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Single Higgs Boson Production via Vector-Boson Fusion at FCC-ee

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Abstract

The FCC-ee at √s = 365 GeV provides a better environment to study Higgs boson production with high precision. This study focuses on single Higgs production via vector-boson fusion (VBF) and associated production (ZH), followed by its H ⟶ WW ⟶ 2 l + MET decay. Using MadGraph5, event generation was performed for $e^+ e^- \longrightarrow \nu l \bar{\nu} \bar{l}$ **H** and $e^+ e^- \longrightarrow$ **Z H**. Parton-level events were hadronized with Pythia8, detector effects were simulated using Delphes, and final-state observables were analyzed via ExRootAnalysis. Histograms for missing transverse energy (MET), invariant mass (m(*ll*)), and transverse momentum (pT(*l*)) were constructed. Background contributions from ***ZZ, WW, l+ l-*** *(l:e,μ)*, and τ+ τ- were systematically studied, and optimized kinematic cuts were applied to enhance signal extraction. The results indicate that FCC-ee provides a highly controlled environment to probe Higgs boson couplings with electroweak gauge bosons. This study contributes to the precise determination of the Higgs coupling constants *gHWW* and *gHZZ*, which play a critical role in testing the Standard Model (SM) predictions and exploring possible deviations that could hint at new physics.

Keywords: Higgs boson, Vector boson, Couplings, FCC, Lepton collider

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