

# Reconstruction of Higgs Boson Pairs in the 4b Final State using Machine Learning

*Friday, 7 November 2025 14:10 (20 minutes)*

In the search for new particles beyond the Standard Model, a promising channel involves the decay of a heavy resonance into a pair of Higgs bosons, each subsequently decaying into a bottom quark-antiquark pair:  $X \rightarrow YH \rightarrow 4b$ . A major challenge in reconstructing this signal is determining which jets originate from which Higgs boson. In this talk, I will present my work on reconstructing Higgs boson pairs using a boosted decision tree (BDT) trained on kinematic features, focusing on the topology where quarks from each Higgs boson decay are well separated. I will show that this machine learning approach performs better than the traditional mass-based method, both in correctly identifying the true jet pairings and in reducing the probability of selecting incorrect ones. Additionally, the BDT reproduces the expected Higgs boson mass distributions more reliably. These results highlight the potential of multivariate techniques to enhance sensitivity in searches for extended Higgs sectors at high-energy colliders such as the LHC.

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**Session Classification:** Parallel Sessions (II)