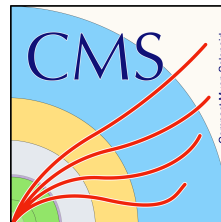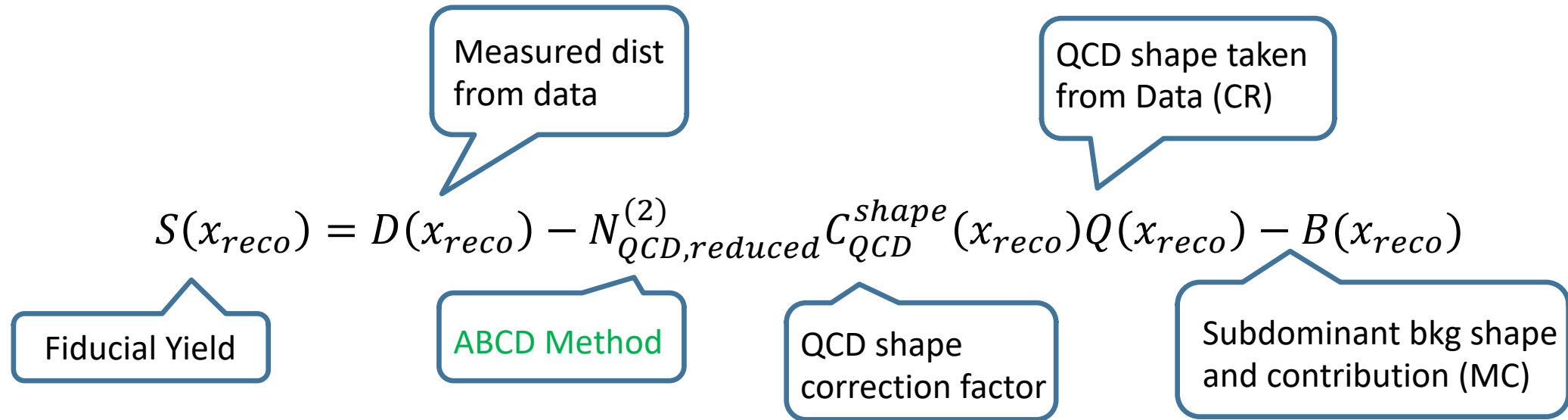# Weekly Report
NTUA
6/12/2019

George Bakas

Status Report

- Combine Tutorial/Workshop

- 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
  - Had to redo Signal extraction for unequal binning to be used in unfolding
  - Acceptance → reco bins (redone)
  - Efficiency → parton/particle bins
  - Unfloding technique
    - If square response matrix → simple inversion
    - If response matrix is not square:
      - Minimum of global correlation
      - L-curve method

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

$$D(m^t)^{(i)} = N_{tt}^{(i)} T^{(i)}(m^t, k_{MassScale}, k_{MassResolution}) + N_{bkg}^{(i)} B(m^t)(1 + k_1 x) + N_{sub}^{(i)} O^{(i)}(m^t)$$
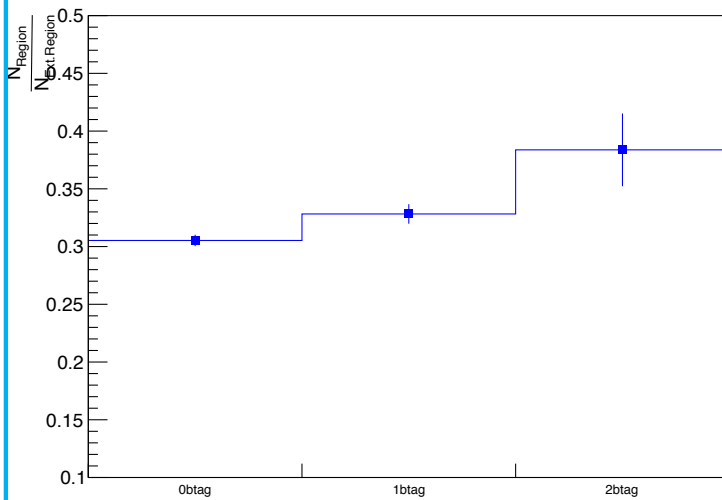
- We assume that $N_{tt}^{(0)} = (1 - e_b)^2 N_{tt}$, $N_{tt}^{(2)} = e_b^2 N_{tt}$ and $N_{tt}^{(1)} = 2(1 - e_b)e_b N_{tt}$ where e_b is the b tagging efficiency and N_{tt} is the total ttbar yield.
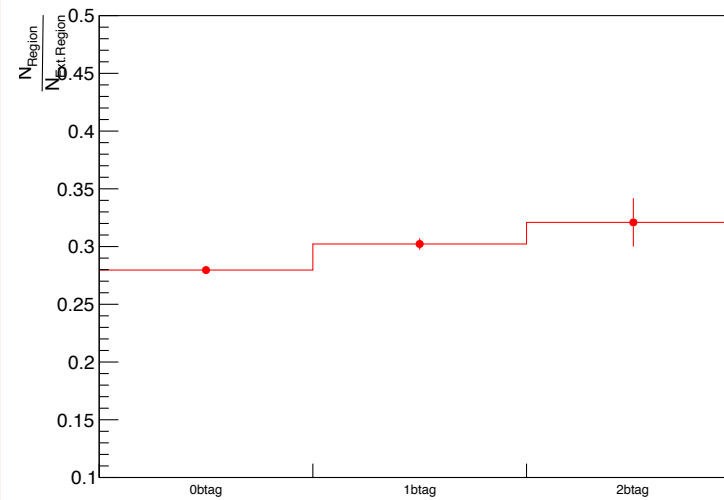
R_{yield} Calculation (MC Closure)

2016

2017

2018

R_{yield} transfer factor 2016 (Closure Test)

R_{yield} transfer factor 2017 (Closure Test)
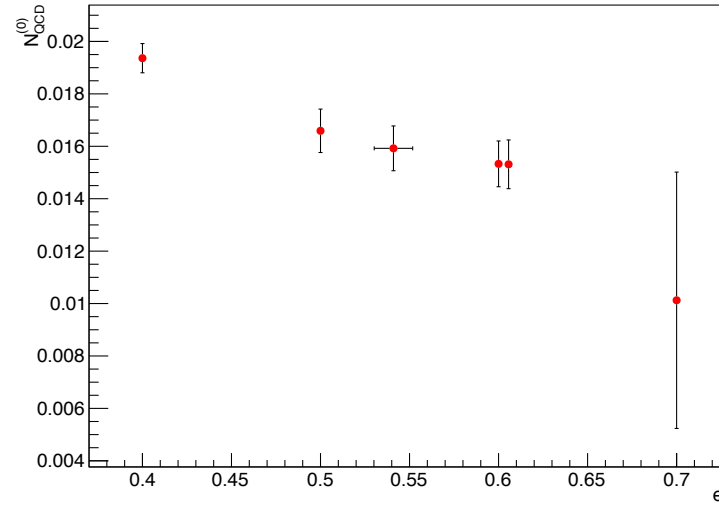

R_{yield} transfer factor 2018 (Closure Test)
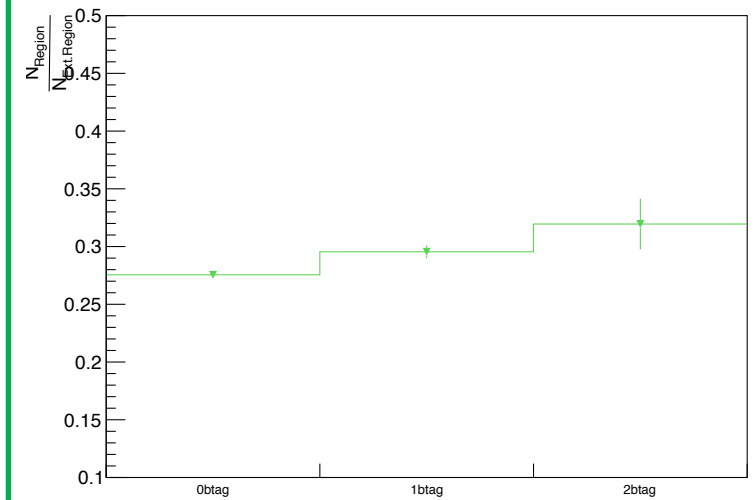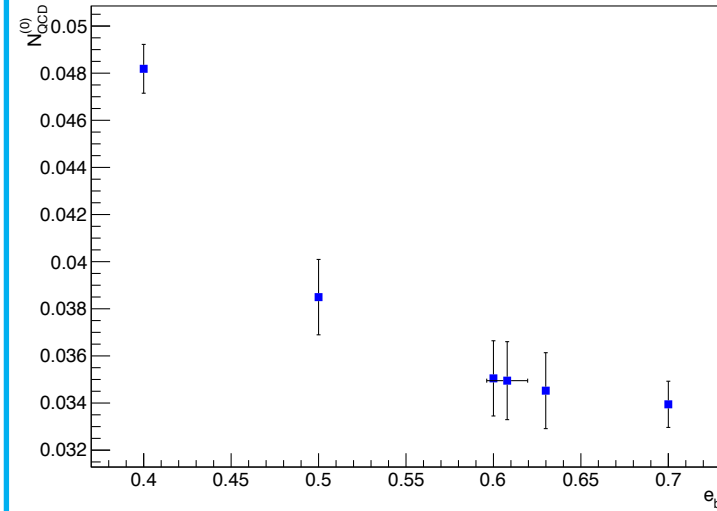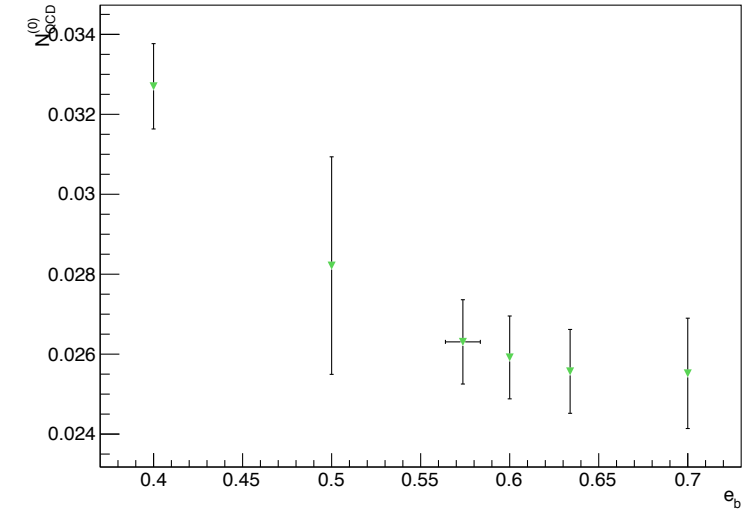
We define $R_0 = \dfrac{D_{red}^{(0)}}{D_{ext}^{(0)}}$ and $R_1 = \dfrac{D_{red}^{(0)} - N_{TT,MC\,red}^{(0)}}{D_{ext}^{(0)} - N_{TT,MC\,ext}^{(0)}}$ and NQCD in Reduced SR

```
----2016----
R0 (just data) = 0.264097
R1 (taking MC into account) = 0.262092
(R[0]-R[1])/R[0] = 0.00759071
```

```
----2017----
R0 (just data) = 0.270622
R1 (taking MC into account) = 0.269242
(R[0]-R[1])/R[0] = 0.00509682
```

```
----2018----
R0 (just data) = 0.266928
R1 (taking MC into account) = 0.265428
(R[0]-R[1])/R[0] = 0.00561997
```

Transfer Factor Calculation

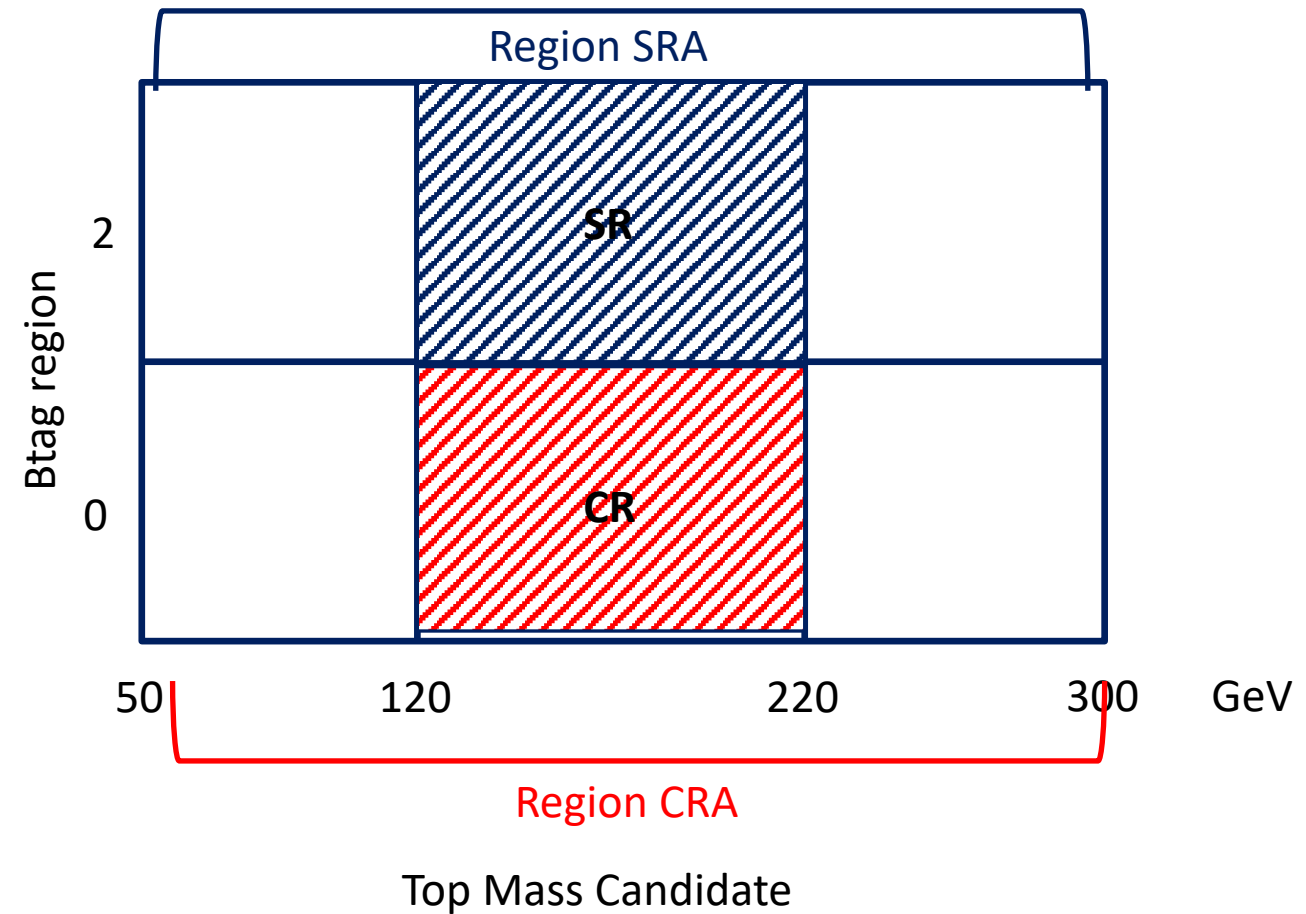We will use an ABCD method to extract the N_{QCD} in the SR

From shape we have:

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

$$N_{QCD,reduced}^{(2)} = \boxed{\frac{N_{QCD,extended}^{(2)}}{N_{QCD,extended}^{(2)}}} \; \overbrace{N_{QCD,reduced}^{(0)}}$$

Taken from fit

$$D_{reduced}^{(0)} - TT_{MC,reduced}^{(0)}$$

Region SRA

2

0

Btag region

SR

CR

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

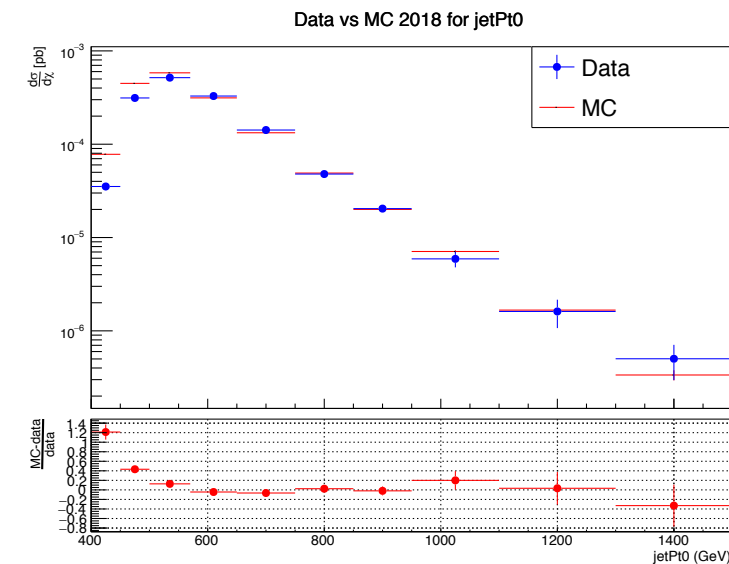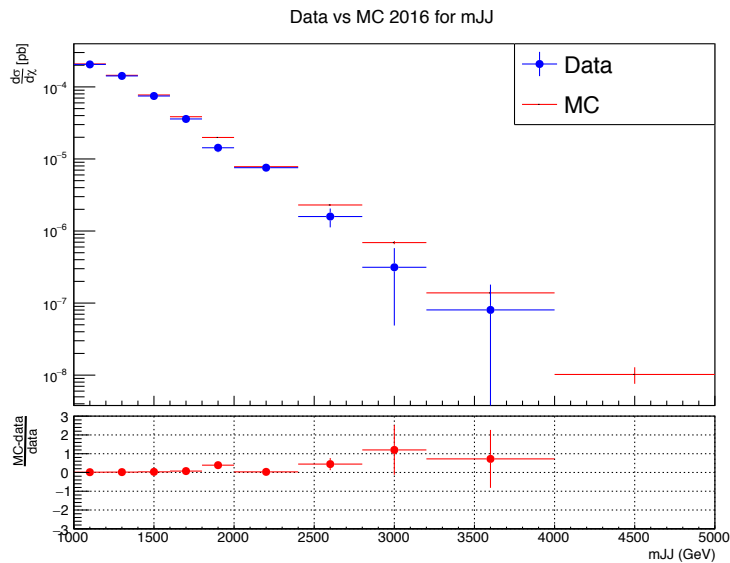2016
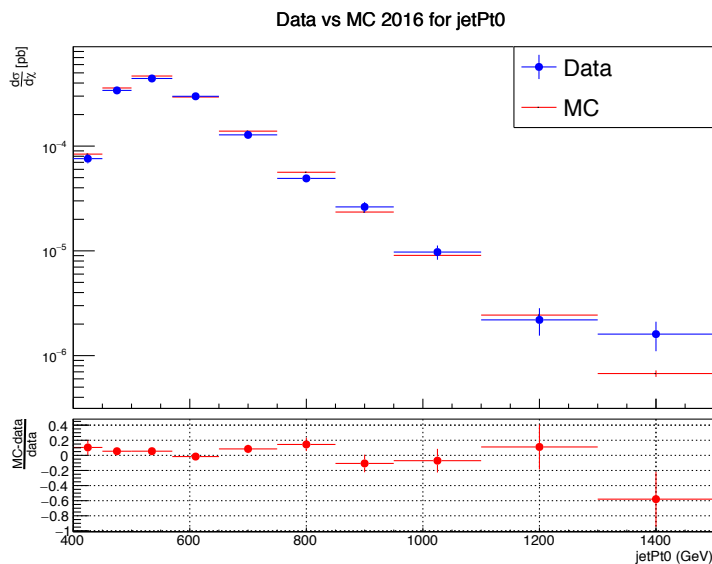
2017
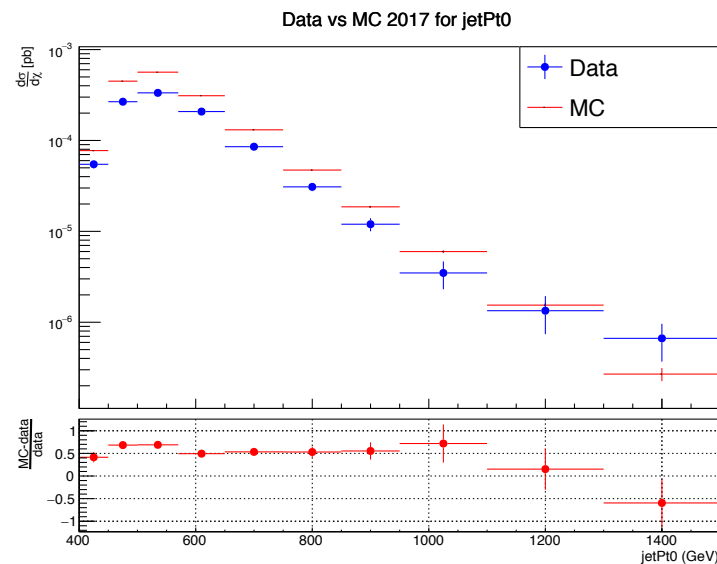
2018

- Output is not consistent with what we expected
  - We expect r ~ 0.85 for 2016, ~0.58 for 2017 and ~0.63 for 2018
  - Nqcd in SR reduced probably the problem

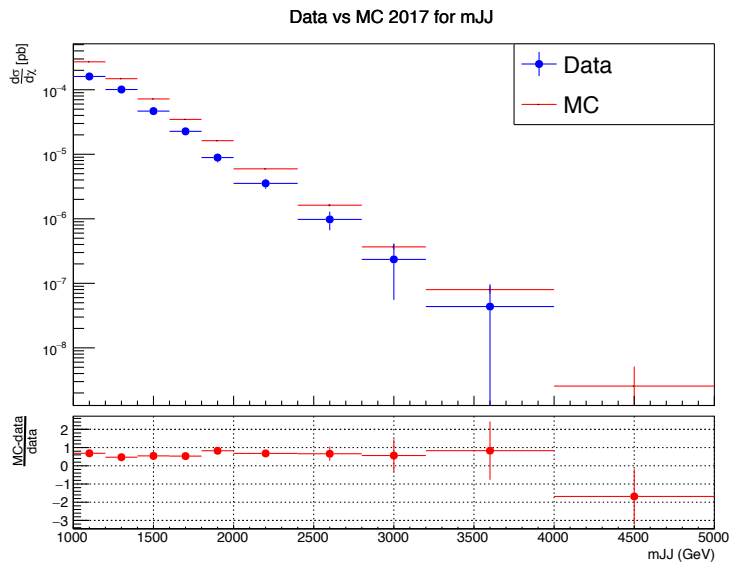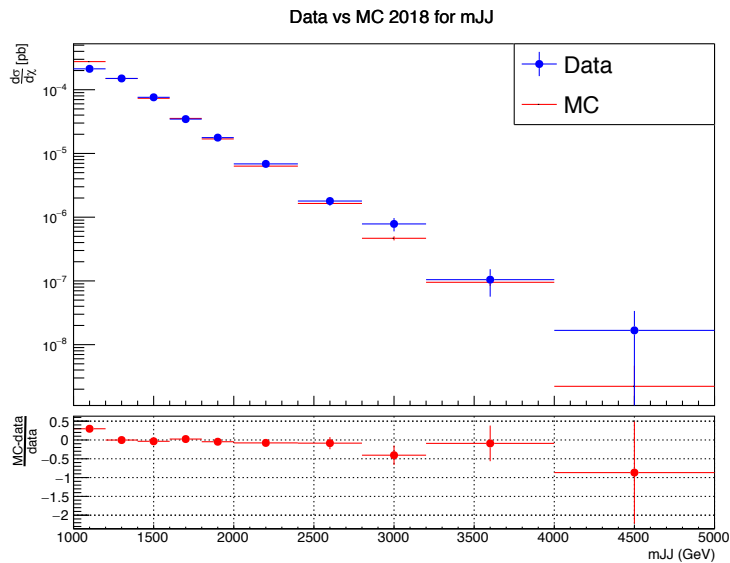# Fiducial Measurements (mJJ)

2016

2017

2018

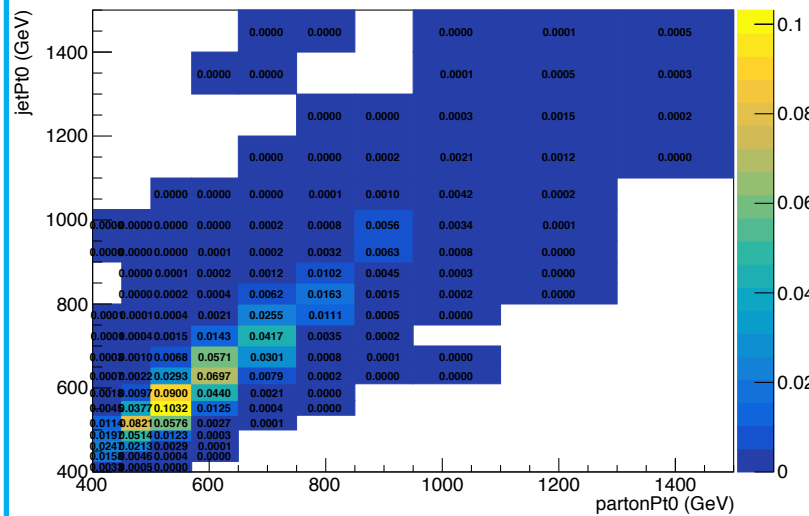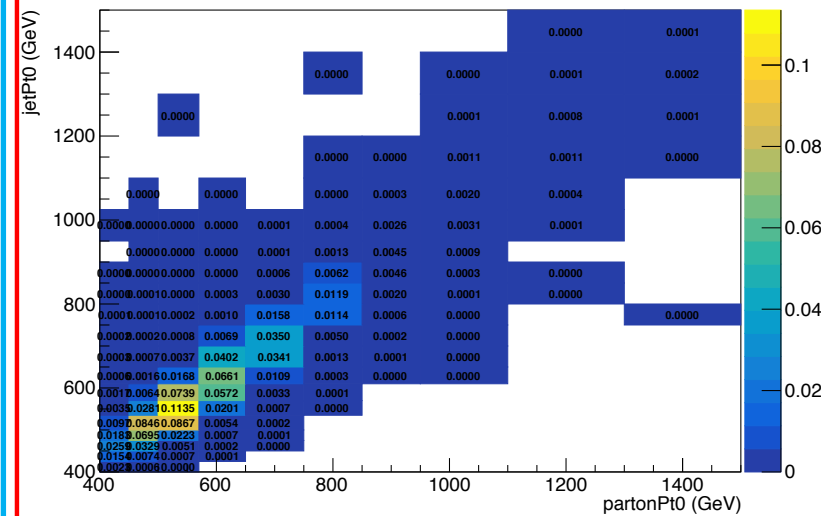# Response Matrices (Unequal Binning, jetPt0)
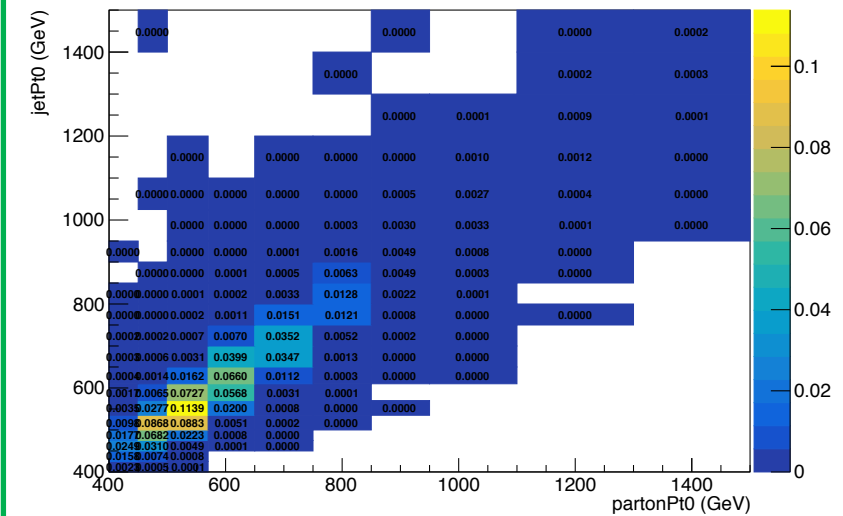
2016

Response Reco-Parton jetPt0 2016
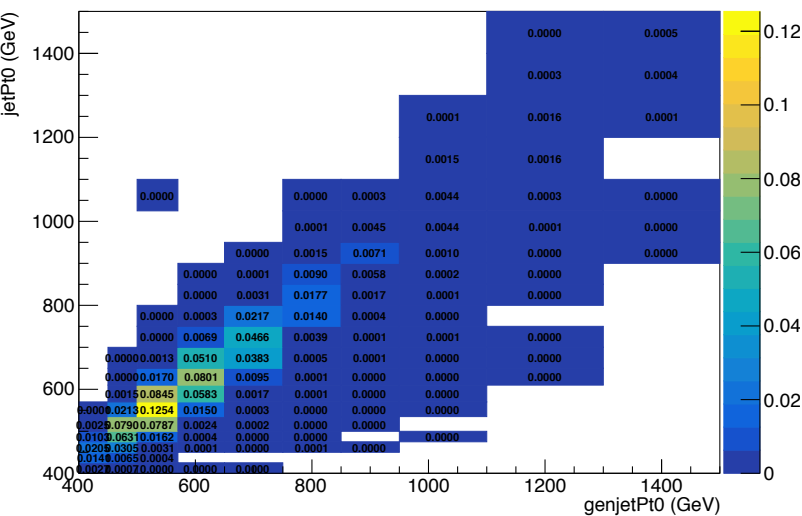

2017

Response Reco-Parton jetPt0 2017

2018

Response Reco-Parton jetPt0 2018

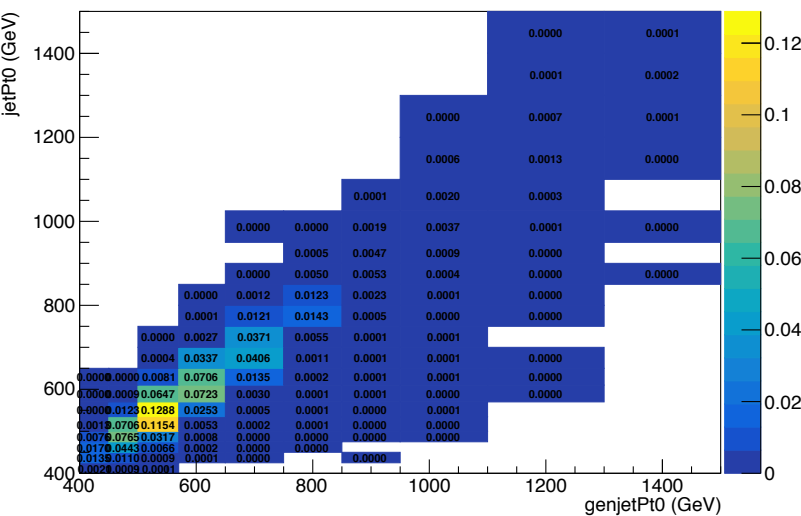# Response Matrices Particle (Unequal Binning, jetPt0)