

Searching for Heavy Higgses decaying into SM and Supersymmetric final states

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We search specifically for the heavy resonant scalars (H/A) decaying via $H \rightarrow hh$, $H \rightarrow t\bar{t}$ and $(b\bar{b})H \rightarrow \tau\tau$ final states, at the HL-LHC. After performing multivariate analysis using the BDT algorithm in various final states, we set upper limits on the production cross-section of a heavy scalar times its branching ratio into final state products for different heavy scalar masses values. Finally, we translate these limits and put strong constraints on the $m_A - \tan\beta$ parameter space in the context of Minimal Supersymmetric Standard Model (MSSM). We further explore the supersymmetric (susy) final states coming from MSSM Higgs decaying via neutralinos and charginos, collectively called electroweakinos. They give rise to mono-(h/Z) + missing energy final states. We consider backgrounds coming from Standard Model (SM) and susy processes. The susy backgrounds have not been considered in this kind of analysis earlier, which comes from direct electroweakino production via SM mediators. The case of wino-like long-lived chargino decaying from MSSM Higgs is also discussed. They improve the sensitivity in disappearing charged track searches at the LHC because of the boost received from heavy Higgs bosons.

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