What is the EPPSU?

• Every ~ 7 years, the European particle physics community reviews and updates the priorities and strategy of the field.
  - Bottom-up process involving the community.
  - Strategy driven by physics, taking into account technical and financial feasibility.
EPPSU organization

- Strategy Update document drafted by European Strategy Group (ESG).
- Scientific input to the Strategy Update prepared by the Physics Preparatory Group (PPG).
  - Processing of submitted community inputs
  - Open Symposium
  - Preparation of Briefing Book
- Strategy Update process coordinated by the Strategy Update Secretariat (SUS).

The composition of each group can be found in the backup slides.
EPPSU 2020 Process

Jan. 2018
Call for proposals for venues for Open Symposium and Strategy Drafting Session

Feb. 2018
Call for scientific input

March 2018
Call for nominations of PPG & ESG members

June 14, 2018
Council decision on venues and dates

Sept. 27, 2018
Council launches the Strategy Update process and establishes the PPG and ESG

Organisation & input preparation by community

Dec. 18, 2018
Closing submission of community input

May 13-16, 2019
Open Symposium Granada, ES

May 2019
Consultation & consensus building

Physics briefing book available

Jan. 20-24, 2020
Strategy Update Drafting Session Bad Honnef, GE

ECFA/EPS-HEPP session during EPS2019 in Ghent 13/07 afternoon

March 2020
Strategy Update to be submitted to Council

May 2020
Council to approve Strategy Update

Physics results appearing after May 2019 will be taken into account in the process

Brigitte Vachon, McGill
Scientific Input to EPPSU

• Call for community inputs issued in February 28, 2018 with deadline for submission set for December 18, 2018.

• 160 written submissions received (LINK).

<table>
<thead>
<tr>
<th>Track ID</th>
<th>Granada sessions</th>
<th># inputs</th>
<th>Description</th>
<th>Conveners</th>
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<tbody>
<tr>
<td>1</td>
<td></td>
<td>40</td>
<td>Large experiments and projects</td>
<td>PPG</td>
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<tr>
<td>2</td>
<td></td>
<td>42</td>
<td>National road maps</td>
<td>ESG</td>
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<tr>
<td>11</td>
<td></td>
<td>22</td>
<td>Other (communication, outreach, strategy process, technology transfer, individual contributions,...)</td>
<td>ESG</td>
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<tr>
<td>7</td>
<td>B1</td>
<td>21</td>
<td>Electroweak physics (physics of the W, Z, H bosons, of the top quark, and QED)</td>
<td>Keith Ellis, Beate Heinemann</td>
</tr>
<tr>
<td>8</td>
<td>B2</td>
<td>27</td>
<td>Flavour Physics and CP violation (quarks, charged leptons and rare processes)</td>
<td>Belen Gavela, Antonio Zoccoli</td>
</tr>
<tr>
<td>5</td>
<td>B3</td>
<td>25</td>
<td>Dark matter and dark sector (accelerator and non-accelerator dark matter, dark photons, hidden sector, axions)</td>
<td>Marcela Carena, Shoji Asai</td>
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<tr>
<td>3</td>
<td>B4</td>
<td>51</td>
<td>Accelerator Science and Technology</td>
<td>Caterina Biscari, Lenny Rivkin</td>
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<tr>
<td>4</td>
<td>B5</td>
<td>20</td>
<td>Beyond the Standard Model at colliders (present and future)</td>
<td>Gian Giudice, Paris Spicas</td>
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<tr>
<td>10</td>
<td>B6</td>
<td>31</td>
<td>Strong interactions (perturbative and non-perturbative QCD, DIS, heavy ions)</td>
<td>Krzysztof Redlich, Jorgen D’Hondt</td>
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<tr>
<td>9</td>
<td>B7</td>
<td>27</td>
<td>Neutrino physics (accelerator and non-accelerator)</td>
<td>Stan Bentvelsen, Marco Zito</td>
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<tr>
<td>6</td>
<td>B8</td>
<td>35</td>
<td>Instrumentation and computing</td>
<td>Xinchou Lou, Brigitte Vachon</td>
</tr>
</tbody>
</table>

• Open Symposium organized based on written inputs.
Open Symposium

• Symposium consisted in both parallel and plenary sessions, organized and convened by members of PPG.

• Parallel sessions were organized around 8 different themes:
  - Accelerator science and technology
  - Instrumentation and computing
  - Electroweak physics
  - Strong interactions
  - Neutrino physics
  - Beyond Standard Model at colliders
  - Dark matter and dark sector
  - Flavour physics and CP violation

• Plenary sessions:
  - Current status of the field and where we stand.
  - Perspectives from different communities.
  - Summaries from parallel sessions.

• Symposium schedule designed to provide sufficient time for detailed discussion.
Open Symposium Participation

- Total of **603 participants**.
- **12%** of participants from outside Europe.
- Outstanding organization and presentations.
  - Thank you to all organizers, contributors and participants.

Distribution of nationalities
(Total = 603)
Implementation of the 2013 EPPSU (F. Gianotti)

- Run 2 completed successfully, with accelerators, detectors and computing performance exceeding expectations.
- HL-LHC approved by CERN Council June 2016.
- Design studies and accelerator R&D: CLIC, FCC, superconducting magnets R&D, AWAKE, etc.
- CERN Neutrino platform established in 2014.
- Physics Beyond Colliders Study group set up in 2016 to explore compelling projects complementary to high-energy colliders.
- New project for education of the general public started in 2018: Science Gateway.

2013 update of ESPP provided 17 “recommendations”:

2: General issues
4: High-priority large-scale scientific projects
5: Other essential scientific activities
3: Organisational issues
3: Wider impact on society
Perspectives on the European Strategy Update from the Americas (Y.-K. Kim)

- Support from EPPSU plays an important role for success of facilities outside of Europe that serves the European / worldwide community.
- American community
  - will continue with its strong partnership with Europe.
  - would like to see steps taken toward a new collider.

“**The worldwide particle physics community can together address the full breadth of the field’s most urgent scientific questions with each major player hosting a unique world-class facility at home and partnering in high-priority facilities hosted elsewhere.**”

[Y.-K. Kim]
Open Symposium Highlights

Our physics landscape today:

- Higgs properties SM-like.
- Neutrinos have masses – not acquired in the SM.
- No (additional) signs of BSM physics.
- Compelling evidence for the existence of dark matter in the Universe with no candidate particle(s) in the SM.
- Prevalence of matter over anti-matter.

The particle physics community is engaged in a rich and diverse research program to address these puzzles.
Strong interactions

\[ \alpha_s (Q^2 \text{ low}) \sim 1 \quad \rightarrow \quad \alpha_s (Q^2 \text{ high}) \ll 1 \]

Hot and Dense QCD

Partonic Structure

Precision QCD

\[ \mu_B \text{ (MeV)} \]

Low energies

Neutrino

BSM

Dark sector

EW & H

Flavour

J. D'Hondt/K. Redlich

M. Klein

Brigitte Vachon, McGill

LP2019, 10 August 2019
Flavour and CP violation

- Study of rare/forbidden reactions in SM.
  - Origin of weak CP and matter-antimatter asymmetry, flavour puzzle (quarks, charged leptons, neutrinos), strong CP problem.
- Outstanding BSM sensitivity: $\Lambda > 10^2 - 10^5$ TeV
- Synergy and complementarity between low-energy precision and high-energy frontier experiments.

Charged LFV expts.

EDM prospects

Exploring the b sector

....kaons beams, LFV, CPV in charm, CPV in Higgs couplings, etc...
Neutrino and Astroparticle Physics

- Complementary window to search for BSM.
- Diverse experimental program.
- Very strong physics case for multimessenger physics, with a high impact on particle physics (e.g. DM, neutrino, GR, etc.)
  - Opportunity for particle physics community and labs to expand involvement.

From S. Pascoli
Dark Matter/Dark Sector

**Dark Matter**
- Direct detection (underground expts, haloscopes, helioscopes)
- Direct production (colliders, fixed target, LSTW)
- Astrophysical probes (indirect searches, gravitational interactions, Galactic scale observables, etc.)

**Dark Sector**
- Colliders
- Accelerator-based experiments (Beam dump, fixed targets)

Portal can be the Higgs boson itself or New Messenger/s

Dark sector has dynamics which is not fixed by Standard Model dynamics
- New Forces and New Symmetries
- Multiple new states in the dark sector, including Dark Matter candidates
Future experiments require **very challenging detector technologies**

Depending on the application:
- Much improved spatial resolutions (few μm per hit, low mass)
- Much improved time resolutions (down to ~10 ps per hit)
- High-performance photodetectors
- Very high tolerance to radiation
- Combined features in the same detector (5D imaging)
- Very large numbers of channels, very high readout speed
- Very large area coverage at low cost
- Accompanied with a large diversity of engineering challenges

From L. Linssen
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From L. Linssen

From M. Kasemann
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**From L. Linssen**

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**Need “holistic” approach to expt. design.**

---

**From M. Kasemann**
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Crucial importance for the future of the field to address human factors:
- Recruitment of the most talented researchers (physicists and engineers).
- Training the next generation of experts.
- Career opportunities for detector/computing experts.

Need “holistic” approach to experiment design.
Future experiments require **very challenging detector technologies** depending on the application:

- Much improved spatial resolutions (few \(\mu\)m per hit, low mass)
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**From L. Linssen**

Crucial importance for the future of the field to address human factors:

- Recruitment of the most talented researchers (physicists and engineers).
- Training the next generation of experts.
- Career opportunities for detector/computing experts.

**From M. Kasemann**

Assessment of proposed future collider projects (physics reach, technological readiness, time scales, financial profile, operational costs, innovation, ...).
## Open Symposium Highlights

### Proposed collider projects

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<tr>
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<tbody>
<tr>
<td><strong>ILC</strong></td>
<td>ee</td>
<td>0.25</td>
<td>2</td>
<td>11</td>
<td>129 (upgr. 150-200)</td>
<td>4.8-5.3 GILCU + upgrade</td>
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<tr>
<td></td>
<td></td>
<td>0.5</td>
<td>4</td>
<td>10</td>
<td>163 (204)</td>
<td>7.98 GILCU</td>
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<td></td>
<td></td>
<td>1.0</td>
<td></td>
<td></td>
<td>300</td>
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<td><strong>CLIC</strong></td>
<td>ee</td>
<td>0.38</td>
<td>1</td>
<td>8</td>
<td>168</td>
<td>5.9 GCHF</td>
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<tr>
<td></td>
<td></td>
<td>1.5</td>
<td>2.5</td>
<td>7</td>
<td>(370)</td>
<td>+5.1 GCHF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>(590)</td>
<td>+7.3 GCHF</td>
</tr>
<tr>
<td><strong>CEPC</strong></td>
<td>ee</td>
<td>0.091+0.16</td>
<td>16+2.6</td>
<td></td>
<td>149</td>
<td>5 G$</td>
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<tr>
<td></td>
<td></td>
<td>0.24</td>
<td>5.6</td>
<td>7</td>
<td></td>
<td>266</td>
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<tr>
<td><strong>FCC-ee</strong></td>
<td>ee</td>
<td>0.091+0.16</td>
<td>15+10</td>
<td>4+1</td>
<td>259</td>
<td>10.5 GCHF</td>
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<tr>
<td></td>
<td></td>
<td>0.24</td>
<td>5</td>
<td>3</td>
<td>282</td>
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<tr>
<td></td>
<td></td>
<td>0.365 (+0.35)</td>
<td>1.5 (+0.2)</td>
<td>4 (+1)</td>
<td>340</td>
<td>+1.1 GCHF</td>
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<tr>
<td><strong>LHeC</strong></td>
<td>ep</td>
<td>60 / 7000</td>
<td>1</td>
<td>12</td>
<td>(+100)</td>
<td>1.75 GCHF</td>
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<tr>
<td><strong>FCC-hh</strong></td>
<td>pp</td>
<td>100</td>
<td>30</td>
<td>25</td>
<td>580 (550)</td>
<td>17 GCHF (+7 GCHF)</td>
</tr>
<tr>
<td><strong>FCC-NbTi</strong></td>
<td>pp</td>
<td>37.5</td>
<td>10</td>
<td>20</td>
<td>240</td>
<td>14 GCHF (including tunnel)</td>
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<tr>
<td><strong>HE-LHC</strong></td>
<td>pp</td>
<td>27</td>
<td>20</td>
<td>20</td>
<td></td>
<td>7.2 GCHF</td>
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</table>

From D. Schulte

New at request of ESG
## Technical challenges of proposed colliders

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<td>FCC-NbTi</td>
<td>(to be filled)</td>
<td>~ 100</td>
<td>&lt; 30</td>
<td></td>
<td></td>
<td>~ 6</td>
<td></td>
<td>...Find the people who want to do it</td>
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<td>FCC-cc</td>
<td>CDR</td>
<td>~ 100</td>
<td>&lt; 30</td>
<td>580</td>
<td>24 or +17 (aft. ee) [BCHF]</td>
<td>~ 16</td>
<td></td>
<td>High-field SC magnet (SCM)</td>
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<td></td>
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<td>- Nb3Sn: Jc and Mechanical stress</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>- Energy management</td>
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<tr>
<td>SPPC</td>
<td>(to be filled)</td>
<td>75 – 120</td>
<td>TBD</td>
<td>TBD</td>
<td>TBD</td>
<td>12 - 24</td>
<td></td>
<td>High-field SCM</td>
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<td></td>
<td></td>
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<td>- IBS: Jcc and mech. stress</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>- Energy management</td>
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<tr>
<td>FCC-ee</td>
<td>CDR</td>
<td>0.18 - 0.37</td>
<td>460 – 31</td>
<td>260 – 350</td>
<td>10.5 +1.1 [BCHF]</td>
<td>10 – 20</td>
<td>(0.4 - 0.8)</td>
<td>High-Q SRF cavity at &lt; GHz, Nb Thin-film Coating</td>
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<td>Synchrotron Radiation constraint</td>
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<td></td>
<td></td>
<td>Energy efficiency (RF efficiency)</td>
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<tr>
<td>CEPC</td>
<td>CDR</td>
<td>0.046 - 0.24</td>
<td>32 – 5</td>
<td>150 – 270</td>
<td>5 [B$]</td>
<td>20 – (40)</td>
<td>(0.65)</td>
<td>High-Q SRF cavity at &lt; GHz, LG Nb-bulk/Thin-film</td>
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<td>(0.37)</td>
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<td>Synchrotron Radiation constraint</td>
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<td>High-precision Low-field magnet</td>
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<td>ILC</td>
<td>TDR update</td>
<td>0.25 –1 (-1)</td>
<td>1.35 (4.9)</td>
<td>129 (300)</td>
<td>4.8- 5.3 (for 0.25 [TeV]) [BILCU]</td>
<td>31.5 - (45)</td>
<td>(1.3)</td>
<td>High-G and high-Q SRF cavity at GHz, Nb-bulk</td>
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<td></td>
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<td>Higher-G for future upgrade</td>
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<td>Nano-beam stability, e+ source, beam dump</td>
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<tr>
<td>CLIC</td>
<td>CDR</td>
<td>0.38 (- 3)</td>
<td>1.5 (- 6)</td>
<td>160 (- 580)</td>
<td>5.9 (for 0.38 [TeV]) [BCHF]</td>
<td>72 – 100</td>
<td>(12)</td>
<td>Large-scale production of Acc. Structure</td>
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<td>Two-beam acceleration in a prototype scale</td>
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<td>Precise alignment and stabilization, timing</td>
</tr>
</tbody>
</table>

*Cost estimates are commonly for “Value” (material) only.

From A. Yamamoto

Brigitte Vachon, McGill

LP2019, 10 August 2019
Possible scenarios of future colliders

ILC: 250 GeV
20 km tunnel
4 years
Proton collider
Electron collider
Electron-Proton collider

Japan

Cern:
ILC: 250 GeV
20-30 ab⁻¹
1 TeV
1.7 ab⁻¹
100 km tunnel
11 km tunnel
5 years
China

CepC:
250 GeV
2 ab⁻¹
5.6 B/9 years
16/2.6/5.6 ab⁻¹
6 B/8 years
5,9 B/7 years

CLIC:
380 GeV
1.5 ab⁻¹
11 km tunnel
20 km tunnel
5 years

FCC:
90/160/240 GeV
16/2.6/5.6 ab⁻¹
20 km tunnel
31 km tunnel
40 km tunnel
5 years

SppC:
≈ FCC-hh
6 B/8 years
100 km tunnel
5,9 B/7 years

FCC-ee:
90/160/240 GeV
1.7 ab⁻¹
4.5 B/7 years
30-350 GeV
2.5 ab⁻¹
1.5 TeV
17 B/11 years

China

CLIC:
380 GeV
1.5 ab⁻¹
1.5 TeV
2.5 ab⁻¹
3 TeV
5 ab⁻¹
11 km tunnel
29 km tunnel
8 years

CERN

FCC:
90/160/240 GeV
150/10/5 ab⁻¹
100 km tunnel
50 km tunnel
8 years

HL-LHC:
13 TeV
3-4 ab⁻¹
7 B/8 years
24 B/15 years
8 years

HE-LHC:
27 TeV
10 ab⁻¹
7 B/8 years
2 years

LHeC:
1.2 TeV
0.25-1 ab⁻¹
100 km tunnel
1.7 B/6 years
2 years

FCC-eh:
3.5 TeV
2 ab⁻¹
1.1 B
24 B/15 years
8 years

FCC hh:
150 TeV
≈ 20-30 ab⁻¹
5 B/7 years
17 B/11 years

From U. Bassler
Future Accelerator Technologies

• Muon collider
  - From proton beams (c.f. MICE)
  - From positron beams (e.g. LEMMA)

• Plasma wakefield acceleration
  - Can reach order 100 GV/m gradient.
  - Many key achievements in last 15 years in plasma based acceleration using laser/electron/proton drivers.

Need vigorous R&D in strongly coordinated global effort to address key challenges.
Higgs precision physics reach

Br_{inv} (<%, 95% C.L.)
Br_{unt} (<%, 95% C.L.)

Higgs@FC WG
- FCC-ee+FCC-ch+FCC-hh
- FCC-ee_{365}+FCC-ee_{240}
- FCC-ee_{240}
- CEPC
- CLIC_{3000}+CLIC_{1500}+CLIC_{380}
- CLIC_{1500}+CLIC_{380}

Kappa-3, May 2019
- CLIC_{380}
- ILC_{500}+ILC_{350}+ILC_{250}
- ILC_{250}
- LLfC (|\kappa_{\gamma}| < 1)
- HE-LHC (|\kappa_{\gamma}| < 1)
- IIL-LIIC (|\kappa_{\gamma}| < 1)
BSM reach at colliders

New high mass resonance

Higgs compositeness

4-fermions Contact interactions

Extended scalar sectors
FCNC
SUSY
etc…
Briefing Book Preparation

• Open Symposium outcomes and community inputs to be summarized in Briefing Book.
  - Prepared by members of the PPG, assisted by Scientific Secretaries (~ 100 pages).
  - Expected to be ready by September 2019.
    ▶ Current status: Complete drafts of each chapter being reviewed.

• Briefing Book content:
  - Executive summary
  - Theoretical introduction
  - Summaries of 8 parallel sessions at Open Symposium
  - Synergies between various areas of research and different projects.
  - Addenda: list of submitted projects, timelines, cost estimates, etc.
Community feedback/considerations

• Emerging consensus for the importance of a “Higgs factory” to fully explore properties of the Higgs, EW sector, etc.

• Need to prepare a clear path towards highest energy.

• Future projects require vigorous R&D in accelerator technologies, detectors and computing.

• Ensure adequate level of dynamism for particle physics to remain attractive (long time scales)
  - Strong case for support of a diverse research program in particle physics.
  - Many interesting ideas to complement energy frontier with precision measurements (EDMs, rare decays, neutrinos, low energy searches for ALP / dark sector, etc.)

• Importance of further exploiting synergies and complementarities between fields (e.g. astroparticle physics, nuclear, material sciences, etc.)
Community feedback/considerations

• Ensure adequate support for **theory development and tools**.
  - E.g. career path: Difficult to convince academia - National labs/CERN may help

• Ensure **development and preservation of expertise** in detector, accelerator and computing sciences.
  - Training - University programs, PhD requirements
  - Recognition and career opportunities - difficult to convince academia - enhance the role of National Institutions.

• **Communicate** interest of science to other fields of research and to society.
  - Seek synergies with ApPEC, NuPPEC, light sources...
  - Help with ECO (Education/Communication/Outreach) with dedicated funding.

• Consider innovative ways to increase **funding**.
Summary

• EPPSU process ongoing and to conclude with approval of strategy, by the CERN Council, in May 2020.

• Open Symposium took place in Granada, Spain, 13-16 May 2019.

• Physics Preparatory Group (PPG) currently drafting the “Briefing Book” to be submitted to the European Strategy Group (ESG) [Sept. 2019]

• Plan to return to community with post-Granada scenarios.

• A very exciting (yet challenging ...) time for particle physics.
Additional Material
Members:

- the Strategy Secretary (acting as Chair),
- one representative appointed by each CERN Member State,
- one representative appointed by each of the Laboratories participating in the major European Laboratory Directors’ meetings, including its Chair (CERN, CIEMAT (Madrid-Spain), DESY (Hamburg-Germany), Irfu (Saclay-France), LAL (Orsay-France), Nikhef (Amsterdam-Netherlands), LNF (Frascati-Italy), LNGS (Gran Sasso-Italy), PSI (Villigen-Switzerland), STFC-RAL (Didcot-UK)),
- the CERN Director-General,
- the SPC Chair,
- the ECFA Chair.

Invitees: [~ 29 people]

- the President of the CERN Council,
- one representative from each of the Associate Member States,
- one representative from each Observer State,
- one representative from the European Commission,
- the Chairs of ApPEC and NuPECC,
- the Chairs of FALC and ESFRI,
- the members of the Physics Preparatory Group.
Physics Preparatory Group (PPG)

http://europeanstrategyupdate.web.cern.ch/composition

- Strategy Secretary
  - Halina Abramowicz (IL)

- SPC chair
  - Keith Ellis (UK)

- Delegates nominated by SPC
  - Caterina Biscari (ES), Belen Gavela (ES), Beate Heinemann (DE), Krzysztof Redlich (PL)

- ECFA chair
  - Jorgen D’Hondt

- Delegates nominated by ECFA
  - Stan Bentvelsen (NL), Paris Sphicas (GR), Marco Zito (FR), Antonio Zoccoli (IT)

- Chair of European Lab Director meeting
  - Lenny Rivkin (CH)

- Delegate nominated by CERN
  - Gian Giudice (CERN)

- Delegates nominated by ICFA
  - Americas: Marcela Carena (US) and Brigitte Vachon (Canada)
  - Asia: Shoji Asai (Japan) and Xinchou Lou (China)
# Strategy Secretariat

http://europeanstrategyupdate.web.cern.ch/composition-0

## STRATEGY SECRETARIAT

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<tr>
<th>Position</th>
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<tr>
<td>Scientific Secretary (Chair)</td>
<td>Prof. Halina Abramowicz (IL)</td>
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<td>SPC Chair</td>
<td>Prof. Keith Ellis (UK)</td>
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<td>Prof. Jorgen D’Hondt (BE)</td>
</tr>
<tr>
<td>Chair EU Lab. Directors’ Mtg</td>
<td>Prof. Lenny Rivkin (CH)</td>
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Contact: EPPSU-Strategy-Secretariat@cern.ch
### Future Colliders

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**FCC-ee**

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<tr>
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**CLIC**

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<td>1.5</td>
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<td>$ep$</td>
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<td>2.0</td>
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Brigitte Vachon, McGill

“Capability of future machines for precision Higgs physics”, M. Cepeda
EPPSU organization

- **Strategy Secretariat:**
  - Organize/coordinate EPPSU process.
  - 4 members.

- **Physics Preparatory Group (PPG):**
  - Prepares the scientific input to the strategy update based on community input, and submits the “Briefing Book” to the ESG.
  - 17 members.
    - Delegates from the Americas: Marcela Carena (US), BV (Canada)
    - Delegates from Asia: Shoji Asai (Japan), Xinchou Lou (China)

- **European Strategy Group (ESG):**
  - Drafts strategy update to be submitted to CERN council for approval.
  - ESG is assisted by the Physics Preparatory Group.
  - ~ 36 members (+ 29 invitees).

Composition of each group can be found in the backup slides.
Submission based on 2017-21 Canadian Subatomic Physics Long Range Plan (LRP)

- LRP Drafted by committee of 11 subatomic physicists appointed by NSERC (funding agency). Note that 1/3 of members were non-Canadian. There were also 7 observers from the IPP, CINP, TRIUMF, SNOLAB, CFI and NSERC.
- LRP Committee Mandate:
  Based on a broad consultation with the Canadian subatomic physics community:
  - Identify subatomic physics scientific ventures and priorities that should be pursued by the Canadian community and that would ensure continuous Canadian global scientific leadership covering the period 2017-21 and look ahead to 2026.
  - Provide budgetary estimates, including funding ranges for prioritized endeavours.
  - Funding ranges should include funding levels that would allow for a restrained, yet efficient, contribution to the ventures, as well as levels that would enable a more extensive contribution.
- Extensive and broad input: documents solicited from IPP and CINP (representing the particle and nuclear physics communities, respectively), surveys of all Canadian subatomic physicists who have held subatomic physics grants, two town hall meetings.

- IPP, CINP, TRIUMF and SNOLAB prepared the Canadian Roadmaps Submission to the European Particle Physics Strategy Update which summarized the 2017-21 Canadian Subatomic Physics LRP and included updates since that recent broad community consultations associated with the LRP. The McDonald and Perimeter Institutes reviewed and provided input to the submission.
  - Note that IPP Council, the elected representatives of the Canadian particle physics community, worked on the submission as did the CINP Board, which consists of the elected representatives of the Canadian nuclear physics community.

IPP: Institute of Particle Physics in Canada
CINP: Canadian Institute of Nuclear Physics
NSERC: National Sciences and Engineering Research Council of Canada
CFI: Canada Foundation for Innovation
US community submission

- Total ~ 8 submissions from US community.
- US community submission organized by APS Division of Particle and Fields (see next slide): “DPF Whitepaper”
- Other submissions received from US community include:
  - “Electron Ion Collider Accelerator Science and Technology - Designs, R&D and Synergies with European research in Accelerators”
  - “Synergies between a U.S.-based Electron-Ion Collider and the European research in Particle Physics”
  - “Deep Underground Neutrino Experiment (DUNE)”
  - “The Short-Baseline Neutrino Program at Fermilab”
  - “Status of Fermilab’s Neutrino Facilities”
  - “MAGIS-1K: A 1000 m Atom Interferometer Device for Searches in Dark Matter and Gravity Waves”
  - “Charged Lepton Flavour Violation using Intense Muon Beams at Future Facilities”
“The focus of this document, […], is to describe research interests in the U.S. particle physics community beyond the P5 timescale. As the U.S. planning process described above has not yet commenced, we are unable to supply a comprehensive or prioritized summary of U.S. plans. For purposes of this document, editors representing the experimental and theoretical side of each science driver were identified [see Addendum] and asked to summarize the status of their sub-field. The DPF Executive Committee and the editors of this document sought and incorporated input from the community regarding future interests as well as feedback on preliminary drafts. This document does not claim to fully speak for the U.S. community, but the editors have attempted to produce an accurate summary of the current state of thinking in the U.S. particle physics community for consideration by the ESG based on input provided to us. An additional document submission describes other important activities within the U.S. and global particle physics communities: theory, accelerator development, computing, and detector R&D. For brevity we are omitting details and references about many of the initiatives mentioned in these white papers, given that independent white papers on specific initiatives are being submitted in parallel and information can easily be found online.”