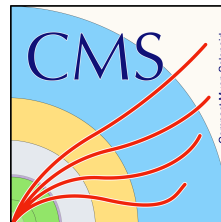


# Weekly Report NTUA 29/11/2019

George Bakas



# Signal Extraction

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

Diagram illustrating the components of the signal extraction equation:

- Fiducial Yield**: Points to  $S(x_{reco})$
- Measured dist from data**: Points to  $D(x_{reco})$
- Fitted number of QCD events in  $SR_A$** : Points to  $N_{QCD}^{fit}$
- QCD shape taken from Data (CR)**: Points to  $C_{QCD}^{shape}(x_{reco})$
- Transfer factor from  $SR_A$  to SR**: Points to  $C_{bkg}^{yield}$
- QCD shape correction factor**: Points to  $Q(x_{reco})$
- Subdominant bkg shape and contribution (MC)**: Points to  $B(x_{reco})$

- 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

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

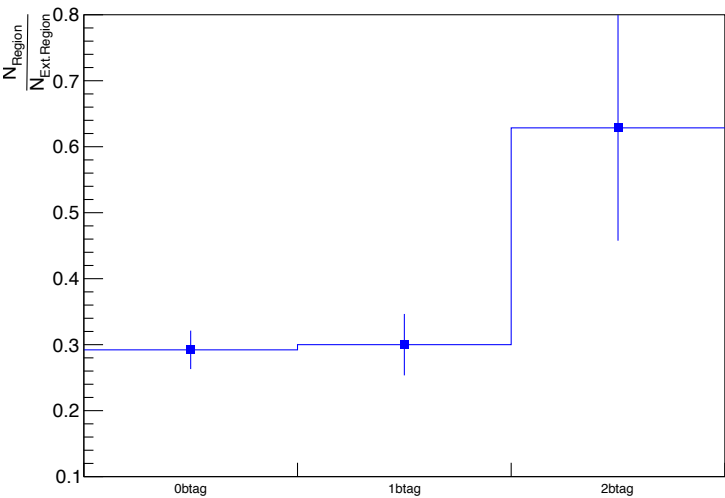
- We assume that  $N_{tt}^{(0)} = (1 - e_b)^2 N_{tt}$ ,  $N_{tt}^{(2)} = e_b^2 N_{tt}$  and  $N_{tt}^{(1)} = 2(1 - e_b)e_b N_{tt}$  where  $e_b$  is the b tagging efficiency and  $N_{tt}$  is the total ttbar yield.



# R<sub>yield</sub> Calculation (Data)

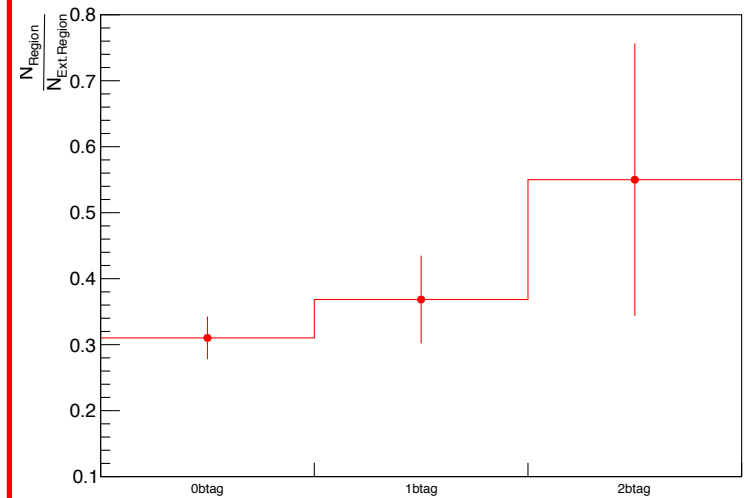
2016

R<sub>yield</sub> transfer factor 2016



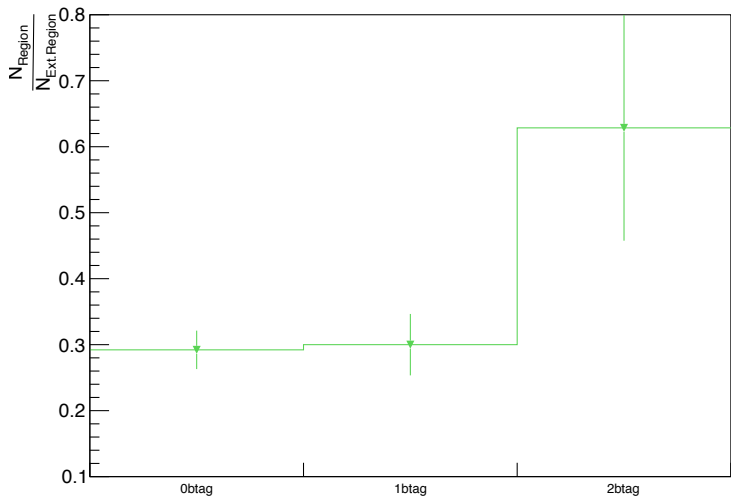
2017

R<sub>yield</sub> transfer factor 2017



2018

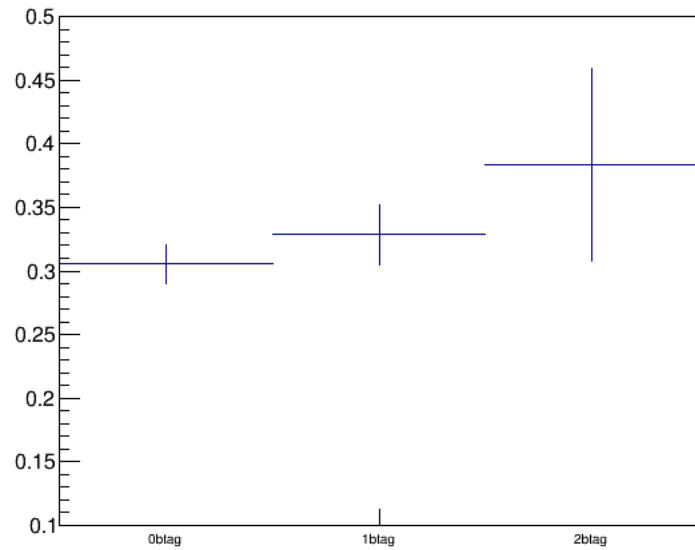
R<sub>yield</sub> transfer factor 2018



# R<sub>yield</sub> Calculation (MC Closure)

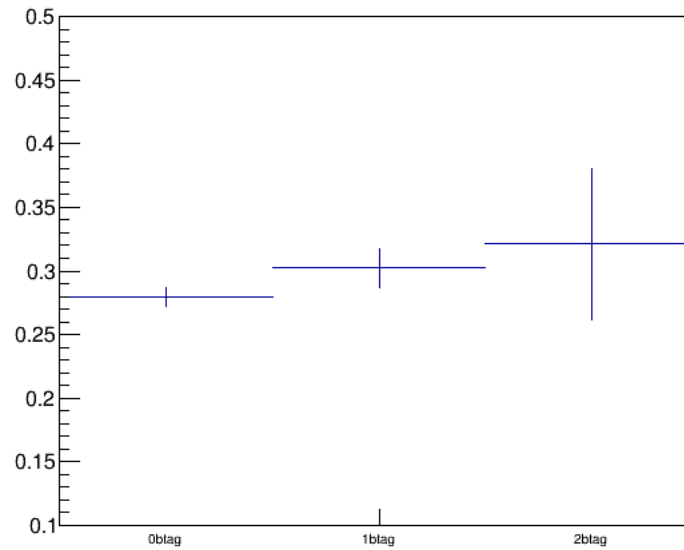
2016

2016



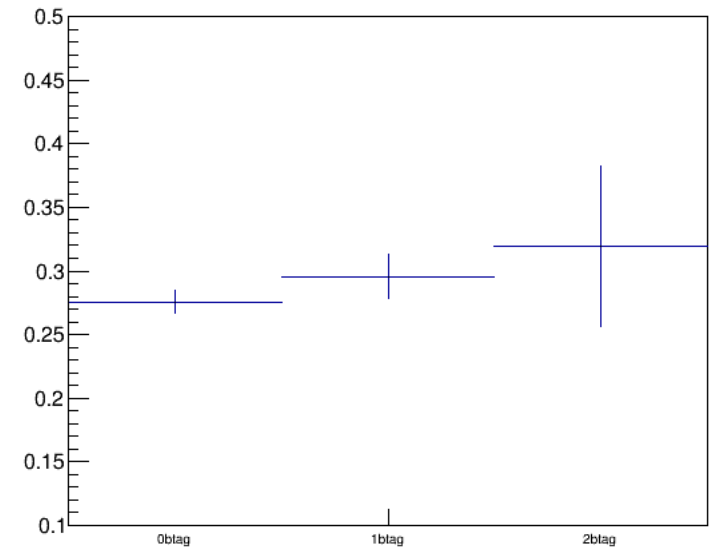
2017

2017



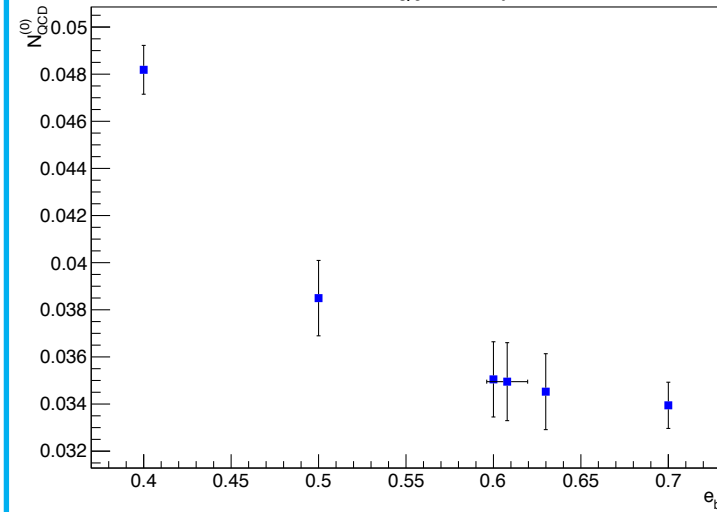
2018

2018

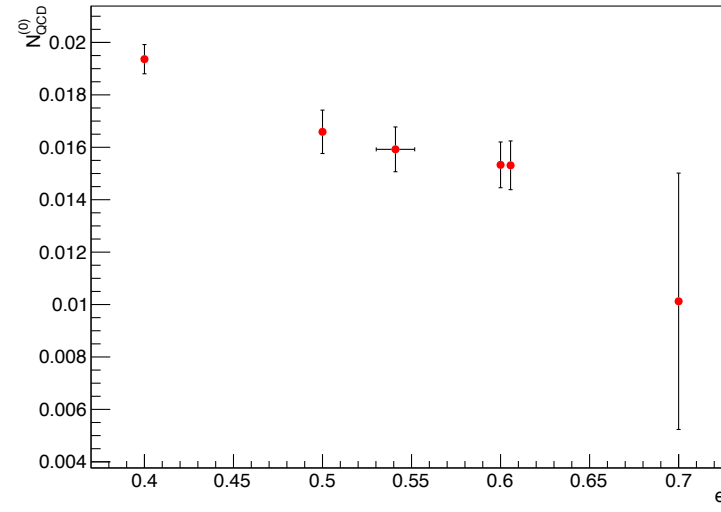


# NQCD (2) / NQCD (0) vs $e_b$

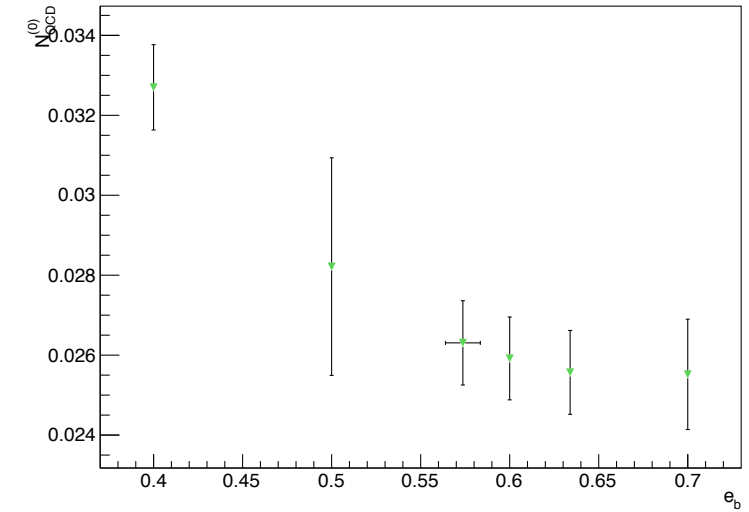
$N_{QCD}^{(2)}/N_{QCD}^{(0)}$  vs  $e_b$



$N_{QCD}^{(2)}/N_{QCD}^{(0)}$  vs  $e_b$



$N_{QCD}^{(2)}/N_{QCD}^{(0)}$  vs  $e_b$



We define  $R_0 = \frac{D_{red}^{(0)}}{D_{ext}^{(0)}}$  and  $R_1 = \frac{D_{red}^{(0)} - N_{TT,MC red}^{(0)}}{D_{ext}^{(0)} - N_{TT,MC ext}^{(0)}}$  and NQCD in Reduced SR  $N_{QCD,red}^{(2)} = \frac{N_{fit,ext}^{(2)}}{N_{fit,red}^{(2)}} * N_{QCDext}^0$  where  $N_{QCDext}^0 = D_{red}^0 - TT_{MC,red}^{(0)}$

----2016----

$R_0$  (just data) = 0.264097  
 $R_1$  (taking MC into account) = 0.262092  
 $(R[0]-R[1])/R[0] = 0.00759071$

NQCD in Reduced (SR): 846.365

----2017----

$R_0$  (just data) = 0.270622  
 $R_1$  (taking MC into account) = 0.269242  
 $(R[0]-R[1])/R[0] = 0.00509682$

NQCD in Reduced (SR): 677.041

----2018----

$R_0$  (just data) = 0.266928  
 $R_1$  (taking MC into account) = 0.265428  
 $(R[0]-R[1])/R[0] = 0.00561997$

NQCD in Reduced (SR): 1201.35

