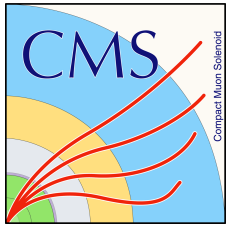
NTUA Top Tagger

Tag & Probe methodology



Overview

- BDT Input and Output in the SR_B Region
  - SR_B : Baseline selection + tight Mass Cut (120,220) GeV, **no TopTagger** Selection
  - Leading + subleading in different pT regions: [400,600], [600,800], [800,1200]
  - **Find** Data vs MC Input and Output for UL our Analysis here

- Top Tagger Scale Factors
  - Data is subtracted QCD and Subdominant bkgs (MC) so that the data sample is pure

$$efficiency = \frac{Tight\ \&\ SR}{Tight\ \&\ Probe} = \frac{\#\ (1\ jet\ pass\ baseline + Tight\ TopTagger\ Cut\ AND\ 1\ jet\ pass\ SR)}{\#\ (1\ jet\ pass\ baseline + Tight\ TopTagger\ Cut\ AND\ 1\ jet\ pass\ only\ baseline)}$$

  - Implemented Randomization (check random jet) to fill histogram to avoid pT bias
  - Divide the phase space into pT regions: [400-600]GeV, [600-800]GeV, [800-Inf]GeV
  - For the QCD estimation, we perform a fit in both regions (Tight & Probe, Tight & SR):
    - Shape of QCD is estimated from Data while inverting btagging requirement
    - # QCD events in each region is calculated from fit using the Leading JetMassSoftDrop variable
    - To scale the ttbar → fit the Leading JetMassSoftDrop in each region and get the signal strength
    - For the evaluation of Signal distribution from data, we do the following:

$$\forall\ region: S(x) = D(x)\ -\ N_{QCD} d_0(x) - Sub.Bkg(x)$$

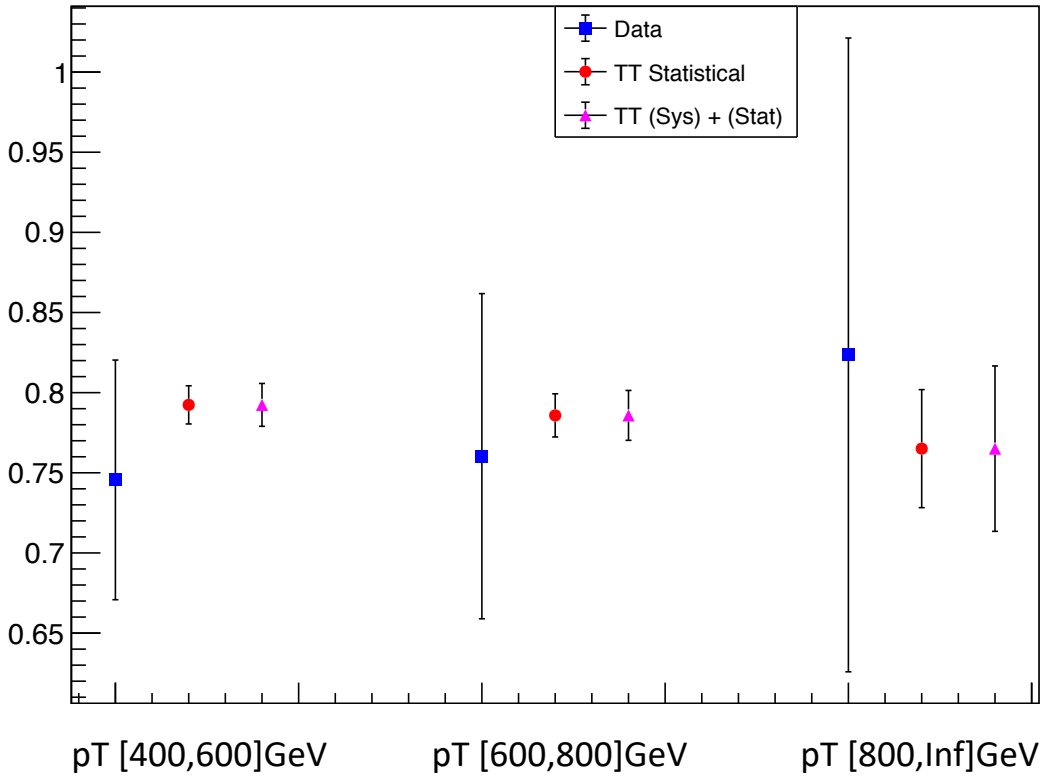
Signal Selection

Variables	Selected Cut
pT leading jets	> 450 GeV
pT 2nd 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
B tagging (2 btagged jets)	> Medium WP
Signal Trigger	

Control Region Selection

Variables	Selected Cut
pT leading jets	> 450 GeV
pT 2nd leading jets	> 400 GeV
N leptons	= 0
|eta| (both leading jets)	< 2.4
mJJ	> 1000 GeV
jetMassSoftDrop (only for fit)	(50,300) GeV
Top Tagger	> 0.2
B tagging (0 btagged jets)	< Medium WP
Control Trigger	

TagAndProbe Efficiency per Pt region (2016_preVFP)



Efficiency--
eff data: 0.757 ± 0.058
eff ttbar: 0.788 ± (stat) 0.009 ± (stat + systematic) 0.01

Efficiency per Pt region
eff data pT[400-600]: 0.746 ± 0.075
eff ttbar pT[400-600]: 0.792 ± (stat) 0.012 ± (stat + systematic) 0.014
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eff data pT[600-800]: 0.76 ± 0.101
eff ttbar pT[600-800]: 0.786 ± (stat) 0.014 ± (stat + systematic) 0.016
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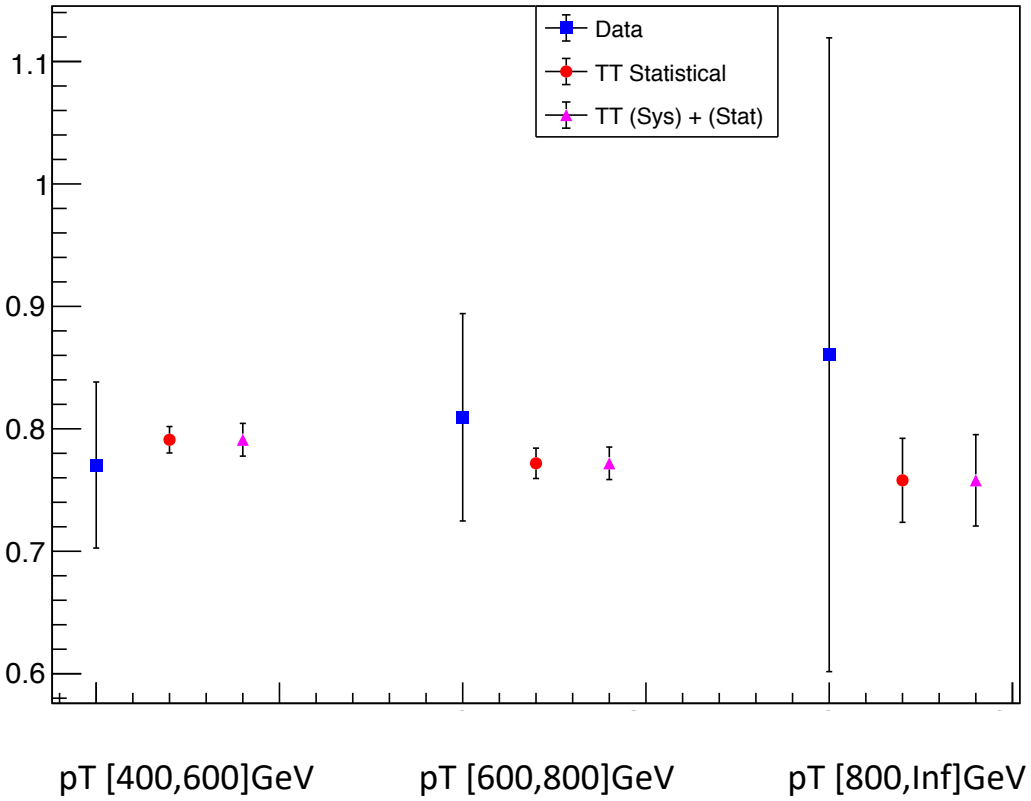
eff data pT[800-Inf]: 0.824 ± 0.197698
eff ttbar pT[800-Inf]: 0.765 ± (stat) 0.037 ± (stat + systematic) 0.052

TagAndProbe Efficiency per Pt region (2016_postVFP)



Efficiency--
eff data: 0.79 ± 0.052
eff ttbar: 0.781 ± (stat) 0.008 ± (stat + systematic) 0.009

Efficiency per Pt region
eff data pT[400-600]: 0.77 ± 0.068
eff ttbar pT[400-600]: 0.791 ± (stat) 0.011 ± (stat + systematic) 0.013
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eff data pT[600-800]: 0.809 ± 0.085
eff ttbar pT[600-800]: 0.772 ± (stat) 0.012 ± (stat + systematic) 0.013
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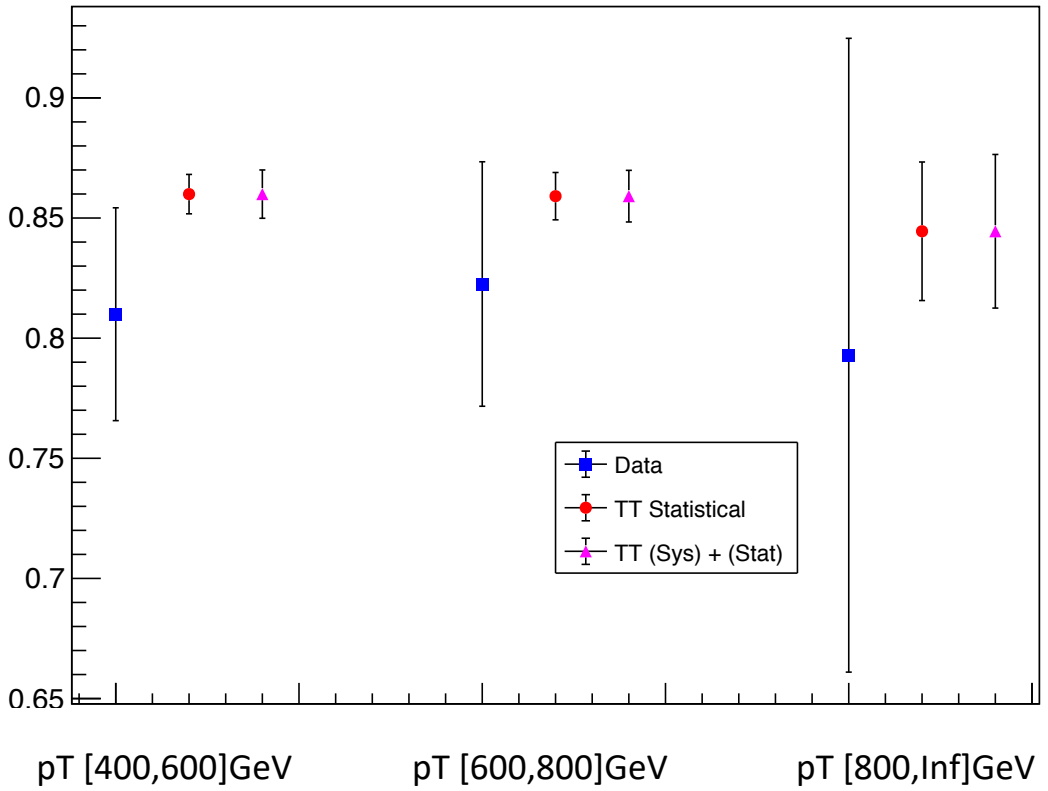
eff data pT[800-Inf]: 0.861 ± 0.259
eff ttbar pT[800-Inf]: 0.758 ± (stat) 0.034 ± (stat + systematic) 0.037

TagAndProbe Efficiency per Pt region(2017)



Efficiency--
eff data: 0.814 ± 0.033
eff ttbar: 0.859 ± (stat) 0.006 ± (stat + systematic) 0.007

Efficiency per Pt region
eff data pT[400-600]: 0.81 ± 0.044
eff ttbar pT[400-600]: 0.86 ± (stat) 0.008 ± (stat + systematic) 0.01
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eff data pT[600-800]: 0.823 ± 0.051
eff ttbar pT[600-800]: 0.859 ± (stat) 0.01 ± (stat + systematic) 0.011
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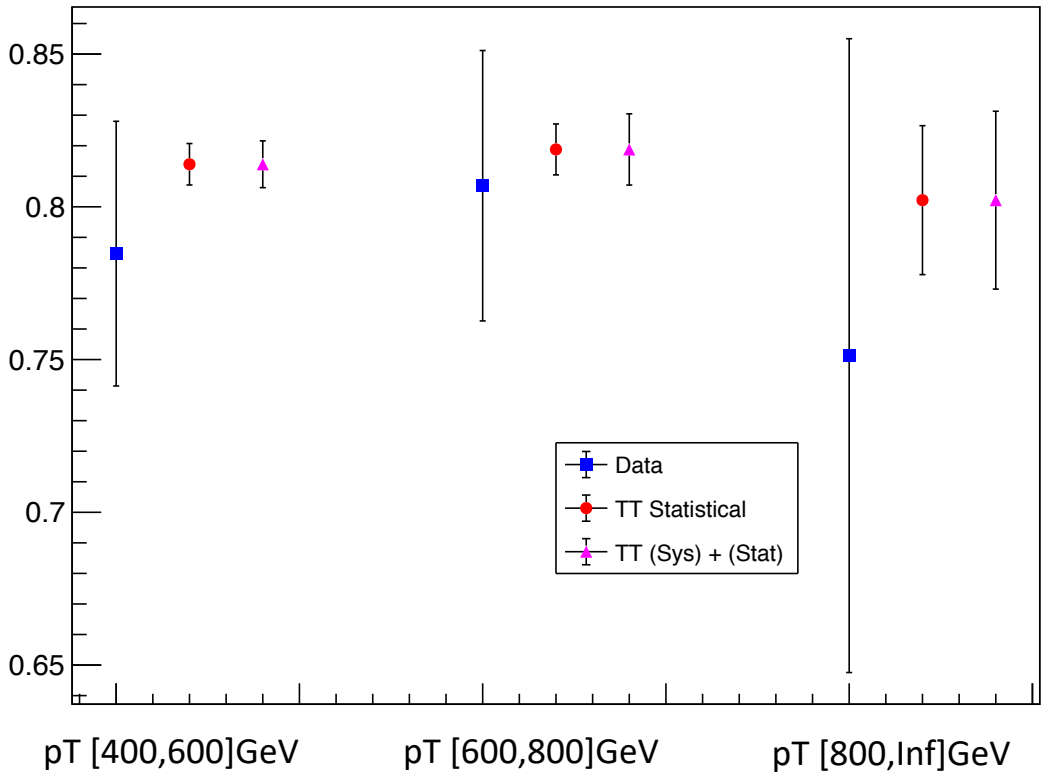
eff data pT[800-Inf]: 0.793 ± 0.132
eff ttbar pT[800-Inf]: 0.845 ± (stat) 0.029 ± (stat + systematic) 0.032

TagAndProbe Efficiency per Pt region(2018)



Efficiency--
eff data: 0.792 ± 0.03
eff ttbar: 0.815 ± (stat) 0.005 ± (stat + systematic) 0.006

Efficiency per Pt region
eff data pT[400-600]: 0.785 ± 0.043
eff ttbar pT[400-600]: 0.814 ± (stat) 0.007 ± (stat + systematic) 0.008
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eff data pT[600-800]: 0.81 ± 0.044
eff ttbar pT[600-800]: 0.819 ± (stat) 0.008 ± (stat + systematic) 0.012
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eff data pT[800-Inf]: 0.753 ± 0.11
eff ttbar pT[800-Inf]: 0.802 ± (stat) 0.024 ± (stat + systematic) 0.029