UPPSALA
UNIVERSITET

Report on ECFA activities

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Partikeldagarna, Göteborg, 25/11/2025

ECFA in one slide

- ECFA = European Committee for Future Accelerators
- https://ecfa.web.cern.ch/
- **Plenary ECFA:**
  - Decides on all ECFA activities,
  - Appoints the Chair and Secretary,
  - Approves final reports of working groups and terminates their activities,
  - Decides on admission of new observers,
  - Makes recommendations to outside organisations,
  - Number of members commensurate with the country size (Sweden: 3),
  - Two (public) meetings and newsletters per year.
- **Restricted ECFA:**
  - Assists and advises the Chair and the Secretary in the running of ECFA,
  - Acts as the communication channel to each participating country, its physics community and national institutes and authorities,
  - Only one member per country (Sweden: A. Ferrari).

ECFA panels

- **ECFA Detector Panel:** https://ecfa-dp.desy.de/
  - Monitors the implementation of the ECFA detector roadmap and assists with the reviews of the scientific progress of the 8 DRD collaborations (expected to be quiet until a new strategy is in place).
- **ECFA Training Panel:**
  - Current main focus on strengthening the European instrumentation training offering to meet the high expectations of students and ECRs:
    - New D.TECT school at DESY and relaunch ESIPAP at/near CERN;
    - Maintain and develop DRD schools at advanced level.
    - Organise a European master's degree in instrumentation.
- **ECFA Early-Career Researchers (ECR) Panel:**
  - Discusses all aspects that contribute in a broad sense to the future of the research field of particle physics.
  - Three Swedish members: Alexander Burgman & Axel Gallén (incoming), Magdalena Vande Voorde (continuing, acts as plenary ECFA observer).

RECFA country visits

These are aimed at gathering reports from the funding bodies and from the high-energy physics community about their scientific activities... and their concerns.

In turn, this gives an opportunity to highlight to the funding agencies and science ministry what actions should be taken to support the community.

- **Country visits in 2025:**
  - Bulgaria: March 7
  - Finland: May 31
  - Belgium: September 12
  - Türkiye: October 31
- **Upcoming visits in 2026:**
  - Spain: March 6
  - Romania: June 5
  - Netherlands: July 8 (followed by the plenary ECFA meeting on July 9-10)
  - Austria: September 11
  - Slovakia: October 23

New: ECFA fund and awards

- As of 2026, ECFA aims to collect a small annual contribution from member countries (1000 CHF each) → alternate among the Swedish institutes?
- The ECFA fund will exclusively support ECRs:
  - ECFA ECR awards to recognise outstanding contributions to future accelerator-based experimental projects, in three sub-fields:
    1. Physics prospect studies and analysis tools;
    2. Detector/instrumentation development;
    3. Accelerator physics at large.
  - ECR workshop/conference support related to the ECFA mandate: around 50 such grants of 400 EUR per event and per person, most likely towards the registration fee (no travel support).
- Sub-committees are being put in place among RECFA members. Call for nominations and applications will be sent in early 2026. Stay tuned!

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  - Assessment of the European particle physics and comparison of the physics potential for the various flagship projects in different physics areas.
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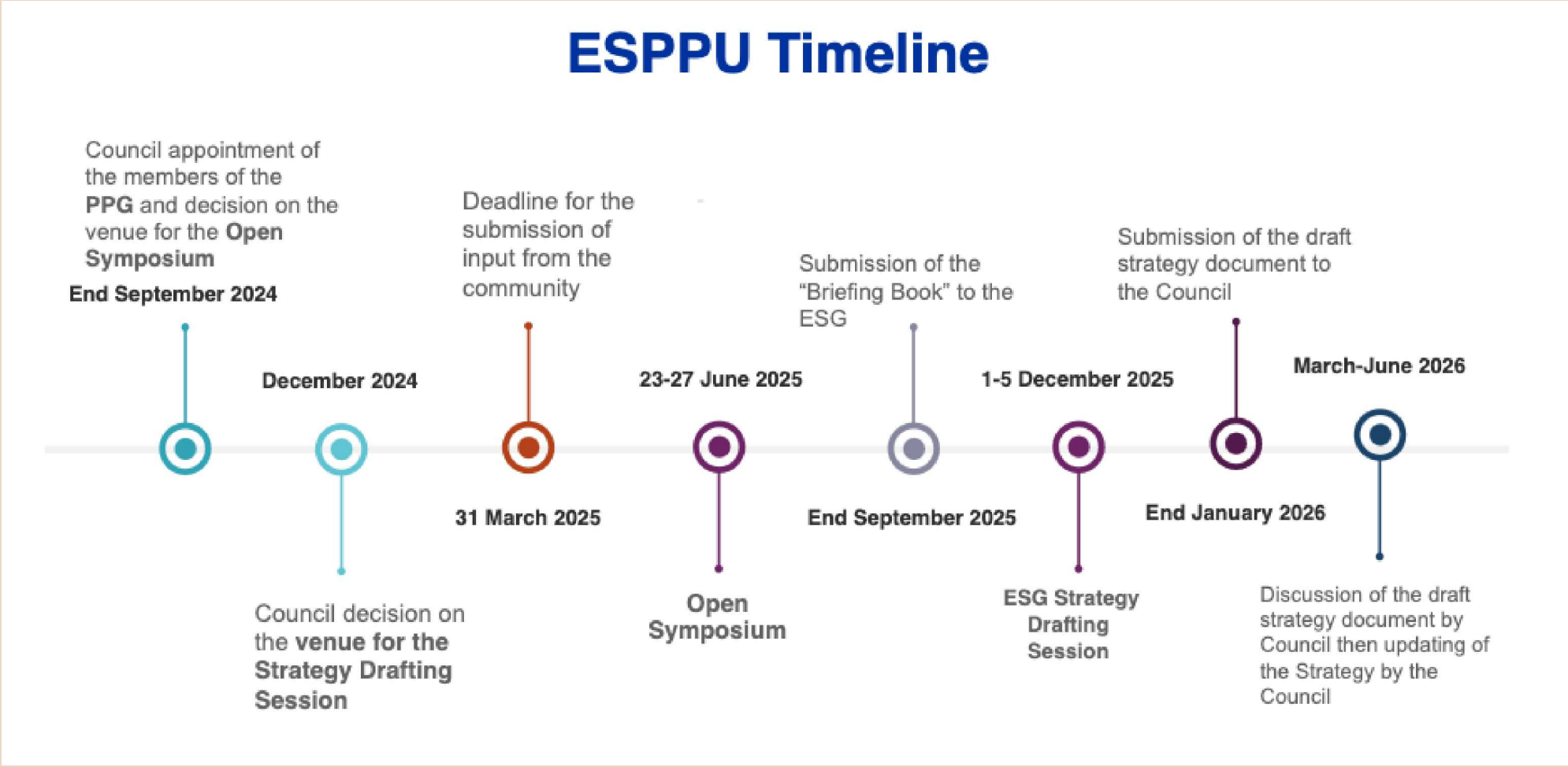
- Recommendations will be prepared during a drafting session on December 1-5 and submitted to the CERN Council in January 2026.

European Strategy for Particle Physics



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- A Nordic ESPP meeting followed in Uppsala on May 7-8 to compare our inputs, as well as to discuss synergies and possible areas of collaboration: https://indico.cern.ch/event/1488493/

ESPP – national inputs (2)

- Following the release of the Physics Briefing Book and of the flagship project assessments, the national communities were asked to update their inputs by November 14, focusing on three questions:
  1. Preferred large-scale post-LHC accelerator for CERN?
  2. Preferred alternative, if the preferred option is not be feasible?
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- The short addendum to the Swedish national input can be found here.

ESPP – summary of the Swedish input

- Which is the preferred next flagship collider project for CERN?
  - We strongly support the FCC integrated program (FCC-ee for precision measurements of the electroweak and Higgs sectors + FCC-hh to further explore the high-energy frontier) to be the next flagship project at CERN.
  - Most important elements: (i) physics potential, (ii) long-term perspective, including sustainability of the research field, (iii) timing.

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- Alternative options for a future collider project at CERN?
  - Neither LEP3 nor LHeC are viable options due to their limited physics potential, the lack of an upgrade path and infrastructure conflicts.
  - A muon collider is not a viable option either, due to its limited technological maturity and the much longer time scale.
  - *A linear e^+e^- collider may be a viable alternative option for precision measurements of the Higgs/electroweak/top-quark sectors, provided that it has the ability to reach high enough energies to allow the direct production of both ttH and HH events.*

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- R&D towards high-field magnets must be pursued as part of the baseline towards the realisation of FCC-hh, with a major role from CERN.
- Consider and fund development and maintenance of event generators in a similar way as other HEP infrastructures.

ESPP – summary of the Swedish input

- What other areas of physics should be pursued?
  - Astroparticle physics (including neutrino and DM experiments).
  - Experiments probing the high-intensity frontier, including several opportunities to probe fundamental physics at the ESS in Lund.
- Most important elements in the response?
  - Potential to advance knowledge in fundamental physics, in a way that is both complementary and synergistic to high-energy colliders.
  - More modest costs, on shorter timescales and with fewer physicists than the large collider experiments.
  - Unique training opportunities for students and post-docs, who learn all facets of their experiment and gain high visibility,

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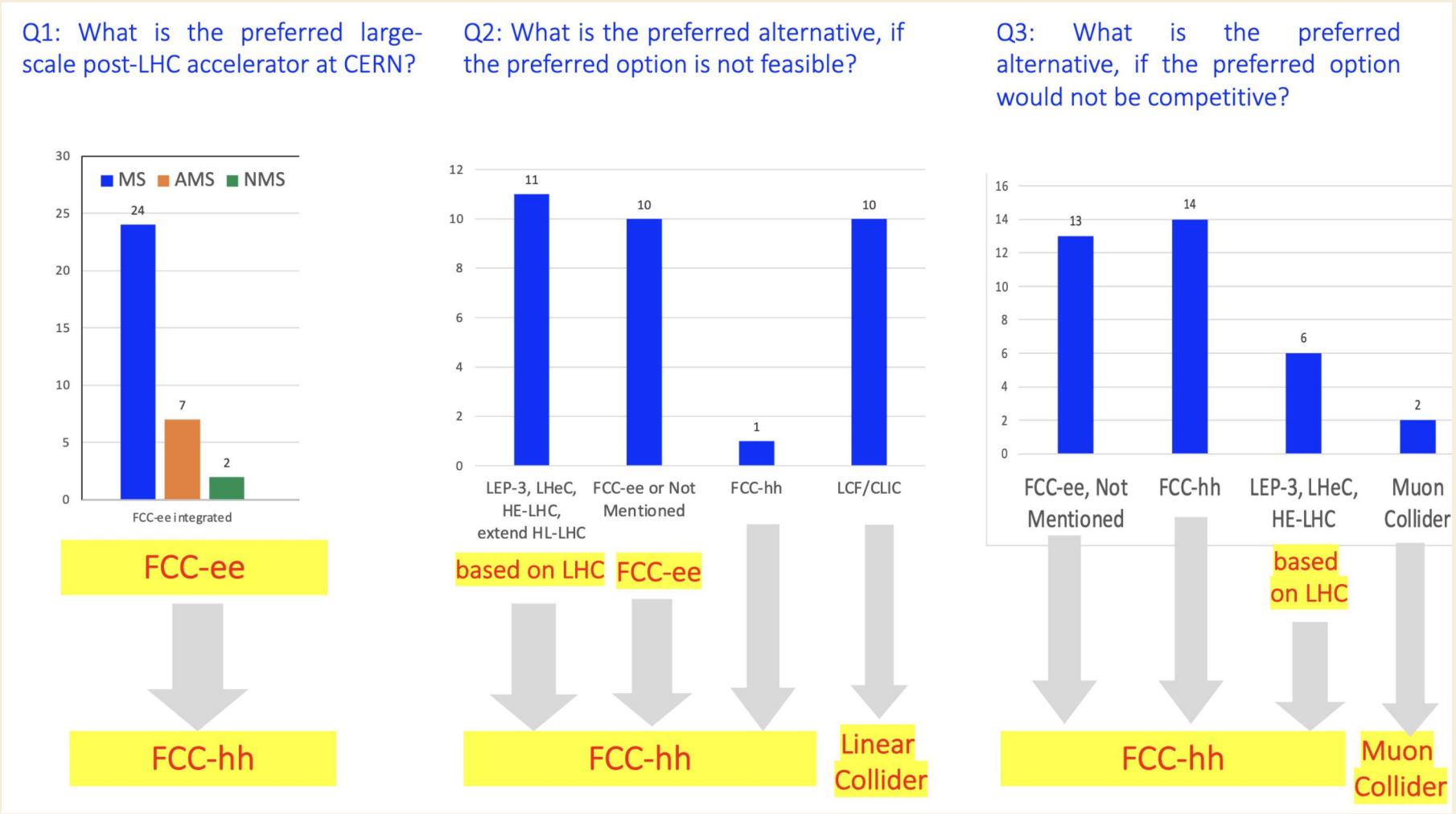
  - More modest costs, on shorter timescales and with fewer physicists than the large collider experiments.
  - Unique training opportunities for students and post-docs, who learn all facets of their experiment and gain high visibility,
- We also recommended to:
  - Keep strong support for CERN-recognised experiments in nuclear/hadron physics, astroparticle physics and other areas of science.
  - Maintain and, if possible, broaden the CERN experimental program that relies on its own infrastructure.
- BONUS: The Swedish input document contains a dedicated ECR chapter.

ESPP highlights from the ECFA meeting



- Very strong support from the HEP community for FCC as plan A;
- More difficult to find a consensus for plan B...

ESPP highlights from the ECFA meeting

Main features of proposed collider projects

Project	Construction start	First beams	Peak L at HZ per IP (10^{34} cm^{-2} s^{-1})	Years of operation	Project cost (BCHF)	Next stage collider
FCC-ee	2033	2046	7.5	16	15.3	FCC-hh
LEP3	2037	2047	1.8	15	4.1	FCC-hh
LHeC	2037	2044	2.3	7	2.1	FCC-hh
LCF 250 → 550 GeV	2035	2045	1.3 – 3.8	21	9.4+5.4 14.8	1-10 TeV collider?
CLIC 380→1500 GeV	2035	2045	2.2 - 3.7	22	7.5 + 7.1 14.6	3 TeV collider?

All first-stage facilities start ~ 2045 (driven by HL-LHC running until 2041)
Higher peak luminosity for FCC-ee and 4 IPs → operation is few years shorter than for linear colliders
Project cost (only CERN part shown here) similar for FCC-ee and linear colliders, lower for colliders re-using the LHC tunnel

Comprehensive assessment of the projects based on specific criteria (e.g. technical readiness, R&D, demonstrators, site, uncertainties in performance, schedule, cost, etc) presented here.

ESPP highlights from the ECFA meeting

Project	Scope	TRL	R&D	Test facilities	Performance	Site preparation	Schedule	Cost	Risk
CLIC 380GeV, 1.5TeV		4 - 6 / 5.2							
FCC-ee 91-365GeV		4 - 7 / 6.0							
FCC-hh 85TeV		4 - 7 (Nb_3Sn) / 4.3 2 - 7 (HTS) / 3.2							
FCC-hh - SA 85TeV		4 - 7 (Nb_3Sn) / 5					Nb_3Sn		
LCF 250-550GeV		5 - 7 / 5.5							
LEP3 91-230GeV		3 - 6 / 4.0							
LHeC: HL-LHC+50GeV ERL		3 - 6 / 4.5							
MC 3.2TeV, 7.6TeV		3.2TeV: 3 - 5 7.6TeV: 2 - 5							

Table 16: Summary table schematically representing the key findings of the WG according to the assessment criteria and based on the present status of the large-scale collider project proposals as submitted to the ESPP2026. Scope=Scope level-of-definition; TDR=Technical Readiness Level score - the range of values and the cost-weighted average for the baseline scenarios are listed; the colour code is selected based on on the cost-weighted average TRL score (TRL≥ 6 - green, 4≤TRL<6 - yellow, TRL<4 - red); R&D=R&D requirements, R&D plan level-of-definition, R&D funding status; Test facilities=need of test facilities or demonstrators and (if needed) level-of-definition of their scope; Performance=Performance uncertainty; Site preparation=Site preparation status; Schedule=Schedule uncertainty; Cost=Cost uncertainty; Risk=Risk level-of-definition. The cost-weighted average TRL score could not be estimated for the MC project as there is no detailed cost breakdown by sub-system.

ESPP highlights from the ECFA meeting

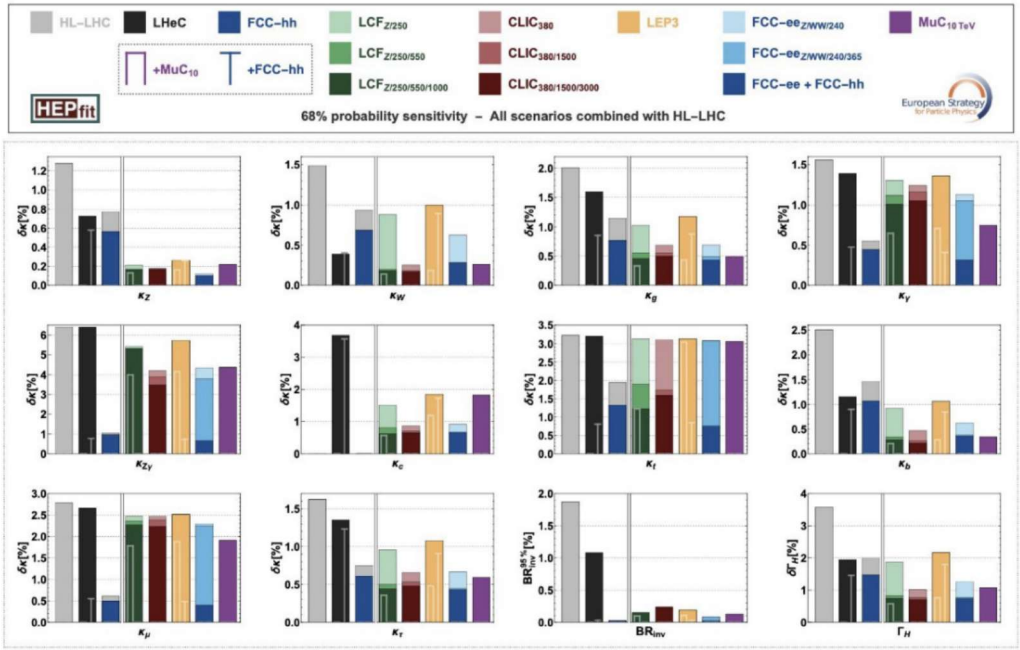
Systematic comparison of the physics potentials of the various plans B_i wrt plan A (FCC) here. Only one (biased) example for illustration below.

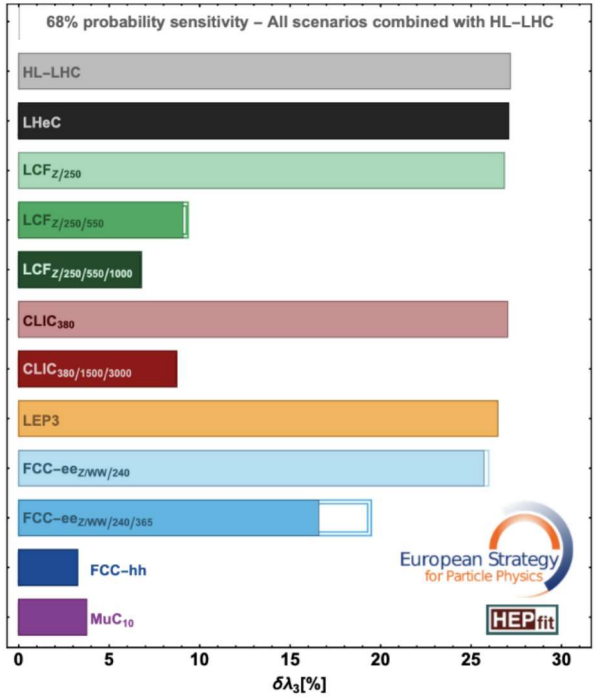
Higgs coupling meaurements

From European Strategy Briefing Book: https://cds.cern.ch/record/2944678?ln=en

$$\mathcal{L}_h = \frac{1}{2} m_H^2 H^2 + \lambda_3 H^3 + \lambda_4 H^4$$

Kappa framework





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Plan B_i : Higgs

	Delta
First-stage e+e- colliders	
LEP3	Less luminosity (~x4), reduced precision w.r.t FCCee, no improvement to self-coupling w.r.t HL-LHC
LCF 250	Reduced precision w.r.t FCCee, no improvement to self-coupling w.r.t HL-LHC
CLIC 380	Less luminosity (~x2), reduced precision w.r.t FCCee, no improvement to self-coupling w.r.t HL-LHC
LHeC	Measurements in HWW and Hcc, in EFT fit improvements w.r.t HL-LHC are small
Second-stage e+e- colliders	
LCF 250+550	Comparable precision w.r.t FCCee, access to HH production for self-coupling
CLIC 380+1500	Comparable precision w.r.t FCCee, access to HH production for self-coupling

Conclusion

- ECFA plays an important role in shaping the future of accelerator-based high-energy physics research.
- New ECFA fund towards ECR awards and conference support.
- The main activity during 2025 was the update of the European Strategy for Particle Physics.