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Precise Higgs mass measurements and cross section measurements at the FCC-ee

Friday, 8 July 2022 14:30 (15 minutes)

The FCC-ee offers powerful opportunities to determine the Higgs boson parameters, exploiting over 10^6 e+e- → ZH events and almost 10^5 WW→H events at centre-of-mass energies around 240 and 365 GeV. This contribution spotlights the important measurements of the ZH production cross section and of the Higgs boson mass. The measurement of the total ZH cross section is an essential input to the absolute determination of the HZZ coupling – a "standard candle" that can be used by all other measurements, including those made at hadron colliders – at the permil level. A combination of the measured cross sections at the two different centre-of-mass energies further provides the first evidence for the trilinear Higgs self-coupling, and possibly its first observation if the cross-section measurement can be made accurate enough. The determination of the Higgs boson mass with a precision significantly better than the Higgs boson width (4.1 MeV in the Standard Model) is a prerequisite to either constrain or measure the electron Yukawa coupling via direct e+e- → H production at √s=125 GeV. Approaching the statistical limit of 0.1% and O(1) MeV on the ZH cross section and the Higgs boson mass, respectively, sets highly demanding requirements on accelerator operation (ZH threshold scan, centre-of-mass energy measurement), detector design (lepton momentum resolution, hadronic final state reconstruction performance), theoretical calculations, and analysis techniques (efficiency and purity optimization with modern tools, constrained kinematic fits, control of systematic uncertainties).

In-person participation

Yes

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