62++; KLEVER; IAXO; LSW; EDM

- **QCD subgroup:**

- current projects: COMPASS++; μ -e; LHC FT (gas target+crystal extraction); DIRAC++; NA60++; NA61++

The subgroup core members include theory and experimental experts of the corresponding domains as well as representatives of the projects.

Presentations from each this afternoon (QCD) and tomorrow morning (BSM)

Physics domain - deliverables

- 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.

Accelerator domain - deliverables

COMPLEX	Fully developed proton performance plan – post LIU era
BDF	<ul style="list-style-type: none">• Complete technical feasibility studies• Preliminary Comprehensive design report
EDM	Fully developed proposal including preliminary costing
CONV. BEAMS	Establish requirements, initiate feasibility studies
LHC FT	Preliminary conceptual design report(s)
GAMMA	Exploratory study, initiate initial tests
nuSTORM	<ul style="list-style-type: none">• Exploratory study of implementation at CERN• Review potential scientific impact
AWAKE+	Exploratory study for potential application of AWAKE concept
Technology	<ul style="list-style-type: none">• Explore possible technological contributions by CERN to externally hosted facilities• Facilitate potential use of CERN infrastructure• Study physics case and technical requirements as input to ESU

We'll hear from most of these this morning...

Deliverables

- Final deliverable due end 2018:
 - Summary document as input to the European Strategy Update process (2019-20)
 - Foresee executive summaries from each group
- Will gather and summarize the status and potential of the projects to help facilitate the update of the ESPP by the ESG group.

The remit of the ESG is to establish a proposal for an Update of the medium and long-term European Strategy for Particle Physics, for approval by the Council.

Conclusions

- Physics Beyond Colliders study to look at CERN's non-collider options out to 2040
- Wide range of physics and accelerator domain groups have been set up...
- ...it looks like being an interesting couple of years!

Workshop organization

Session	Room
Wednesday 1 st March - AM	40-S2-D01 - Salle Dirac
Wednesday 1 st March - PM	60-6-015 - Room Georges Charpak (Room F)
Thursday 2 nd March - AM	40-S2-B01 - Salle Bohr
Thursday 2 nd March - PM	40-S2-B01 - Salle Bohr

- Coffee will be served at each session (fresh croissants c/o Connie)
- Lunch is up to you
- There will be a drink in restaurant 1 (opposite the self service coffee machines) at the end of the day Wednesday