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Taming a leading theoretical uncertainty in HH measurements via accurate simulation for bbH production

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We present a new simulation for Higgs boson production in association with bottom quarks (bbH) at next-to-leading order (NLO) matched to parton showers. The contributions proportional to the bottom-quark Yukawa coupling and top-quark Yukawa coupling (from gluon fusion) are both taken into account in a scheme with massive bottom quarks. The bbH process constitutes a crucial background to measurements of Higgs-boson pair (HH) production at the LHC when at least one of the Higgs bosons decays to bottom quarks. So far, the modeling of bbH induced one of the dominant theoretical uncertainties to HH measurements, as the gluon-fusion component was described only at the leading order with uncertainties of O(100%). Including NLO corrections allows to reduce the scale dependence to O(50%). We provide an in-depth analysis of the bbH background to HH measurements and we propagate the effect of the new bbH simulation to HH searches in the $2b2\gamma$ and $2b2\tau$ final states.

Author: MAZZEO, Elena (Università degli Studi e INFN Milano (IT))

Co-authors: MAZZITELLI, Javier (Paul Scherrer Institut (CH)); ZARO, Marco (Università degli Studi e INFN Milano (IT)); WIESEMANN, Marius (Max Planck Institute for Physics); MANZONI, Stefano (CERN)

Presenter: MAZZEO, Elena (Università degli Studi e INFN Milano (IT))

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