

- ▶ Congratulations on achieving an excellent NuPECC LRP
 - ▶ Now we begin again the corresponding process in particle physics...

- *In June 2024, the CERN Council established and approved the **remit of the European Strategy Group***
*"The aim of the Strategy update should be to develop a **visionary and concrete plan** that greatly advances human knowledge in fundamental physics through the **realisation of the next flagship project at CERN**. This plan should attract and value **international collaboration** and should **allow Europe to continue to play a leading role in the field.**"*
- The ESG should take into consideration:
 - The **input of the particle physics community**;
 - The **status of implementation of the 2020 Strategy update**;
 - The **accomplishments over recent years**, including the results from the LHC and other experiments and facilities worldwide, the progress in the construction of the High-Luminosity LHC, the outcome of the Future Circular Collider Feasibility Study, and recent technological developments in accelerator, detector and computing;
 - **The international landscape of the field**
- *The Strategy update should include the **preferred option** for the next collider at CERN and **prioritised alternative options** to be pursued if the chosen preferred plan turns out not to be feasible or competitive.*

▶ Definitions

- ▶ ESPPU = ‘European Strategy for Particle Physics update’; 2026 = 2024, i.e. now

▶ Analogous in many ways to the NuPECC LRP

- ▶ However, this strategy process is ‘special’ in that we have a central key decision

▶ Interaction with NuPECC

- ▶ Structural: NuPECC represented in the strategy update process
- ▶ Scientific: Many PP facilities are also nuclear facilities
- ▶ Technological: share a common workforce in detectors, engineering, technology – in universities and laboratories
- ▶ Economic: the total pot of European physics funding is finite (?)
- ▶ Practical: NP has recent experience of ‘fully international’ large-scale infrastructures
- ▶ Tactical: Many common concerns in scientific practice, skills, careers, labs, etc.
- ▶ Strategic: The extent of CERN’s mission in PP and NP is in scope

Update of the European Strategy for Particle Physics 2020

Strategy Statements

5. Synergies with neighbouring fields

a) A variety of research lines at the boundary between particle and nuclear physics require dedicated experiments and facilities. Europe has a vibrant nuclear physics programme at CERN, including the heavy-ion programme, and at other European facilities. In the global context, a new electron-ion collider, EIC, is foreseen in the United States to study the partonic structure of the proton and nuclei, in which there is interest among European researchers. **Europe should maintain its capability to perform innovative experiments at the boundary between particle and nuclear physics, and CERN should continue to coordinate with NuPECC on topics of mutual interest.**

Deliberation Document

The synergies between particle and nuclear physics are driven by the ambition to achieve first-principle understanding of strong dynamics based on QCD. In addition, they share similar experimental tools. The CERN baseline programme includes not only the ISOLDE and n_TOF facilities but also the heavy-ion programme at the SPS and the LHC. Future European facilities such as FAIR, NICA and ESS envisage research programmes that are of interest to particle physics. The nuclear physics roadmap in Europe is coordinated by the Nuclear Physics European Collaboration Committee (NuPECC) and there are well established communication lines between the nuclear and the particle physics communities. **NuPECC has expressed strong support for the extension of the heavy-ion programme into the HL-LHC era and beyond, should a high-energy hadron collider be built at CERN in the future.** Electron-proton colliders, such as **LHeC or FCC-ep**, with the option of including ion-targets, are also of interest to NuPECC, which is preparing a support statement for the participation of Europe in the **Electron-Ion Collider** in the United States.

▶ See Marek's ECFA talk last week: <https://indico.cern.ch/event/1361604>

Strategy Secretariat:

Karl Jakobs (Strategy Secretary, Chair)

Hugh Montgomery (SPC Chair)

Dave Newbold (LDG Chair) (→ will be replaced by Mike Seidel (PSI, as new LDG Chair) on 1st Jan. 2025)

Paris Spiccas (ECFA Chair)

Organising and running the ESPP process

(bi-weekly meetings over the past two months to ramp up the process)

European Strategy Group (ESG)

Preparation of the Strategy Document

(kick-off meeting held on 18th September)

- The Strategy Secretary (acting as Chair)
- **One representative appointed by each CERN Member State**
- **One representative appointed by each of the laboratories represented in the Large Particle Physics Laboratory Directors Group (LDG), including its Chair**
- **The CERN Director-General**
- **The CERN Director-General elect**
- The SPC Chair
- The ECFA Chair
- Invitees: President of CERN Council, one representative from each of the Associate Member and Observer States, one representative from the European Commission, the Chairs of APPEC, NuPECC and ESFRI, the members of the Physics Preparatory Group.



Physics Preparatory Group collects input from the community, organises the Open Symposium, prepares the Briefing Book

- Strategy Secretary (acting as Chair)
- **Four members appointed by Council on the recommendation of the SPC**
- **Four members appointed by Council on the recommendation of ECFA**
- **One representative appointed by CERN**
- **Two representatives from the Americas**
- **Two representatives from Asia**
- The SPC Chair
- The ECFA Chair
- The LDG Chair



Working Group	Co-convener (PPG member)	Co-convener
Electroweak physics	Monica Dunford (DE, exp)	Jorge de Blas (ES, theory)
Strong interaction	Cristinel Diaconu (FR, exp)	Andrea Dainese (IT, exp, HI)
Flavour physics	Gino Isidori (CH, theory)	Marie-Hélène Schune (FR, exp)
BSM physics	Fabio Maltoni (BE/IT, theory)	Rebeca Gonzalez-Suarez (SE, exp)
Neutrino physics and cosmic messengers	Pilar Hernandez (ES, theory)	Sara Bolognesi (FR, exp)
Dark matter and dark sector	Jocelyn Monroe (UK, exp)	Matthew McCullough (CERN, theory)
Accelerator science and technology	Gianluigi Arduini (CERN, acc)	Phil Burrows (UK, exp, acc)
Detector instrumentation	Thomas Bergauer (AT, exp)	Ulrich Husemann (DE, exp)
Computing	Tommaso Boccali (IT, exp, comp)	Borut Kersevan (SL, exp, comp)

PPG: Physics + Technology working groups

- Electroweak physics (including Higgs physics)
- Strong interaction
- Flavour physics
- Beyond the Standard Model physics
- Neutrino physics and cosmic messengers
- Dark matter and dark sector
- Accelerator science and technology
- Detector instrumentation
- Computing

→ **Physics Briefing Book**

ESG: Overarching topics

- **National input / roadmaps (→ strategic)**
- **Projects (FCC, LC/C³, LE-FCC-hh, MC, ..)**
(timeline, costs, (physics → PPG))
- Comparisons across proposed projects
- Relations with other fields of physics
- Implementation of the Strategy
(role of CERN and National Labs, coordination of European participation in projects sited outside Europe, ...)
- Knowledge and Technology transfer
- Sustainability, environmental impact
- Public engagement, education, communication
- ...

→ *ESG working groups to be set up, in preparation*

Current baseline – justified by 2020 Strategy – :

FCC integrated programme (FCC-ee followed by a hadron collider of at least 100 TeV)

Possible alternative scenarios (for next collider, following the HL-LHC)

- Realisation of a lower-energy hadron collider (50 – 80 TeV) on an earlier timescale (2050 – 2055)
- Linear Collider at CERN (CLIC, ...)
- Muon Collider at CERN
- Further exploitation of the LHC physics programme, eventually with the addition of e-h collisions
- ...

Non-exhaustive list, other scenarios may come up and be proposed by the community

- ▶ **NP community will likely be interested in additional points**
 - ▶ What else happens at CERN while the next big thing is under construction?
 - ▶ What is the long-term balance of activities, complementing the energy frontier?
 - ▶ What are the additional NP-related science opportunities from the next big thing?

- Input and involvement of the community is important!
(... and explicitly asked for in the remit)

Goal must be to reach a consensus in the community on the way forward for our field!

- There are several ways the community should provide input:
 - (i) Submission of input from the community by **31 March 2025**

[Guidelines](#) for documents to be submitted have been defined

→ **Comprehensive and self-contained summary of 10 pages (max)**

Additional information and details can be submitted in a **separate back-up document**, which can be consulted by the Physics Preparatory Group (PPG) if clarification on any aspects is required.
But the back-up document is not a mandatory component of the submission.

July 2024



Contact:
eppsu2024-strategy-secretariat@cern.ch

Guidelines for submitting input for the 2026 update of the European Strategy for Particle Physics

Cover page (1 page)

Each document submitted should carry a single cover page containing no more than the title, the contact person(s) and an abstract.

Comprehensive summary (maximum 10 pages)

The submitted document must be no more than 10 pages long (excluding the cover page) and must provide a comprehensive and self-contained summary of the input. It should address:

- scientific context,
- objectives,
- methodology,
- readiness and expected challenges,
- timeline,
- construction and operational costs (if applicable).

Back-up document

Additional information and details can be submitted in a separate back-up document, which can be consulted by the Physics Preparatory Group (PPG) if clarification on any aspects is required. But the back-up document is not a mandatory component of the submission.

Format and deadline for submission

The cover page and the comprehensive summary are to be submitted in portable document format (pdf) by 31 March 2025. The back-up document should have a cover page with the same title and contact persons and with the words "Back-up Document" added. A dedicated submission portal for both documents will be made available via the ESPPU website.

Distribution

All the documents submitted will be forwarded to the PPG and the European Strategy Group (ESG). Unless explicitly requested otherwise, they will also be made public. The option not to make a given document public will be available upon submission via the dedicated portal.

<https://europeanstrategy.cern/>



Klick on "*Information for the physics community*"

→ 2026 update;
direct link: [2026 update](#)

All inputs shall be submitted via this [portal](#)

(ii) Input from **projects** (FCC, Linear Collider, ..., Muon Collider, ..., theory, ...) is expected

(iii) Input from **national HEP communities** is a vital component of the Strategy Process

(Meetings of the national HEP communities have already taken place in several countries)

Key input will become available only at end of March 2025:

- * Final report on the FCC feasibility study (including progress on financial feasibility)
- * Important input from alternative projects
- * Reports on accelerator R&D, detector R&D, ...
- * ...

Therefore, we foresee further community input (national HEP communities) at later stages

Timeline for the update of the European Strategy for Particle Physics



ECFA Guidelines for National Input

- a) Which is the preferred next major/flagship collider project for CERN?
- b) What are the most important elements in the response to (a)?
 - i) **Physics potential**
 - ii) **Long-term perspective**
 - iii) **Financial and human resources: requirements and effect on other projects**
 - iv) **Timing**
 - v) **Careers and training**
 - vi) **Sustainability**
- c) Should CERN/Europe proceed with the preferred option set out in (a) or should alternative options be considered:
 - i) **if Japan proceeds with the ILC in a timely way?**
 - ii) **if China proceeds with the CEPC on the announced timescale?**
 - iii) **if the US proceeds with a muon collider?**
 - iv) **if there are major new (unexpected) results from the HL-LHC or other HEP experiments?**
- d) Beyond the preferred option in (a), what other accelerator R&D topics (e.g. high-field magnets, RF technology, alternative accelerators/colliders) should be pursued in parallel?
- e) What is the prioritised list of alternative options if the preferred option is not feasible (due to cost, timing, international developments, or for other reasons)?
- f) What are the most important elements in the response to (e)? (The set of considerations in (b) should be used).

Remit to ESG also specifies:

“The Strategy update should also indicate areas of priority for exploration complementary to colliders and for other experiments to be considered at CERN and at other laboratories in Europe, as well as for participation in projects outside Europe.”

It would thus be most useful if the national inputs explicitly included the preferred prioritisation for non-collider projects. Specific questions to address:

- a) What other areas of physics should be pursued, and with what relative priority?
- b) What are the most important elements in the response to (a)? (The set of considerations as for the “next collider” should be used).
- c) To what extent should CERN participate in nuclear physics, astroparticle physics or other areas of science, while keeping in mind and adhering to the CERN Convention? Please use the current level and form of activity as the baseline for comparisons.



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- It is important to submit input by **31 March 2025**
 - Reaching a consensus on the next large collider project at CERN in this Strategy Update is vital!
 - Given the scale of the project, large timescales, ... the decision cannot be postponed.
 - It will define the path to the future of our field
 - Get engaged (in discussions at the national level, projects, ...)
 - Attend the Open Symposium in Venice on 23 – 27 June 2025. → Discussion sessions!
 - In order to maximise the chances to get the next collider approved, we must reach consensus, and support the final plan, whatever it will turn out to be!
 - Finally, it should be noted that the European Strategy for Particle Physics is not a project approval process. Projects are approved by the Council through a separate decision process.
 - Council decision on a future collider at CERN is expected to be taken in 2027-2028, in order to be able to begin construction in the early 2030s.

▶ Key messages today

- ▶ To community: please input to our strategy process where useful and appropriate
 - ▶ All inputs and statements will be given full consideration throughout the later stages
- ▶ To NuPECC: please help stimulate inputs and coordinate where useful