European Particle Physics Strategy Update 2020

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- European Particle Physics Strategy (EPPS) – why?
- Recommendations and outcome of EPPSU 2013
- Preparations for the EPPSU 2020

Why European Strategy for Particle Physics?

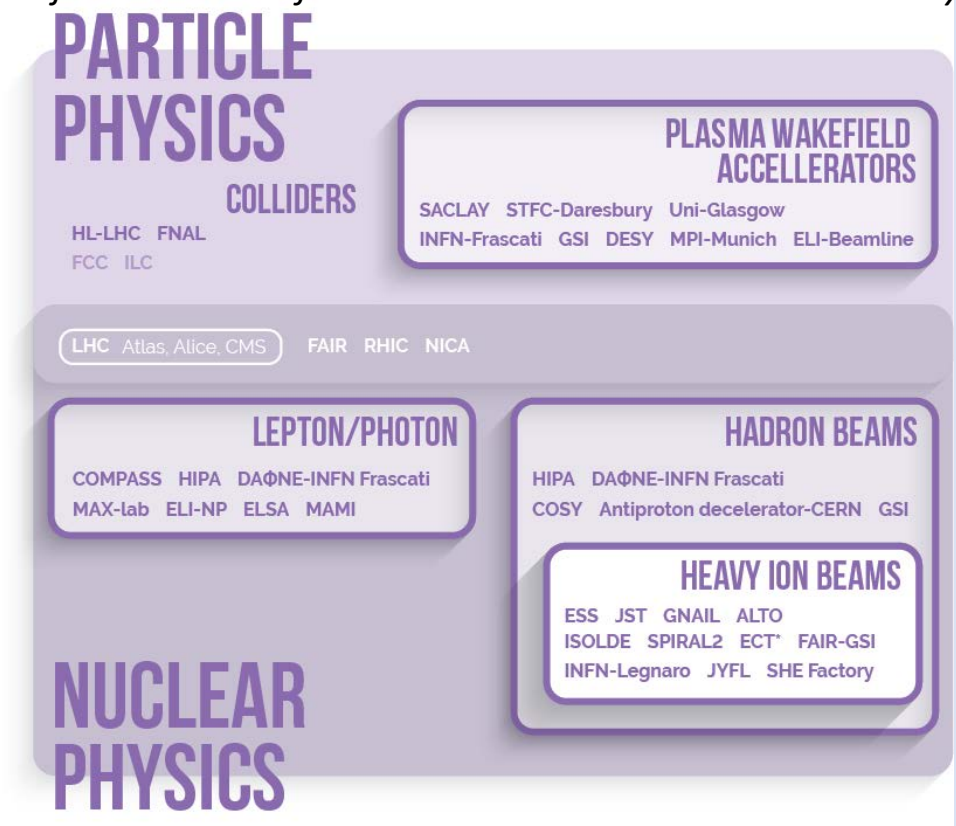
- Relation between ESFRI and CERN had to be clarified within the European Commission
  - ESFRI, the European Strategy Forum on Research Infrastructures (initiated in 2002, mandated in 2004), is a strategic instrument to develop the scientific integration of Europe and to strengthen its international outreach.
  - CERN's convention mandates coordination of infrastructure of particle physics for Member States

- First ESFRI roadmap published in 2006, with 35 projects, the Roadmap was updated in 2008 bringing the number of RIs of pan-European relevance to 44. Later updates 2010, 2016, 2018 (49+6 new)

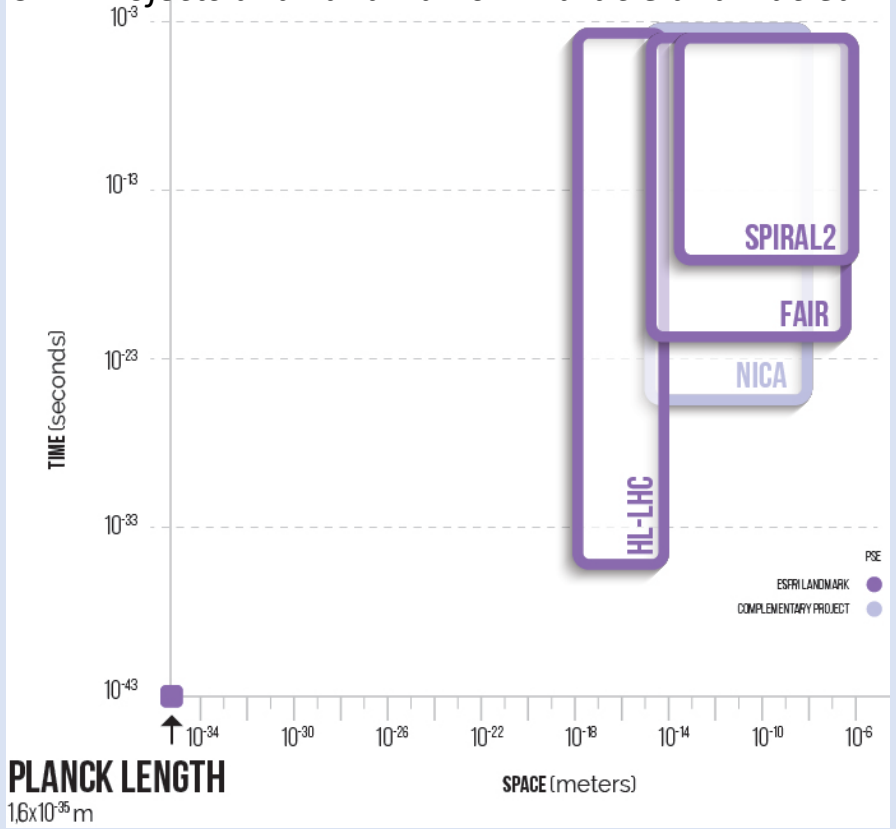
- First European Particle Physics Strategy (EPPS) called by CERN Council in 2005 and endorsed in 2006, latest update in 2013… next in 2020.

Why European Strategy for Particle Physics?

Major Research Infrastructures in Particle and Nuclear Physics



ESFRI Projects and Landmarks in Particle and Nuclear Physics



Strategy Group Remit for the 2006 EPPS

The Strategy Group shall aim:

- to enhance the visibility of existing European particle physics programs;
- to foster increased collaboration among Europe's particle physics laboratories and institutes;
- to promote a coordinated European participation in world-wide projects;
- to reiterate the CERN Council's 2004 position on the European strategy for the International Linear Collider;
- to encourage knowledge transfer to other disciplines, industries, and society;

- to outline priorities, at least implicitly;

- to consider time scales;

- to follow a thematic or project approach, whichever is more appropriate.

Implementation of the 2013 EPPSU

A regional strategy implemented in a worldwide context

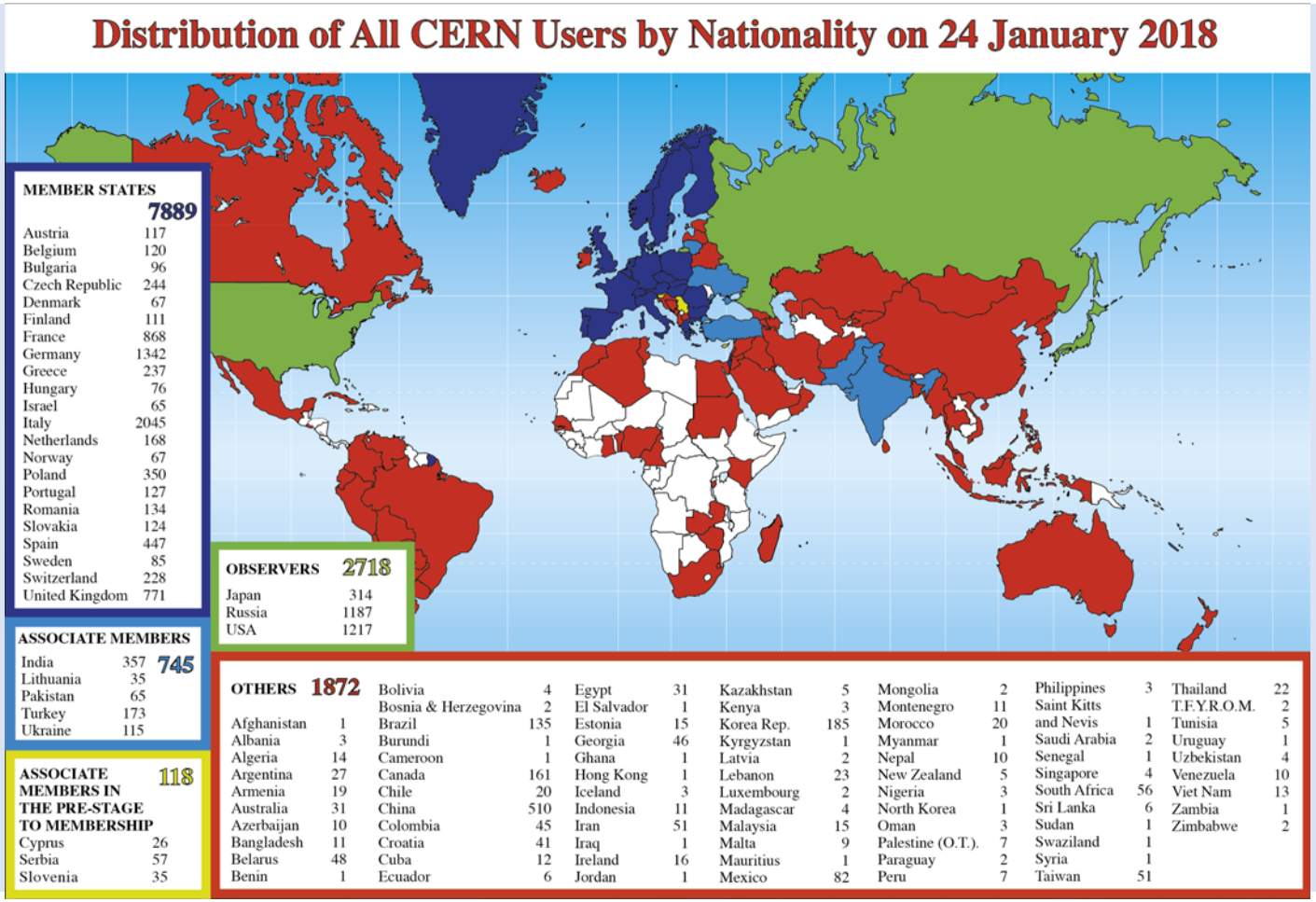
Key information from the presentation of the CERN DG (F. Gianotti) to Council, Sept 2017

…..

Approved by Council, March 2014:

"… since the Director-General has the mandate to execute all the Council's decisions, it follows that the Director-General should also be responsible for the implementation of the European Strategy for Particle Physics."

Geographical distribution of CERN Users



Total 13342 users

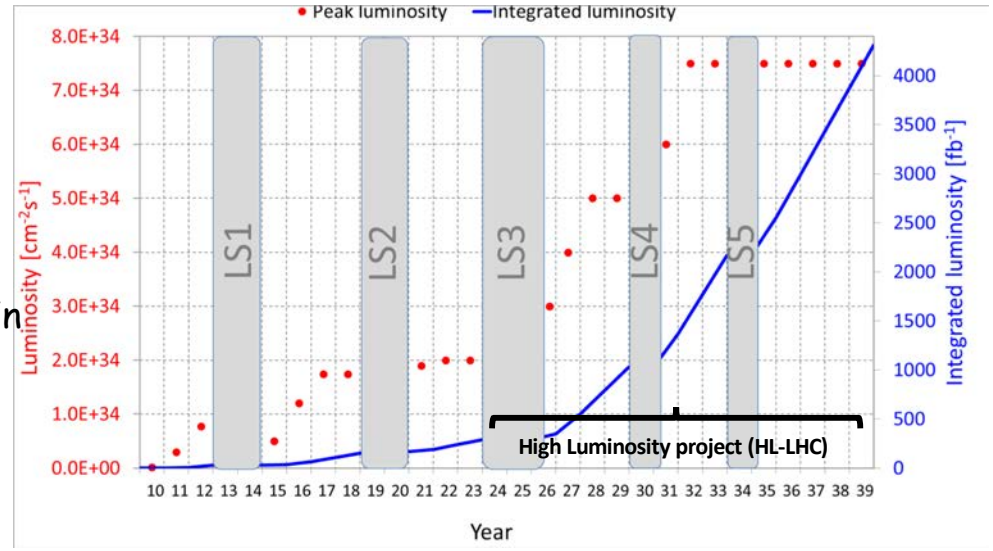
Observer States 20%

US 1217 users 9%

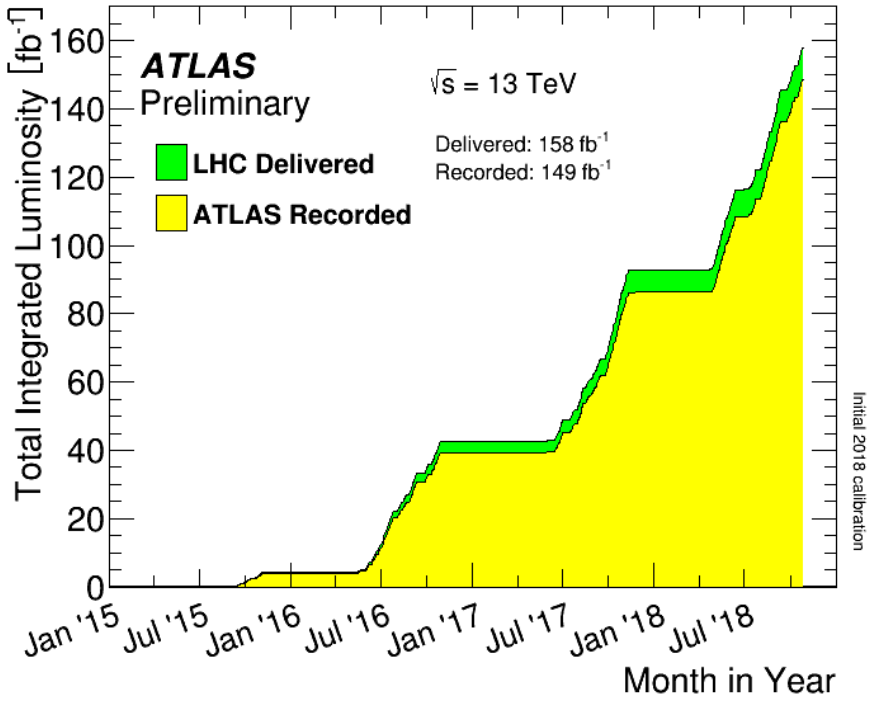
Implementation of the 2013 EPPSU

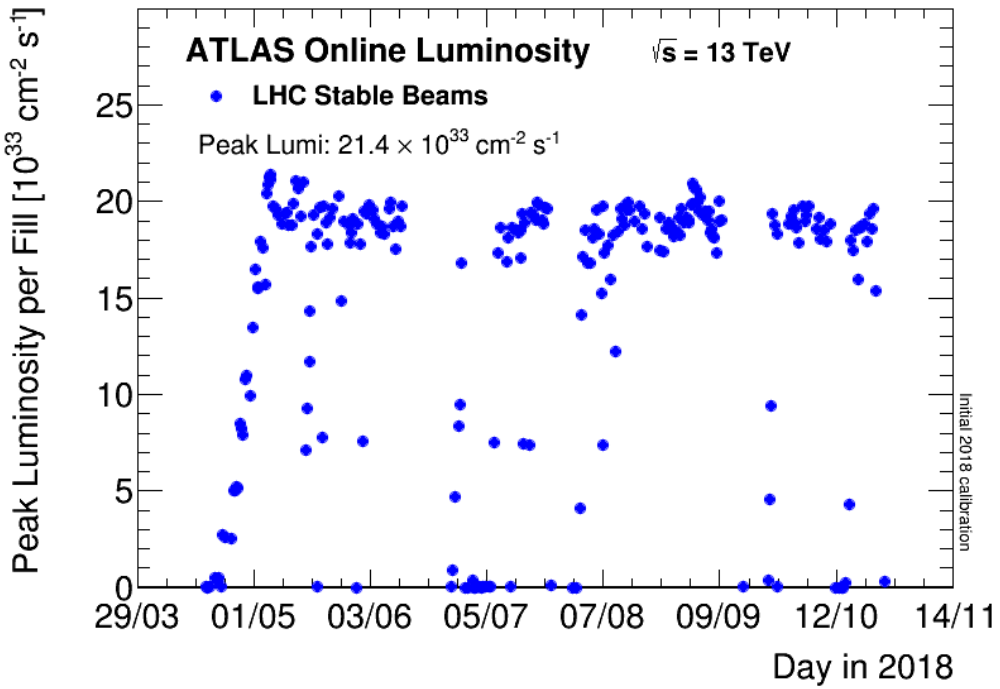
Europe's top priority should be the exploitation of the full potential of the LHC, including the high-luminosity upgrade of the machine and detectors with a view to collecting ten times more data than in the initial design, by around 2030. This upgrade programme will also provide further exciting opportunities for the study of flavour physics and the quark-gluon plasma.

- Running at 13 TeV, goal is 300/fb by end of Run3 (2023)
- HL-LHC approved by Council in June 2016, goal is 3000/fb by ~2038
- LIU (LHC injector upgrade), HL-LHC and detector upgrades on schedule for installation in LS2 and LS3
- Expect to move to 14 TeV after LS2; exploring possibility to push energy to "ultimate" value (15 TeV) in Run4++



CERN and the LHC – integrated performance





Peak Luminosity 2.14 10^{34} cm^{-2} s^{-1}
above design

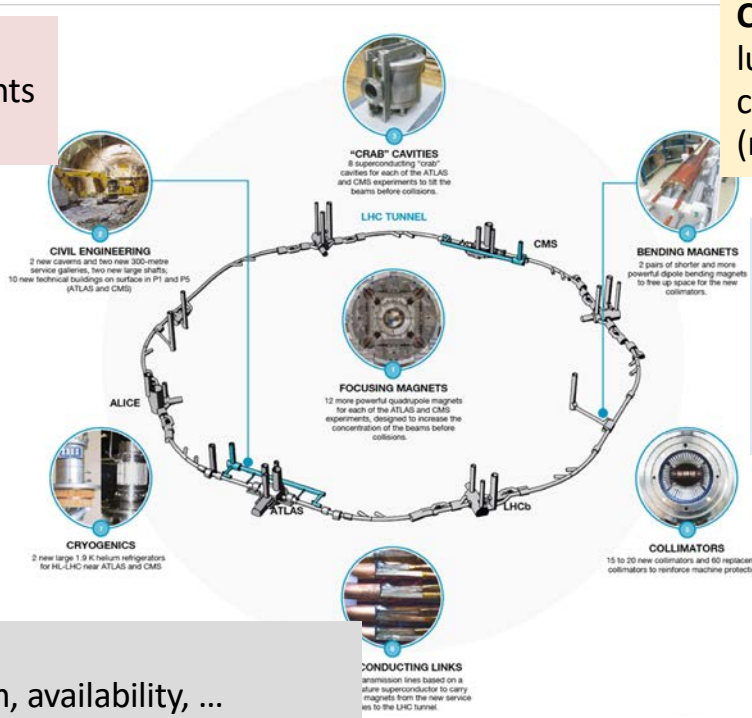
CERN and the High-Luminosity LHC: 300/fb → 3000/fb

From D. Schulte

Higher field focusing magnets at experiments
Models tested

Injector upgrade

Civil engineering and more **kryogenics**



Crab cavities to reduce luminosity reduction by crossing angle
(recent first tests in SPS)

Additional collimators to protect arcs
Stronger dipoles to make space for additional collimators
(recent first prototype)

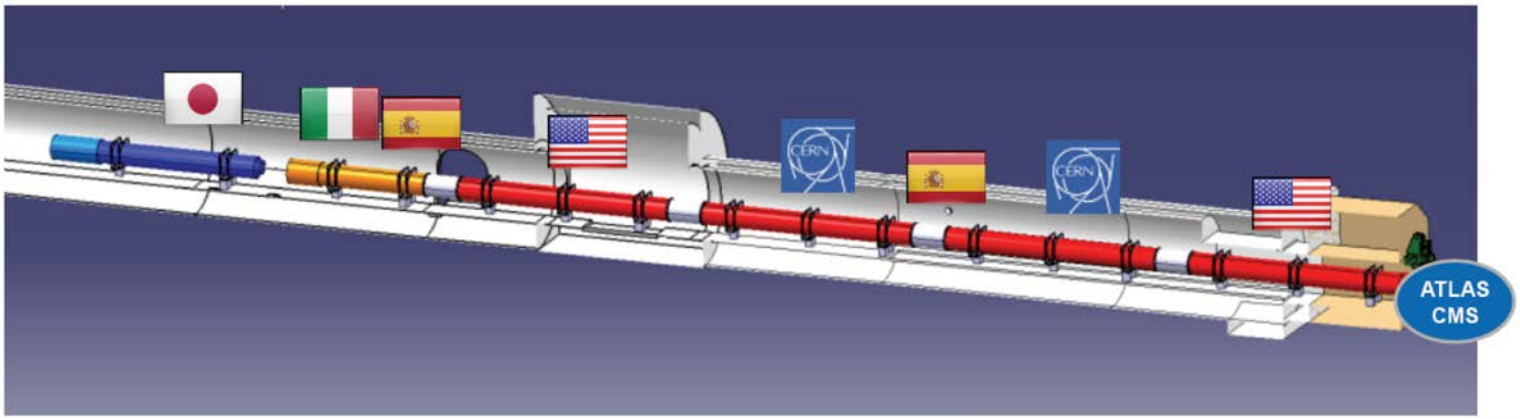
Improved collimator design and material

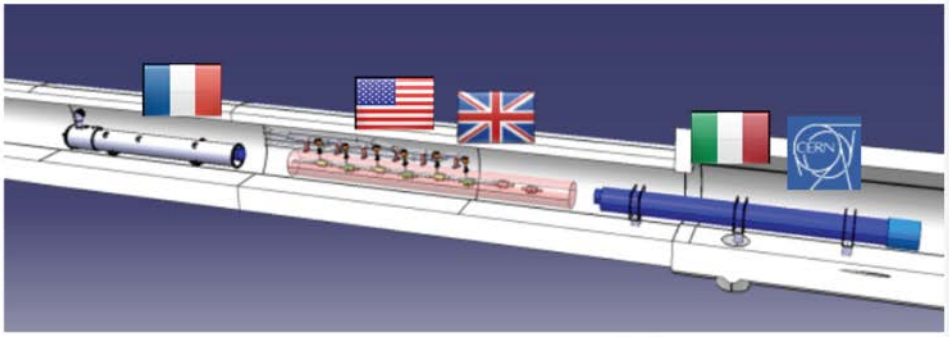
And many **more**
Instrumentation, vacuum, availability, …
Optics design, electron cloud, impedances, …

CERN and the High-Luminosity LHC: construction phase

In-kind contributions and collaborations for design, prototypes, production and tests

Discussions are ongoing with other countries, e.g India, Canada, Russia, China,...





Q1-Q3 : R&D, Design, Prototypes and in-kind **USA**
D1 : R&D, Design, Prototypes and in-kind **JP**
MCBX : Design and Prototype **ES**
HO Correctors: Design and Prototypes **IT**
Q4 : Design and Prototype **FR**

CC : R&D, Design and in-kind **USA**

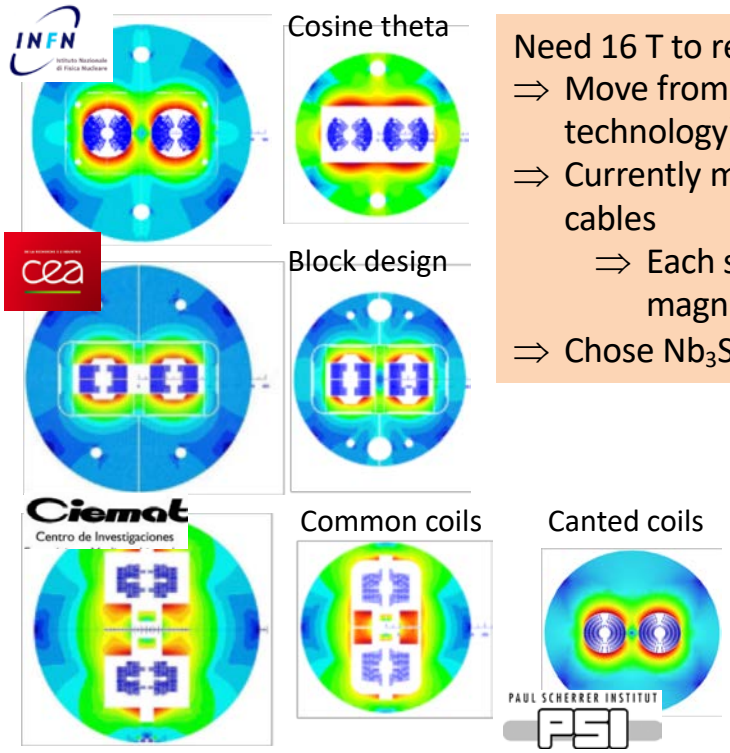
CC : R&D and Design **UK**

Implementation of the 2013 EPPSU

CERN should undertake design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines. These design studies should be coupled to a vigorous accelerator R&D programme, including high-field magnets and high-gradient accelerating structures, in collaboration with national institutes, laboratories and universities worldwide.

- CLIC working on implementation plan & cost reduction as input to ESPPU; CTF3 completed, evolved into CERN Linear Electron Accelerator for Research (CLEAR)
- FCC design studies started in 2014 → CDR in 2018 as input to ESPPU
- Superconducting magnets are developed mainly within HL-LHC and FCC projects
- Efforts on SCRF intensified (HIE-ISOLDE, LHC spares, HL-LHC crab cavities, etc.)
- New acceleration technologies are being explored: AWAKE (proton driven plasma wake field) – Acceleration of electrons in the plasma wakefield of a proton bunch - Nature 561 (2018) 363
- Strong collaborations and complementarity with labs and institutes worldwide (CEA, CIEMAT, DESY, INFN, RAL, FNAL, KEK, etc.)

Superconducting Magnets R&D



Need 16 T to reach 50 TeV /beam
⇒ Move from NbTi (LHC technology) to Nb_3Sn (or HTS)
⇒ Currently much higher cost for cables
  ⇒ Each step factor of a few magnitude in cost
⇒ Chose Nb_3Sn

Magnet is key cost driver
- Improve cable performance
- Reduce cable cost
- Improve fabrication of magnet
- Minimise amount of cables
- Push lattice filling factor

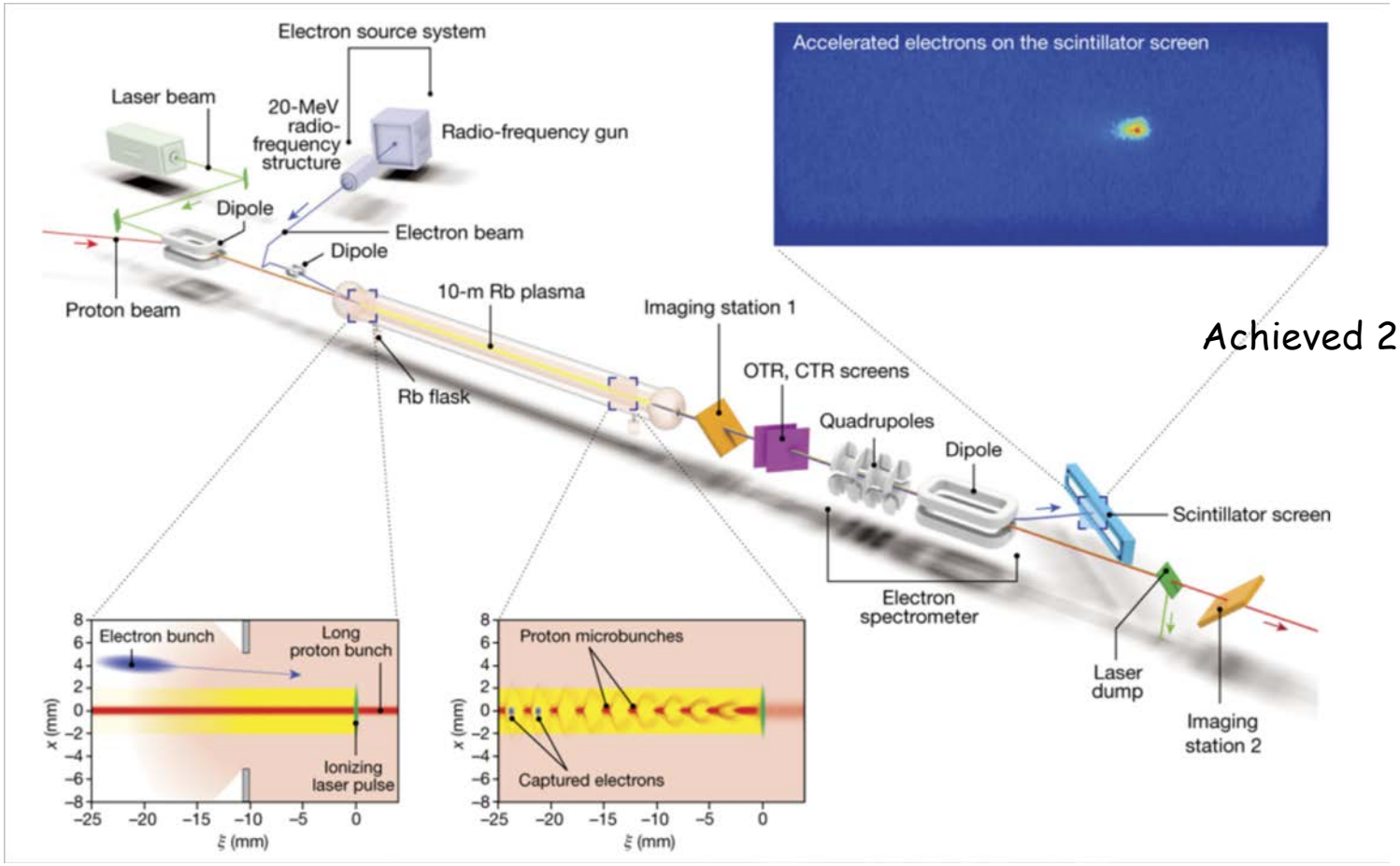
Several steps to reduce material
- Safety margin from 18% to 14%
- Stray field up to 0.1 T
- Attempt to reduce inter-beam distance (but not good for beam)

⇒ Total conductor (incl. copper) from O(10 kt) to 7.6 kt

Short models in 2018 – 2023
Prototypes 2026 -- 2032

16 T magnets would allow doubling the energy of the LHC machine (HE-LHC)

AWAKE – acceleration of electrons



Achieved 2 GeV over 10m

Implementation of the 2013 EPPSU

There is a strong scientific case for an electron-positron collider, … Europe looks forward to a proposal from Japan to discuss a possible participation.

- Many ongoing collaborations and synergies CLIC-ILC on accelerators (beam dynamics, damping rings, beam delivery systems, etc.) and detectors (CERN Linear Collider Detector group)
- CERN-KEK cooperation agreements (e.g. accelerator studies at ATF-KEK); CERN's help for civil engineering and geological studies of tunnel layout in Japan
- ILC action plan in Europe being prepared for CERN Council
- Baseline ILC – 250 GeV Higgs factory for cost reduction; technology proven ready with European XFEL at DESY
- Waiting for a statement from the Japanese Government for their willingness to host ILC ….

Implementation of the 2013 EPPSU

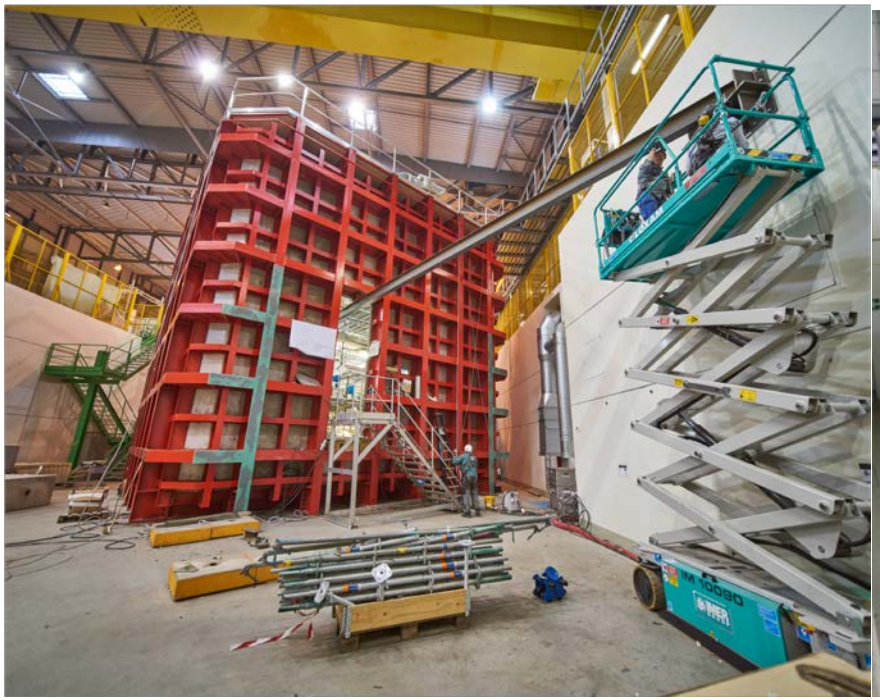
CERN should develop a neutrino programme to pave the way for a substantial European role in future long-baseline experiments. Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.

- CERN Neutrino Platform established in 2014 → became a project in 2016
- North Area extended to provide test beams and space for detector prototypes
- Supports detector R&D and construction in Europe (e.g. BabyMIND for T2K, DUNE prototypes, Near Detectors for both)
- CERN building first of four cryostats for DUNE detector based on new (for HEP) technology
- Neutrino group set up in EP in 2016 to carry out software and physics activities in synergy with TH, and help enhance coherence of efforts in the European community (e.g. currently providing forum for Near Detectors discussions and studies → Summer 2017 WS; Town Meeting October 2018)

Neutrino Platform at CERN

CERN's Neutrino Platform as a European "portal" to accelerator-based neutrino facilities worldwide

protoDUNE detectors at CERN



Baby MIND from CERN to Japan

Implementation of the 2013 EPPSU

Experiments studying quark flavour physics, dipole moments, charged-lepton violation and performing other precision measurements ... with neutrons, muons and antiprotons may give access to higher energy scales than direct particle production ... They can be based in national laboratories, with a moderate cost … Experiments in Europe with unique reach should be supported, as well as participation in experiments in other regions of the world.

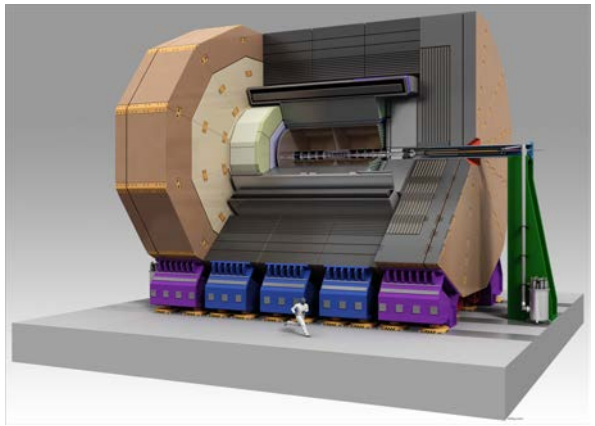
- Discussed e.g. in the framework of ELDM and ECFA plenary sessions (esp. outside CERN)
- Recognized Experiments @ CERN (REC): approved experiments from particle physics and nearby disciplines (e.g. astroparticle and GW) with substantial participation of CERN Member State physicists. REC benefit from intellectual exchanges with scientists at CERN and, within available CERN resources, from usage of computing, infrastructure for meetings, access to test beam and laboratory equipment. Examples of REC: MEG, Belle-II, Panda.
- Physics Beyond Collider Study Group set up in 2016 to explore compelling projects complementary to high-energy colliders → report in 2018 as input to the ESPP. Targeting mainly projects at CERN's injectors, but looking more broadly to experiments that can be realised in other labs with CERN support (e.g. axion searches at DESY).

Implementation of the 2013 EPPSU

Detector R&D programmes should be supported strongly at CERN, national institutes, laboratories and universities. Infrastructure and engineering capabilities for the R&D programme and construction of large detectors, as well as infrastructures for data analysis, data preservation and distributed data-intensive computing should be maintained and further developed.

- Detector R&D: intense activities at CERN and laboratories/institutes across Europe; generic R&D (e.g. CERN RDx projects, EU projects) and targeted (Phase-2 detector upgrades, Linear Collider Detector group, Neutrino Platform, etc.). Since few years also includes knowledge transfer activities (e.g. medical applications). Review panels put in place by ECFA (covering particle and astroparticle) and ICFA.
- Data, software and computing: conceptual, design and prototyping efforts to address the requirements of the HL-LHC phase started at CERN with Member States and in the broader framework of European Open Science Cloud (EIRO forum paper on Federated Scientific Data Hub). Tomorrow's SW requirements being addressed by HEP Software Foundation
- A Roadmap for HEP Software and Computing R&D for the 2020s (White Paper, arXiv:1712.06982)

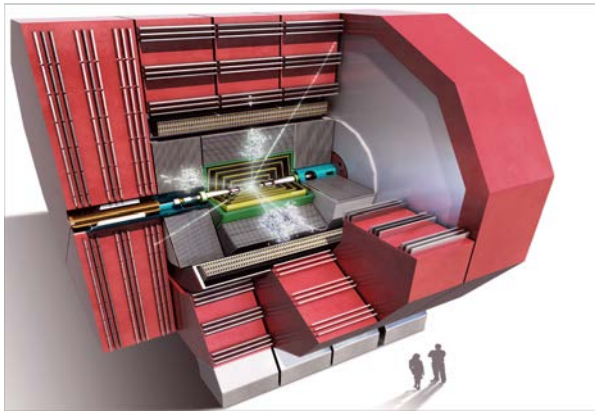
Linear Collider detector & physics studies: Europe engaged

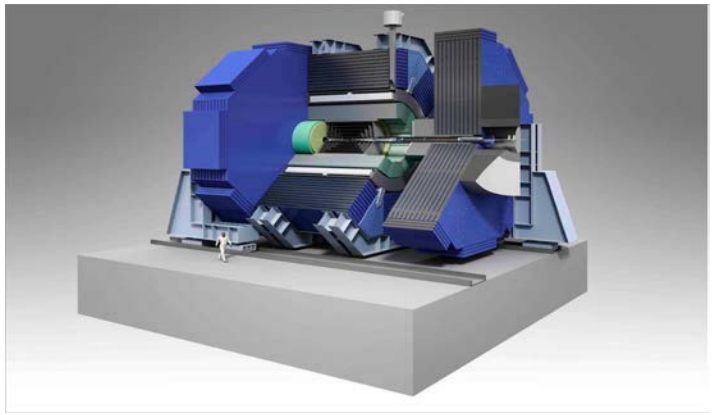


The LCC physics & detector directorate is responsible for activities that advance the physics and detectors of the linear collider.

Three detector concepts:

- ILD: 71 institutions mostly from the European Region
- SiD: 24 institutions many from the European Region
- CLICdp: 29 institutions mostly from the European Region





Three detector R&D groups:

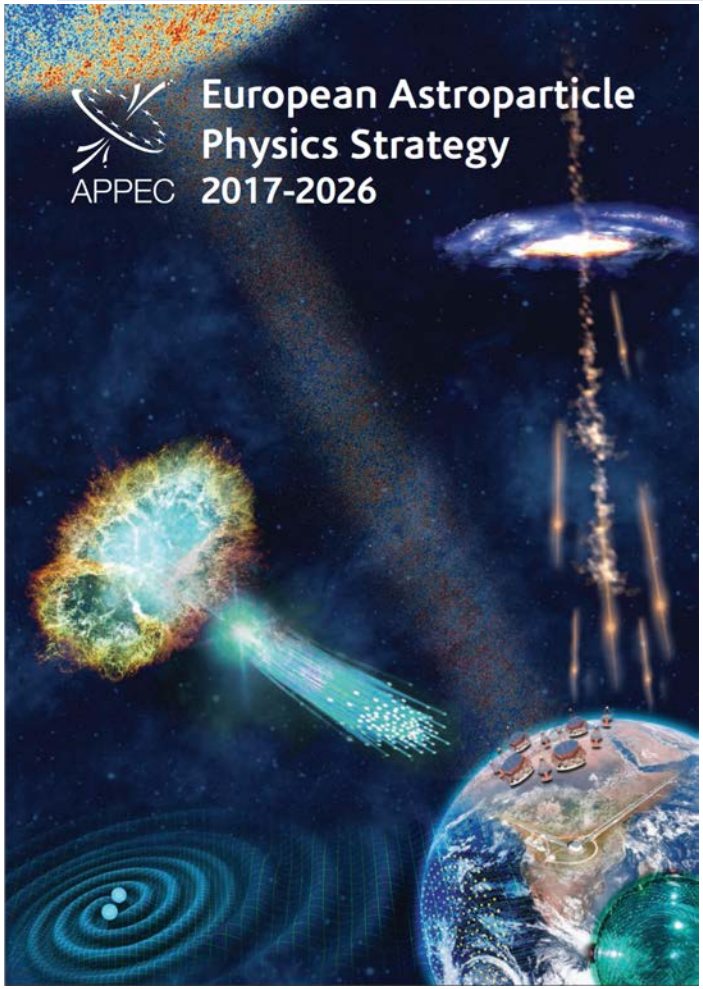
- CALICE: 57 institutions mostly from the European Region
- LCTPC: 32 institutions many from the European Region
- FCAL: 14 institutions mostly from the European Region

Implementation of the 2013 EPPSU

In the coming years, CERN should seek a closer collaboration with ApPEC on detector R&D with a view to maintaining the community's capability for unique projects in this field.

- Relations with ApPEC and astroparticle community cover more than detector R&D
- CERN Director for Research and Computing attends ApPEC General Assembly meetings
- Many REC experiments from astroparticle physics: Auger, AMS, Fermi, IceCube, ArDM, CTA, LIGO, VIRGO, Km3Net, JUNO, SNO+, etc.
- CERN TH Institutes cover astroparticle and cosmology topics
- Working together on future exa-scale computing (e.g. agreement signed with SKA)
- CERN offers test beams, irradiation facilities, equipment/support for tests (e.g. Aria/DarkSide)
- August 2017: joint CERN-LIGO/Virgo meeting to identify areas of collaboration (from physics to governance, vacuum and cryogenics, civil engineering, etc.)

Astroparticle Physics European Consortium Roadmap



European Astroparticle Physics Strategy 2017-2026

http://www.appec.org/roadmap

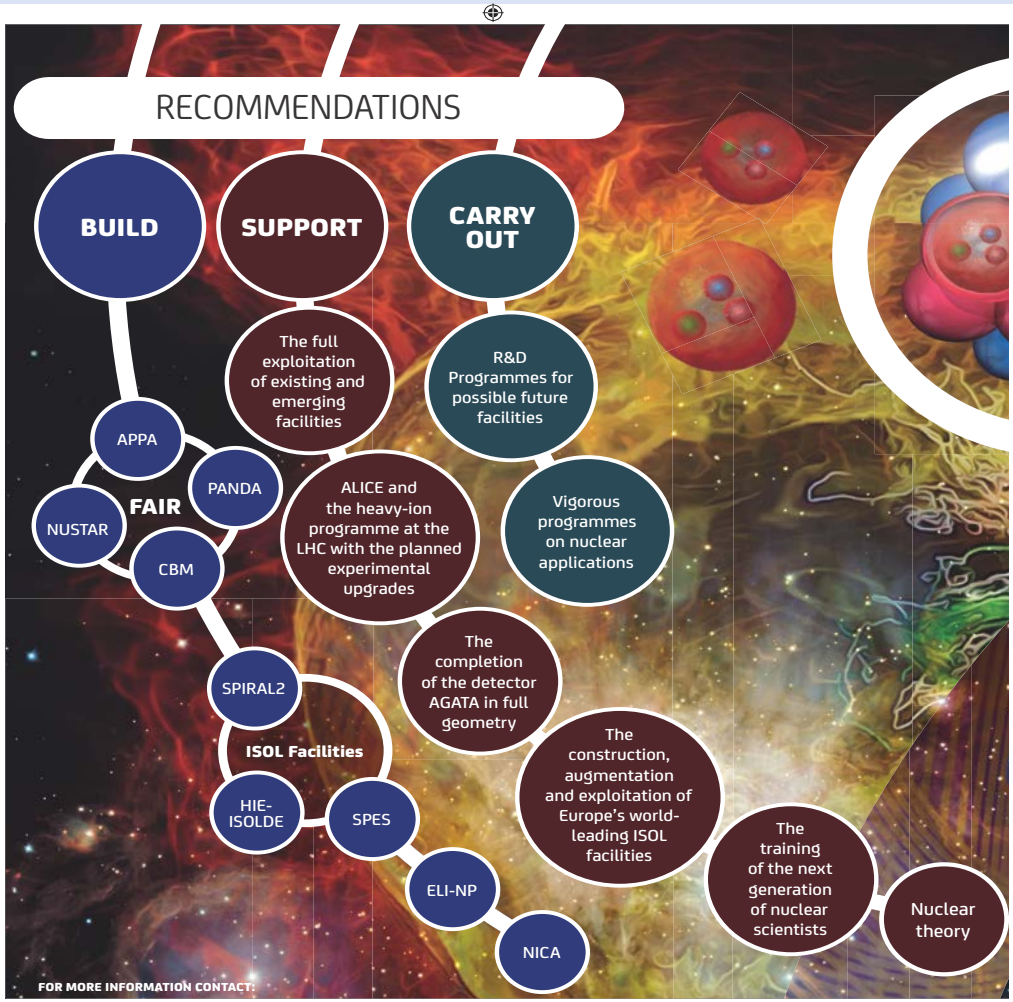
Implementation of the 2013 EPPSU

A variety of research lines at the boundary between particle and nuclear physics require dedicated experiments. The CERN Laboratory should maintain its capability to perform unique experiments. CERN should continue to work with NuPECC on topics of mutual interest.

- CERN has compelling programme in (or at the boundary with) nuclear physics: ISOLDE, HIE-ISOLDE, n_TOF, COMPASS, Heavy Ion programme (NA61, LHC experiments), AD (ALPHA, ATRAP, AEGIS, ASACUSA, BASE, GBAR,…. with ELENA 5.3 MeV to 0.1 MeV)
- 2017 NuPECC Long-Range Plan (report finalised in a meeting at CERN in March 2017): CERN experiments appear in all six domains considered by NuPECC
- CERN Director for Research and Computing regularly attends NuPECC meetings
- In addition: ongoing collaborations (mainly on accelerator aspects) with GSI/FAIR, European Spallation Source, etc.

- Follow closely the NuPECC Long Range Plan

Nuclear Physics European Collaboration Committee – long range plan



Outreach and Communication in particle physics

CERN Courier March 2017

Viewpoint

Reaching out in the era of big science

Now a formal collaboration, IPPOG provides a new force for global particle-physics outreach.

CERN director for international relations, Charlotte Warakaulle, signs the memorandum of understanding with IPPOG chairperson Hans Peter Beck on 19 December, allowing the IPPOG collaboration to officially enter into force.

Hans Peter Beck is chairperson of IPPOG, member of the ATLAS experiment and a reader at the University of Bern. (Image credit: C Marcellini.)

By Hans Peter Beck

Establishing and maintaining a strong link between science and society is vital, and is something that has long been recognised by CERN. Writing in 1972, former Director-General Victor Weisskopf put it well when he argued that a concerted effort towards the presentation and popularisation of science would "provide a potent antidote to overspecialisation, bring out clearly what is significant in current research, and make science a more integral part of the culture of today".

Forty-five years later, as we enter the so-called "post-factual world" emerging from political ideologies in a growing number of modern democracies, it is more important than ever for science and society to maintain an open and transparent dialogue. It has also become evident that the tools and methods currently used to support such a dialogue have not been as successful as we would have hoped. Indeed, many excellent outreach activities at research centres, universities and museums often attract only those people who are already interested and appreciative of the basic and fundamental relevance of science.

Without compromising established methods, we must explore new paths to engage citizens – especially the young. Reaching out to high-school students and their teachers to convey the methods and tools used in fundamental science is a strong investment in the future. While only a fraction of young students will become scientists, and fewer still will become particle physicists, all will become ambassadors for the scientific method and evidence-based decision-making. Developing a dialogue with those who have left school early raises important challenges of its own, and requires that scientists take courageous steps. Partnering with artists, musicians and celebrities, for instance, has enormous potential to get science into the spotlight. But it involves a delicate balance between raising curiosity and descending into trivialities.

The International Particle Physics Outreach Group (IPPOG) is making a concerted and systematic effort to present and popularise particle physics across all audiences and age groups. Established 20 years ago following the recommendations of former CERN Director-General Christopher Llewellyn Smith, IPPOG has evolved from a European to a global network that involves countries, laboratories and scientific collaborations active in particle-physics research. It is best known for its International Masterclasses (IMC) programme, which evolved in the mid-1990s from national outreach efforts in the days of the LEP collider and has gone from strength to strength. Since 2005, the programme has offered high-school students the opportunity to become physicists for a day by performing a tailor-made physics analysis involving real LHC data (*CERN Courier* June 2014 p37). In terms of numbers, last year's edition of the IMC included 213 institutions in 46 countries and around 13,000 students took part.

Particle physics has become a truly global activity, with experimental collaborations such as those of the LHC experiments featuring thousands of researchers from all over the world. With this trend, IPPOG is evolving further to cover more countries, laboratories and experiments spanning all aspects of collider and non-collider research, including astroparticle physics and accelerator and detector technology. This expanding remit demands that IPPOG adopts a more formal structure to guarantee the quality and sustainability of its work.

Following the model of collaboration in experimental particle physics, on 19 December IPPOG became a formal scientific collaboration based on a memorandum of understanding. A total of 13 countries have now signed as members, with several candidate members expected to join soon, and each is required to contribute a membership fee weighted by its GDP and the size of its particle-physics community. Laboratories and even individual scientific collaborations are also part of IPPOG, where they contribute to the expert knowledge and skills required to inspire young thinkers.

The new collaboration status of IPPOG, and CERN's formal membership, demonstrates a clear commitment to sustainable science outreach. With further countries and organisations expected to join soon, and others invited to get involved, the worldwide particle-physics community has a strong partner at hand when reaching out to wider society in diverse ways that are adapted for every target audience.

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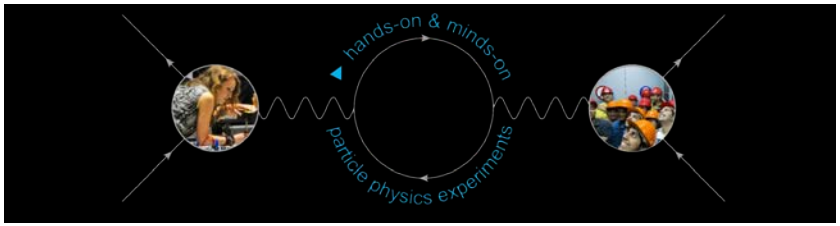
Activities throughout Europe and at CERN with national & international teachers programmes, the new **S'Cool LAB**



A formal collaboration for **IPPOG** with an MoU
(International Particle Physics Outreach Group)

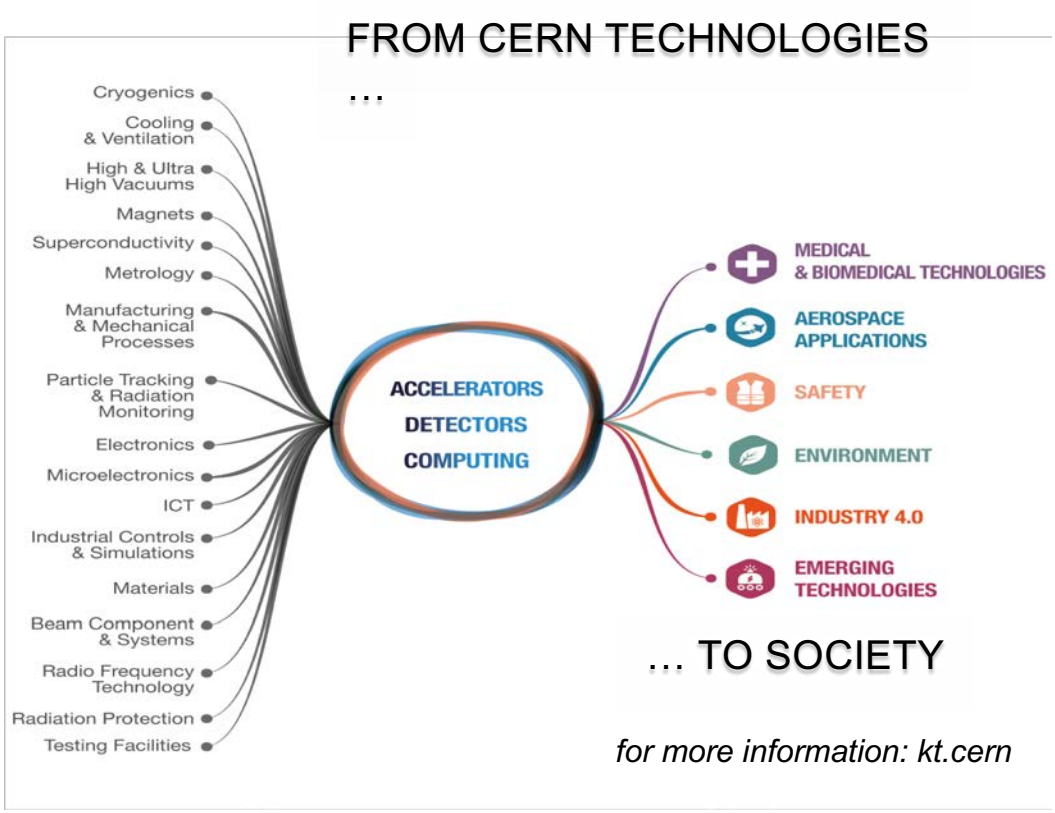
- Collaboration established: 19 December 2016
- Annual membership fees of countries based on GDP and community
- Experiments and labs involved as well

With the IPPOG budget from the Membership fees ca 50k€ annually, we can improve IPPOG's communication, develop, print and distribute educational material, give support to global or otherwise worth while activities.

Implementation of the 2013 EPPSU

HEPTech should pursue and amplify its efforts and continue reporting regularly to the Council

- Since 2011 CERN signed more than 250 licenses and other kind of agreements with industry and other partners
- Every year several tens of new technology disclosures (91 in 2016)
- 18 new start-ups are using CERN technologies since 2012



Call for the EPPS update by 2020

The timing of the Strategy Update is dictated by

- physics considerations, mainly the results of the LHC experiments after end of Run2;
- need to review ongoing design studies and update plans for future colliders (ILC, CLIC, FCC), explore opportunities for non-collider projects at CERN and elsewhere, as well as R&D work on accelerator technologies;
- results from other experiments and facilities, in particular the status of the various neutrino physics projects across the world;.

Inputs from scientists and institutions worldwide will be essential to deliver a proper Update of the European Strategy for Particle Physics.

Existing Input

Input from LHC results

- The Standard Model is doing amazingly well
- The Higgs scalar is very much like expected in the Standard Model
- There is no indication of physics BSM up to scales of the order of TeVs
- Lepton/flavor conservation – hints from LHCb in c/b-decays???

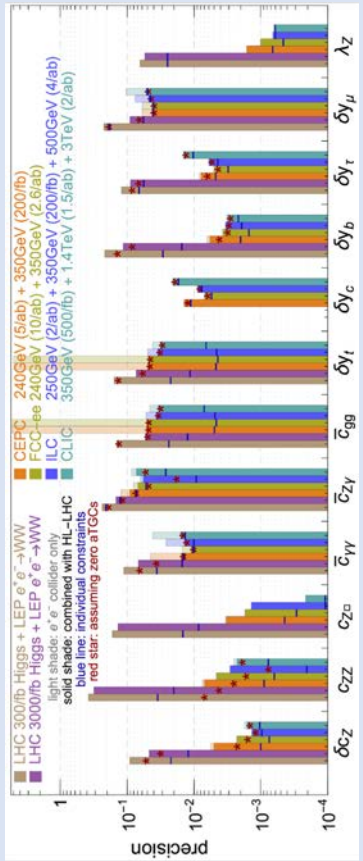
Input from outside LHC

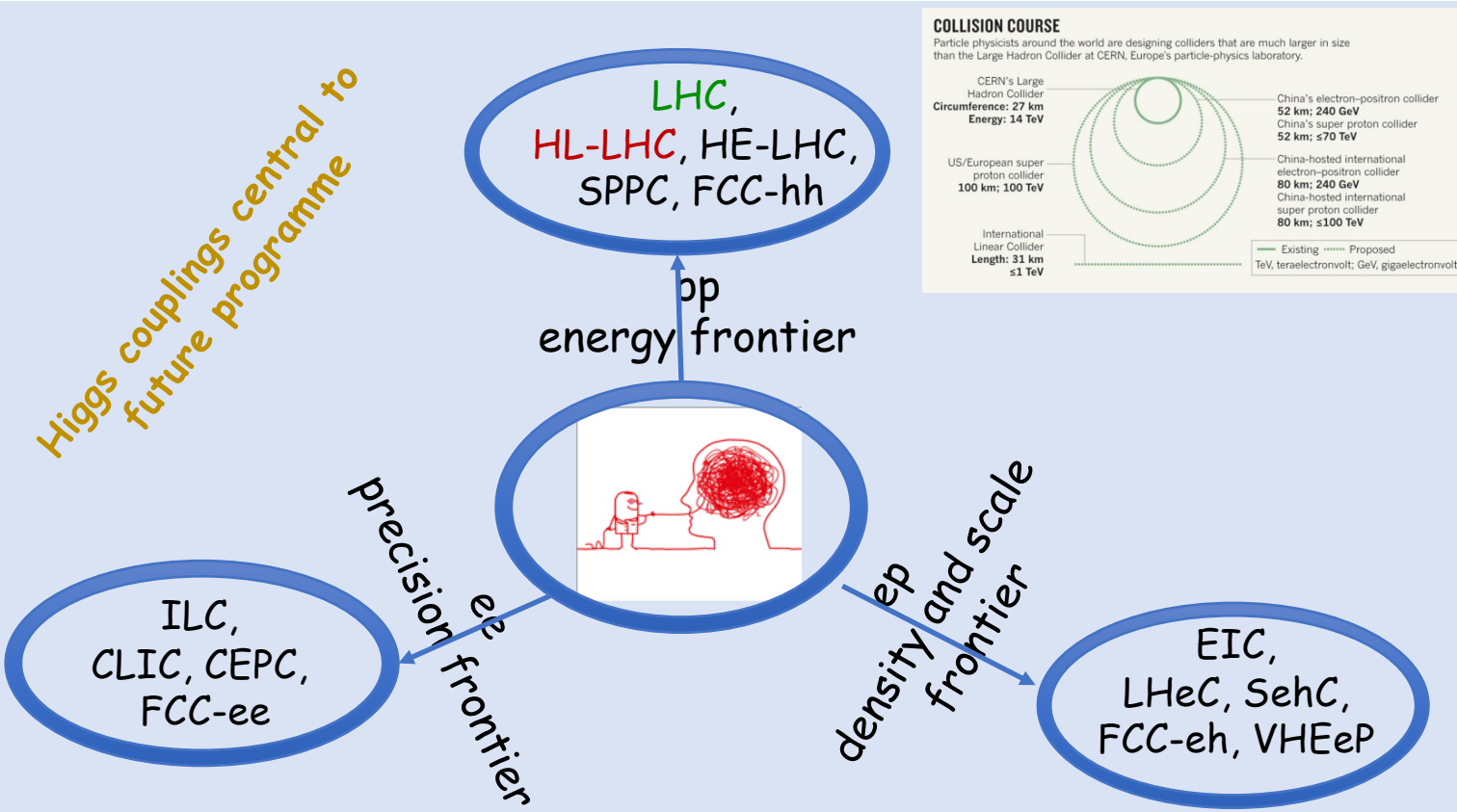
- Neutrinos have masses (oscillations) – not acquired in the SM
- There is dark matter in the Universe with no candidates within the SM (axions???)
- Prevalence of matter over anti-matter
- Theorist believe that the theory is not complete

How should we go about understanding all these issues ?

Can precision studies of the Higgs sector lead to a break-through?

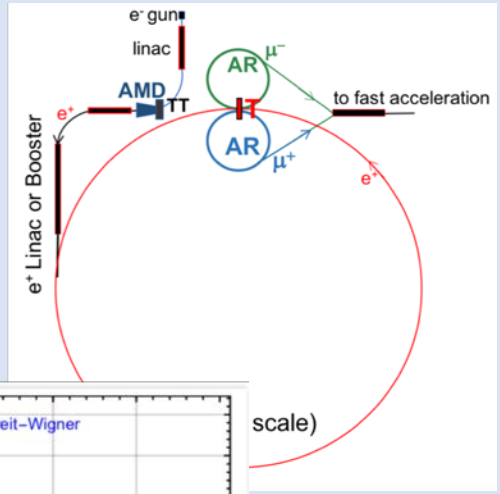
Controlled experiments at accelerators

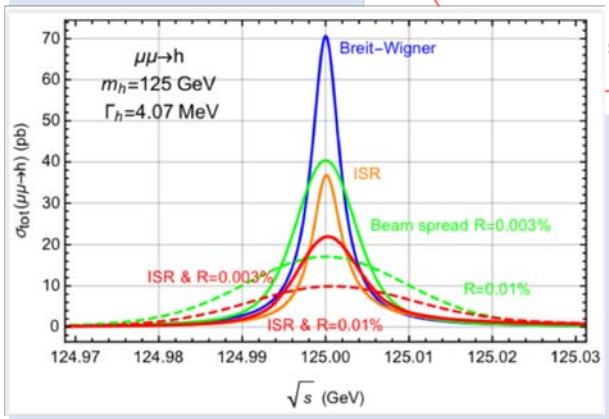


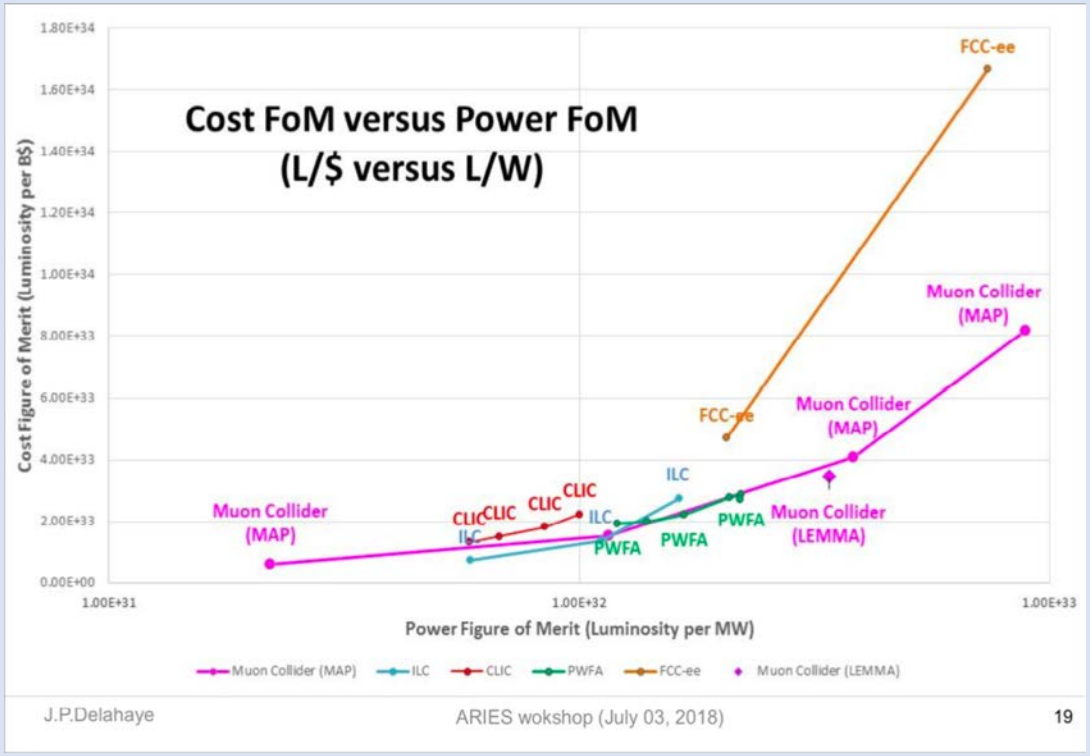


Prescision Frontier – muon collider

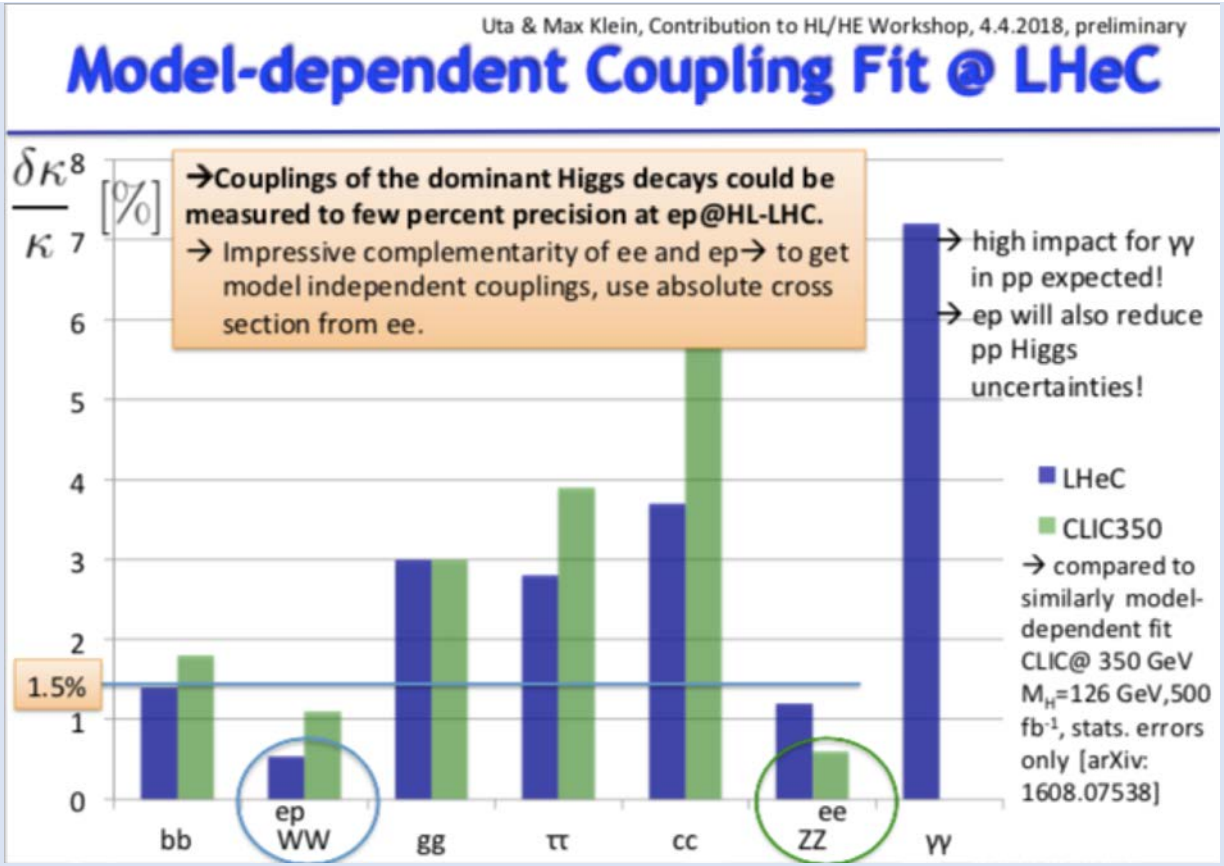
Muon collider – Circular collider – 120 GeV to 5 TeV, 300 m long (neutrino factory as added bonus)



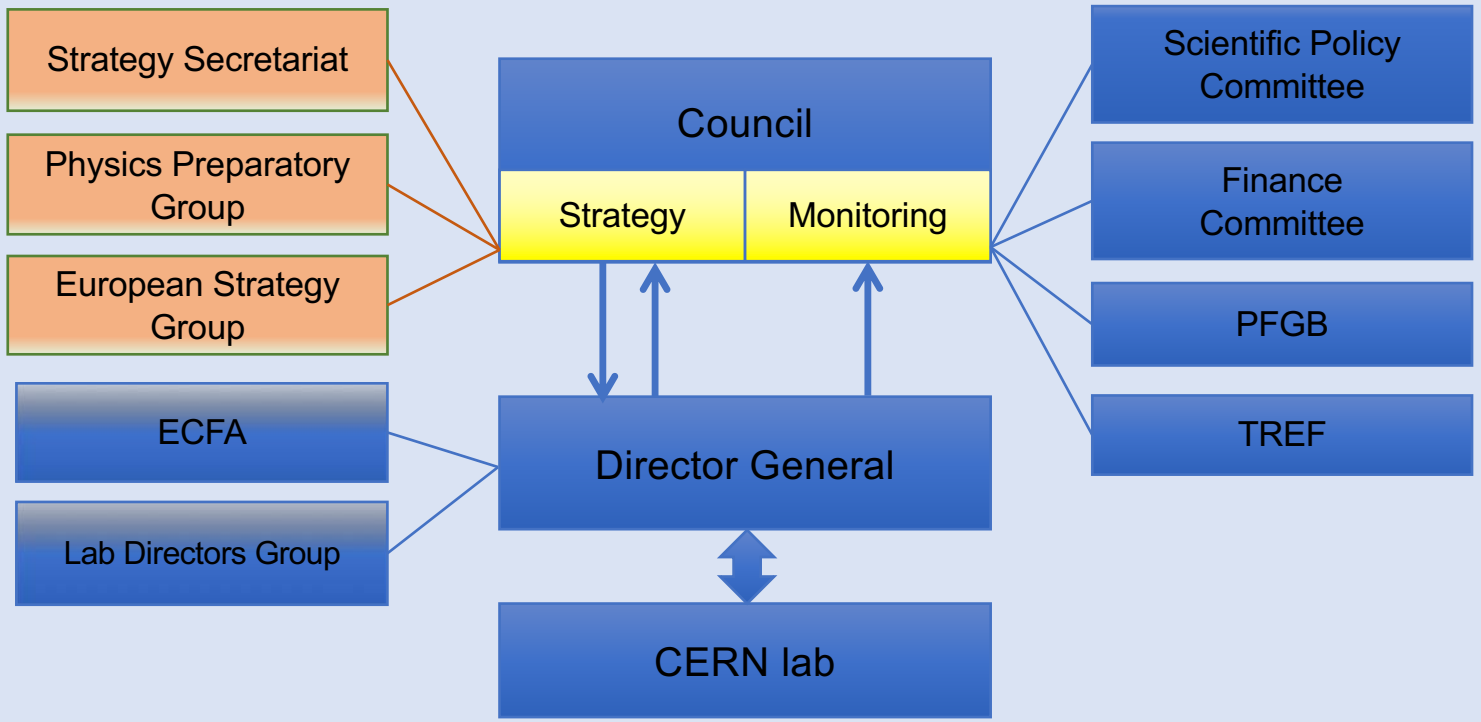




Precision Frontier – high luminosity ep collider (LHeC)

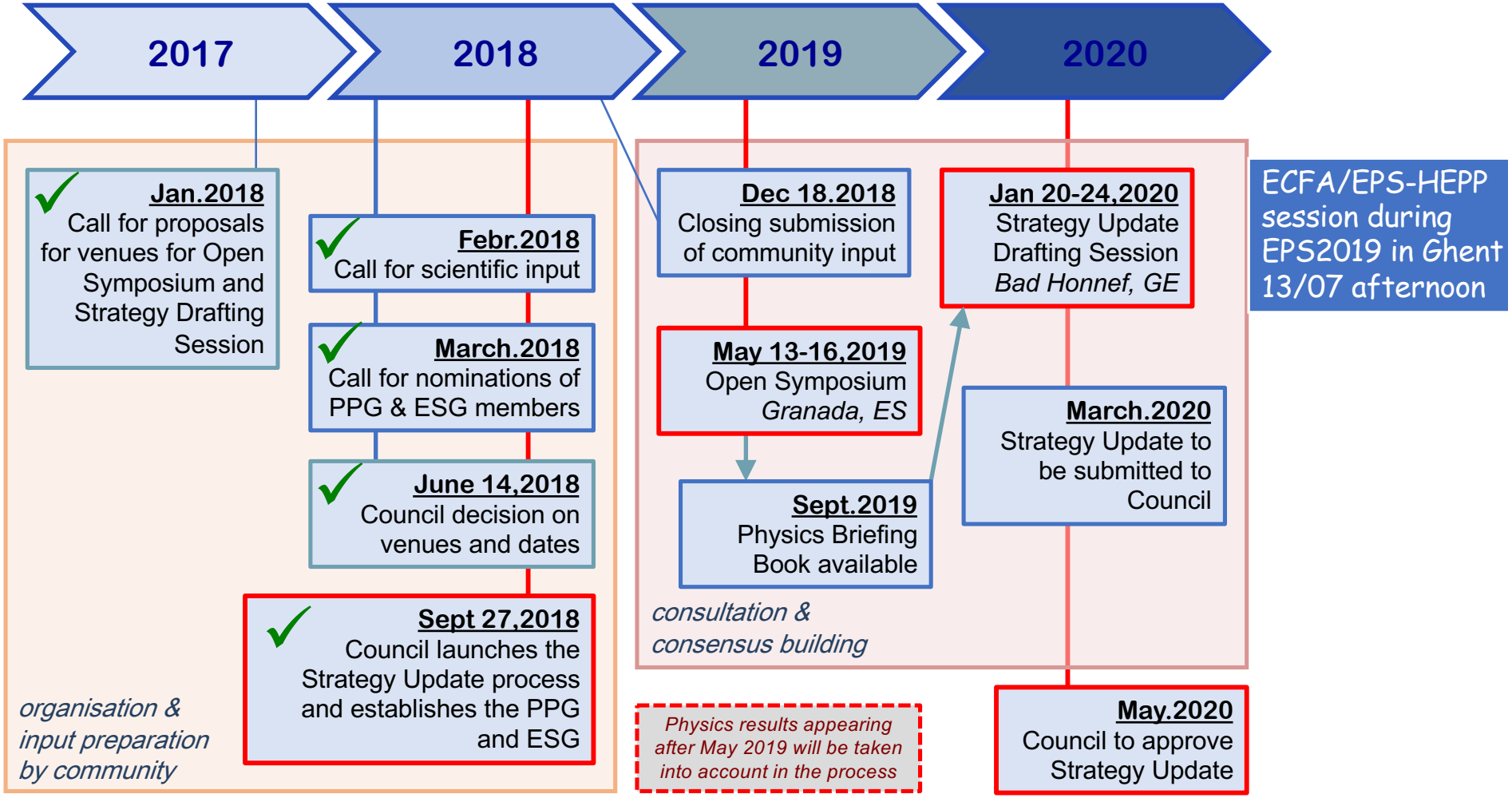


European Particle Physics Organisation and Governance



Based on a slide from the President of Council, at the FALC meeting, Cambridge (UK), March 8, 2018

EPPSU 2020 timeline



Composition of the Secretariat

Members

- The Strategy Secretary - HA
- SPC chair – Keith Ellis
- ECFA chair – Jorgen D'Hondt
- Chair of the (major) *European Laboratory Directors' Meeting* (ELDM) – Lenny Rivkin

- The Secretariat is responsible for
  - Collecting input from the community
  - Organising an Open Symposium (OS) on physics with the help of the PPG
  - Setting up Working Groups from among the ESG members to discuss "organisational matters" to make the strategy realisation a success
  - Preparing the Briefing Book and Summaries from the OS discussions for the ESG
  - Organising the Drafting Session of the final strategy update document
  - Presenting the final document to the CERN Council for endorsement

ELDM Composition

- CERN
- CIEMAT
- DESY
- IRFU
- LAL
- NIKHEF
- LNF
- LNGS
- PSI
- STFC-RAL

Composition of the PPG

Members

- The Strategy Secretary (chair)
- SPC chair
- ECFA chair
- Chair of the the European Laboratory Directors Group
- Four members recommended by the SPC
- Four members recommended by ECFA
- One representative appointed by CERN
- Two representatives from Asia
- Two representatives from the Americas

17 people

PPG members

Halina Abramowicz – Tel Aviv University, Israel (chair); high energy experiments
Shoji Asai - Tokyo University, Japan; experimental non-accelerator particle physics and high-energy colliders
Stan Bentvelsen – Nikhef, Netherlands; experimental particle and astroparticle physics
Caterina Biscari – ALBA, Spain; accelerator science
Marcela Carena – University of Chicago and Fermilab, US; dark matter and BSM theory
Jorgen D'Hondt – University of Brussels (VUB), Belgium; high energy collider experiments
Keith Ellis –University of Durham, UK – QCD theory and colliders phenomenology
Belen Gavela – University of Madrid (UOM), Spain; beyond-the-Standard Model theory
Gian Giudice: CERN; theory (everything)
Beate Heinemann – DESY and Freiburg University, Germany; high-energy collider experiments
Xinchou Lou - Institute of High Energy Physics, China; heavy flavour physics and detectors
Krzysztof Redlich – Wroclaw University, Poland; QCD (strong interaction) theory
Lenny Rivkin – EPFL/PSI, Switzerland; accelerator science
Paris Sphicas – University of Athens, Greece, and CERN; high-energy collider experiments
Brigitte Vachon - McGill University, Canada; detector physics
Marco Zito – Saclay, France; experimental neutrino physics
Antonio Zoccoli – INFN Bologna, Italy; experimental heavy flavour physics

Among 17 members – 15 countries and CERN, 4(T) and 13(E), 6(F) and 11(M)

Proposed Input Themes and PPG/ESG assignments

- Large experiments and projects - PPG
- National road maps - ESG
- Accelerator Science and Technology - Caterina Biscari and Lenny Rivkin
- Beyond the Standard Model at colliders (present and future) – Gian Giudice (th) and Paris Sphicas (exp)
- Dark matter and dark sector (accelerator and non-accelerator dark matter, dark photons, hidden sector, axions) – Marcela Carena (th) and Shoji Asai (exp)
- Instrumentation and computing – Xinchou Lou (exp) and Brigitte Vachon (exp)
- Electroweak physics (physics of the W, Z, H bosons, of the top quark, and QED) – Keith Ellis (th) and Beate Heinemann (exp)
- Flavour Physics and CP violation (quarks, charged leptons and rare processes) – Belen Gavela (th) and Antonio Zoccoli (exp)
- Neutrino physics (accelerator and non-accelerator) – Stan Bentvelsen (astro-exp) and Marco Zito (exp)
- Strong interactions (perturbative and non-perturbative QCD, DIS, heavy ions) – Krzysztof Redlich (th) and Jorgen D'Hondt (exp)
- Other (communication, outreach, strategy process, technology transfer, individual contributions,…) - ESG

There are 8 physics themes and 3 general ones. The large experiments/projects will be split among the physics themes.

Open Symposium in Granada May 13-16

Proposed format

Monday

Morning
Plenary session
"Where do we stand"
(still to be discussed)

Afternoon
Parallel sessions
B1 – Electroweak physics
B2 – Flavour physics and CP violation
B3 – Neutrinos
B4 - Accelerator science and technology

Tuesday

Morning
Parallel sessions
B5 - BSM at colliders
B6 – Strong interactions
B7 - Detectors and computing
B8 – Dark matter and dark sector

Afternoon
Parallel sessions
(possible merging)
B1 – Electroweak physics
B2 - Flavour physics and CP violation
B3 – Neutrinos
B4 - Accelerator science and technology

Wednesday

Morning
Parallel sessions
(possible merging)
B5 - BSM at colliders
B6 – Strong interactions
B7 - Detectors and computing
B8 – Dark matter and dark sector

Afternoon
Plenary session
"Future facilities"

Thursday

Plenary session
Summary Reports (8)
Close-out

ESG meeting

Web page for the Open Symposium in Granada
Please register

Composition of the ESG

Members

- The Strategy Secretary (chair)
- One representative appointed by each CERN MS (22)
- One representative appointed by each of the Labs participating in the European Laboratory Directors' Meeting including its chair (9)
- CERN DG
- SPC chair
- ECFA chair

Invitees

- President of CERN Council
- One representative from each AMS (pre-stage 3 and 3) and Observers (EU Commission, JINR, Japan, Russia, US)
- Chairs of ApPEC, NuPECC, FALC, ESFRI
- Members of the PPG (17 - Secretariat)
- Scientific Assistant (Roger Forty)

65 people

ESG - Organisational Matters discussed in 2013

In parallel to the discussion on scientific issues, ESG deals with organizational and other matters through discussions in working groups (WG)

During the 2013 Strategy update, 5 WGs were set up (see Summary of the 2013 European Strategy Update) to discuss recommendations for

1. WG1 - Mandate and organisational structure for the Council for the European Strategy and its implementation (to be handled by the President's Group);
2. WG2 - Organisational structure for European participation in global projects, including the role and definition of the National Laboratories and the CERN Laboratory in the European Strategy;
3. WG3 - Relations with external bodies, in particular EU-related;
4. WG4 - Knowledge and technology transfer, relations with industry;
5. WG5 - Outreach, education and communication

Closing remarks

- The period from now till March 2019 (draft submitted to Council) promises to be very interesting and dynamic
- Please come to the Open Symposium in Granada, May 13 to 16! Especially the young generation should be encouraged to participate
- Don't forget to communicate with your representative in Council and ESG, Prof. Siggi Bethke, if you would like to bring up issues that affect your scientific life….