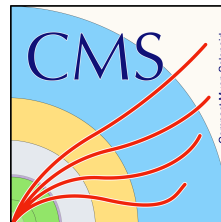# Weekly Report
NTUA
13/12/2019

George Bakas

Status Report

- TOP-18-013 approval

- Signal Extraction
  - Various methods for extracting number of QCD events in Signal reduced mass region
  - Fixed eb or free eb

- Unfolding
  - Response Matrices where Nbins Reco ~ 2Nbins Parton/Particle
  - Unfolding to parton and particle level
    - For a number of regularization parameters tau do the unfolding and find the average global correlation
    - $\rho_j = \sqrt{1 - \left[(V_x)_{jj} - (V_x^{-1})_{jj}\right]^{-1}}$ $where\ V_x\ is\ the\ covariance\ matrix\ of\ x\ (gen\ level)$
    - We select the tau that minimizes ρ
    - The tau spectrum is ~[10E-10, 10]

Signal Extraction

Measured dist from data

QCD shape taken from Data (CR)

$$S(x_{reco}) = D(x_{reco}) - N_{QCD,reduced}^{(2)} C_{QCD}^{shape}(x_{reco}) Q(x_{reco}) - B(x_{reco})$$

Fiducial Yield

ABCD Method

QCD shape correction factor

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 simultaneous fit in 3 regions (0,1,2 btag) because we do not have a pure Control Region.
    - Our data CR is ttbar contaminated

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

- We assume that $N_{tt}^{(0)} = (1 - e_b)^2 N_{tt}$, $N_{tt}^{(2)} = e_b^2 N_{tt}$ and $N_{tt}^{(1)} = 2(1 - e_b)e_b N_{tt}$ where e_b is the b tagging efficiency and N_{tt} is the total ttbar yield.

Transfer Factor Calculation

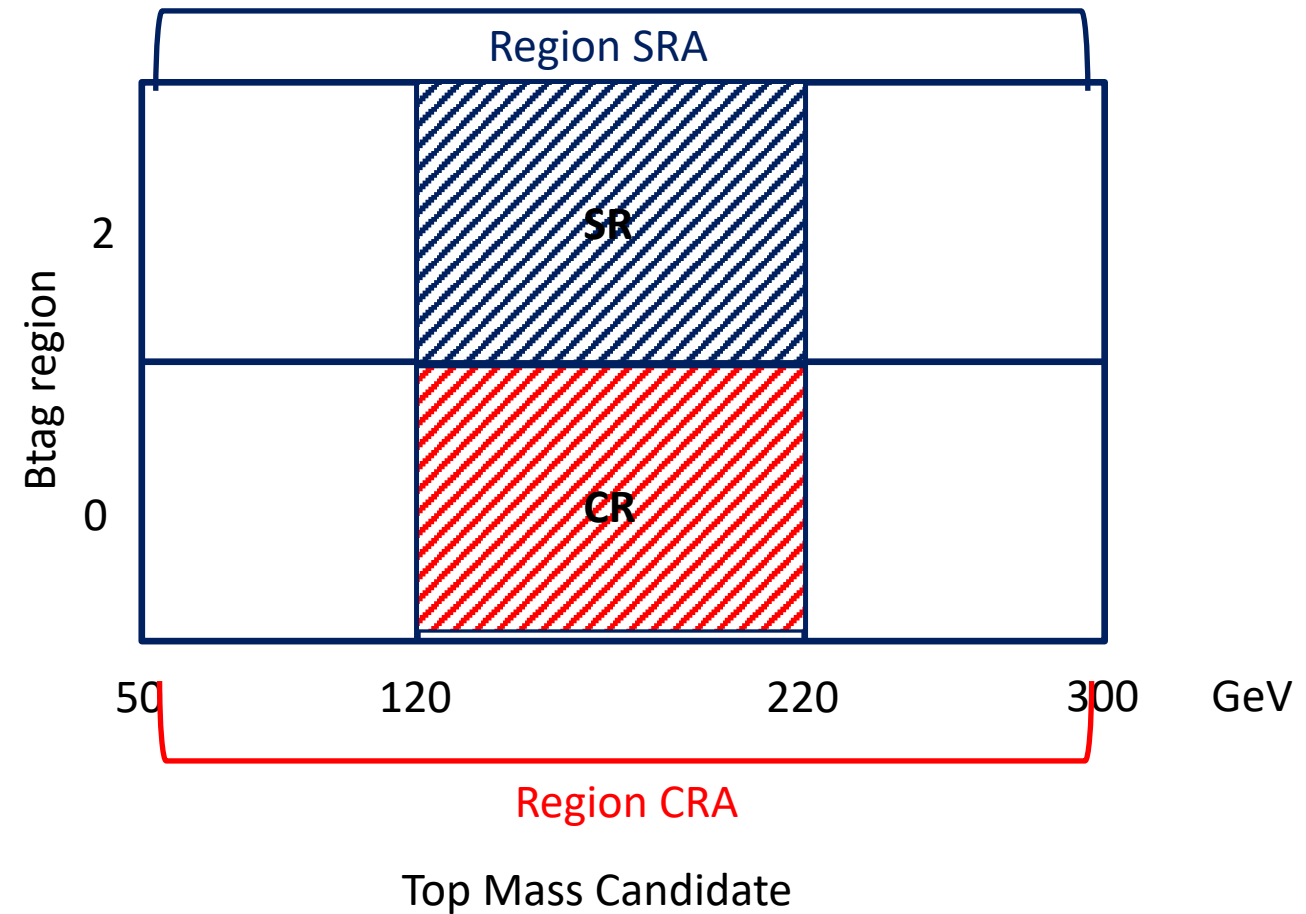We will use an ABCD method to extract the N_{QCD} in the SR

From shape we have:

$$\frac{N^{(2)}_{QCD,reduced}}{N^{(0)}_{QCD,reduced}} = \frac{N^{(2)}_{QCD,extended}}{N^{(0)}_{QCD,extended}} \implies$$

$$N^{(2)}_{QCD,reduced} = \frac{N^{(2)}_{QCD,extended}}{N^{(2)}_{QCD,extended}} N^{(0)}_{QCD,reduced}$$

Taken from fit using free e_b

$$D^{(0)}_{reduced} - TT^{(0)}_{MC,reduced}$$

Region SRA

SR

CR

Btag region

2

0

50   120   220   300   GeV

Region CRA

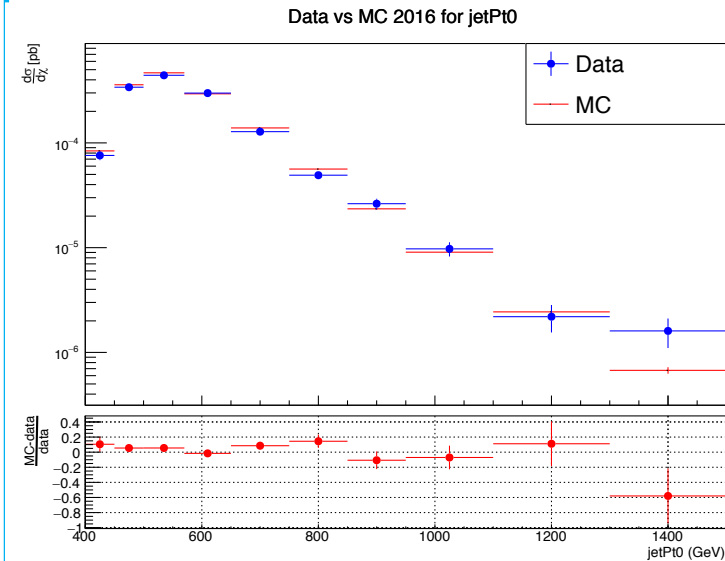Top Mass Candidate

```
NQCD in Reduced (SR):
2016: 846.365
2017: 677.041
2018: 1201.35
```

Fiducial Measurements (jetPt0) ABCD method and free eb

2016

Data vs MC 2016 for jetPt0

2017

Data vs MC 2017 for jetPt0

2018

Data vs MC 2018 for jetPt0
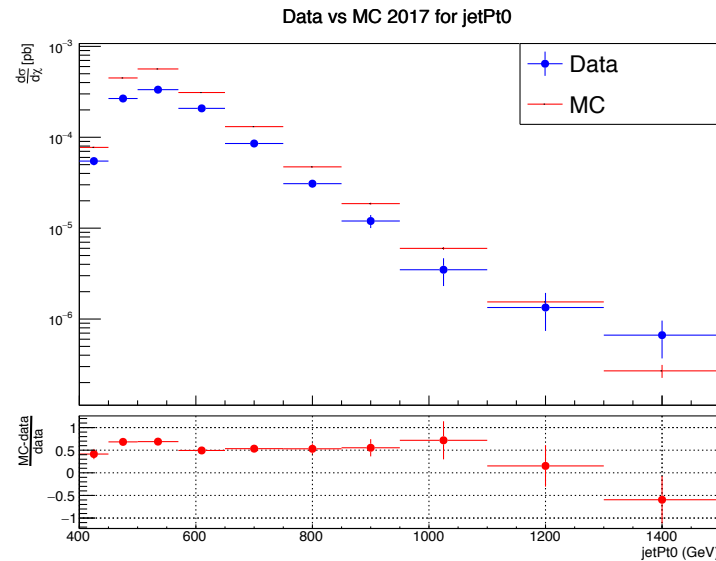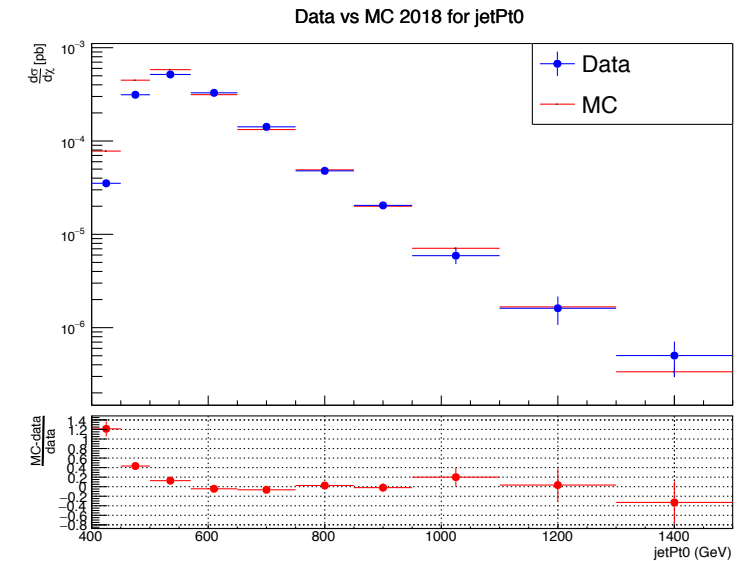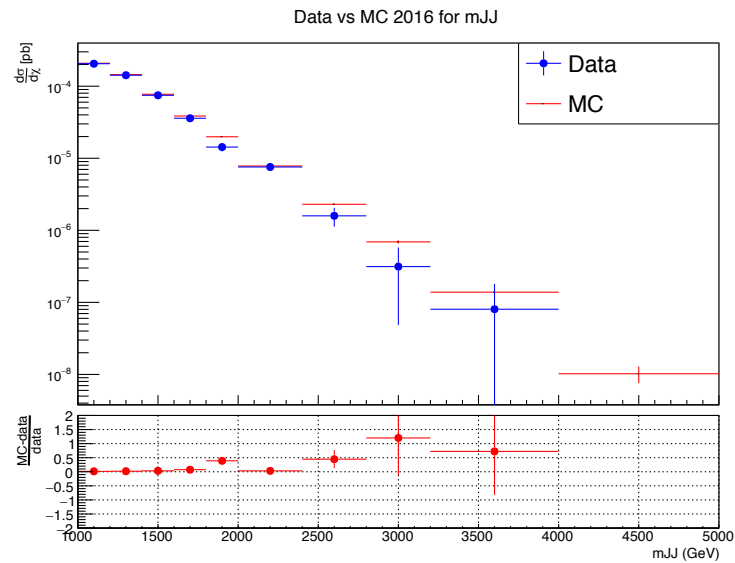

- Output is not consistent with what we expected
  - We expect r ~ 0.85 for 2016, ~0.65 for 2017 and ~0.75 for 2018
  - After signal extraction r ~ 0.96 for 2016, ~0.63 for 2017 and ~0.89 for 2018
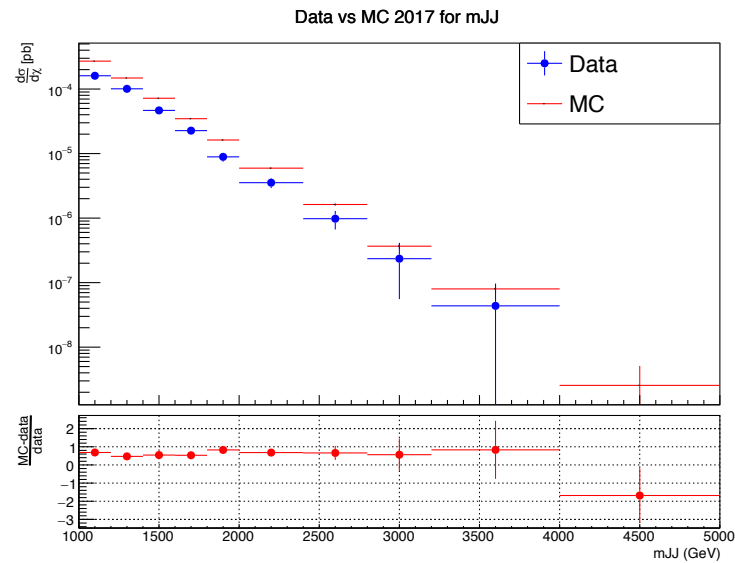 - Nqcd in SR reduced probably the problem (not enough QCD extracted?)
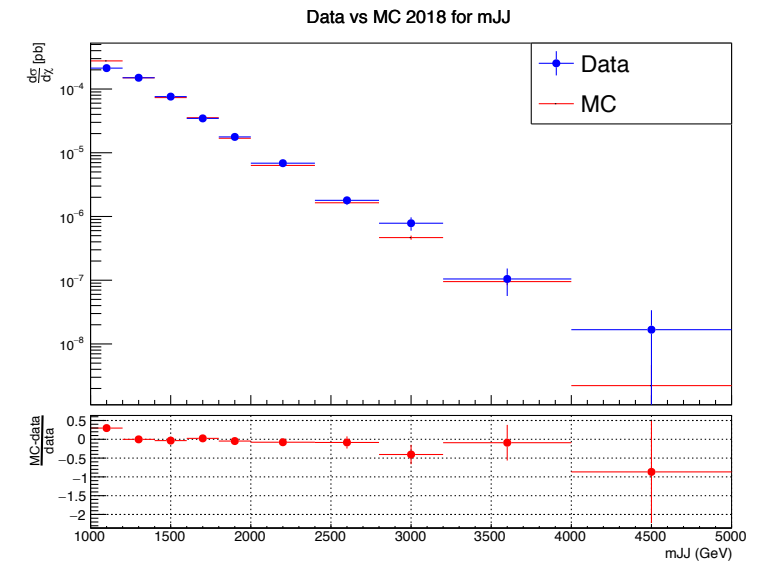
Fiducial Measurements (mJJ) ABCD method and free eb
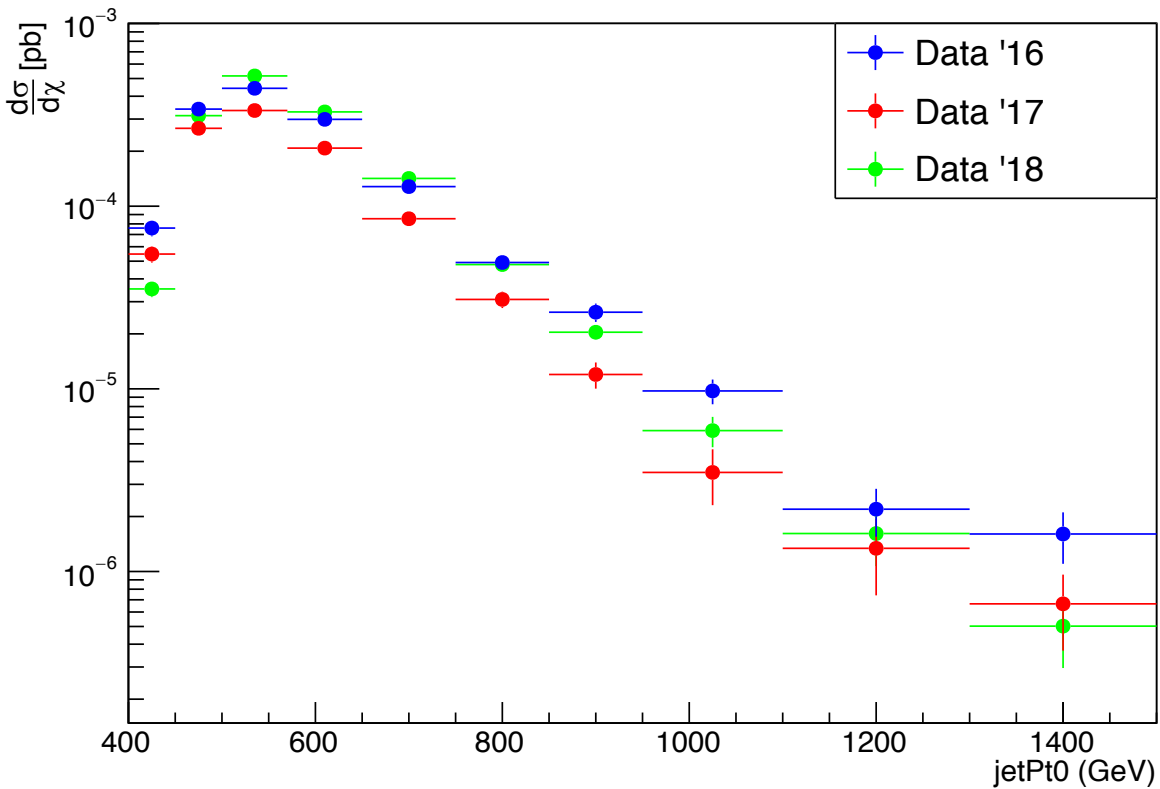
2016

2017

2018

Fiducial Measurements for all years combined

Fid. Measurements All years combined

Fid. Measurements All years combined