Studies of $t\bar{t}HH$ couplings with the CMS Detector WEI WEI, University of California, Davis, CMS COLLABORATION COLLABORATION — Precision measurements of the Higgs boson couplings to SM particles is a central task at the LHC today and for the HL-LHC in the future. Due to the $\sim$ O(nb) $t\bar{t}$ cross section and large Yukawa coupling, measurements of the interaction of the Higgs with top quarks is particularly compelling. Both $t\bar{t}H$ and $t\bar{t}HH$ signals can be used to probe this coupling. In this analysis, we search for $t\bar{t}HH$ production with the CMS detector at the LHC, including possible deviations signalling BSM physics. As a toy model, to study this signal independently of $t\bar{t}H$, we introduce both 6D and 8D gauge-invariant operators 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 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. Thus, boosted Higgs decaying to b-pairs appears to be a relevant signature to reduce the SM background for this search. To optimize signal efficiency, we apply techniques such as ML based double b-tagging for clustered b-jet identification and energy correlation functions.

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