ECR Workshop on EPPSU
informal discussion

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European Strategy for Particle Physics

- The European Strategy for Particle Physics defines the long-term future of the field.
- In March 2024, the CERN Council launched the process for the update of the Strategy.
- The update process is expected to converge in **January 2026** and the community is asked to provide input by **March 2025**.
- Early Career Researchers (ECR) are welcome to contribute!

Why are we here?

- We want to provide input to EPPSU as **young researchers**:
  - non-permanent or <10 years after PhD
  - studying or employed in ECFA member states or CERN
- “we” = ECFA ECR panel + **anyone** interested in joining the activities
- **General spirit:** today’s students => tomorrow’s leaders
- Trying to answer the question how to keep (make?) our field efficient and livable

Organisation

- 5 working groups (WGs) established:
  - WG1: Communicating the importance of particle physics
  - WG2: Future colliders
  - WG3: Future particle physics experiments beyond colliders
  - WG4: Interplay with neighbouring fields
  - WG5: Career prospects and ECR leadership

- Communication via Mattermost and regular online meetings: **everyone** is invited!

Higgs factory as the future project

- EPPSU is focused on long-term planning => large-scale projects are of the main interest
- The 2020 Update of the Strategy stated:

  An electron-positron Higgs factory is the highest-priority next collider.

- How do we want this issue to be addressed in the 2026 Update?

Physics case for an e^+e^- collider

Higgs physics

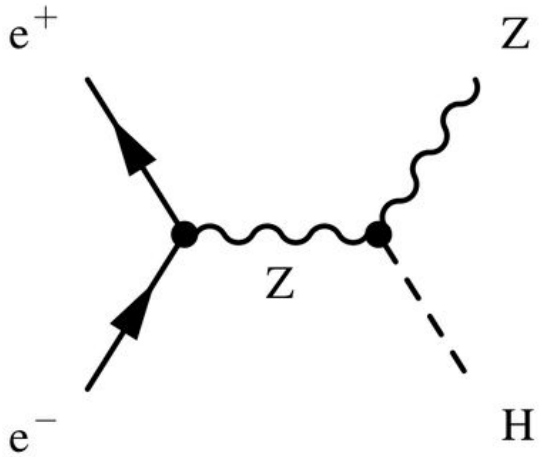
top physics

EW measurements

direct searches

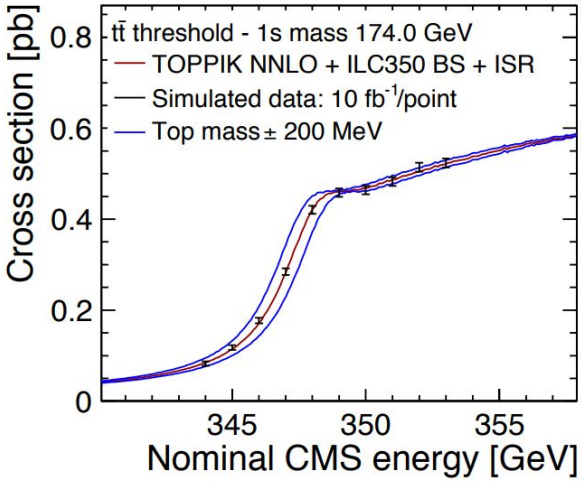
Higgs physics

- Numerous Higgs bosons produced in the *Higgstrahlung* process: *e+e- -> ZH*
- Higgs mass, width, CP properties, couplings to the SM particles, self-coupling, …
  still to be **measured**



top physics

- A dedicated threshold scan to measure the top mass, width and Yukawa coupling
- Further tests of the Standard Model: forward-backward asymmetry, beam polarisation asymmetry, polarisation of the top in decays, etc.



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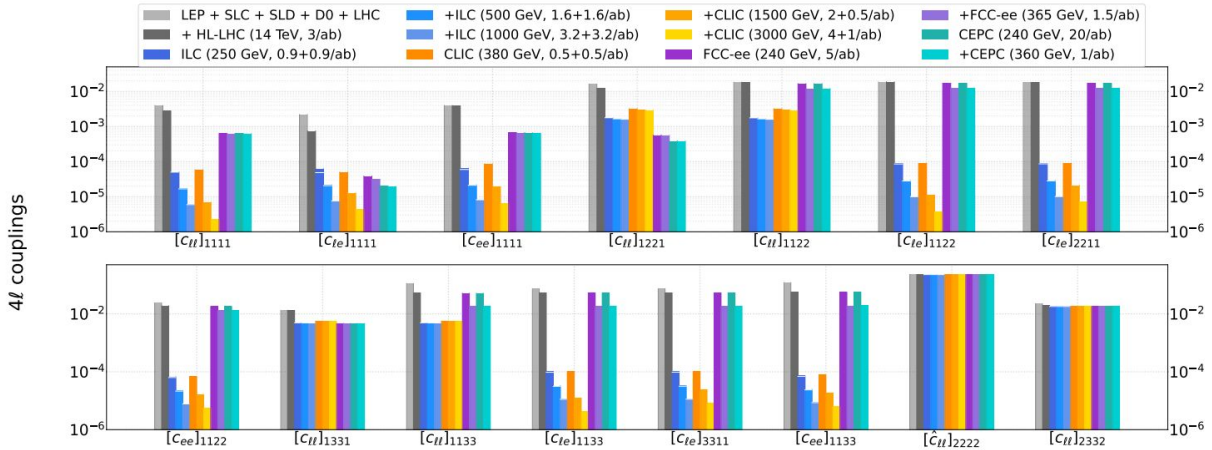
EW measurements

Possible improvements in many fields:

- parameters of the SM, e.g. electroweak couplings
- new Vector-Boson Scattering processes
- many Effective Field Theory operators to be constrained
- …



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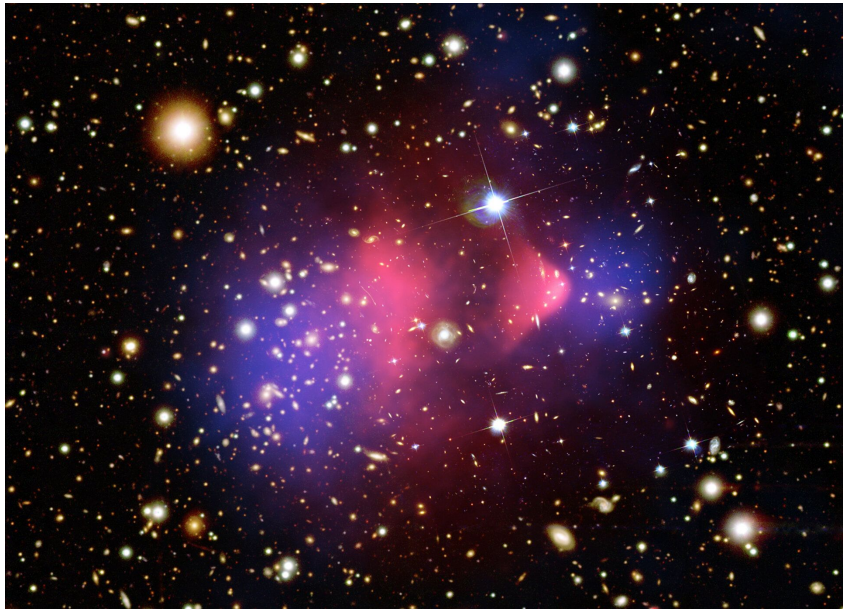
Direct searches

Many BSM scenarios remain to be probed:

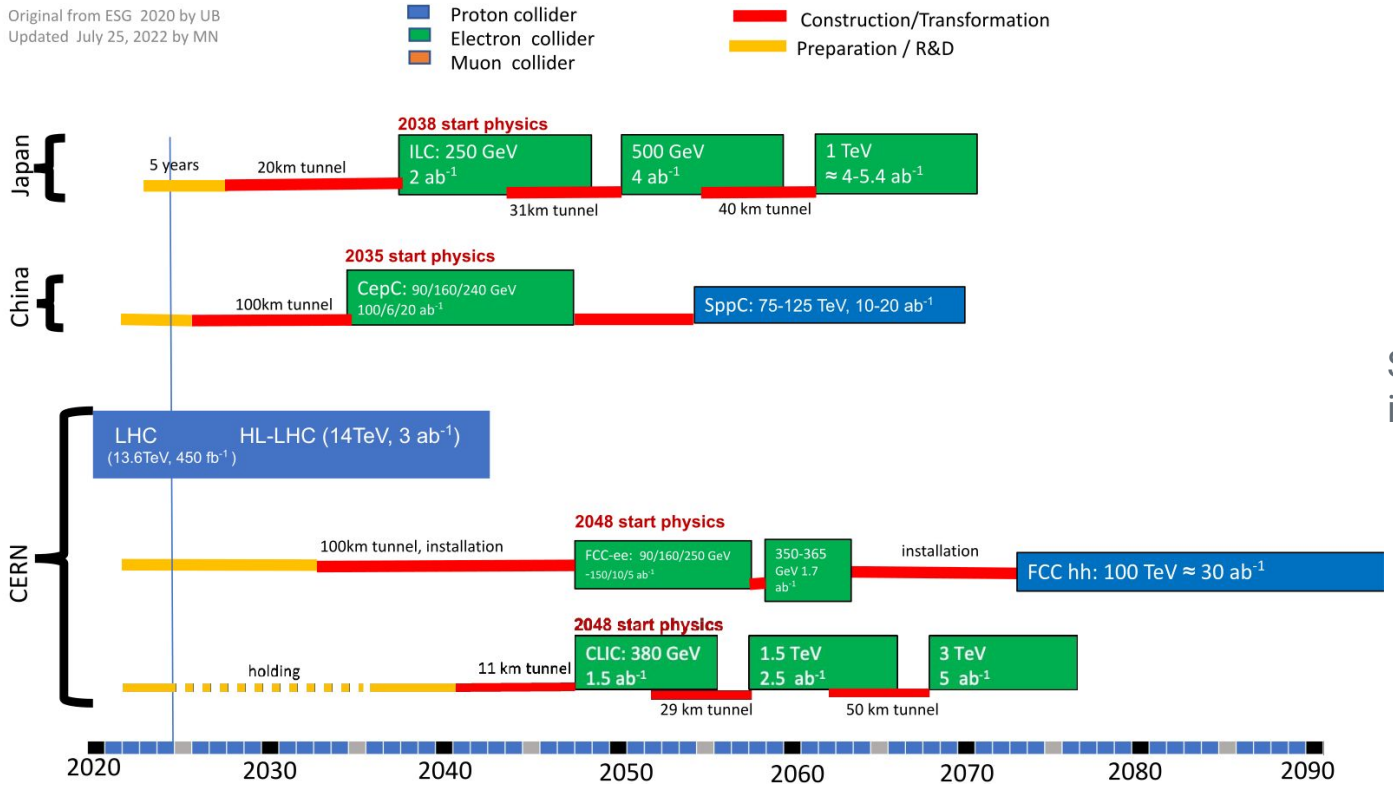
- SUSY
- exotic scalars
- extra gauge bosons
- extra dimensions
- compositeness
- heavy neutrinos
- axions
- dark matter
- …

In many cases scenarios excluded up to the kinematic limit!



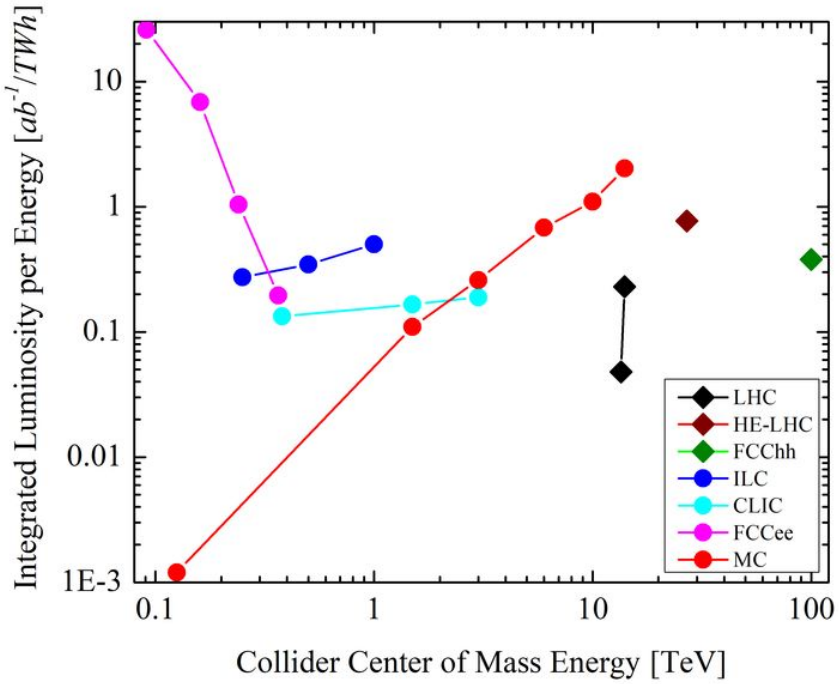
https://www.esa.int/ESA_Multimedia/Images/2007/07/The_Bullet_Cluster2

Collider proposals – timeline



Scenarios considered in the previous EPPSU

Collider proposals – energy and luminosity



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Collider proposals – other aspects

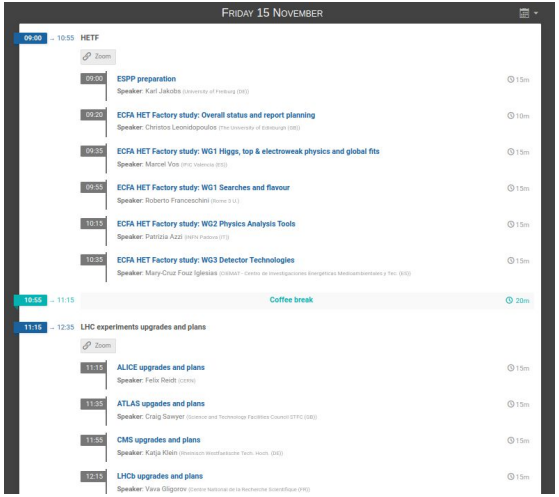
- Physics reach: energy and polarisation or luminosity?
- Extendibility: higher energies with leptons or hadrons?
- Location: in Europe or anywhere else?
- Collaboration: international or global project?
- Cost: what can we sacrifice for a cheaper collider?
- Sustainability: what does it mean in this context?
- …

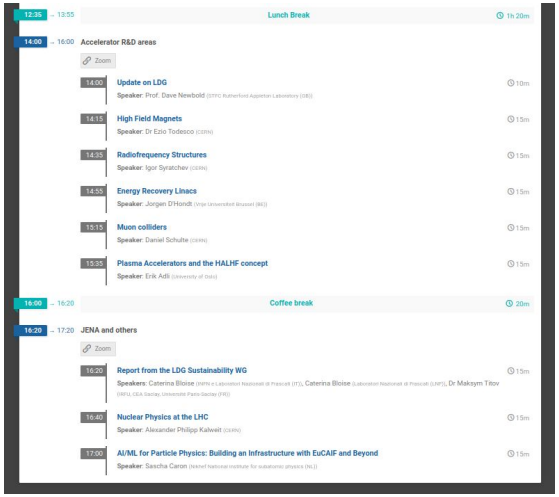
Today’s WG reports

- **WG1**: communication skills are important to stay visible in the society, even though we have not been trained in this direction; different levels of communication needed (colleagues vs. general public)
- **WG2**: emphasize the importance of a future collider; demand transparency; highlight criteria useful for the decision-making process
- **WG3**: smaller experiments are complementary to collider searches; how to position them in the big-collider era?
- **WG4**: exchange of methods, tools, knowledge, people is crucial and unavoidable - how to facilitate it?
- **WG5**: our future depends on the choice of the next collider - please, include us in the process

Open Plenary ECFA

- The ECFA member country, CERN, and the ECFA ECR panel have representatives in Plenary ECFA (PECFA).
- The November meetings are at CERN, with most of the meeting open to anyone!





Discussion session

- What aspects are the most important for us? What is irrelevant?
- What are our expectations? Hopes? Concerns?
- How can we contribute as young researchers? What is our responsibility?
- How to make sure we are heard? Do we feel part of the community?
- …