

# Search for Higgs boson pair production in $bbll$ final states

Friday, November 5, 2021 3:00 PM (20 minutes)

The discovery of the Higgs boson in 2012 by the ATLAS and CMS collaborations was one of the major achievements of particle physics in recent times.

However, the discovery of this particle was only the first step of its characterization, as the confirmation of the Higgs mechanism requires the determination of its quantum numbers, widths and couplings. Playing such a key role in the the architecture of the SM it is a topic of the utmost importance in understanding the SM as well as a promising portal to BSM physics.

More specifically, measuring the couplings of the Higgs boson can allow us to test the Higgs mechanism and hence the whole electro-weak symmetry breaking (EWSB) mechanism, which is one of the main goals of the LHC.

The SM predicts non-resonant production of Higgs boson pairs (HH) in proton–proton collisions, referred to as non-resonant HH production.

In many BSM theories, HH production can be enhanced by modifying the Higgs boson self-coupling or other Higgs-fermion couplings. One of the possible production modes, where a Higgs decays into two Higgses, would be an ideal probe for determining the trilinear Higgs self-coupling, which is directly linked to the Higgs potential. Measuring it would be a challenge of key importance for the LHC in its high luminosity phase.

A search for HH production in  $bbll$  final states has been carried out using the full Run 2. Among other decay channels,  $bbll$  has the advantage of allowing for a better discrimination against background.

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**Session Classification:** Parallel 2C