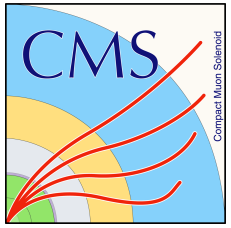
HEP NTUA
Weekly Report

21/10/2020

George Bakas



Summary

- Start investigating ttbar Systematic Uncertainties

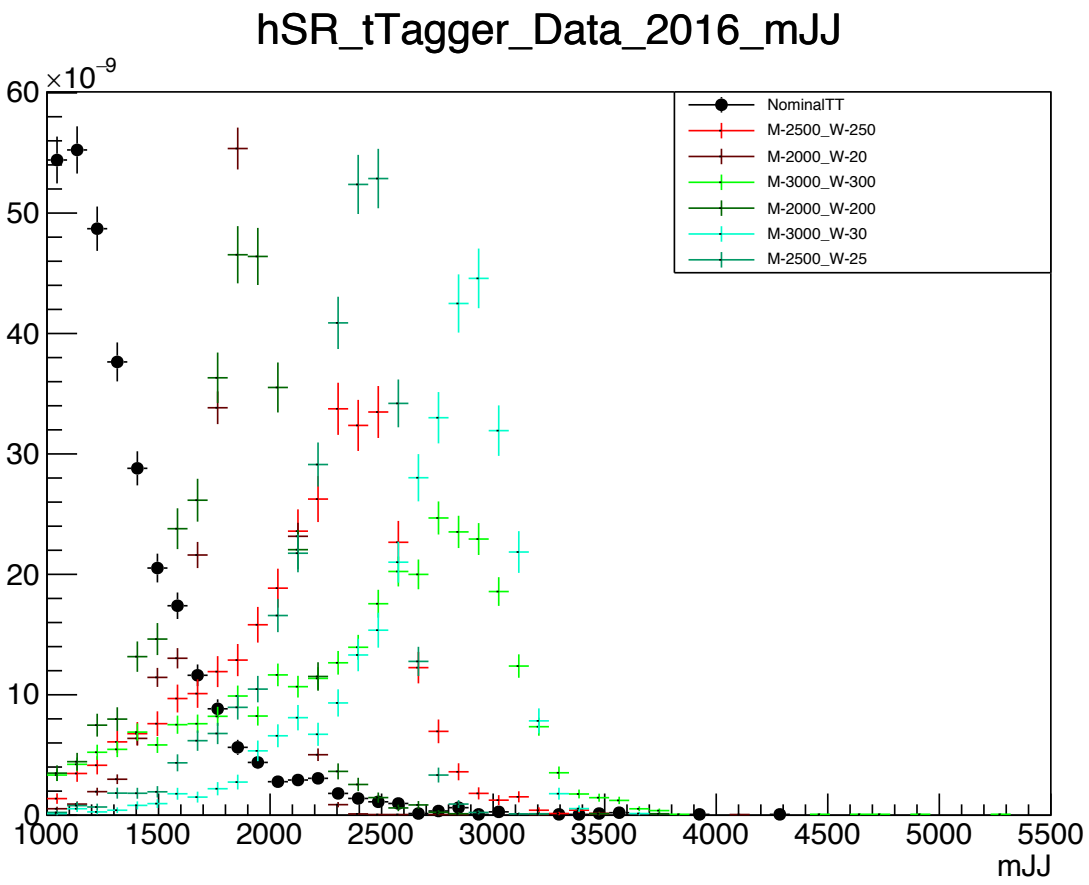
- Top Angular Distributions: chi, |cosθ*| leading and subleading
  - Changed binning for the cos(θ*) distributions

- Z’ analysis:
  - Goal is to plot the ttbar mc samples and Z’ mc’s to check sensitivity wrt angular dists
    - Switch between several mJJ cuts(1,2,3)TeV
    - For each mJJ cut, plot Z’ for a set of masses (1% and 10% width) [2,2.5,3]TeV and Nominal TT angular distributions
    - Angular distributions for 2016

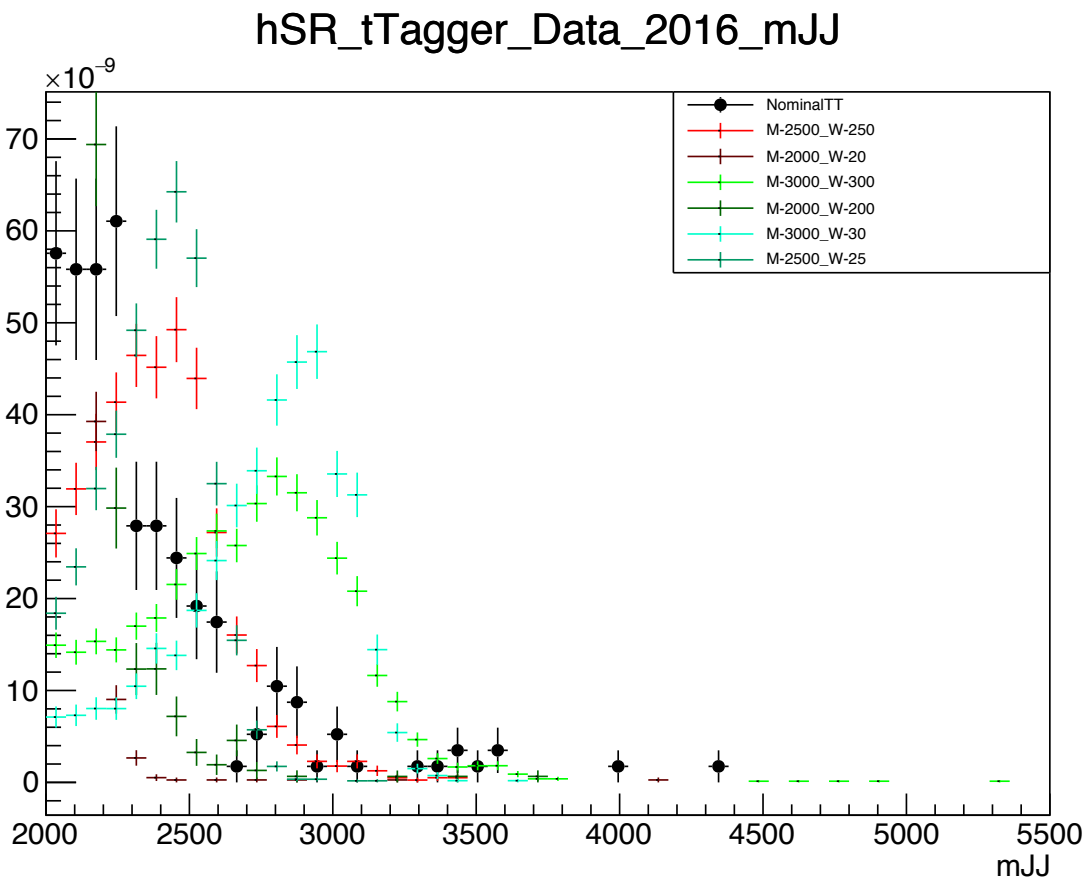
- PoS for ICHEP 2020

Angular Distributions

mJJ > 1TeV

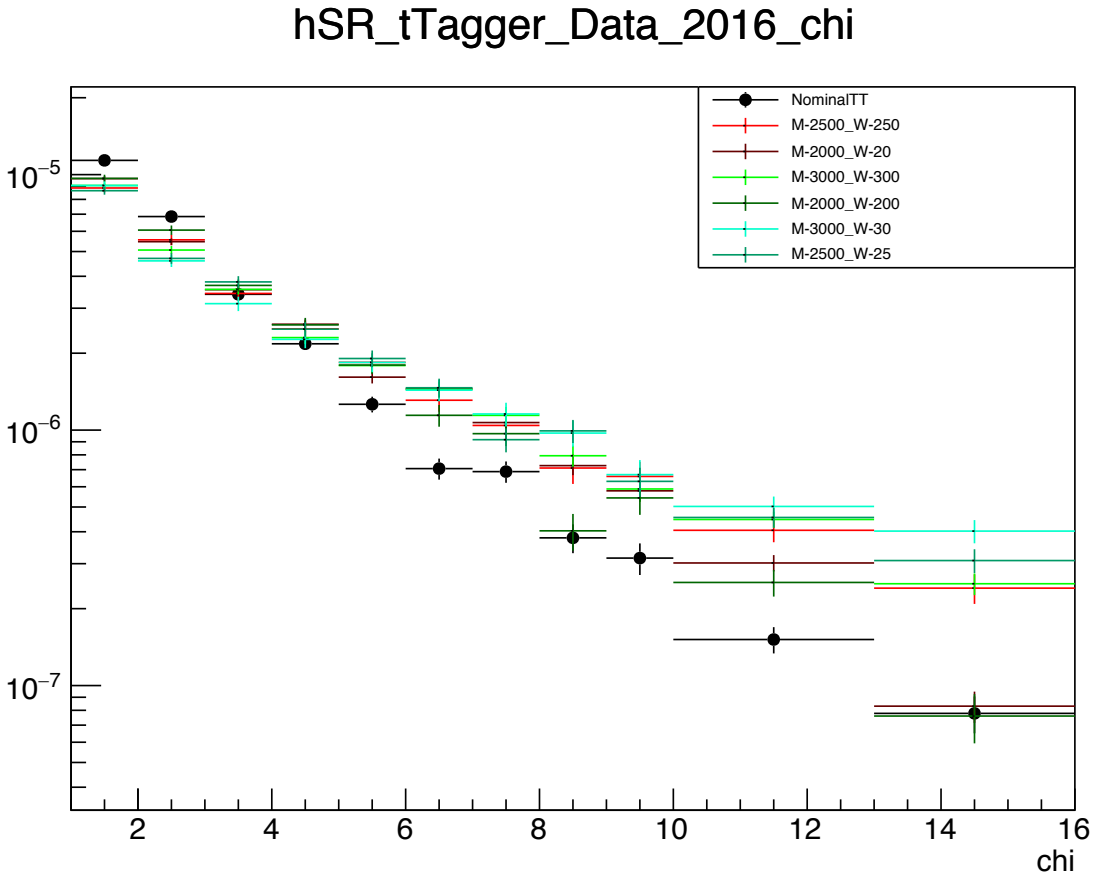


mJJ > 2TeV

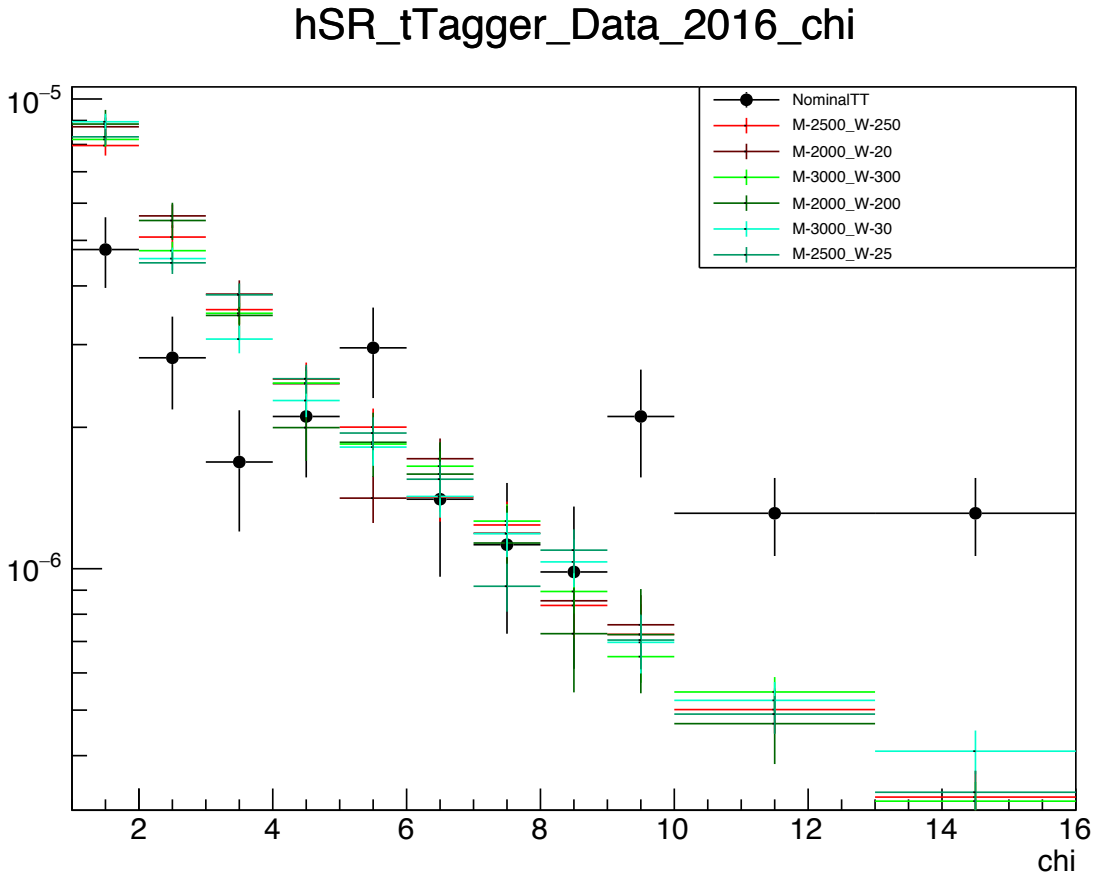


Angular Distributions

mJJ > 1TeV

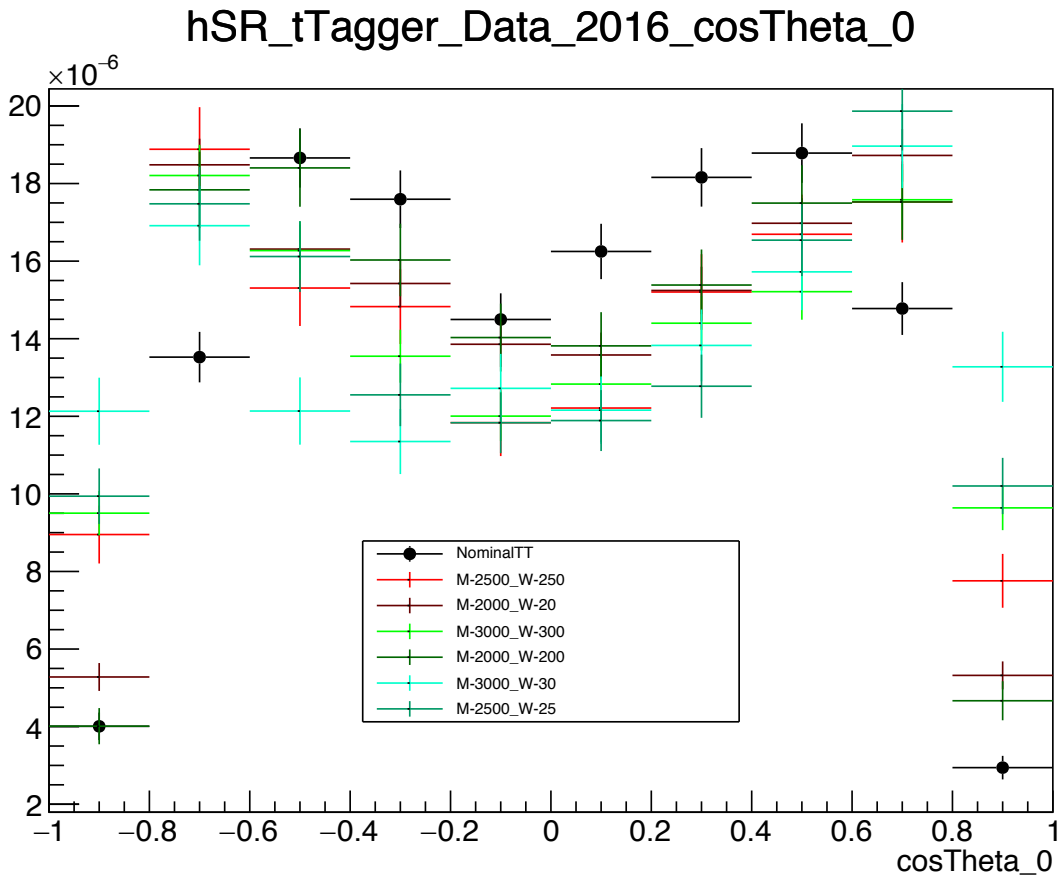


mJJ > 2TeV

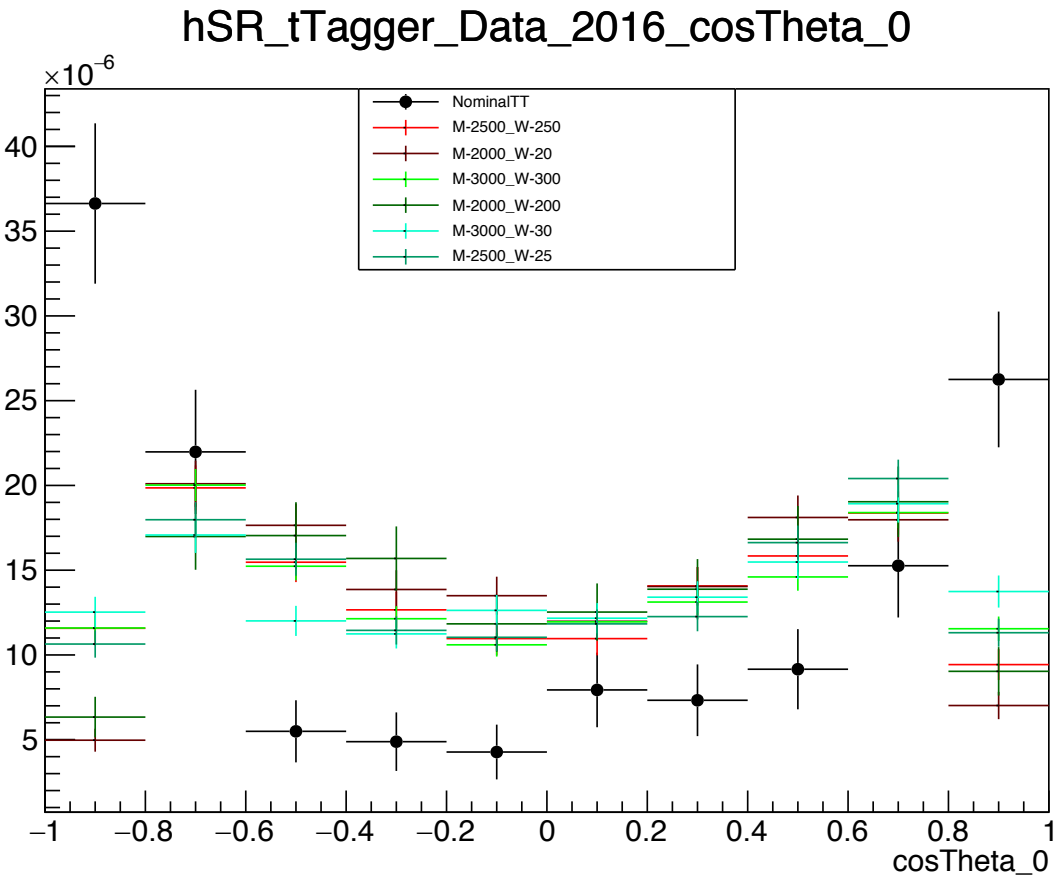


Angular Distributions

mJJ > 1TeV

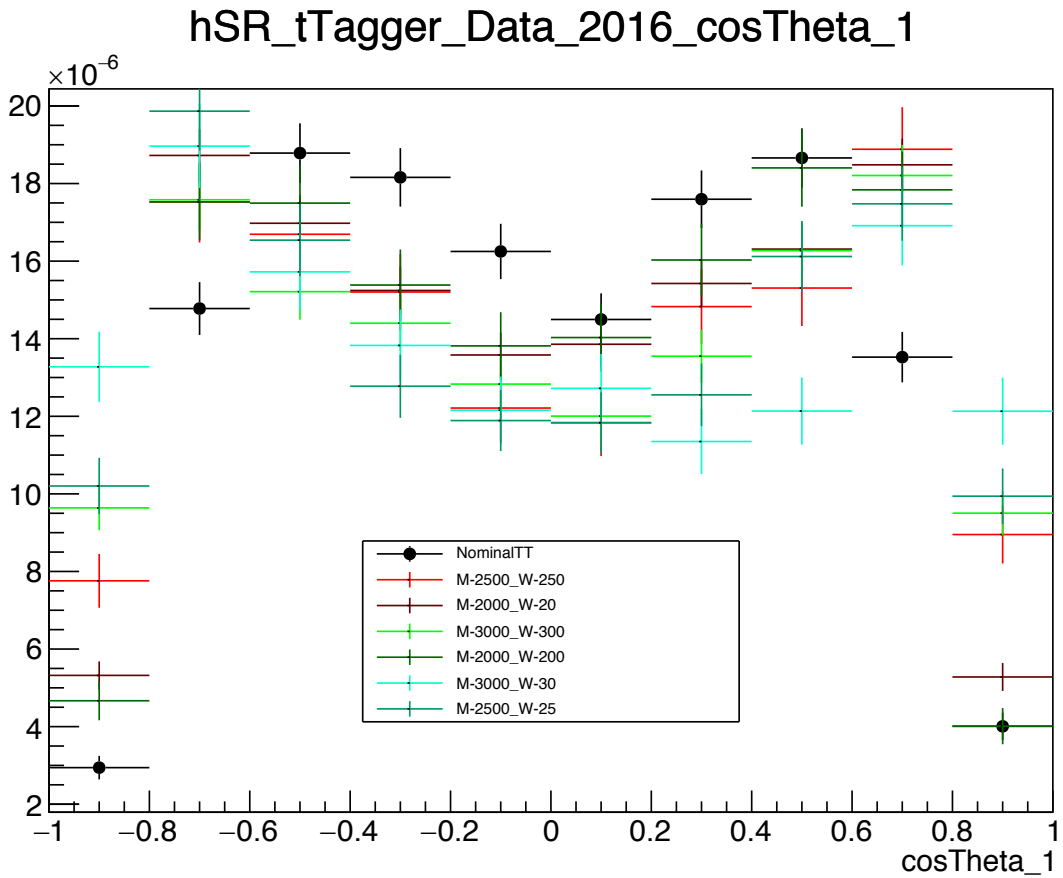


mJJ > 2TeV

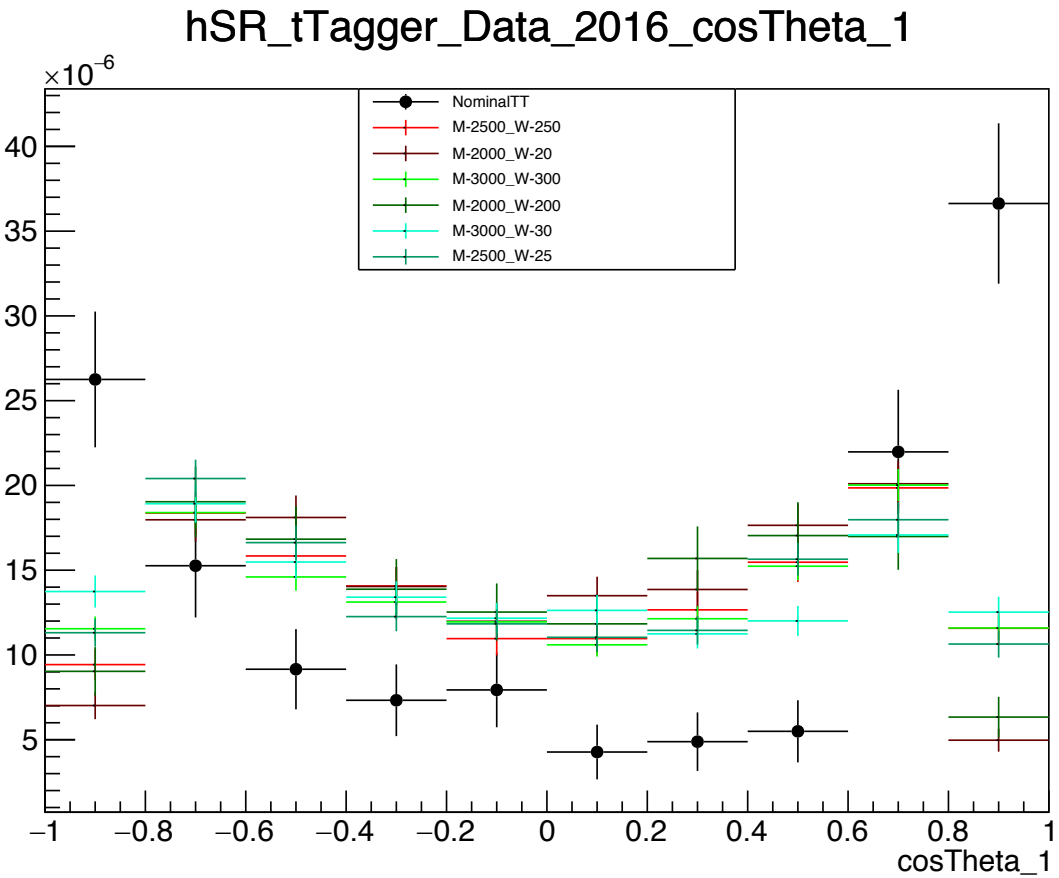


Angular Distributions

mJJ > 1TeV



mJJ > 2TeV



BACKUP

Signal Selection

Variables	Selected Cut
pT (both leading jets)	> 400 GeV
Njets	> 1
N leptons	= 0
|eta| (both leading jets)	< 2.4
mJJ	> 1000 GeV
jetMassSoftDrop (only for fit)	(50,300) GeV
Top Tagger	> 0.2, 0, 0.1
B tagging (2 btagged jets)	> Medium WP
Signal Trigger	

Control Region Selection

Variables	Selected Cut
pT (both leading jets)	> 400 GeV
Njets	> 1
N leptons	= 0
|eta| (both leading jets)	< 2.4
mJJ	> 1000 GeV
jetMassSoftDrop (only for fit)	(50,300) GeV
Top Tagger	> 0.2, 0, 0.1
B tagging (0 btagged jets)	< Medium WP
Control Trigger	

Top Angular Distributions

- We employ the dijet angular variable χ from the rapidities of the two leading jets
- Why χ?
  - The distributions associated with the final states produced via QCD interactions are relatively flat in comparison with the distributions of the BSM models or new particles, which typically peak at low values of x

- We can measure the variable χ in two ways

1. By measuring the difference of the rapidities of the two leading jets such as the corresponding rapidity in the ZMF is:

$$y^* = \frac{1}{2}(y_1 - y_2)$$

X is defined as $\chi = e^{|y^*|} = e^{|y_1 - y_2|}$ (1) and can be measured by creating the TLorentzVector, boost it to the ZMF and find the rapidity difference of the two leading jets

2. By measuring the scattering angle θ* (angle between top quark and z-axis in the Zero Momentum Frame)
We define as $y^* = \frac{1}{2}\ln(\frac{1+|cos\theta^*|}{1-|cos\theta^*|})$ and from (1) we can find that:

$$\chi = \frac{1 + |cos\theta^*|}{1 - |cos\theta^*|}$$