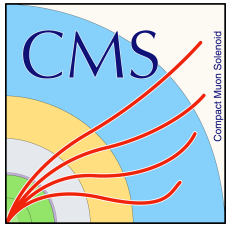
HEP NTUA
Top Angular Report

24/3/2021

George Bakas



Summary

- Signal Region is now the same with ttX analysis:
  - mJJ > 1000 GeV
  - Angular distribution integration

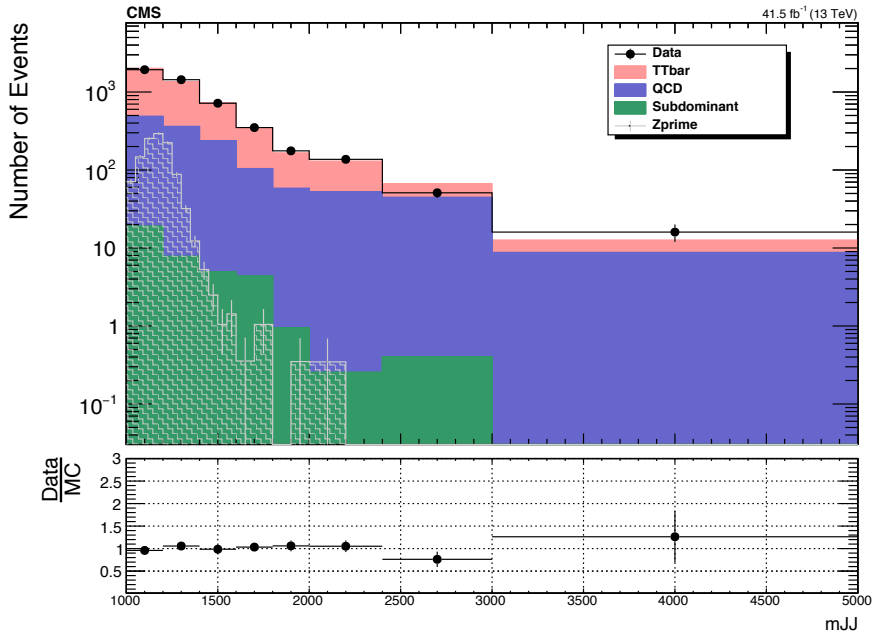
- Stack histograms: ($m_{Z'}$: 1.2, 1.4, 1.6, 1.8, 2, 2.5, 3, 3.5, 4, 4.5 TeV width 1%)
  - Year 2017
  - Data vs MC (qcd scaled with k-factor to data)
  - TTbar scaled with signal strength
  - mJJ and chi

- Asymptotic Limits (Brazilian plots)
  - 2017 and 2018

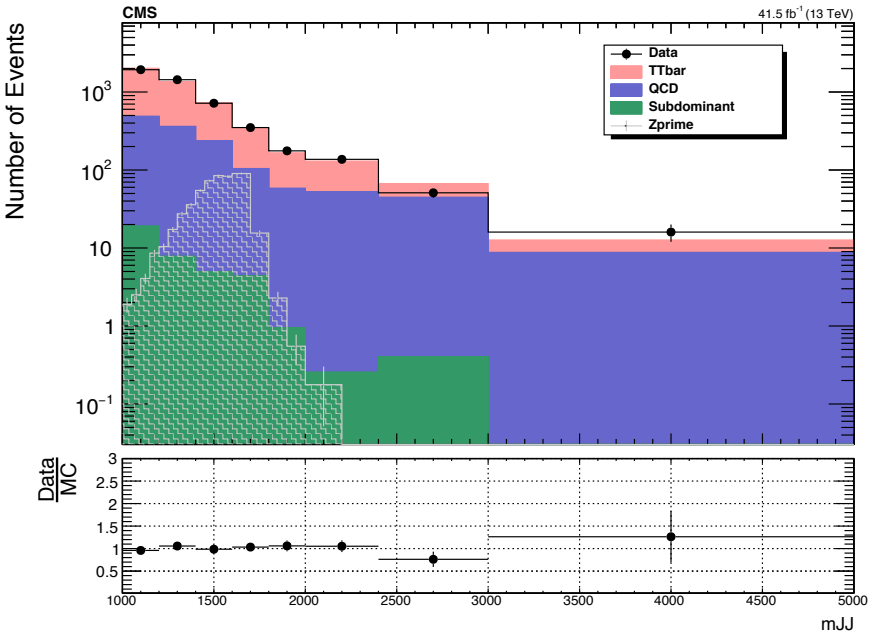
- Comparison with the B2G-16-015 results

Stack Histograms mJJ

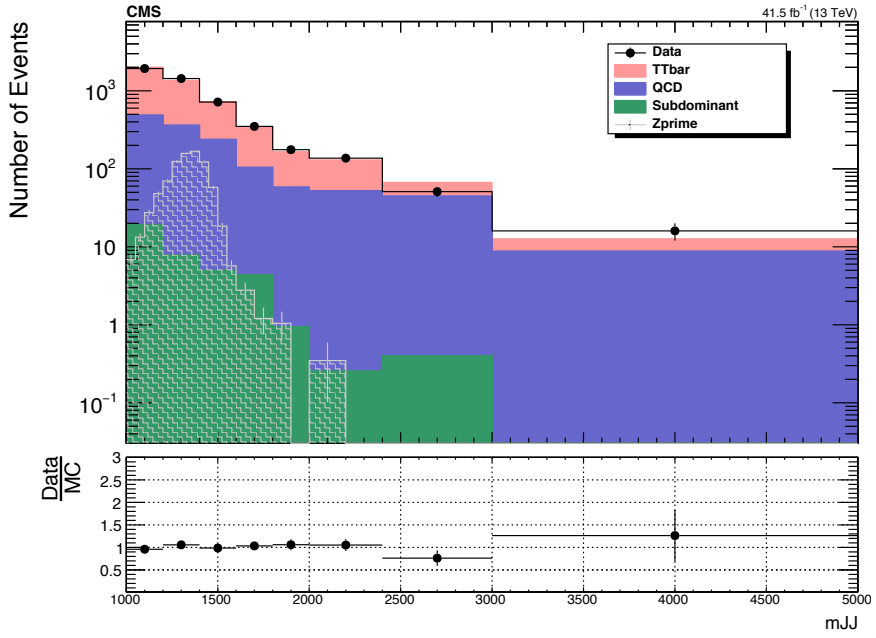
$M_{z'}$ =1200, w = 1%



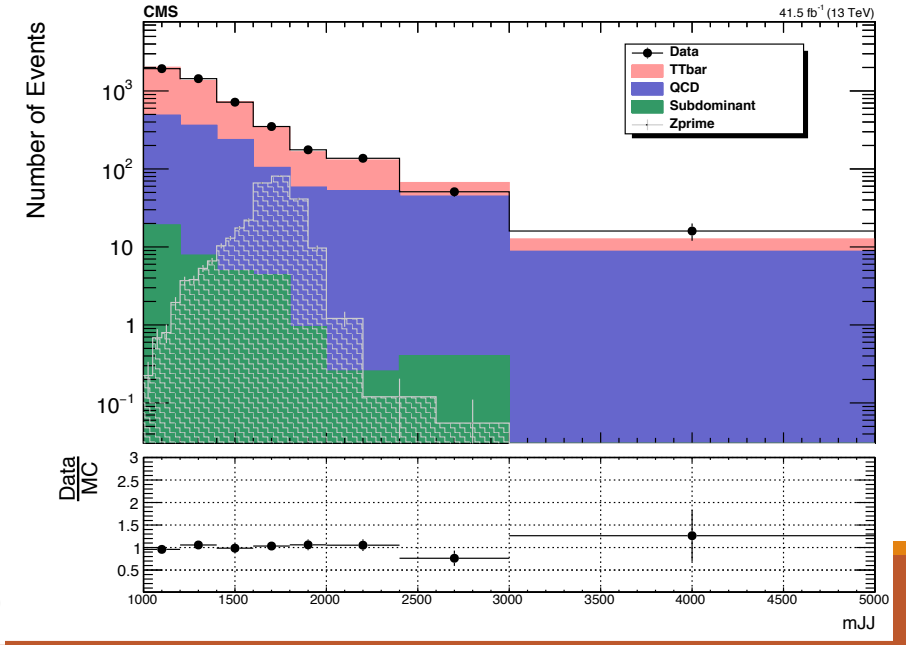
$M_{z'}$ =1600, w = 1%



$M_{z'}$ =1400, w = 1%

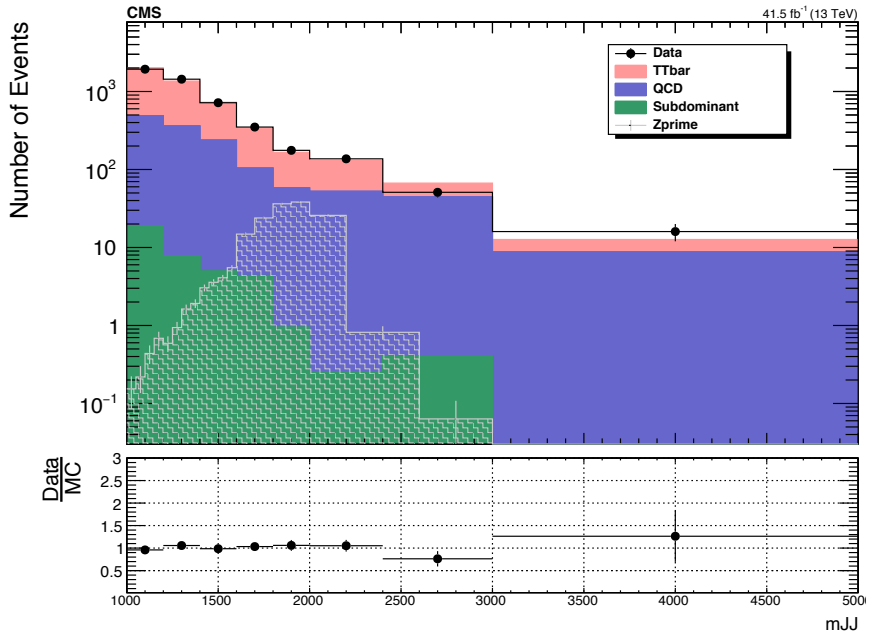


$M_{z'}$ =1800, w = 1%

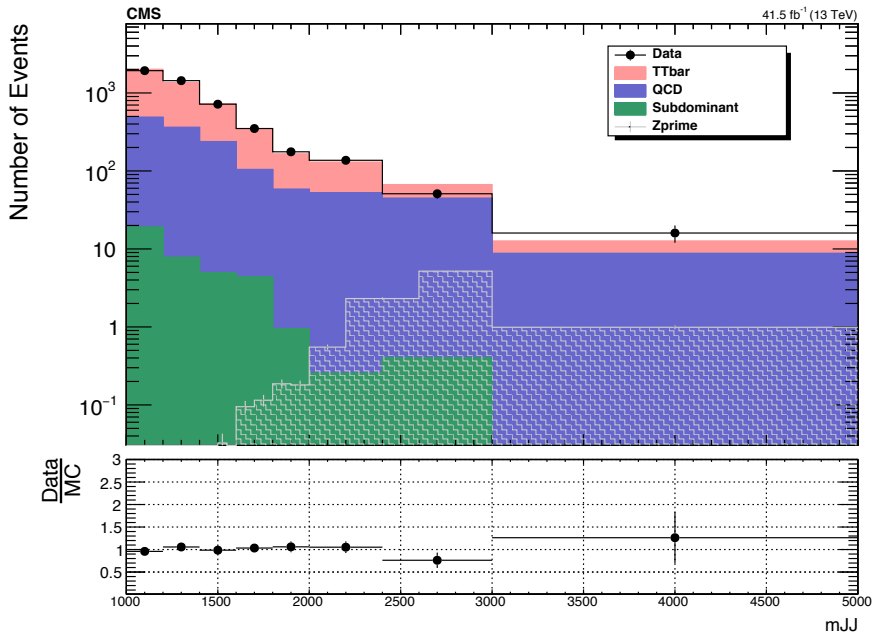


Stack Histograms mJJ

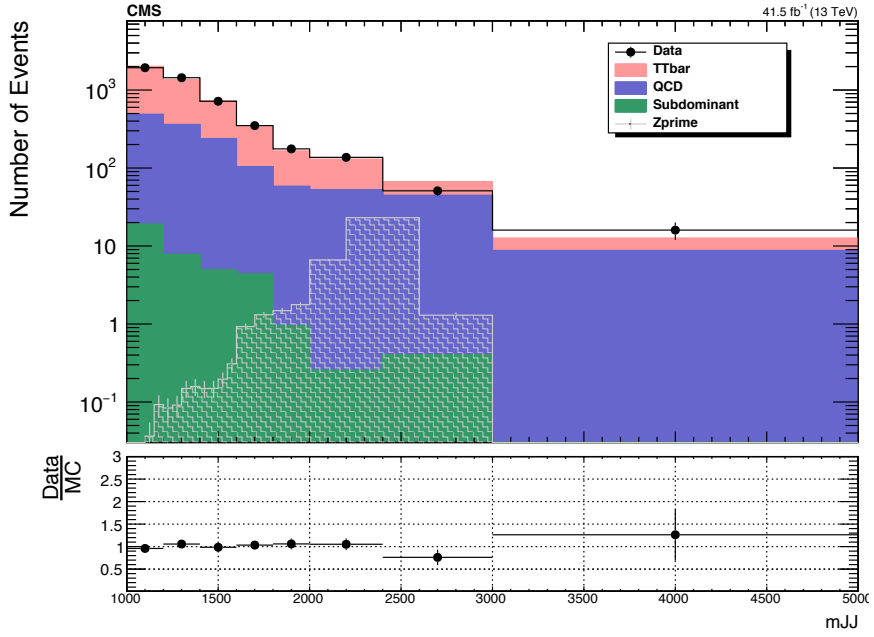
$M_{z'}$ =2000, w = 1%



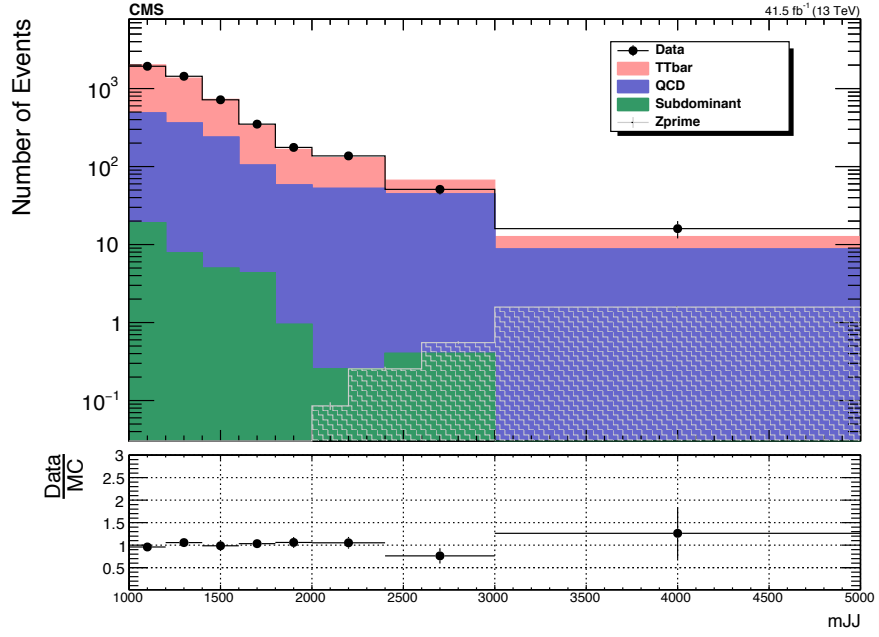
$M_{z'}$ =3000, w = 1%



$M_{z'}$ =2500, w = 1%

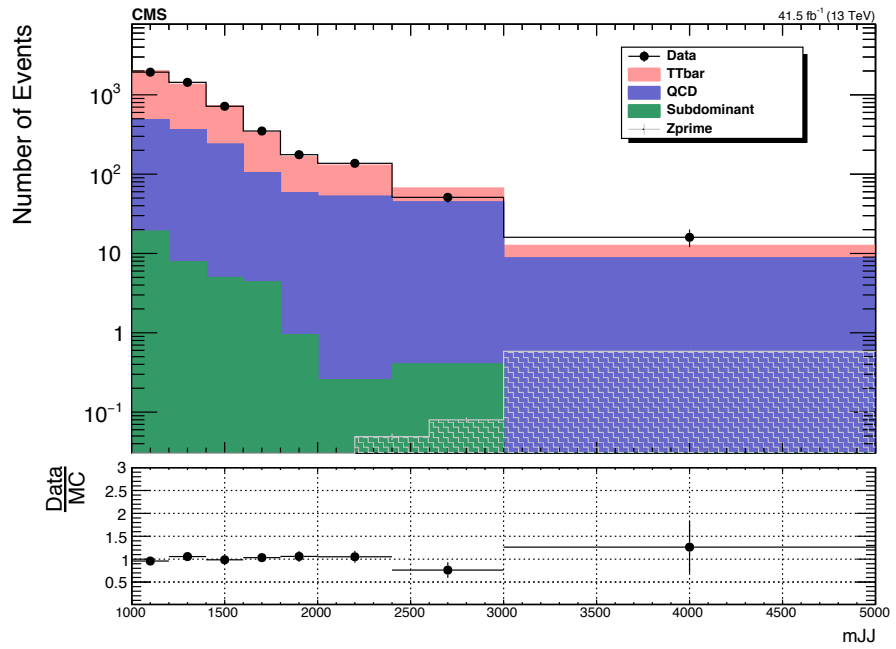


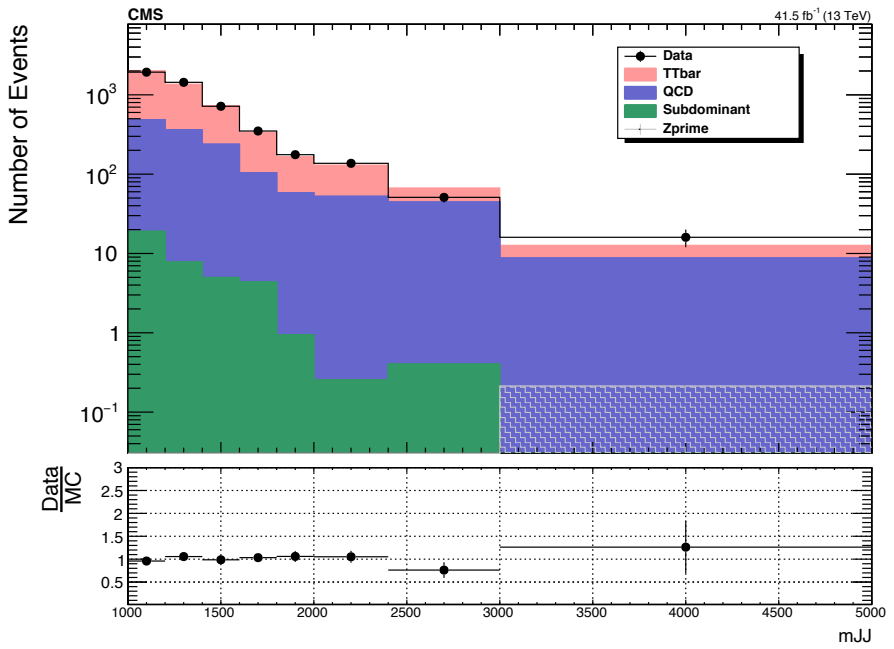
$M_{z'}$ =3500, w = 1%



Stack Histograms mJJ

$M_{Z'}$ =4000, w = 1

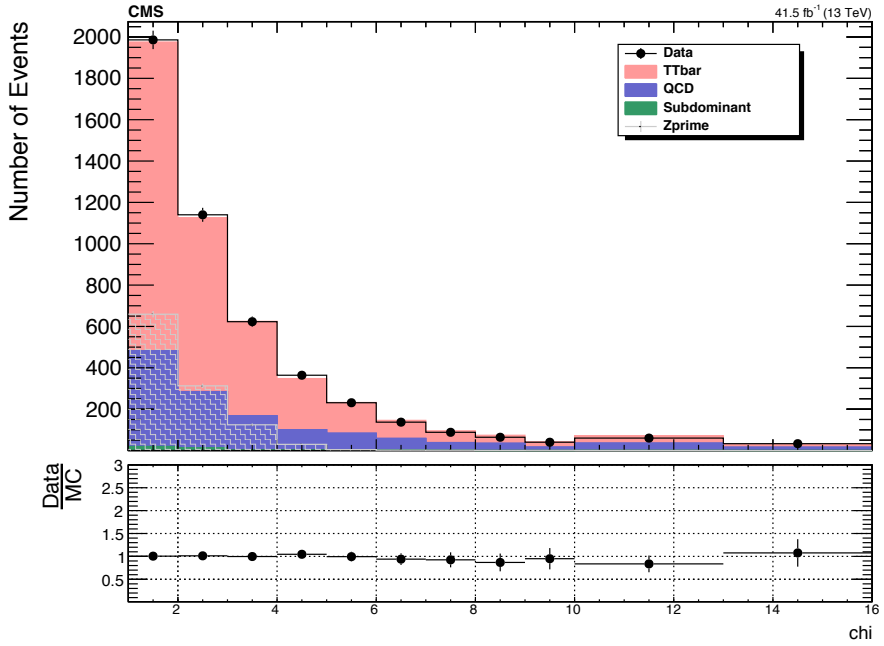




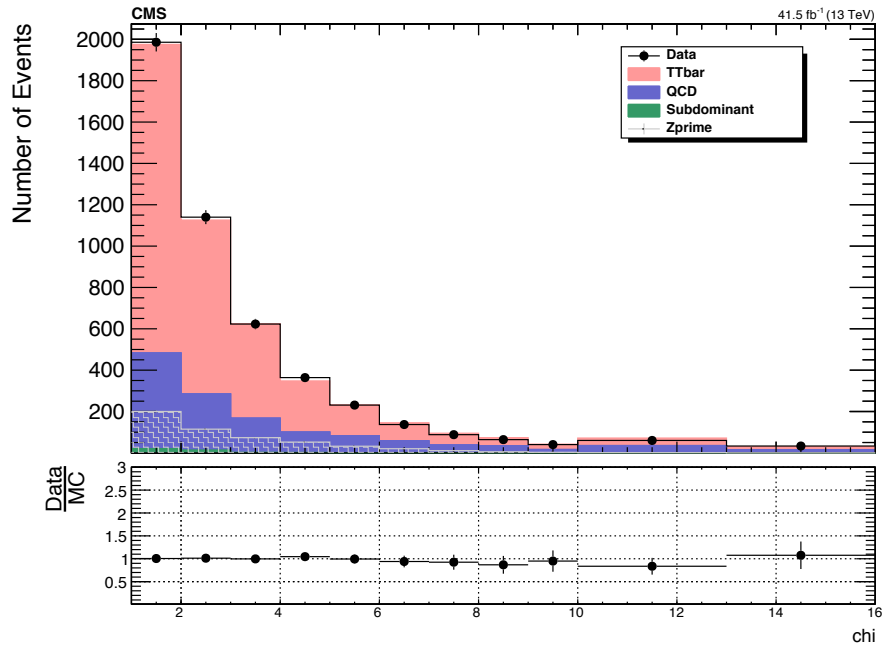
$M_{Z'}$ =4500, w = 1%

Stack Histograms chi

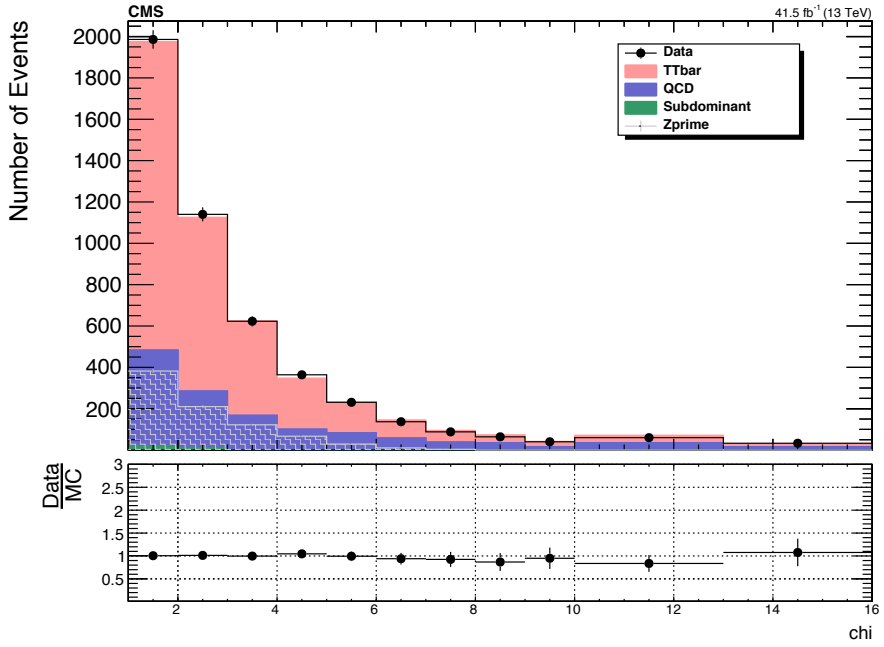
$M_{z'}$ =1200, w = 1%



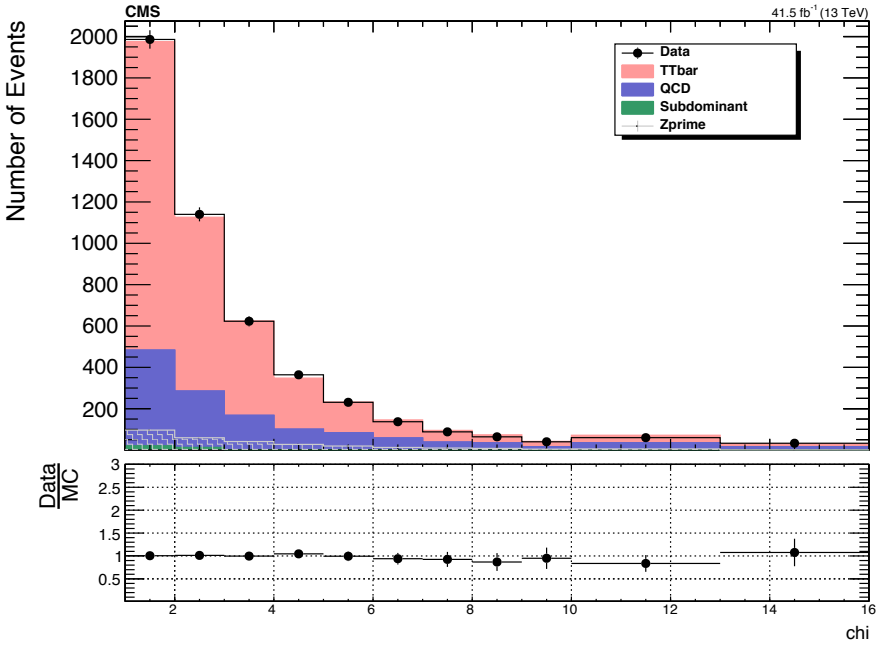
$M_{z'}$ =1600, w = 1%



$M_{z'}$ =1400, w = 1%

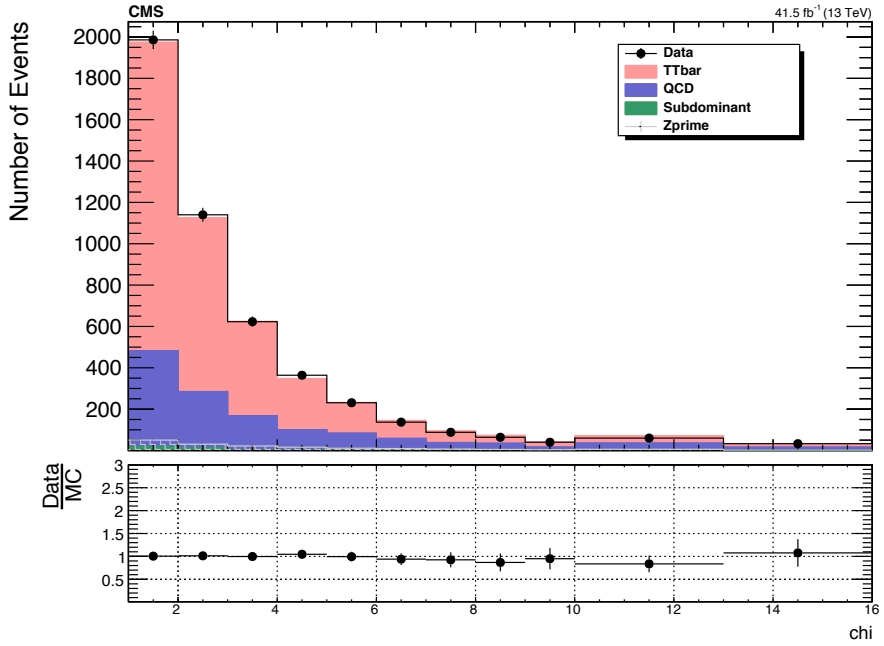


$M_{z'}$ =1800, w = 1%

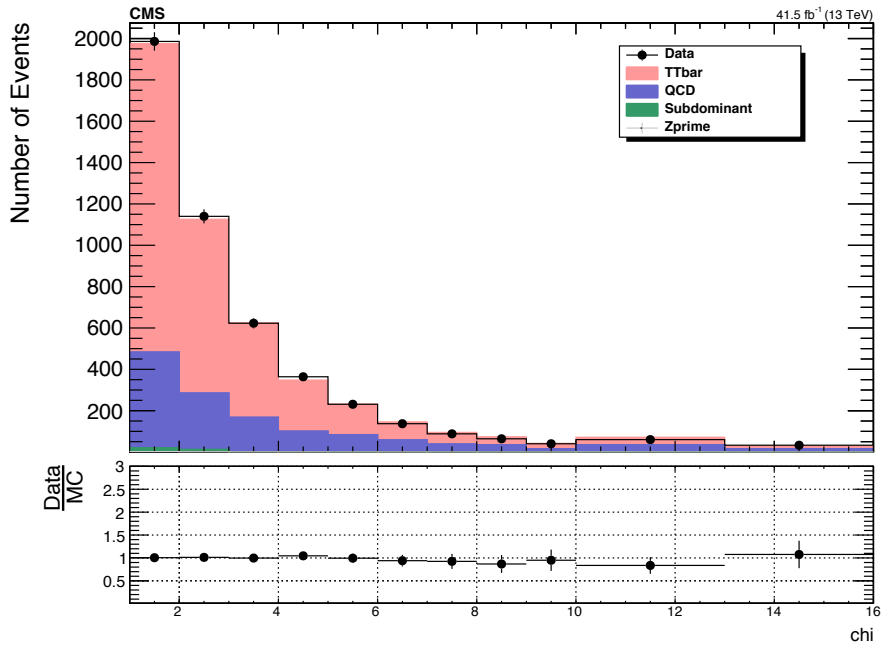


Stack Histograms chi

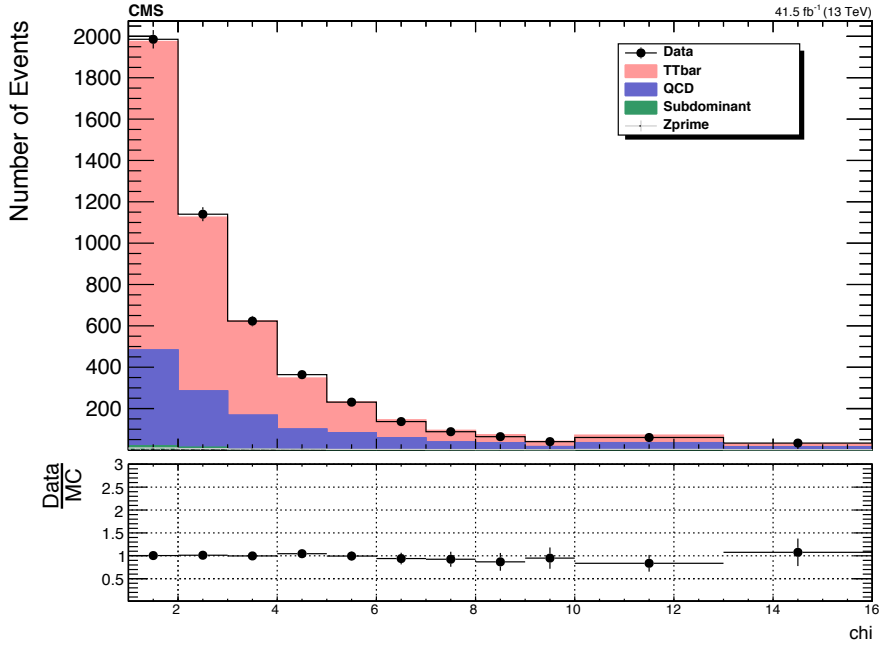
$M_{z'}$ =2000, w = 1%



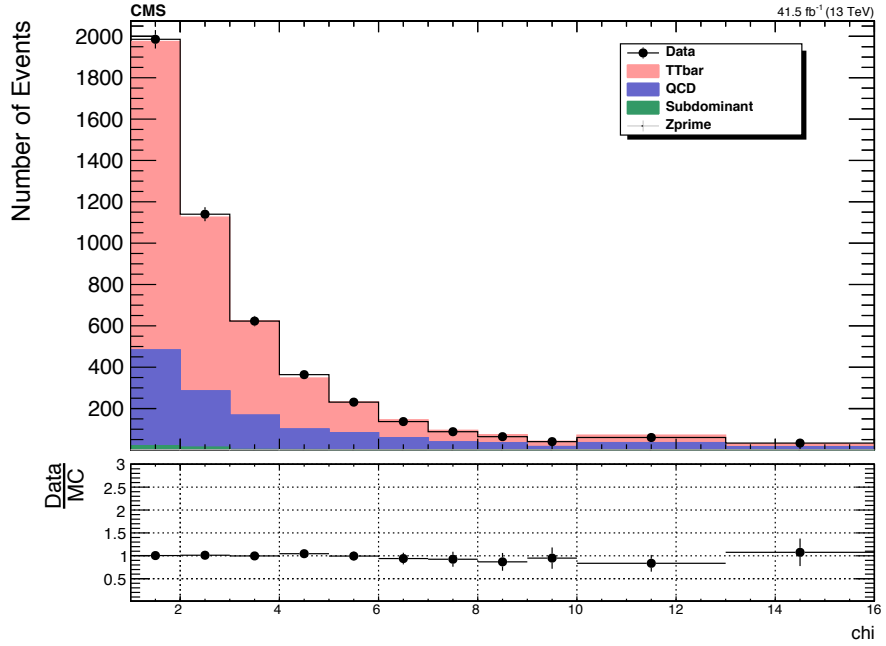
$M_{z'}$ =3000, w = 1%



$M_{z'}$ =2500, w = 1%

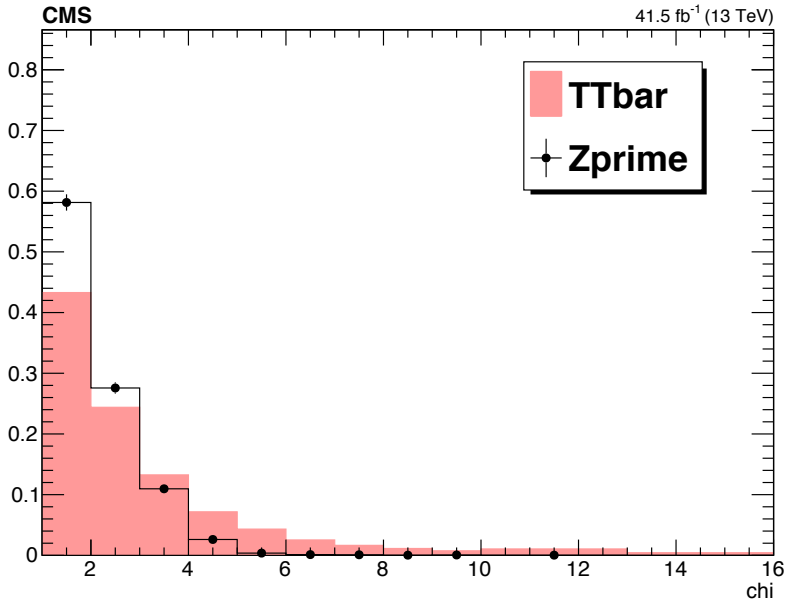


$M_{z'}$ =3500, w = 1%

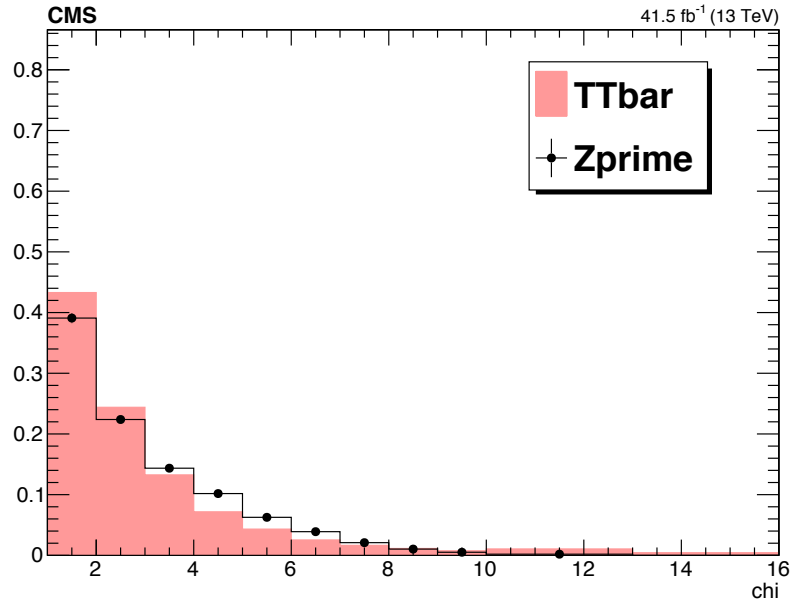


Chi (χ) sensitivity

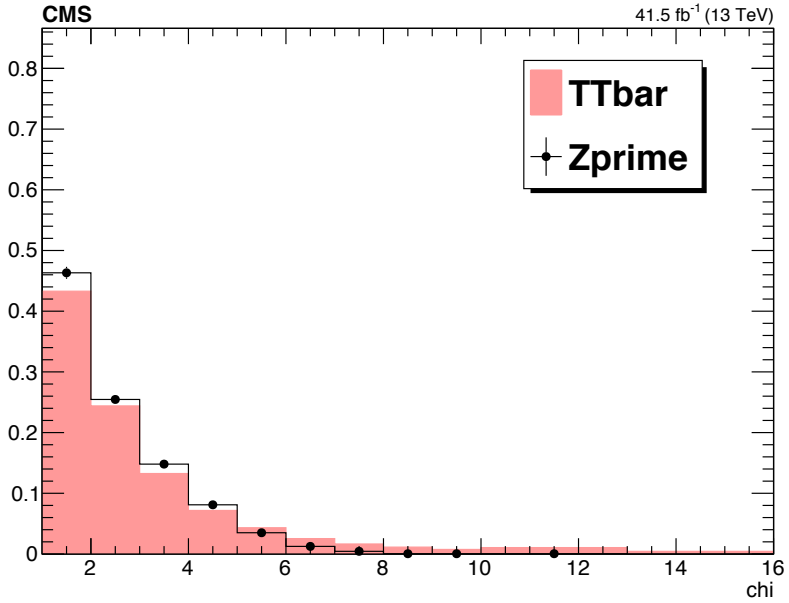
$M_{z'}$ =1200, w = 1%



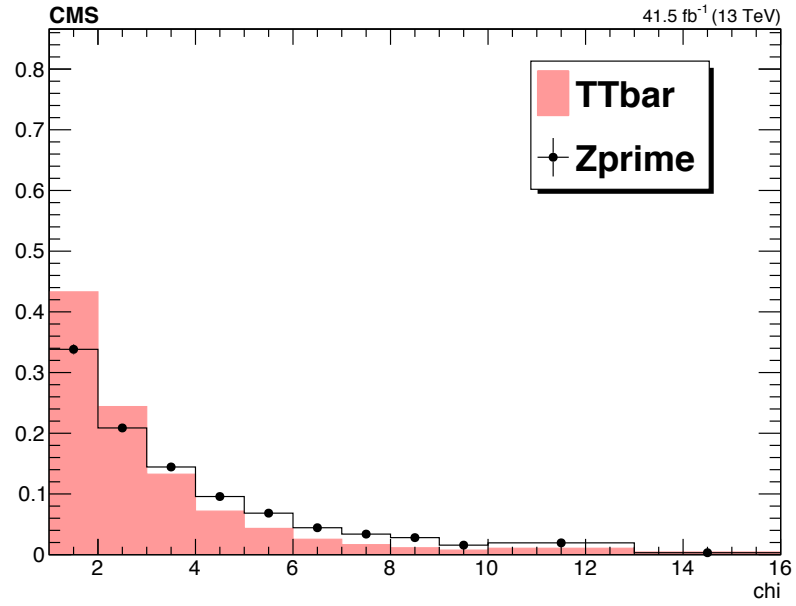
$M_{z'}$ =1600, w = 1%



$M_{z'}$ =1400, w = 1%



$M_{z'}$ =1800, w = 1%



Chi (χ) sensitivity

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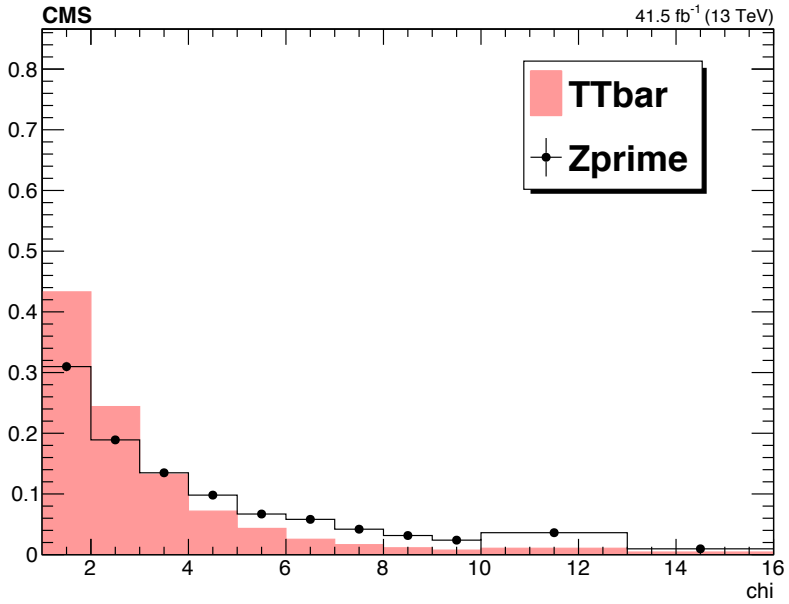
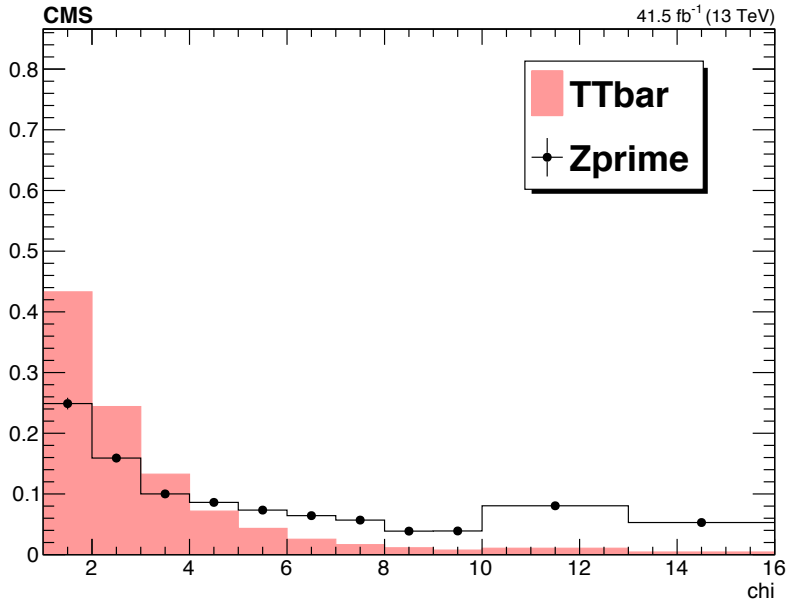


$M_{z'}$ =3000, w = 1%



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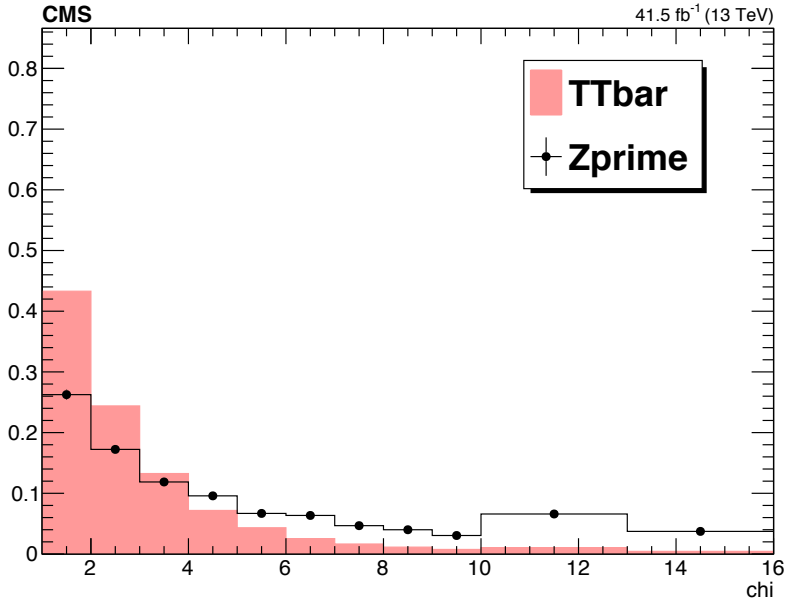

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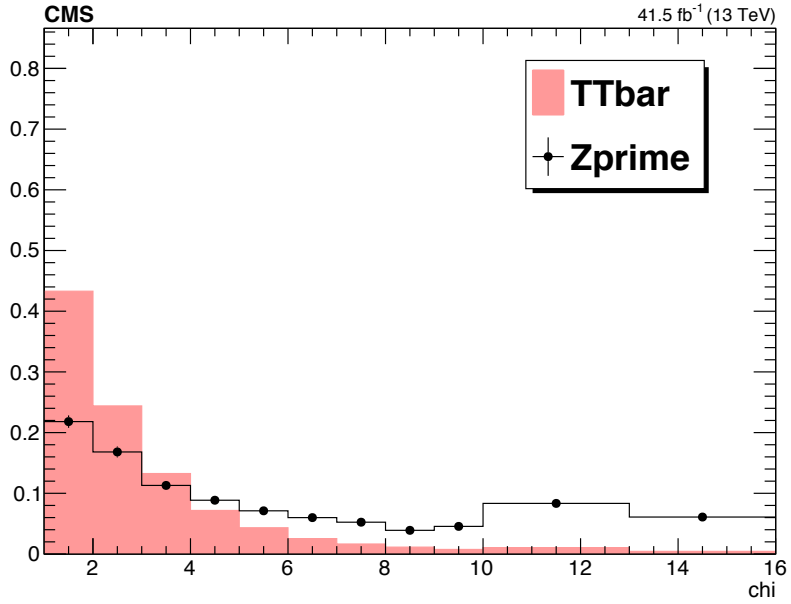
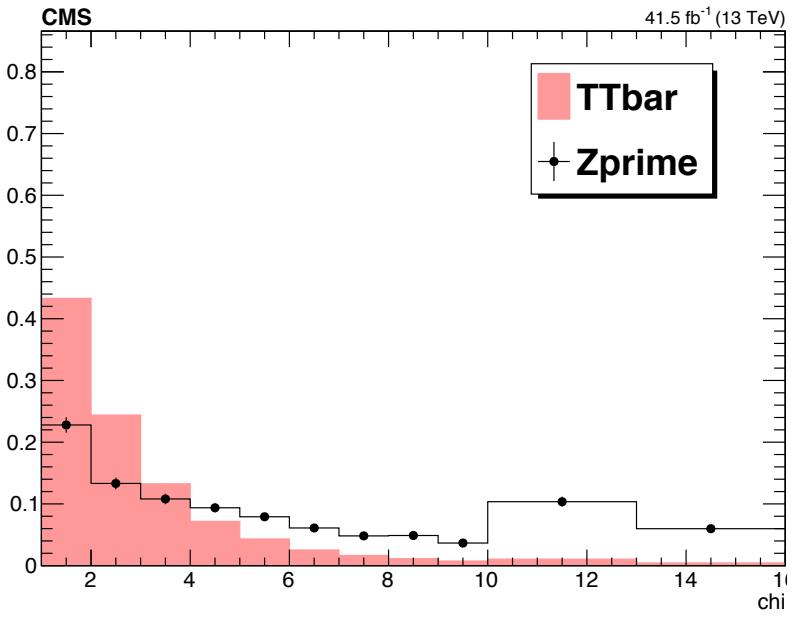
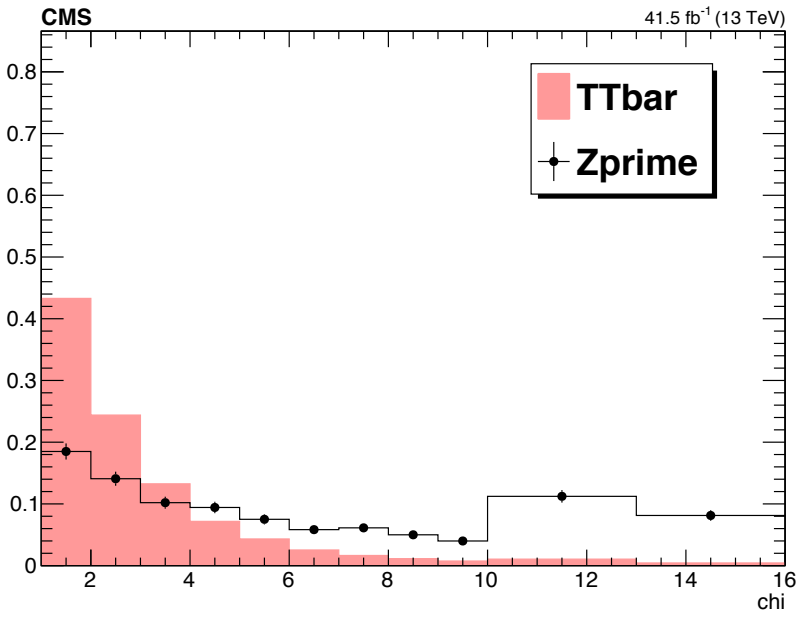


Chi (χ) sensitivity

$M_{Z'}$ =4000, w = 1%



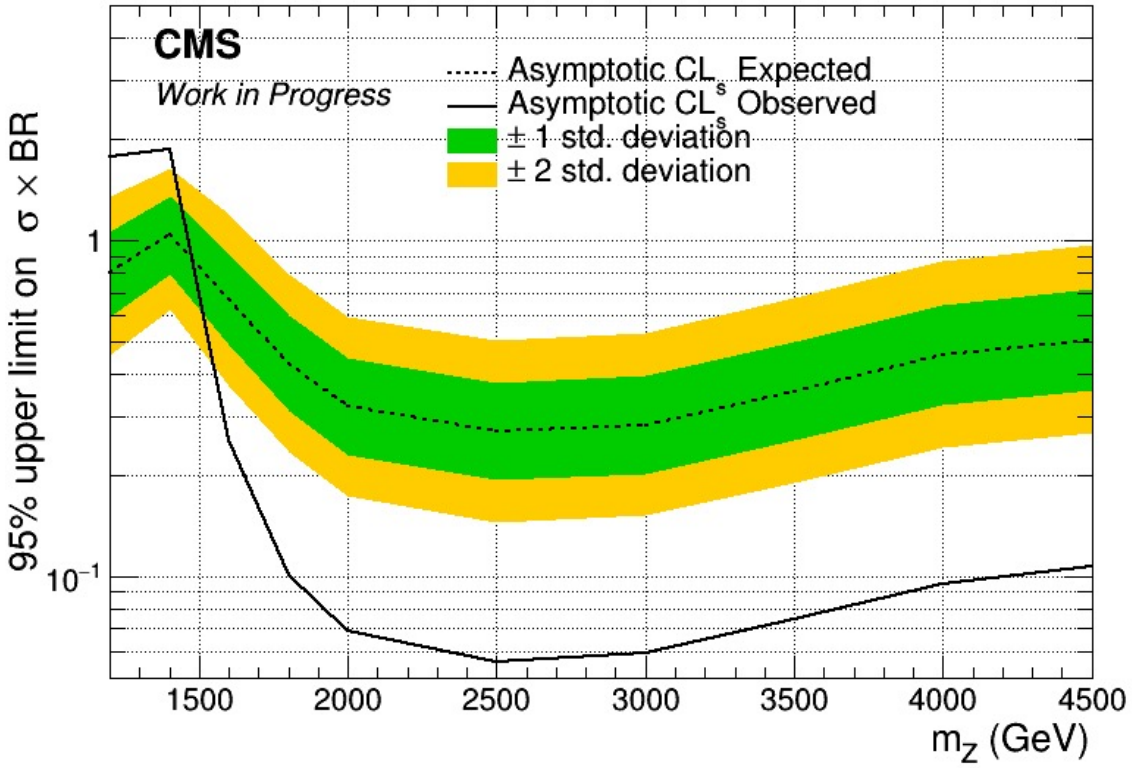


$M_{Z'}$ =4500, w = 1%

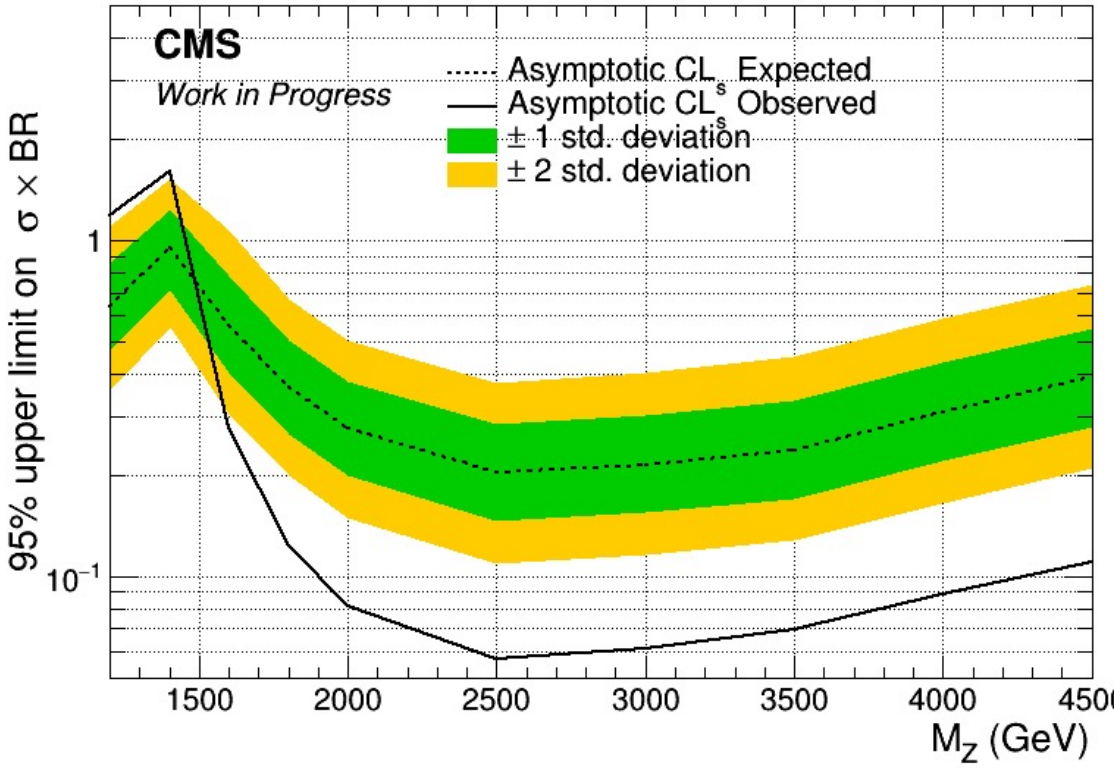
Angular Distributions (Brazilian Plot)

Assymptotic limits for M Z': 1.2, 1.4, 1.6, 1.8, 2, 2.5, 3, 3.5, 4, 4.5 TeV
Width 1%

2017



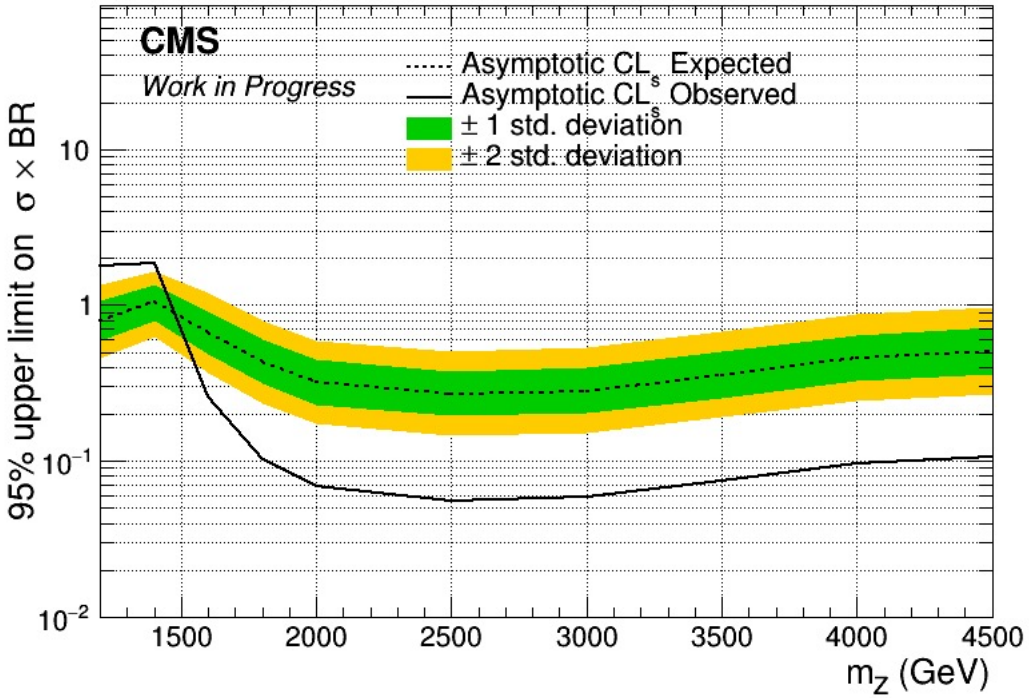
2018



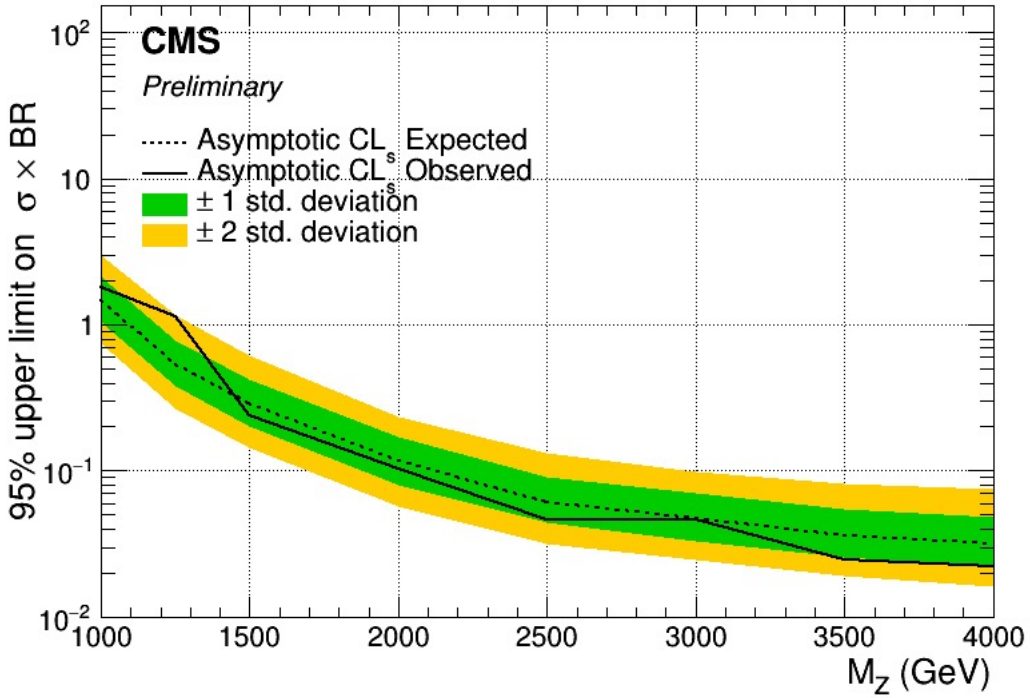
Angular Distributions (Brazilian Plot) vs B2G-16-015

Assymptotic limits for M Z': 1.2, 1.4, 1.6, 1.8, 2, 2.5, 3, 3.5, 4, 4.5 TeV
Width 1%

2017



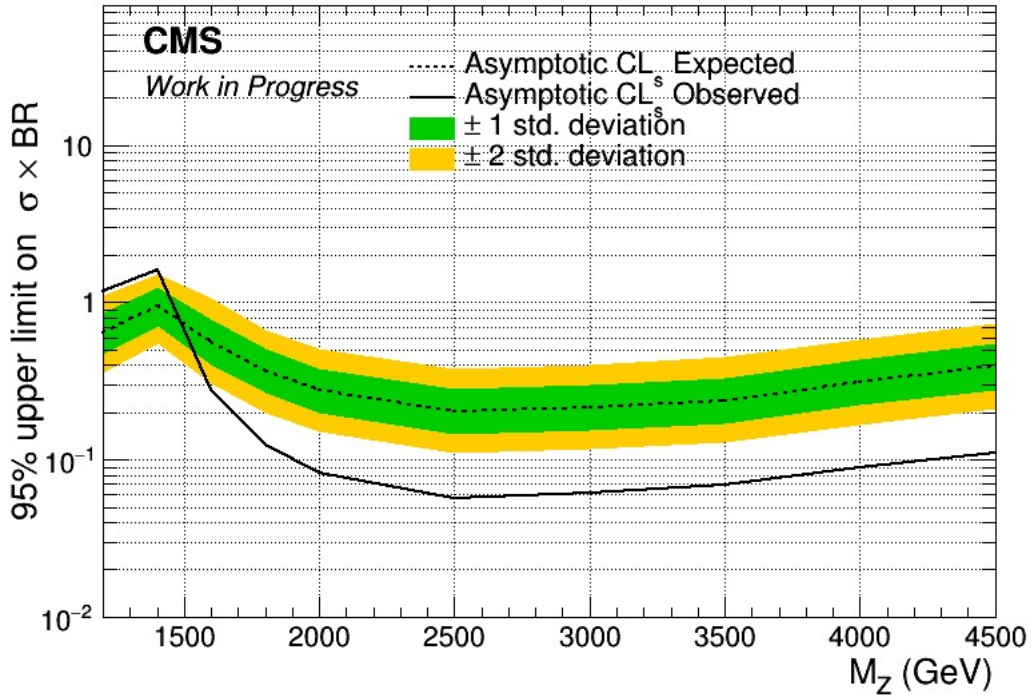
B2G-16-015



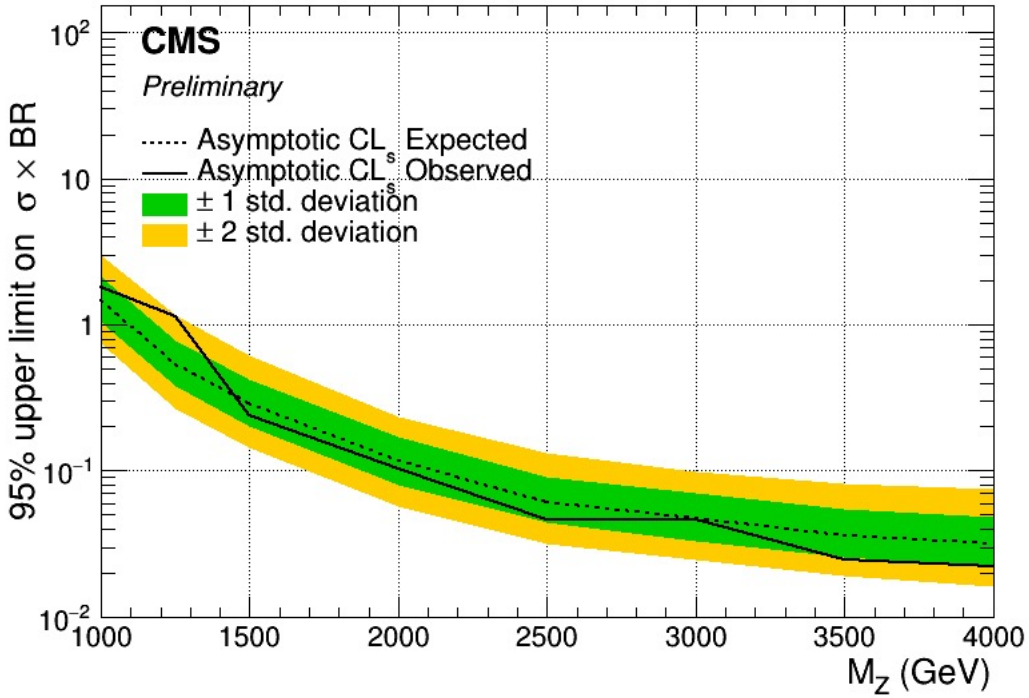
Angular Distributions (Brazilian Plot) vs B2G-16-015

Assymptotic limits for M Z': 1.2, 1.4, 1.6, 1.8, 2, 2.5, 3, 3.5, 4, 4.5 TeV
Width 1%

2018



B2G-16-015



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:

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