Higgs boson pair production in the bb$\tau\tau$ channel with the CMS experiment

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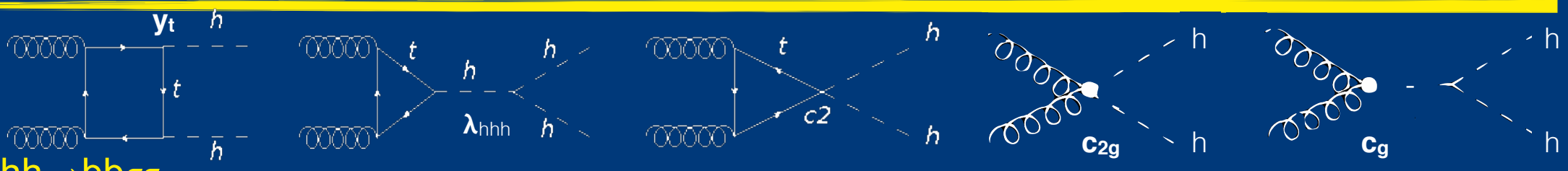
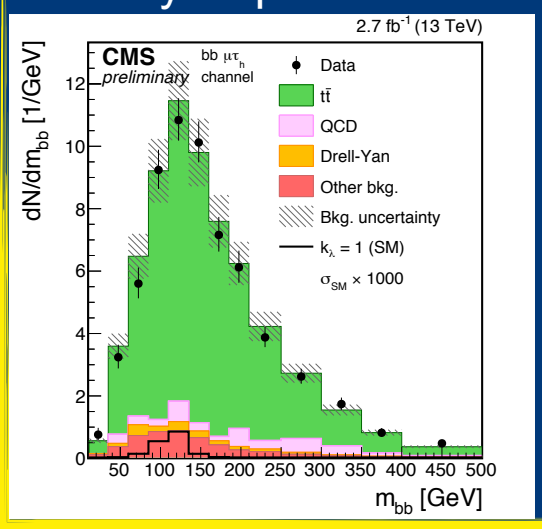
Introduction

- Non-resonant hh production is the only way to access Higgs boson self-coupling
- Sensitive to BSM physics
- BSM physics can be modelled with EFT adding dim-6 operators to the SM Lagrangian, and the physics can be described with 5 parameters: λ_{hhh}, y_t (SM), c_2, c_g, c_{2g} (BSM).
- Can probe X→hh resonant production, where X couples to the SM Higgs boson.
- Most promising hh channels: bbbb, **bb**$\tau\tau$, bbWW, bb$\gamma\gamma$



hh→bb$\tau\tau$

- Relatively large BR (7.3%), small background.
- Most sensitive final state: $\tau_h\tau_h$. Semi-leptonic final states (eτ_h, $\mu\tau_h$) are also analysed.
- Analysis performed on full LHC 2015 dataset collected by CMS experiment (L=2.7fb^{-1}). Update with 2016 data is ongoing.



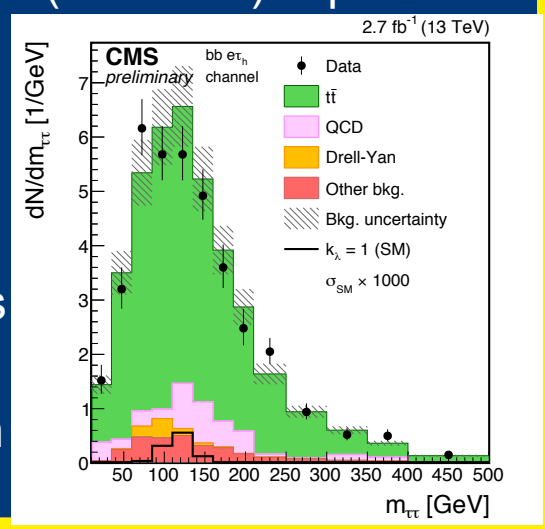
Assign lepton pairs to final states according to trigger information

Kinematic fit to reconstruct most probable $\tau\tau$ mass

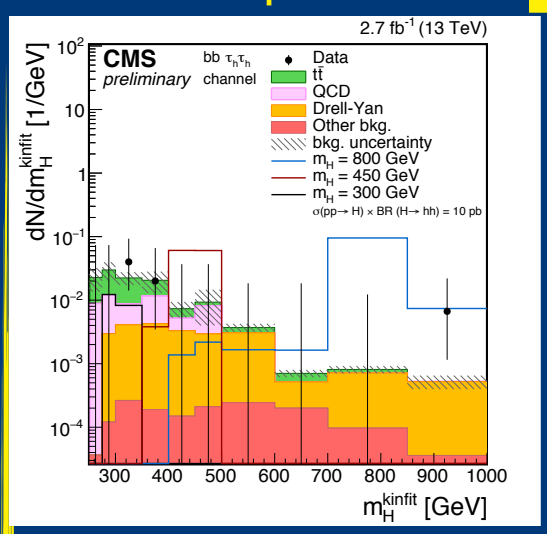
b-tagging algorithm to identify the b-jets candidates

Signal region defined by cuts on $\tau\tau$ and bb mass

QCD background extracted from data in same-sign control region.



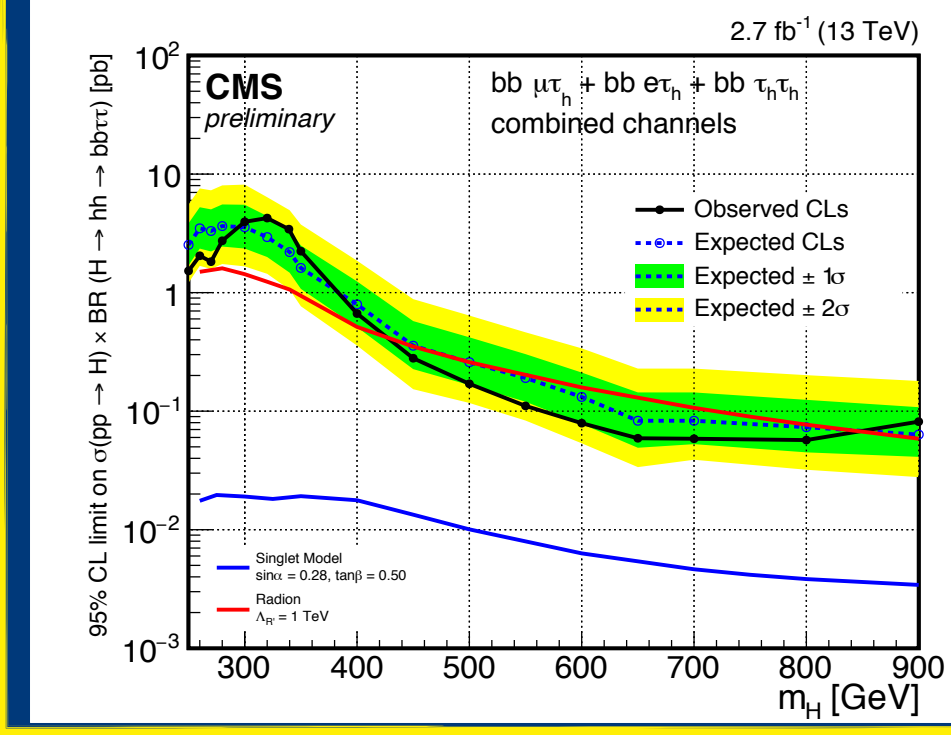
Resonant production



Kinematic fit of the 4 final state objects to reconstruct the most probable hh mass

Already sensitive to BSM production

No excess observed



CMS-PAS-HIG-16-013 Search for resonant Higgs boson pair production in the bb$\tau^+\tau^-$ final state

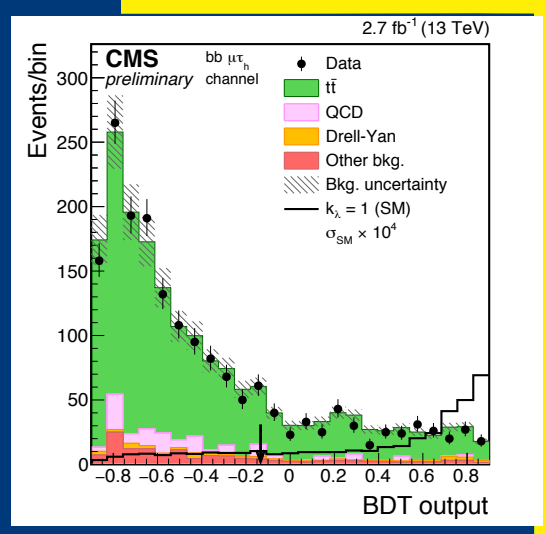
Non-resonant production

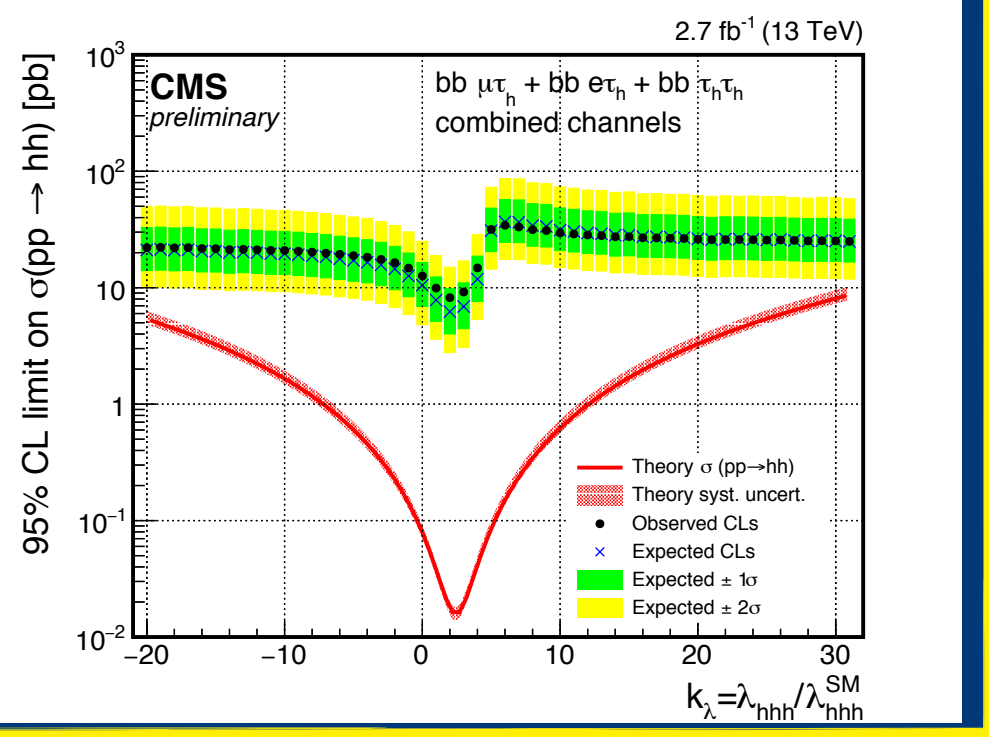
Rare process in SM.

Large cross-section increase if anomalous couplings are present.

Event kinematic (BDT) to reject background

Limits computed as functions of kλ, k$_t$.





CMS-PAS-HIG-16-012 Search for non-resonant Higgs boson pair production in the bb$\tau^+\tau^-$ final state