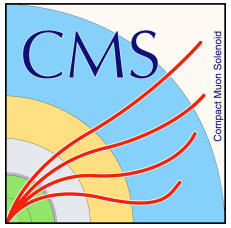
HEP NTUA
Weekly Report

6/10/2020

George Bakas



Summary

- Analysis:
  - Start investigating ttbar Systematic Uncertainties
  - Consistency checks with Giannis

  - Top Angular Distributions: chi, |cosθ*| leading and subleading
    - Responses, Signal Extraction →Unfolding
    - Results
    - Changed binning for the cos(θ*) distributions:

  - EFT interpretation
    - Angular distributions with EFT parameters

  - AN 2020/156

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:

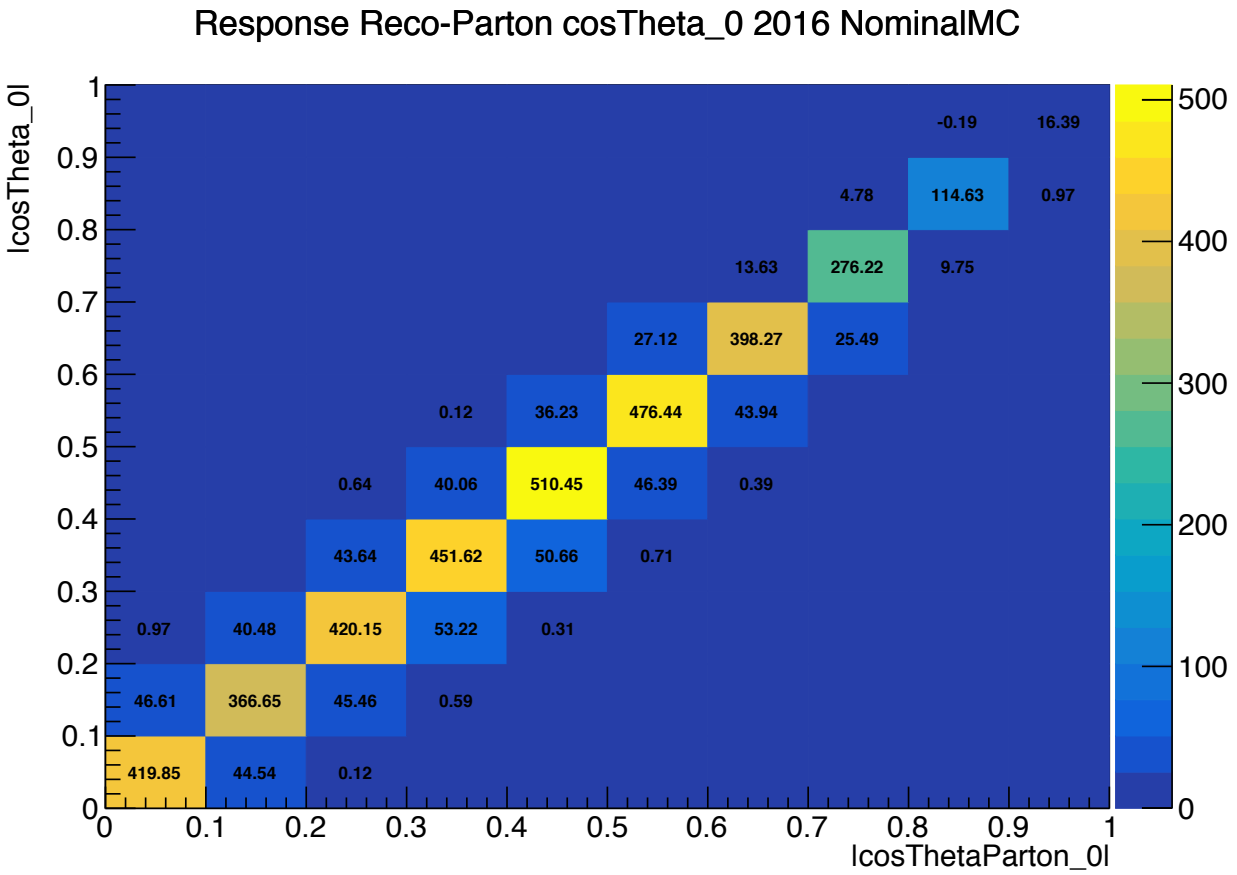
$$y^* = \frac{1}{2}(y_1 - y_2)$$

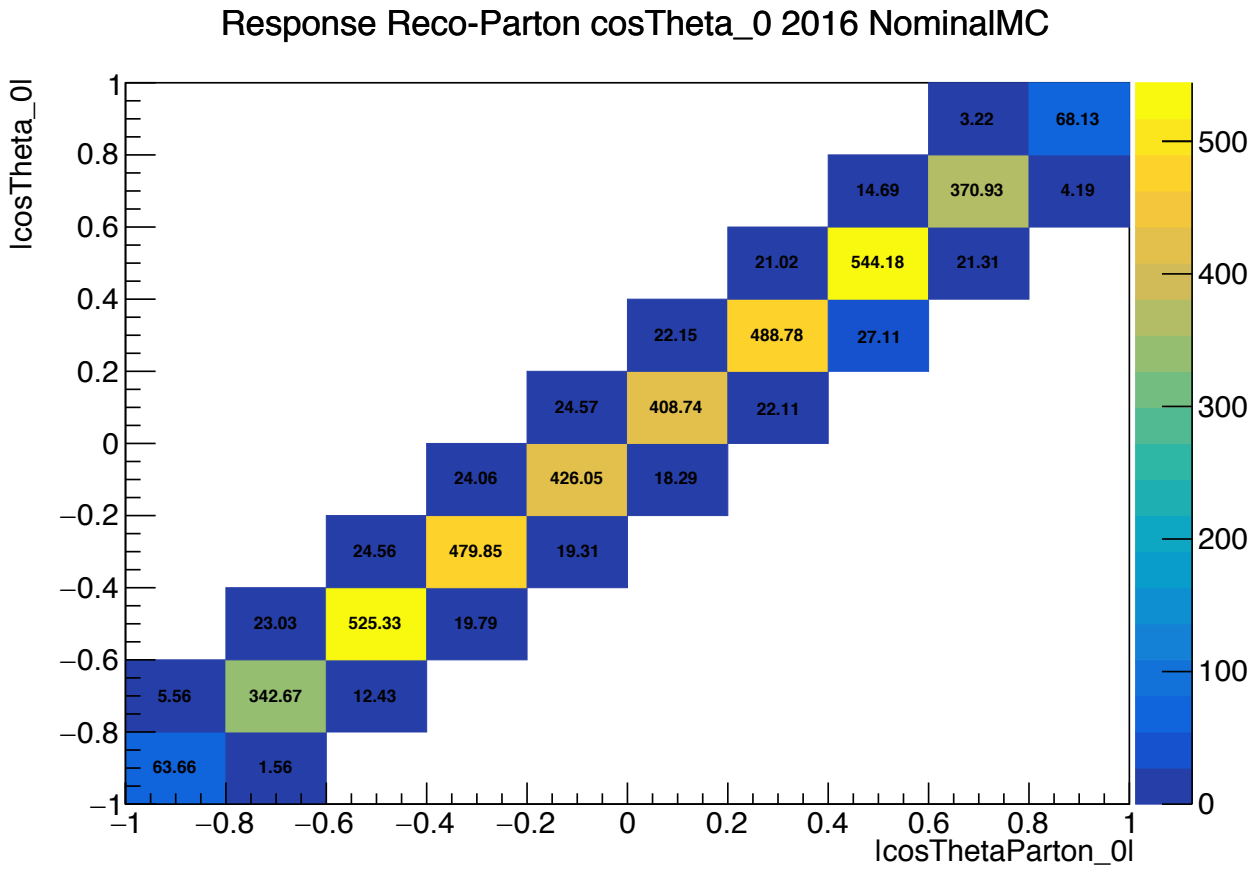
X is defined as $\chi = e^{|y^*|} = e^{|y_1 - y_2|}$ (1) and can be measured by creating the TLorentzVector, boost it to the ZMF and find the rapidity difference of the two leading jets

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:

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

Response Matrices





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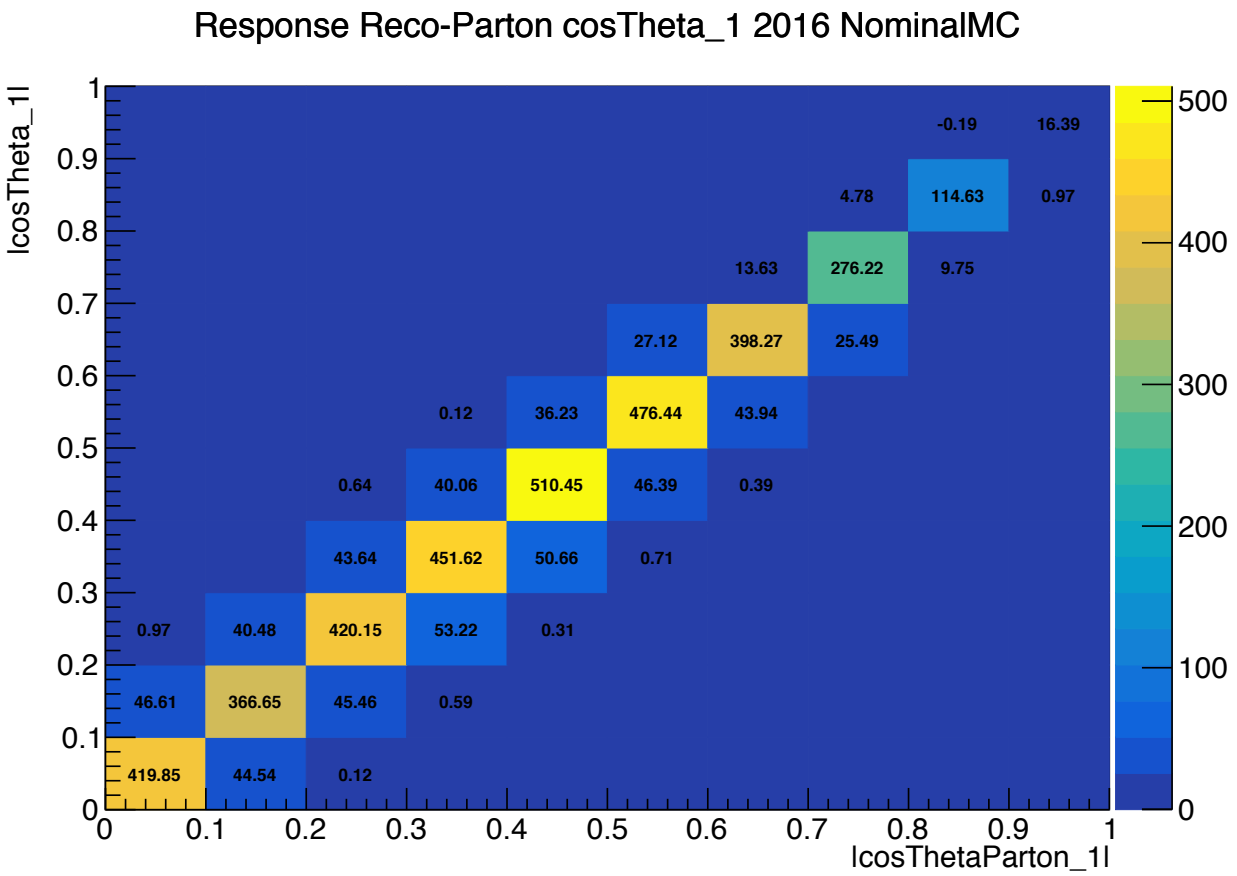
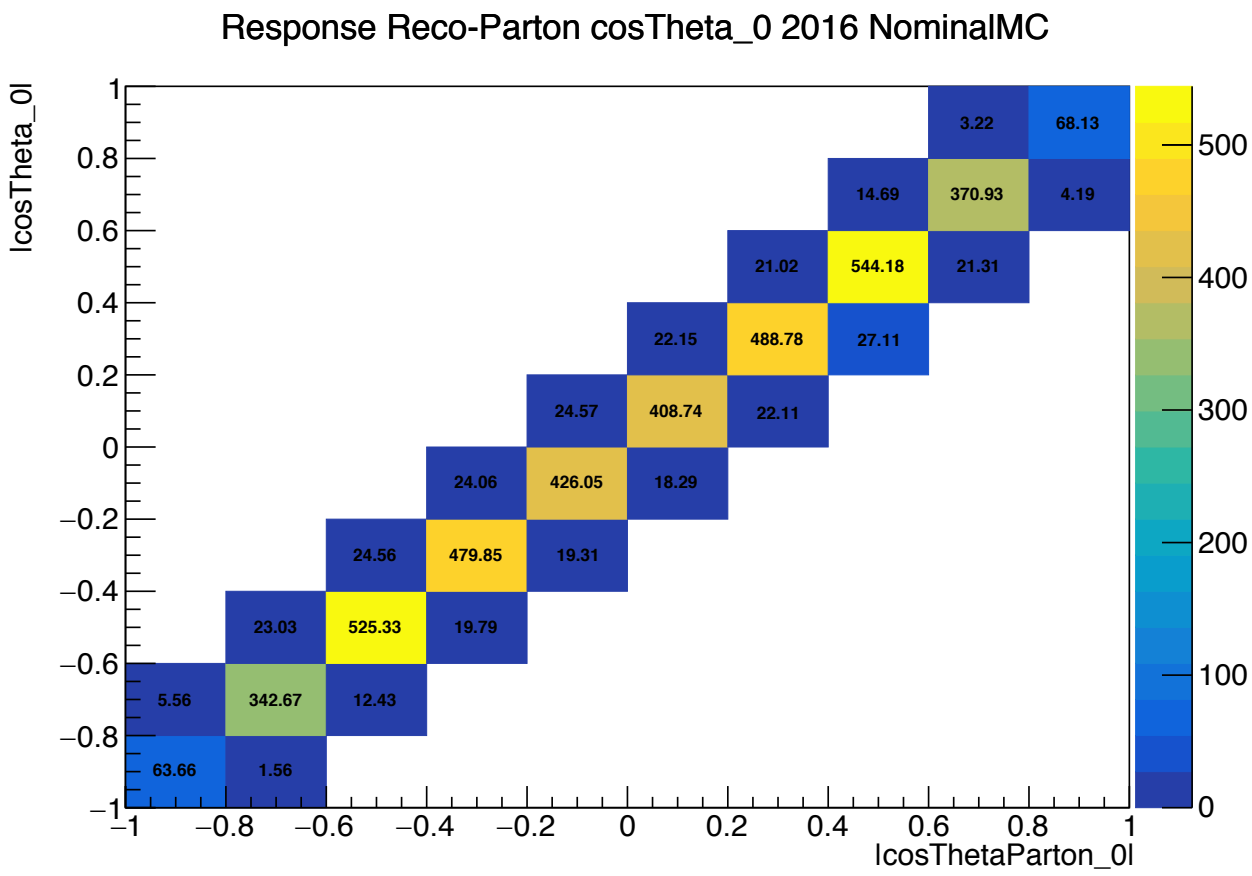




Signal Extraction

Measured dist from data

Fitted number of QCD events in SR_A

QCD shape taken from Data (CR)

$$S(x_{reco}) = D(x_{reco}) - C_{bkg}^{yield} N_{QCD}^{fit}(x_{reco}) Q(x_{reco}) - B(x_{reco})$$

Fiducial Yield

Transfer factor from SR_A to SR

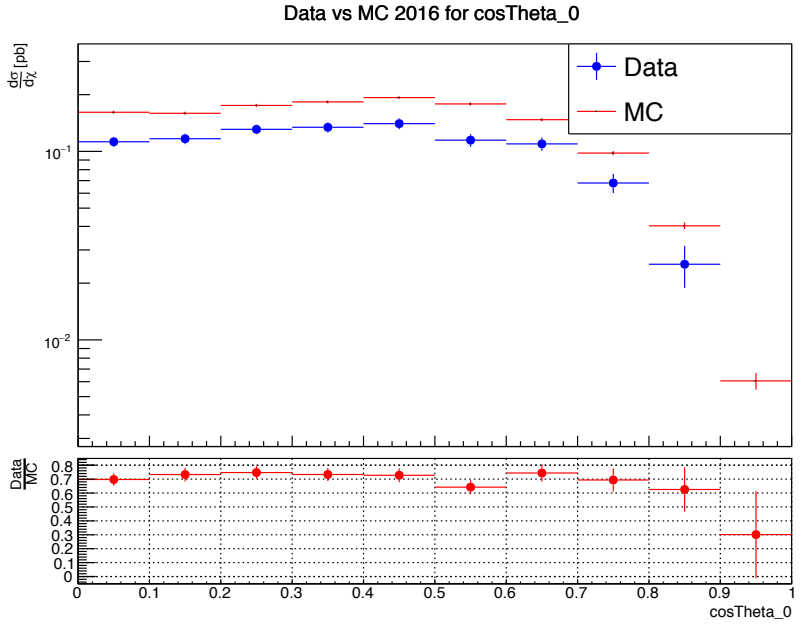
Subdominant bkg shape and contribution (MC)

- Where x_{reco} is the respected variable of interest (ttbar mass, pt, rapidity, leading and subleading jetPt and |jetY|)
- We deploy a fit in the Signal Region (2btag) to extract the N_{QCD}^{fit}

$$D(m^t)^{(i)} = N_{tt}^{(i)} T^{(i)}(m^t, k_{MassScale}, k_{MassResolution}) + N_{bkg}^{(i)} B(m^t)(1 + k_1 x) + N_{sub}^{(i)} O^{(i)}(m^t)$$

- Our data CR is contaminated from ttbar and subdominant bkgs which has to be dealt with.

Fiducial Measurement



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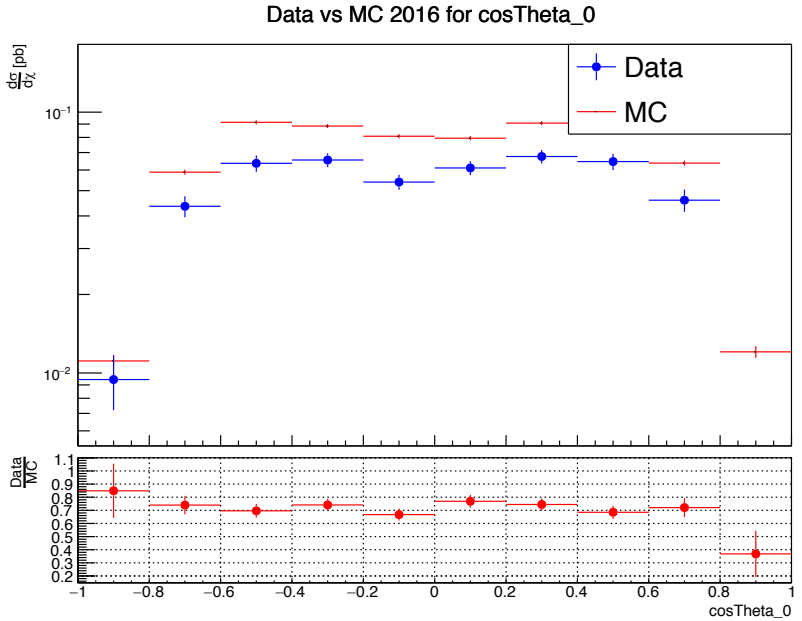

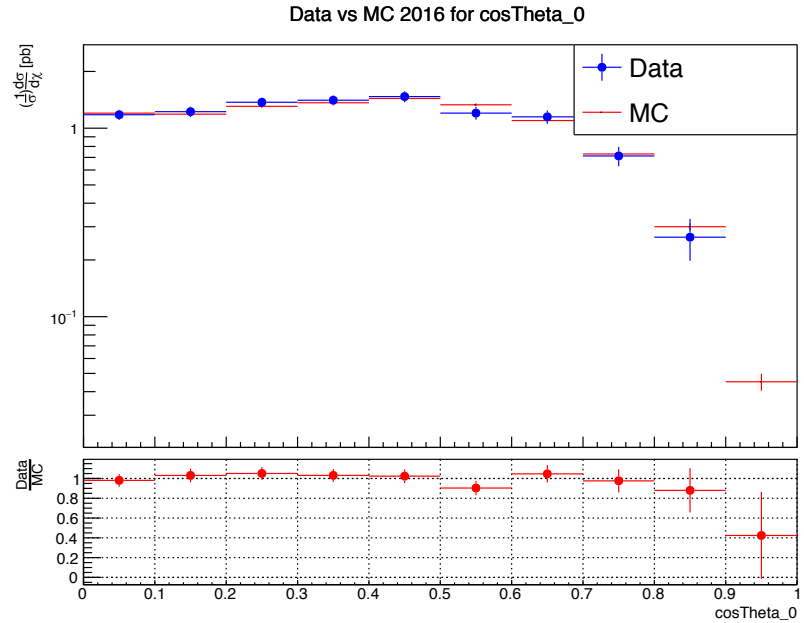

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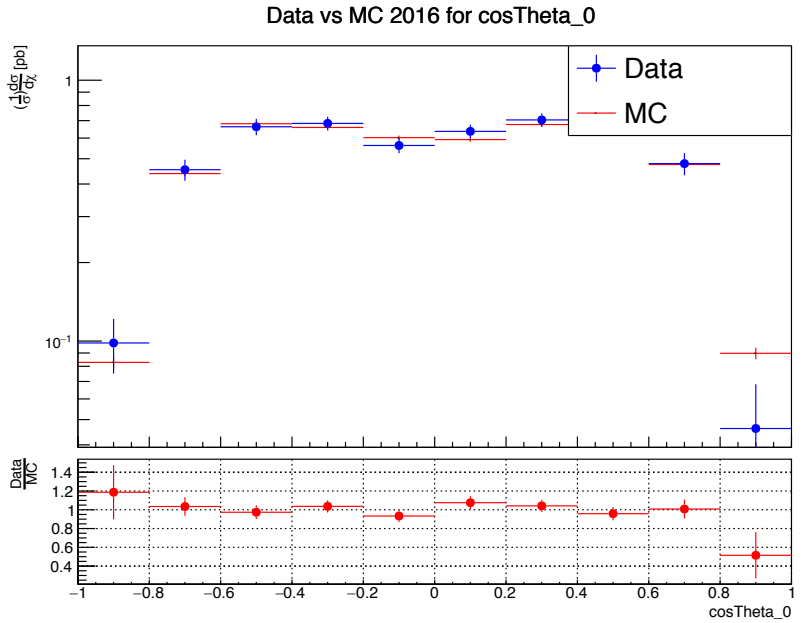

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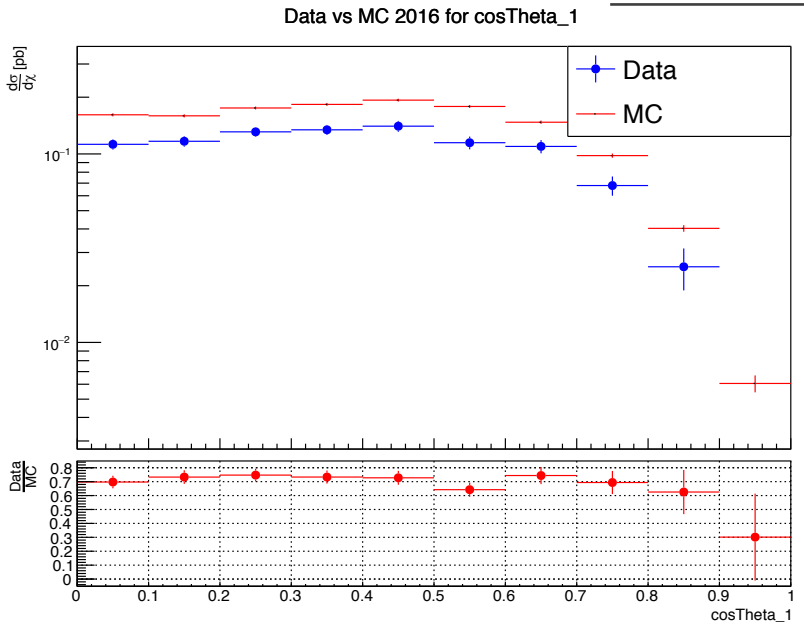

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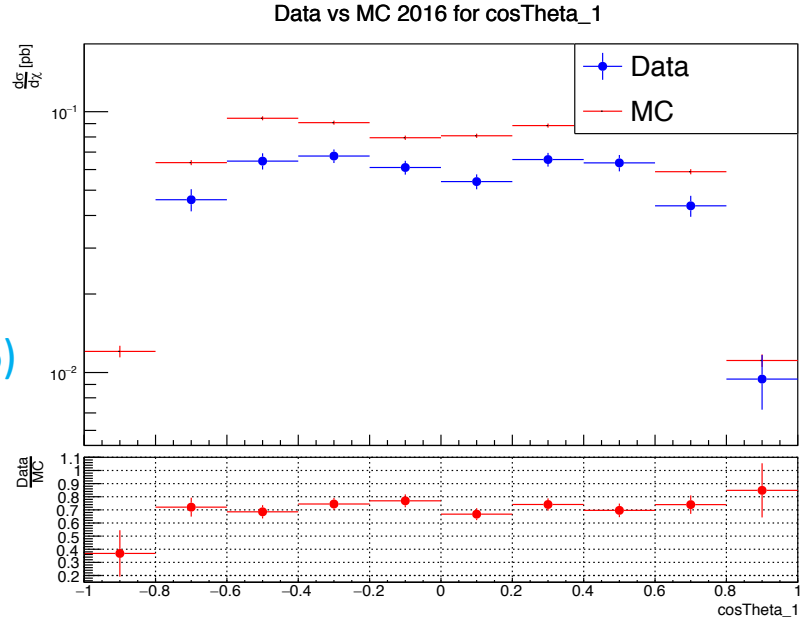

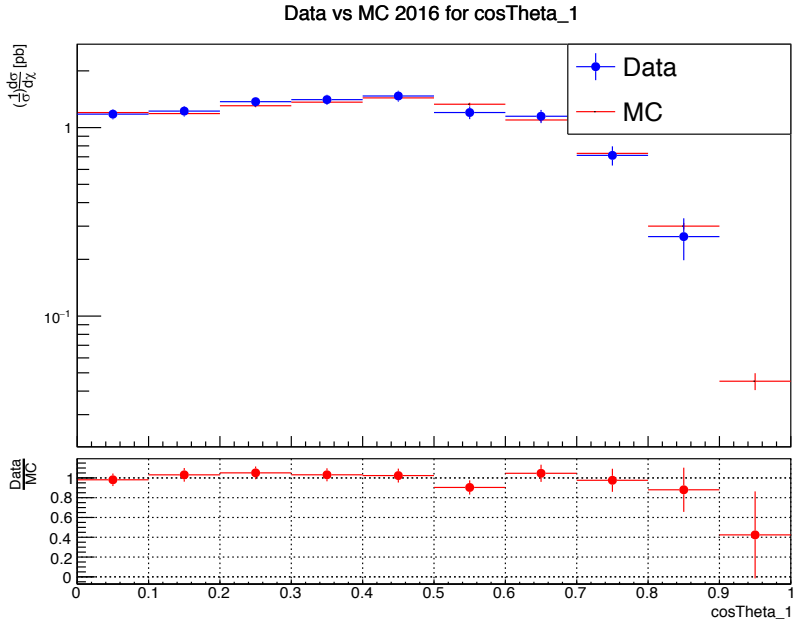

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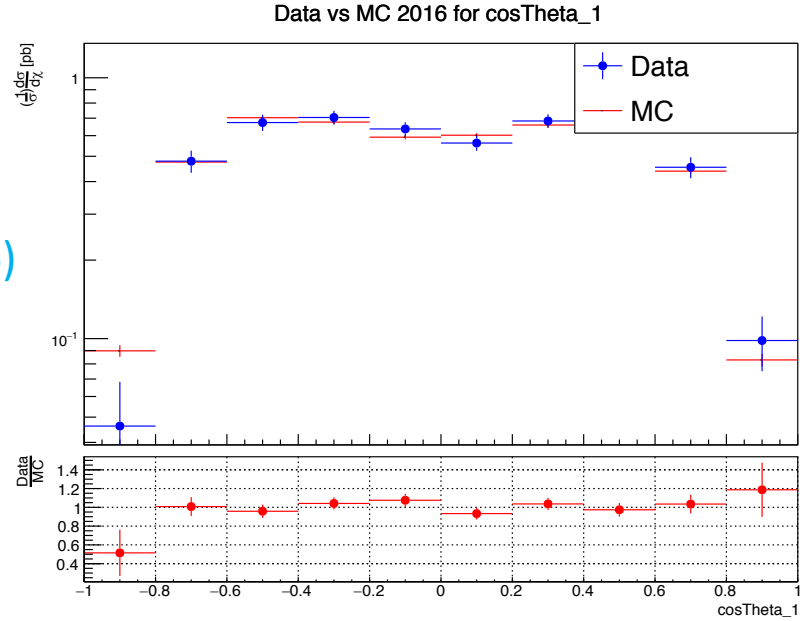
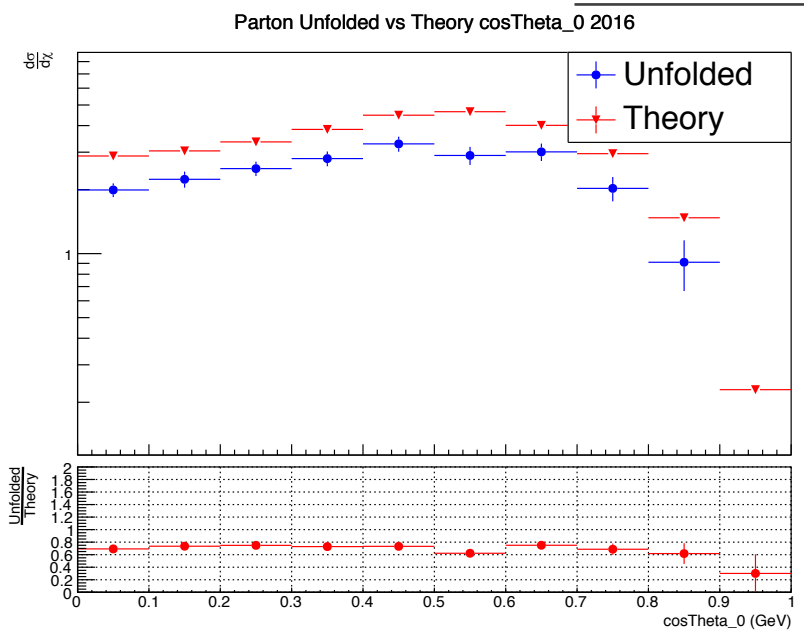


Parton Measurement



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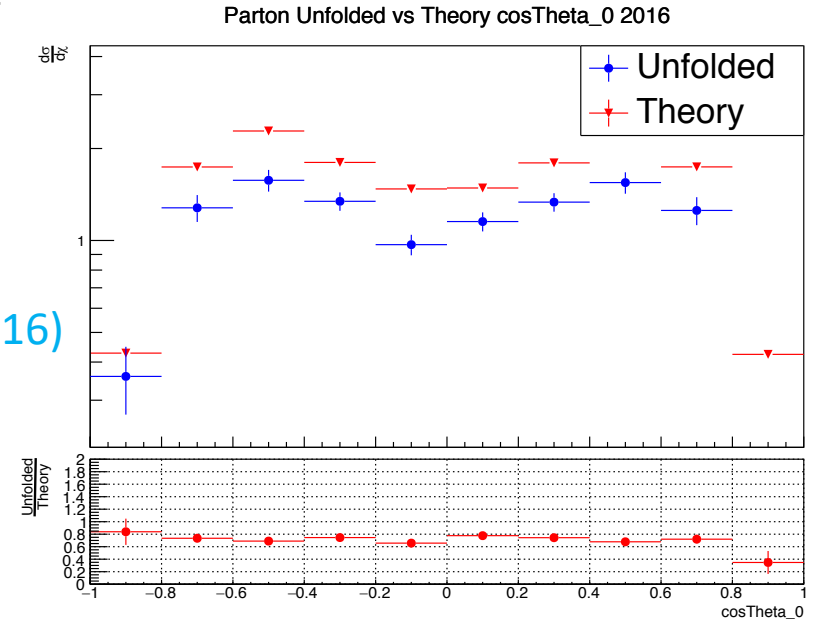

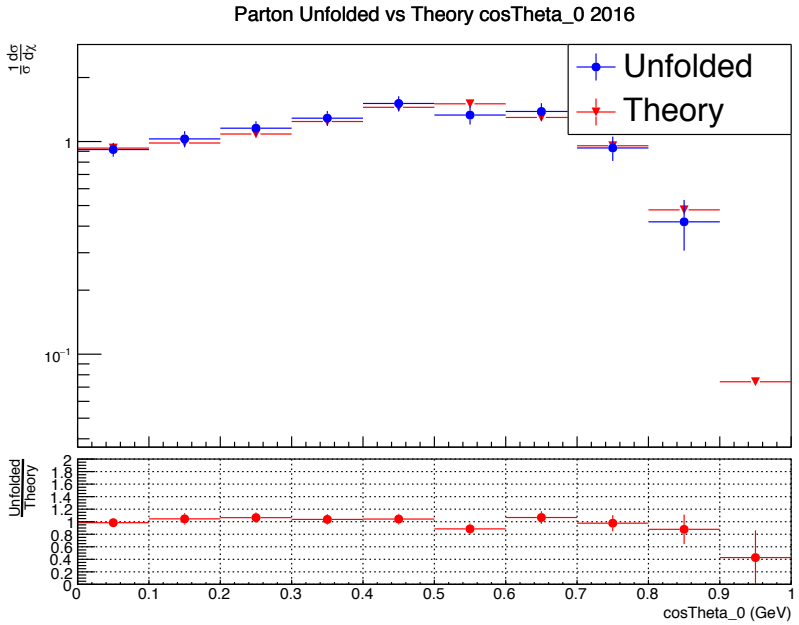

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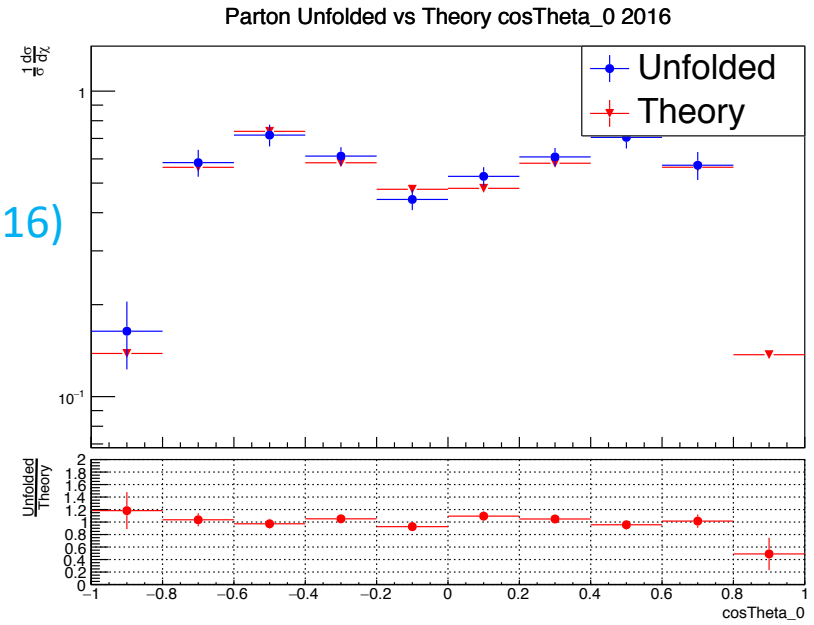

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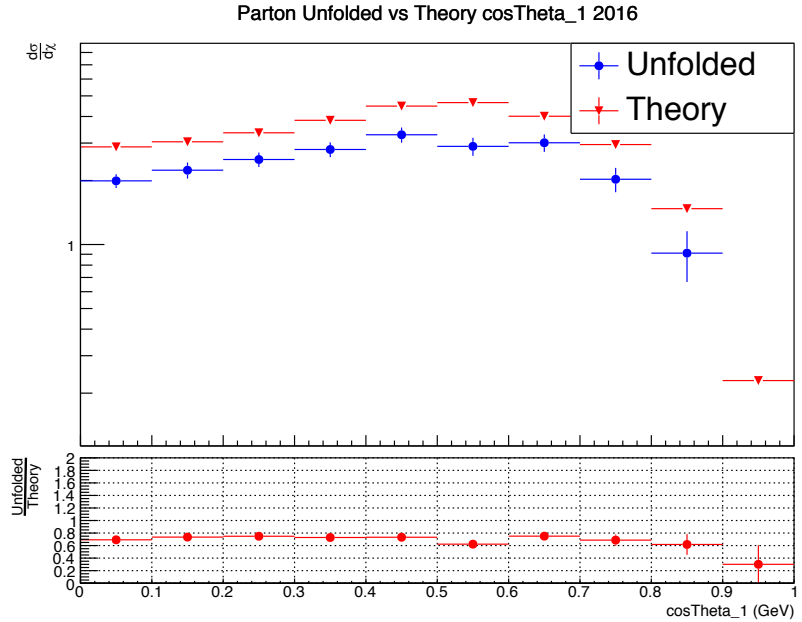

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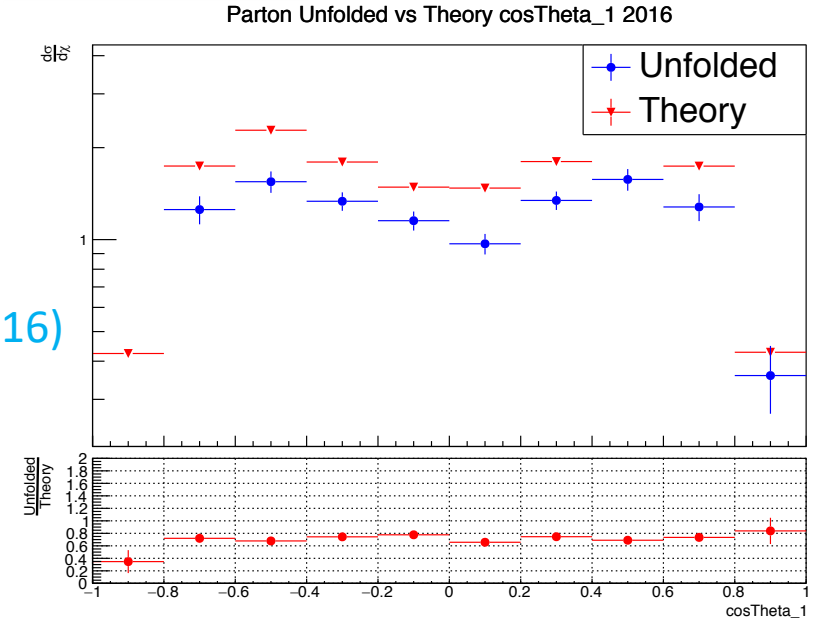

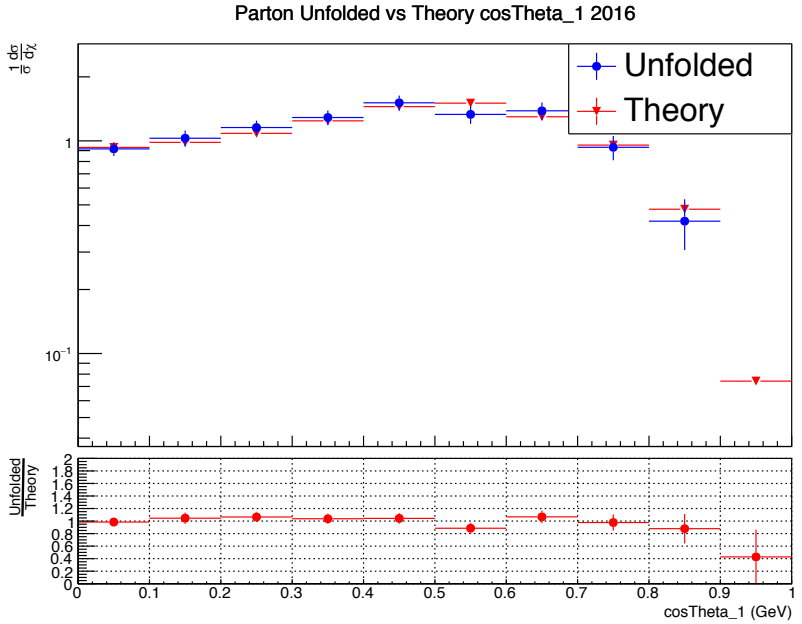

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