Search for high mass Higgs bosons production in Final States with b-quarks at 13 TeV

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Abstract
A search for new Higgs bosons produced in association with bottom quarks and decaying into a bottom anti-bottom quark pair is performed with the CMS detector. The data collected for this analysis were recorded in proton-proton collisions at a centre-of-mass energy of 13 TeV in 2016, corresponding to an integrated luminosity of 35.7 fb\(^{-1}\). No signal excess above the standard model background is observed. Stringent upper limits on the cross section times branching fraction are calculated for Higgs states with masses up to 1300 GeV at 95% confidence level. The results are also interpreted within various minimal supersymmetric model (MSSM) scenarios and in the context of the flipped two-higgs-doublet model (2HDM).

Motivation for measurement
✦ Search for degenerate heavy A and H bosons in higher mass region
✦ A/H decaying to a b-quark pair is a dominant channel in MSSM and H2DM
✦ Main background - QCD multijet production
✦ B-associated production
  • cross section enhanced up to \(\sim 2\tan\beta\) in MSSM and 2HDM

Signal Model
✦ Signal reconstructed from the invariant mass of the leading two b-jets \(M_{12}\)
✦ Monte Carlo: Pythia 8 LO + Madgraph 5 NLO for the corrections
✦ Signal masses: \(M_{\text{A/H}} = [300; 1300]\) GeV
  • Sensitive starting from \(M_{\text{A/H}} = 300\) GeV, because of the high \(p_T\) trigger threshold

Event Selection
✦ Dedicated triggers with two online b-tagged jets
✦ Event offline selection requires at least 2 jets to be b-tagged

Background Model
✦ Data-driven parametric approach developed in the CR
✦ CR chosen to have shape of \(M_{12}\) similar to SR
✦ Subrange division designed to reduce bias uncertainty
  • Optimized to improve sensitivity limits

Results
✦ No signal excess above SM background observed
✦ Model-independent upper limits on cross-section times branching fraction at 95% confidence level

Cross-section upper limits

MSSM (\(m_{A/H}\) scenario)

2HDM (flipped model)

References