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Higgs boson production in weak-boson fusion and H → bb̄ decay at NNLO with realistic event selection criteria

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The b-quark Yukawa coupling y_b can be measured in $H \to b\bar{b}$ decay. While $H \to b\bar{b}$ is the main decay mode of the Higgs boson, measuring it experimentally is challenging because of the large number of b-quarks from other QCD processes. However, Higgs boson production in weak-boson fusion (WBF) can be distinguished from those QCD backgrounds by the presence of two nearly back-to-back forward jets. In order to isolate such a signal it is important to have a good theoretical model of this process in the kinematic region defined by event selection criteria.

We present fully-differential results for Higgs boson production in weak-boson fusion followed by $H \to b\bar{b}$ Higgs decay in the narrow-width approximation, at NNLO in QCD. The nested soft-collinear subtraction scheme is used to cancel infrared divergences between real and virtual corrections and obtain finite predictions.

We find that the perturbative corrections to this process reduce the fiducial cross-section by about 40% in comparison to the leading-order predictions. Such large corrections can be attributed to a number of distinct sources, the strongest of which is the tendency of the QCD radiation in the $H \to b\bar{b}$ decay to reduce the transverse momentum of b-jets to the point where they no longer pass the b-jet selection criteria.

Authors: BEHRING, Arnd (CERN); NOVIKOV, Ivan; MELNIKOV, Kirill (KIT); Dr ASTERIADIS, Konstantin (University of Regensburg); Dr RÖNTSCH, Raoul (University of Milan)

Presenter: NOVIKOV, Ivan

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