

Measuring the Higgs Trilinear Self-Coupling at the FCC-ee

The determination of the Higgs self-couplings are of primary importance in particle physics and cosmology. They characterise the Higgs potential and thus the electroweak symmetry breaking mechanism. Moreover, the structure of the potential could shed some light on the naturalness problem and the self-couplings control the properties of the electroweak phase transition, determining its possible relevance for baryogenesis. Sizeable deviations in the Higgs self-couplings are expected in several Beyond the Standard Model scenarios, including Higgs portal models or theories with Higgs compositeness. All of these considerations motivate the effort spent investigating the achievable precision on the Higgs self-interactions at future collider experiments. Here we will report on our investigation of the measurement of the Standard Model Higgs trilinear self-coupling parameter at the FCC-ee using single Higgs production channels, via its production cross section. We have introduced several Higgs boson production channels at $\sqrt{s} = 240, 365$ GeV, used improved Monte Carlo samples including initial and final state radiation and a new orthogonal categorization of events. The Higgs boson mass was constrained to be within 5.6 MeV around the nominal value of 125 GeV at 68% CL using inclusive leptonic Higgsstrahlung channels at both energies. We used inclusive Higgsstrahlung (leptonic and hadronic) and exclusive vector boson fusion channels in a combined analysis to extract the sensitivity on the respective cross sections as well as on the trilinear self-coupling. We show that the signal strength modifiers used to estimate the precision on the Higgsstrahlung and vector boson fusion production cross sections could be measured with sub-percent and percent precision at the FCC-ee under the assumption that the decay of the Higgs boson follows the Standard Model expectation. In a similar manner, we extracted the Higgs boson trilinear self-coupling κ_λ using one-loop corrections to the leading order Feynman diagrams of Higgsstrahlung and vector boson fusion. Results are obtained assuming all couplings except for κ_λ are set to the Standard Model values.

Type of talk

Future prospects

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Session Classification: Wednesday Session B

Track Classification: Physics Topics: Future Colliders