Electroweak and Higgs Physics Discussion

Electroweak and Higgs Physics Preparatory Group
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Questions overview

For electroweak and Higgs physics:

1. Role of HL-LHC results
2. Importance of precision for the next collider
3. Comparative capabilities of future facilities
4. Limiting factor of theory uncertainties
5. BSM sensitivity via precision
6. Importance of PDFs

Question 1

- *How much does the physics program of electroweak and Higgs for e^+e^- colliders depend on results expected from the HL-LHC, such as m_{top}?*

Question 2

- *What are the key questions we want to answer in Higgs and electroweak physics in the next facility?*
  - *Is there a facility or a combination of them that achieves this best?*

- *How important is the precision of the Higgs self coupling in the whole program?*
  - *Compare the extraction of k_λ from loop vs direct measurement*

Question 3

- *What is lost -or gained- in the electroweak and Higgs physics program if one collider is replaced by another? How important is this difference?*
  - *FCC-ee → ILC 250/550*
  - *FCC-ee → LEP3*
  - *FCC-ee/FCC-hh → ILC 250/550/1000*

  And what if we do not do precision (electron-colliders) and go directly to energy (hadron-colliders)?
  - *FCC-ee → FCC-hh*

Question 4

How critical are theoretical uncertainties across the full landscape of e^+e^- collider programs?

- *What are the strategies for reducing them?*
- *Can we expect that the necessary precision will be achieved?*

How early must theoretical advances be done to prevent these limitations from becoming a constraint on the physics program?

- *Noting that HL-LHC results are also affected by the current (large) theory uncertainties*

Question 5

- *Can precision electroweak and Higgs at e^+e^- collider reveal new physics that cannot be seen at HL-LHC or FCC-hh?*

- *If no deviations from the SM are observed in e^+e^- colliders,*
  - *how relevant would this be for the new physics scenarios at FCC-hh (85-120 TeV) or MuC (10 TeV)?*
  - *Would this influence the high-energy plans?*

Question 6

- *How important are PDF uncertainties in electroweak and Higgs physics at FCC-hh?*
  - *How beneficial would be to have results from the LHeC program*