

HIGGS DECAYS IN ASSOCIATION WITH MISSING TRANSVERSE ENERGY AT CMS



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BACKGROUND

- Existence of DM is well established, not much is known about its underlying
- Collider searches for dark matter, mainly mono-X searches feature a large amount of missing transverse energy (MET) and the recoiling SM particle the X object γ, j, Z boson, etc.)
- In the analysis presented here, the Higgs boson is the SM particle that recoils. This process is examined in the decay channel where the Higgs goes to two taus.
- This is the first search for Mono-Higgs in the di- τ decay channel that CMS has produced.

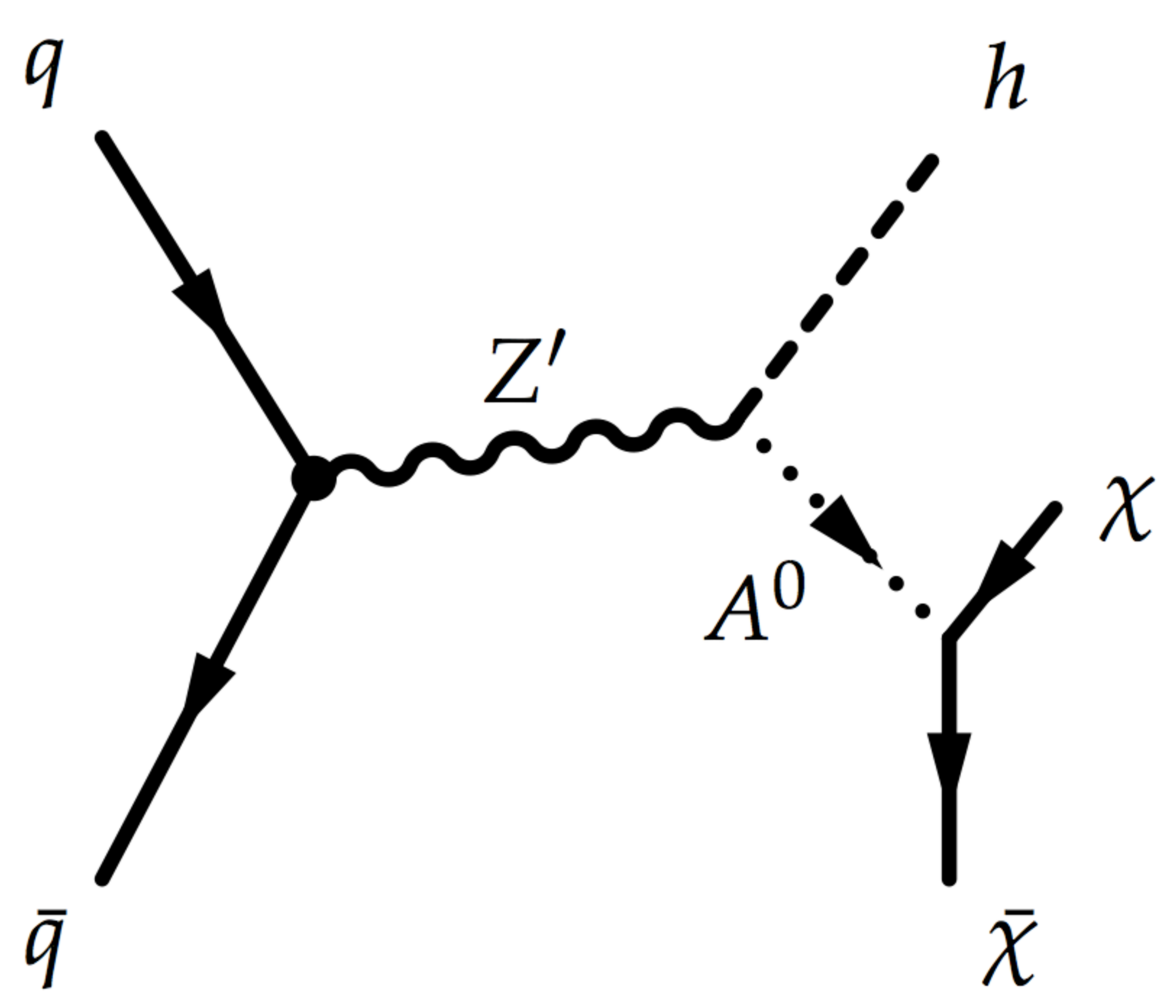


Figure 1: 2HDM Z' decays to Higgs+ $\chi\chi$

CROSS SECTIONS

Zprime $A_0=300$ GeV	Cross Section (pb)
600	0.45217
800	0.27765
1000	0.14383
1200	0.075451
1400	0.041208
1700	0.017786
2000	0.0082317
2500	0.0025458

MONO-H \rightarrow BB

Mono- $H \rightarrow bb$ split up their search into two main categories:

- **resolved** 2 AK4 jets with $|\eta| < 2.4$ and $p_T > 30$ GeV. $MET > 170$ GeV.
- **boosted** 1 AK8 jet with $|\eta| < 2.4$ and $p_T > 200$. $MET > 200$ GeV.

Extra lepton vetos are added.

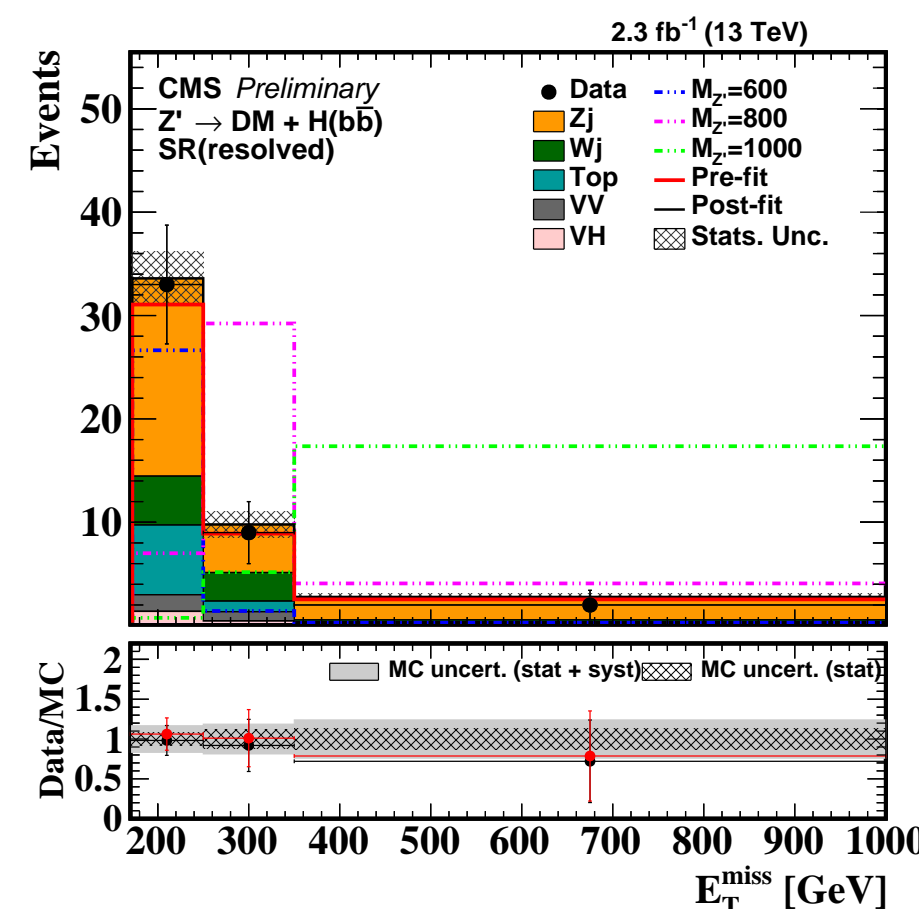


Figure 2: Resolved Category $H \rightarrow bb$

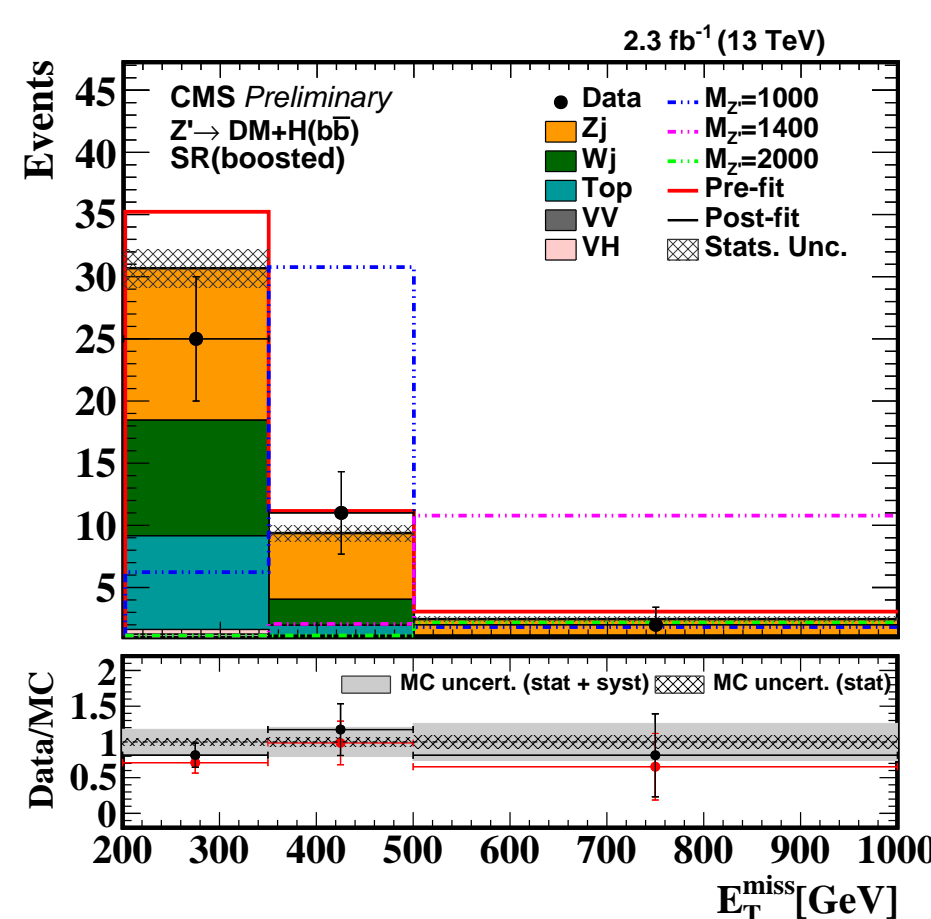


Figure 3: Boosted Regime HBB

The limit is then extracted from the MET distributions in figure 2 and 3.

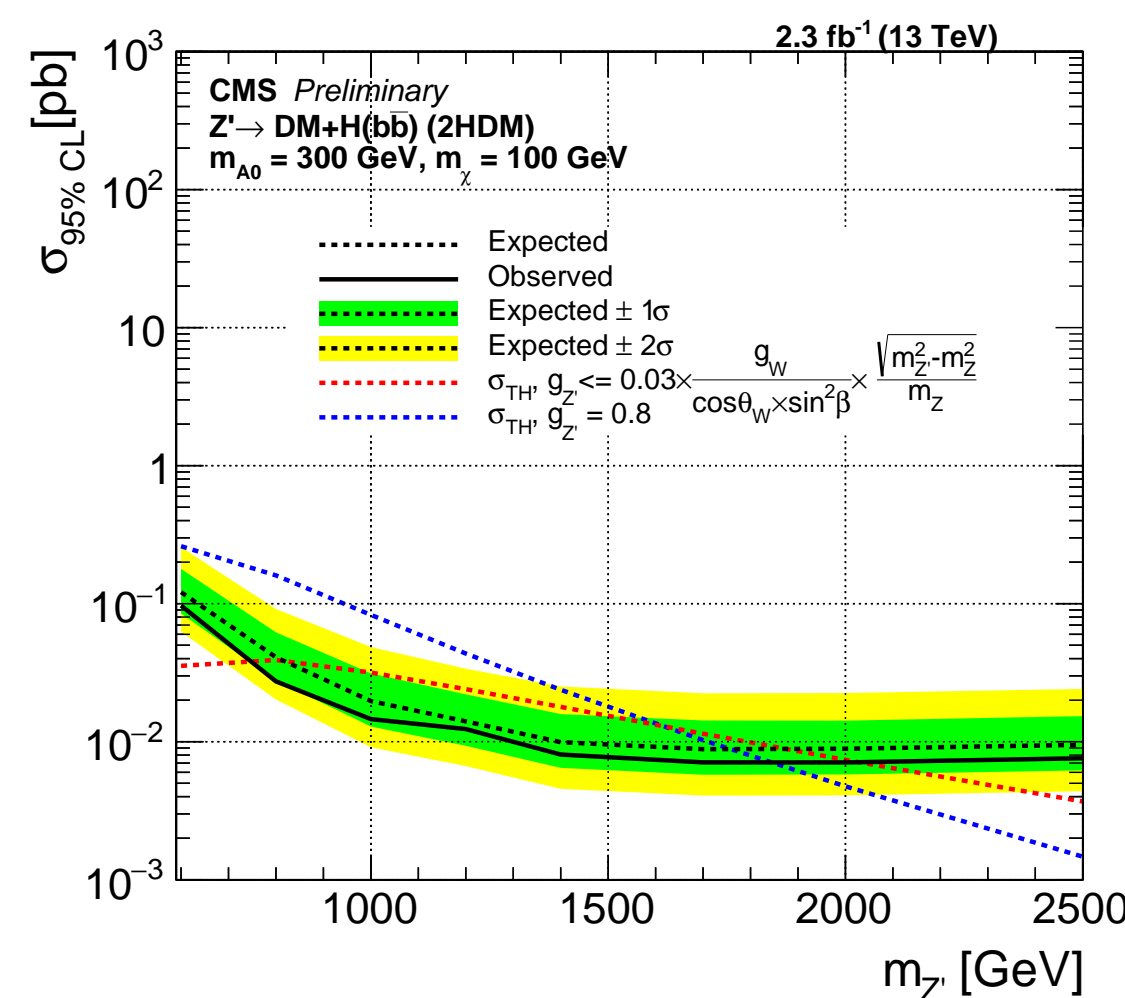


Figure 4: 2HDM Limit $A_0 = 300, M_\chi = 100$

MONO-H \rightarrow ττ

How can we look for Mono- $H \rightarrow \tau\tau$?

- 3 different channels in a Mono-Higgs $\rightarrow \tau\tau$ search: $\mu\tau_h, e\tau_h,$ and $\tau_h\tau_h$.
- Mono- $H \rightarrow \tau\tau$ is not dependent on a MET Trigger, so the phase space can be extended to lower MET ranges.

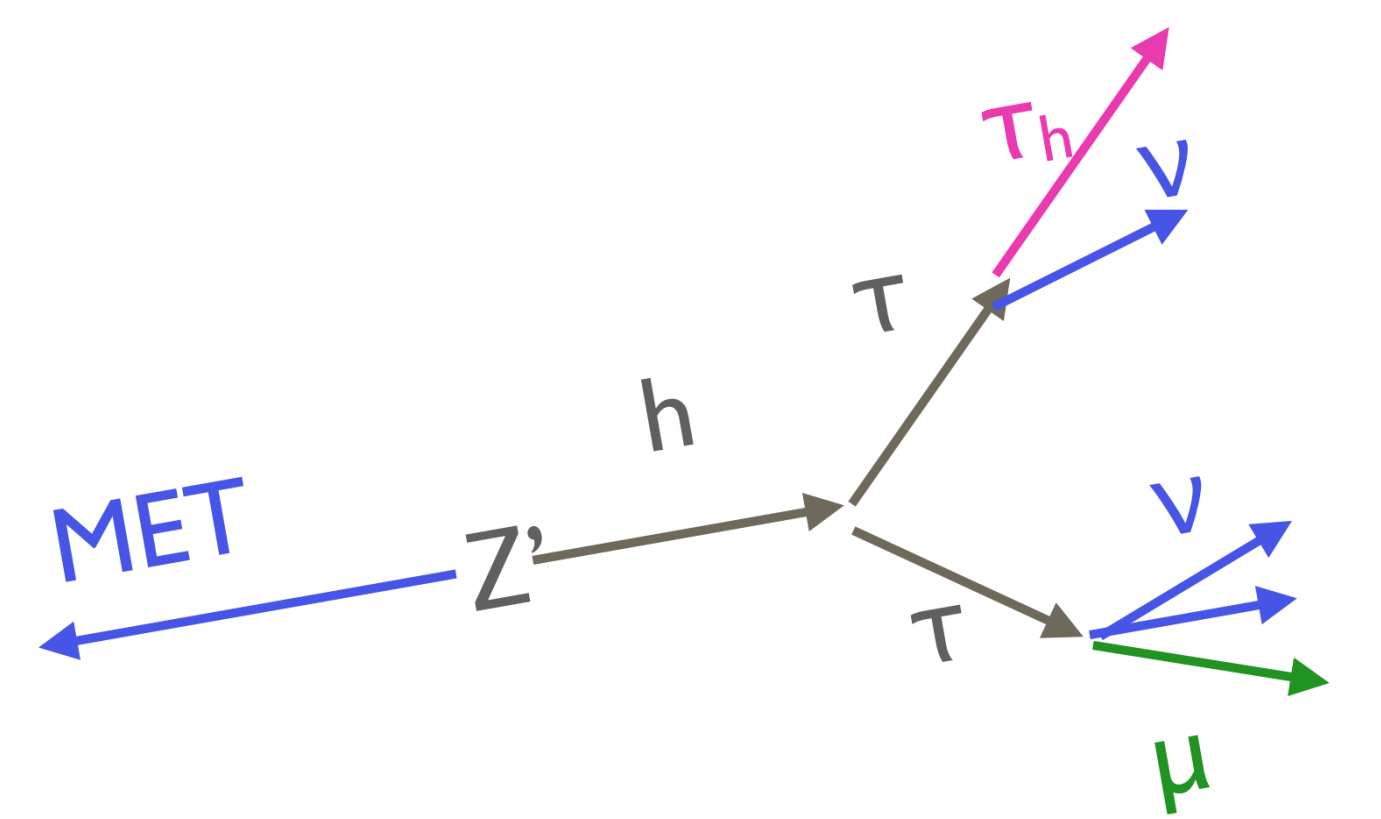


Figure 7: in the $H \rightarrow \tau\tau$ system we expect the MET to be reduced due to the presence of neutrinos in the tau decay

The **resolved** category is defined by having the two tau candidates separated by $\Delta R > 0.3$. An event will enter the **boosted** category if it does not fall into the resolved category and the τ candidates are within $\Delta R < 0.3$.

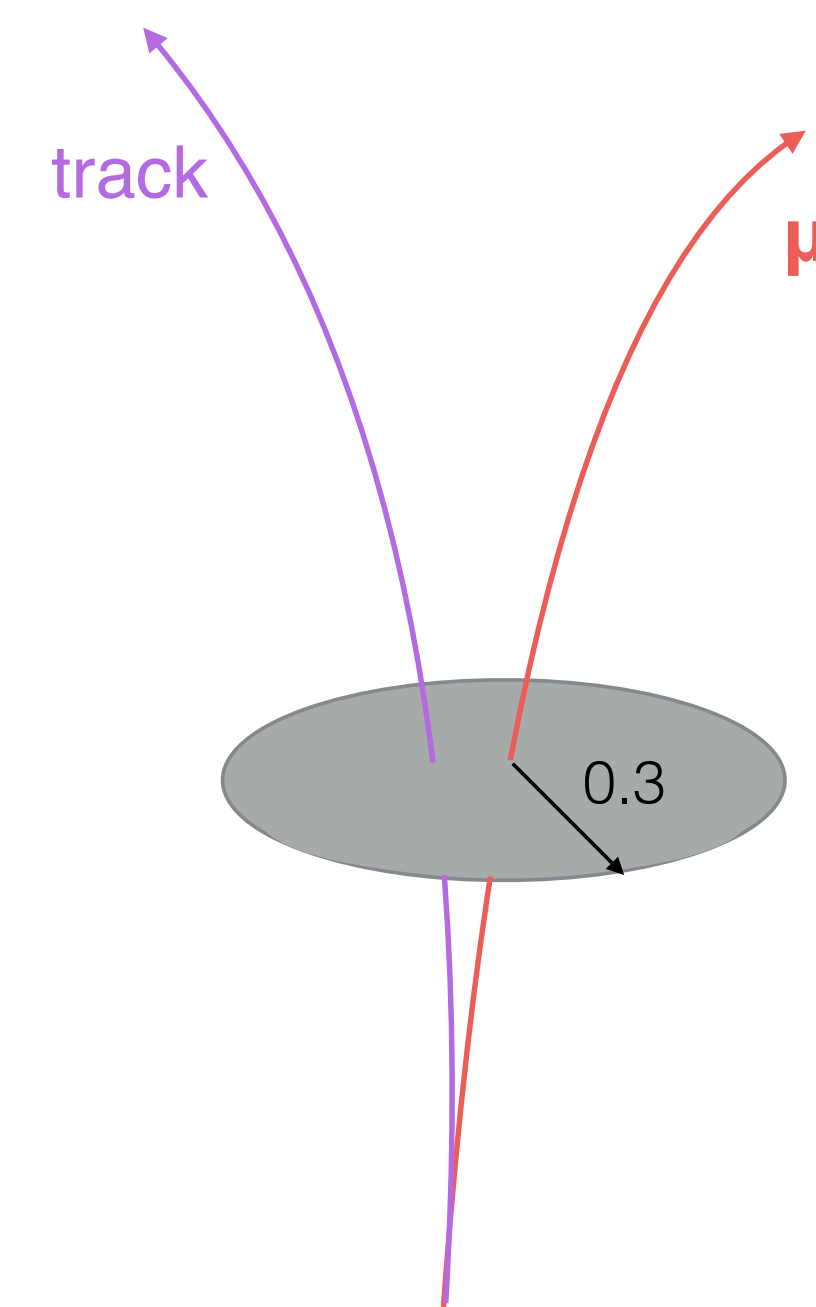


Figure 8: The two tau objects are within $\Delta R=0.3$, a boosted category is needed.

MONO-H \rightarrow ττ MASS RECONSTRUCTION

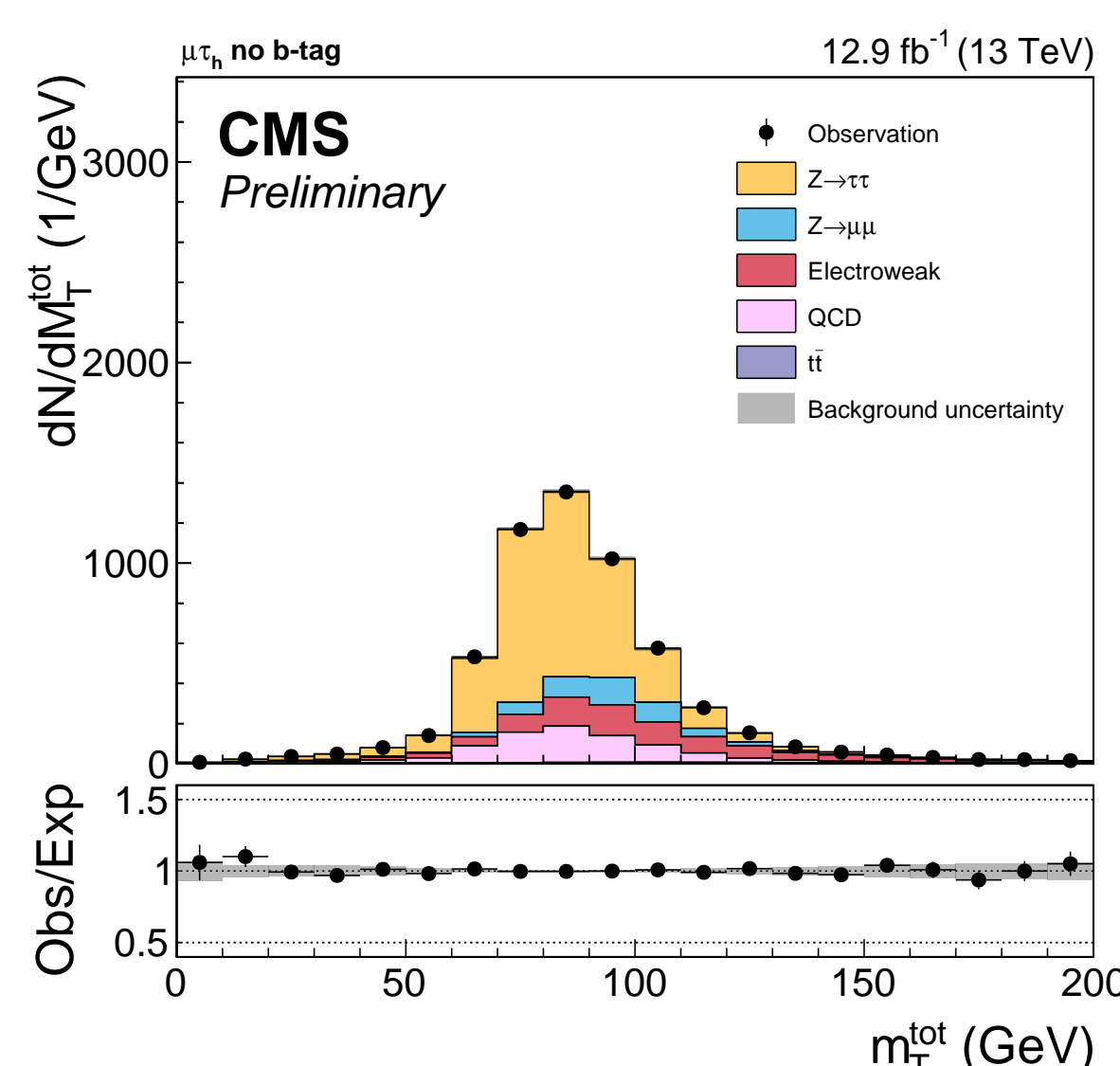


Figure 5: The total transverse mass is used for limit extraction. Z +Jets peaks near 90 GeV. MET is included in the mass estimation.

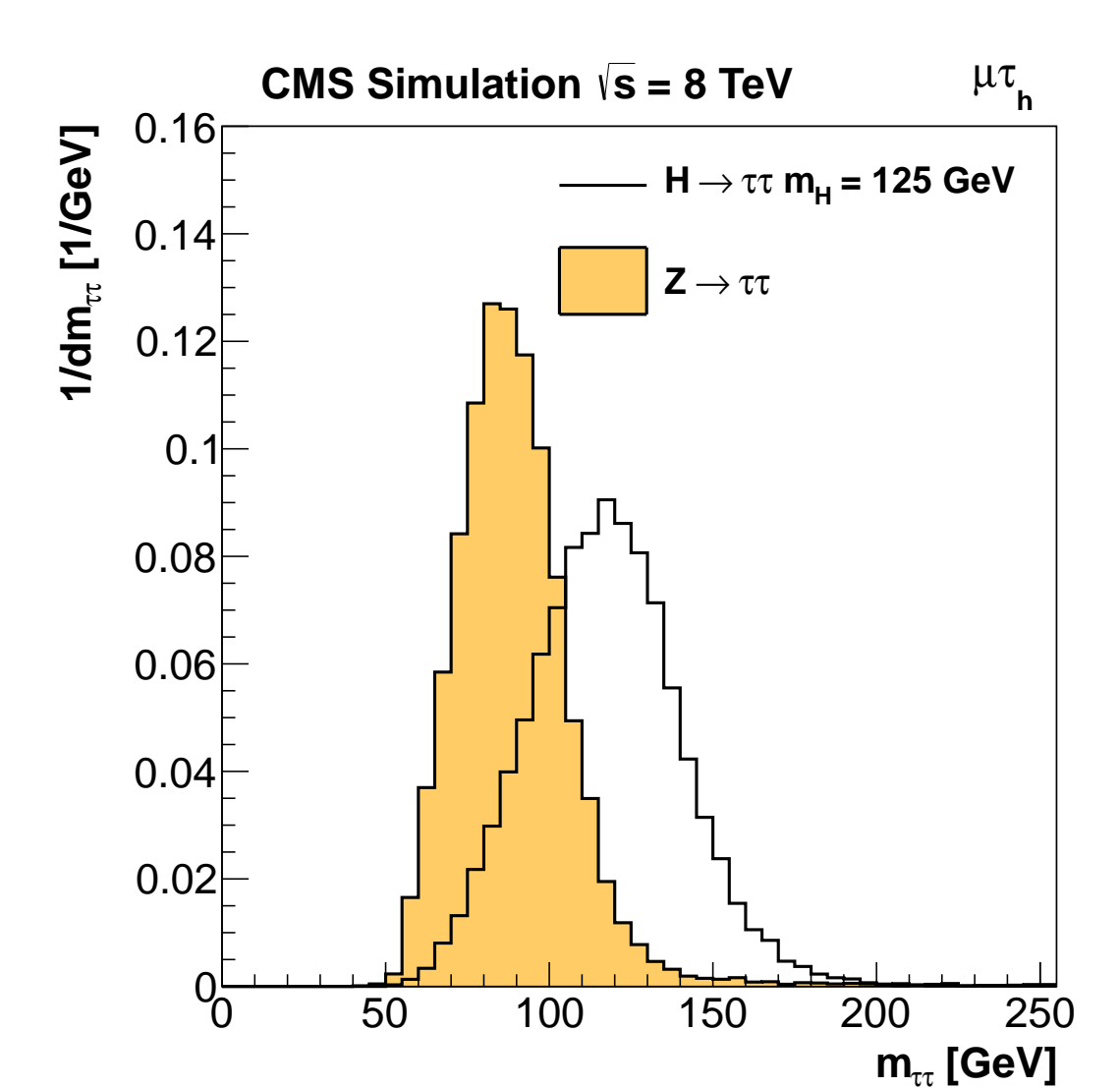
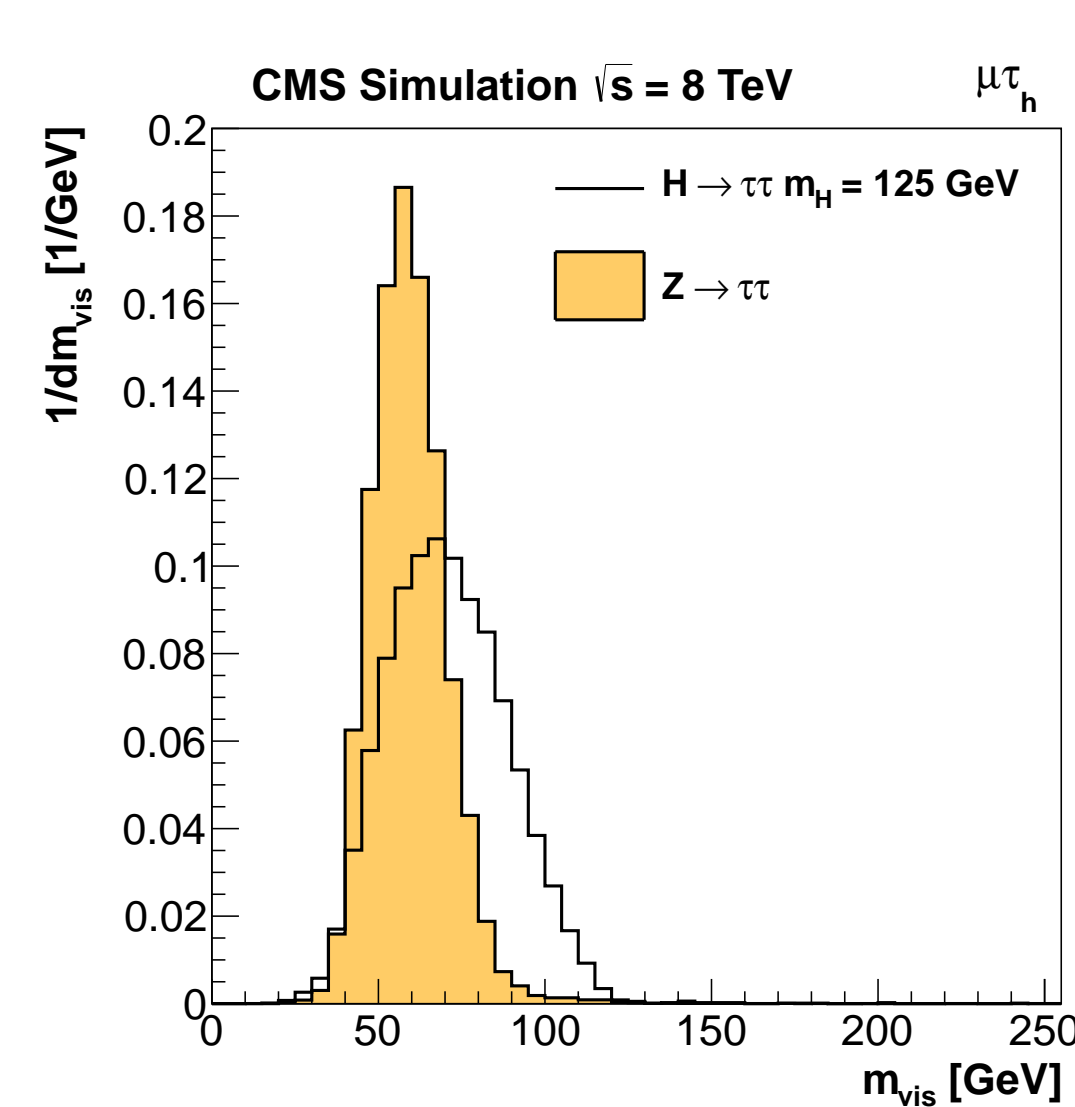


Figure 6: The mass of the 125 GeV Higgs cannot be fully reconstructed using the SVfit method used in the Standard Model Analysis. A comparison between the 125 GeV higgs mass and the $Z \rightarrow \tau\tau$ in fig. shows that when using the visible mass as an extraction the $m_{\tau\tau,vis} < 125$ GeV for the 125 GeV boson.

REFERENCES

CMS-PAS-EXO-16-012
HIG-13-004
CMS-PAS-HIG-16-037

FUTURE RESEARCH

Mono- $H \rightarrow \tau\tau$ analysis in progress on 2016 Data.

CONTACT INFORMATION

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