

FCC-LPNHE monthly meeting

Luc

- Feedback from ESG
- FCC_France news
- Snowmass feedback
- Ongoing activities
- Manpower, Budget
- AOB

ESG feedback



Scientific priorities include

- ❑ Full exploitation of LHC physics potential → successful completion of the high-luminosity upgrade of accelerators and experiments
- ❑ e^+e^- Higgs factory as the highest-priority next collider
- ❑ Increased R&D on accelerator technologies: high-field superconducting magnets, high-gradient accelerating structures, plasma wakefield, muon colliders, ERL, etc. Development of Accelerator R&D roadmap.
- ❑ Investigation of the technical and financial feasibility of a future ≥ 100 TeV hadron collider at CERN, with e^+e^- Higgs and electroweak factory as a possible first stage. To be completed by next Strategy update (~ 2026).
- ❑ Support to long-baseline neutrino projects in Japan and US. Support to high-impact scientific diversity programme complementary to high-energy colliders (role of national labs emphasised)

(My) remarks:

- ❑ Strategy gives a direction for future collider(s) at CERN (FCC). Prudent: feasibility study first.
- ❑ Intensified accelerator R&D to prepare alternatives if FCC feasibility study fails
- ❑ No consensus in European community on which type of Higgs factory (linear or circular)
If FCC feasibility study successful and project approved → FCC-ee is natural choice at CERN
- ❑ ILC: - compatible with ESPP if timely (otherwise conflict of resources with next collider at CERN)
- are ILC and FCC-ee complementary enough in terms of physics? No consensus
- ❑ Chinese colliders (CepC, SppC): direct competition → if CepC goes ahead, Europe would go directly to FCC-hh (if feasible)

Inputs

- Open CERN Council session 16/06
- Fabiola to CERN members& associates 29/06

In 'summary'

- Lack of consensus for ee BUT
 - If FCC feasibility OK, then FCC-ee is the natural choice
 - Timescale for the FCC-ee is after HL-LHC, ie operation asap after 2038
- Medium Term Plan (MTP)
 - Positive feedback
 - Clear recommendation for Technical & Financial Feasibility studies of FCCs
 - > Green light for FCC-ee & FCC-hh TDRs (machine and instrumentation)
- For us: FCC is highest CERN priority for future (ee included)
 - Physics studies (benchmark case studies towards detector requirements)
 - Development of detector concepts matching the requirements
 - Intensify theoretical developments, esp. precision calculations
 - Reinforce/enlarge worldwide community (OK for France, Italy)

FCC-ee organization (Alain)

FCC-ee PE&D SG approved a proposal for a Physics Performance group

1. Physics working groups (conveners) establish list of BENCHMARK MEASUREMENTS
2. Case study teams establish DETECTOR REQUIREMENTS for optimizing measurement, and in particular matching exp. systematics with the expected statistical precision.
3. This requires simulations of detector setup (fast sim or full sim as appropriate) with help/guidance from detector experts

-> List of benchmarks measurements at FCC-ee (Contribution to Snowmass2021) <https://www.overleaf.com/read/dyjpdszrqxhz>

Benchmarks

A first list of benchmark studies

1. Towards an ultimate measurement of $R_\ell = \frac{\sigma(Z \rightarrow \text{hadrons})}{\sigma(Z \rightarrow \text{leptons})}$
2. Towards an ultimate measurement of the Z total width Γ_Z
3. Towards an ultimate measurement of the Z peak cross section
4. Direct determination of $\sin^2 \theta_{\text{eff}}^\ell$ and of $\alpha_{\text{QED}}(m_Z^2)$ from muon pair asymmetries
5. Determination of the QCD coupling constant $\alpha_s(m_Z^2)$
6. Tau Physics, Lepton Universality, and Lepton Flavour Violation
7. Tau exclusive branching ratios and polarization observables
8. Z-pole Electroweak observables with heavy quarks
9. Long lived particle searches
10. Measurement of the W mass
11. Measurement of the Higgs boson coupling to the c quark
12. Measurement of the ZH production cross section
13. Measurement of the Higgs boson mass - Part I
14. Measurement of the Higgs boson mass - Part II
15. Inferring the total Higgs boson decay width - Part I
16. Inferring the total Higgs boson decay width - Part II
17. Determination of the HZ γ effective coupling
18. Electron Yukawa via s-channel $e^+e^- \rightarrow H$ production at the Higgs pole
19. Measurement of top properties at threshold and above
20. Search for FCNC in the top sector
21. Theory Needs for FCC-ee
22. Beyond MFV: constraints on RH charged currents and on dipole operators
23. Construction of CP-odd observables to probe CP-violating Higgs couplings
24. Combined fit of Higgs and top data

tera Z

WW

H fact

ee \rightarrow H

top

theory

Can we contribute as a group?

Ongoing activities

- Ongoing activities
 - H to cc/bb/gg
 - α_s measurement at Z pole
- Interest?
 - Precise granularity & energy resolution needs for EM calorimeter
 - Mostly done for CDR at ZH
 - At Z pole, does it change? (eg B physics, tau physics)
- Question
 - Is there for FCC-hh the equivalent as for FCC-ee (Physics cases, benchmarks,...)?

Budget

- Request by Marco yesterday to evaluate needs for 2021
 - Mission
 - Equipement/Fonctionnement
- To be finalized for next week
 - To be filled into DIALOG
- At 1st order (to be discussed)
 - Mission 7-8 k€ (as last year)
 - Equipement 0
 - Fonctionnement 2k€ (abonnement train, laptop)

Other points

- Informal presentation of FCC status after ESG outcome?
 - Useful. Could help in attracting more people
 - Which format? Réunion du vendredi,...
- Manpower
 - ITN did not succeed
 - Need to get PhD next year 2021
- Next
 - FCC-IS kickoff & FCC physics workshop 9-13 November
 - FCC-France next workshop. December or January at LAPP
- Conseil Scientifique in November
 - Mentioned at Réunion de Coordination 19/06