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Constraining the Higgs trilinear self-coupling from off-shell production using neural simulation-based inference

Experimental verification of the Higgs trilinear self-coupling is one of the next major challenges of particle physics. While prospects from proton-proton collisions have centred around measuring the on-shell single- and di-Higgs production processes, the off-shell Higgs production process has also been suggested as a complementary channel to resolve the degeneracy in Higgs couplings. We employ neural simulation-based inference to evaluate an expansion of the likelihood ratio that fully describes the Higgs signal under effective field theory modifications to the self-coupling, relevant backgrounds, and possible quantum interference effects between them in the $pp \to ZZ$ process. We demonstrate that NSBI approaches the best possible sensitivity and report the expected constraint at the High-Luminosity Large Hadron Collider.

Secondary track

T16 - AI for HEP (special topic 2025)

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