

## Studies of $t\bar{t}HH$ with the CMS Detector

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Precision measurements of Higgs boson couplings to SM particles is a central task at the LHC today and for the future HL-LHC. Due to the  $\sim O(\text{nb})$   $t\bar{t}$  cross section and large Yukawa coupling, measurements of the interaction of the Higgs with top quarks is particularly compelling. The  $t\bar{t}HH$  signal can be used to probe this coupling and also provides a direct measurement of trilinear Higgs self-coupling. We search for  $t\bar{t}HH$  production with the CMS detector at the LHC both in the SM and in an EFT model. In SM we look for semi-leptonic decay of the top-quark pair and the decay of both Higgs bosons to b-quarks using full Run 2 data. We also develop a simplified EFT model to study this signal independently of  $t\bar{t}H$ , in which 6D and 8D gauge-invariant operators are included to modify  $t\bar{t}HH$  while keeping  $t\bar{t}H$  unchanged at tree level. In this model, which includes a BSM  $t\bar{t}HH$  vertex, Higgs bosons are produced at higher  $p_T$  compared with those from SM production. Due to the resulting Lorentz boost, we observe an enhancement around the Higgs mass in the single b-jet mass spectrum.

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