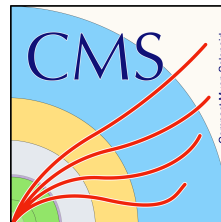


# Mass Fit results and btagging efficiency

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# Simultaneous Fit in 3 regions

- As decided the previous week → Simultaneous fit in 3 regions (2btag, 1btag and 0btag)

$$D(x)^{(0)} = N_{tt}^{(0)} T(x, kMassScale, kMassResolution) + N_{bkg}^{(0)} B(x, \vec{p}) + N_{sub}^{(0)} O(x)$$

$$D(x)^{(2)} = N_{tt}^{(2)} T(x, kMassScale, kMassResolution) + N_{bkg}^{(2)} B(x, \vec{p})(1 + kx) + N_{sub}^{(2)} O(x)$$

$$D(x)^{(1)} = N_{tt}^{(1)} T(x, kMassScale, kMassResolution) + N_{bkg}^{(1)} B(x, \vec{p})(1 + kx) + N_{sub}^{(1)} O(x)$$

- $N_{sub}^{(0)}$  is limited into  $0.9N_{sub,MC}^0$  up to  $1.1N_{sub,MC}^0$
- 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.

We can either have  $e_b$  and  $N_{tt}$  as free parameters in the fit or  $N_{tt}^{(0)}$ ,  $N_{tt}^{(1)}$ ,  $N_{tt}^{(2)}$

- We found out the the btagging efficiency and the total Ntt yield are highly correlated.
  - We decided to try and fix the btagging parameter by measuring it ourselves
  - For the btagging efficiency calculation:
  - $e_b = \frac{\#subjects with flavour id requirement + deepCSV btagged}{\#subjects with flavour id requirement (b)}$  where all selected events pass baseline + parton selection
- With mass restriction loose (50,300) GeV:  $e_b = 0.0629909$
- With mass restriction tight (120,220) GeV  $e_b = 0.656748$



# Overview

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- Extension of Signal Region  $\rightarrow SR_A = SR - \text{Mass Selection cuts}$
- Selection:
  - Jet Matching
  - Parton cuts:
    - $\text{partonPt}[0],[1] > 400$
    - $|\text{partonEta}[0],[1]| < 2.4$
    - $m_{T\bar{T}b} \text{Parton} > 1000$
  - Reco cuts:
    - $n_{\text{Jets}} > 1$
    - $n_{\text{Leptons}} = 0$
    - $m_{JJ} > 1000$
    - $\text{jetPt}[0],[1] > 400$
    - $|\text{jetEta}[0],[1]| < 2.4$
    - bTagging cut (medium WP **deepCSV**) (2016: 0.6321, 2017: 0.4941, 2018: 0.4184)
    - Tagger cut (**top Tagger**) (2016: 0.2, 2017: 0.0, 2018: 0.1)
    - TriggerBit



# Purpose of this presentation

- Show the fit result in two ways:
  - Fix the  $e_b$  parameter at a certain value → This will be **Method A**
  - Let the  $e_b$  parameter run on a very tight interval [0.5,0.8] → This will be **Method B**
- Results:
  - **Method A**:  $r = 0.85347$  with Ntt expected = 16351 and Ntt observed = 13955
  - **Method B**:  $r = 1.02045$  with Ntt expected = 16351 and Ntt observed = 16686

Floating Parameter	FinalValue	+/-	Error
kMassResol	9.2150e-01	+/-	2.07e-02
kMassScale	1.0023e+00	+/-	1.60e-03
kQCD_1b	6.3680e-03	+/-	4.58e-04
kQCD_2b	5.9385e-02	+/-	3.48e-02
nFitBkg_0b	4.5269e+03	+/-	4.25e+01
nFitBkg_1b	2.3356e+03	+/-	2.73e+02
nFitBkg_2b	2.0703e+02	+/-	2.32e+01
nFitQCD_0b	8.8323e+04	+/-	3.13e+02
nFitQCD_1b	3.0542e+04	+/-	2.62e+02
nFitQCD_2b	2.8400e+03	+/-	1.55e+02
nFitSig	1.3955e+04	+/-	3.69e+02

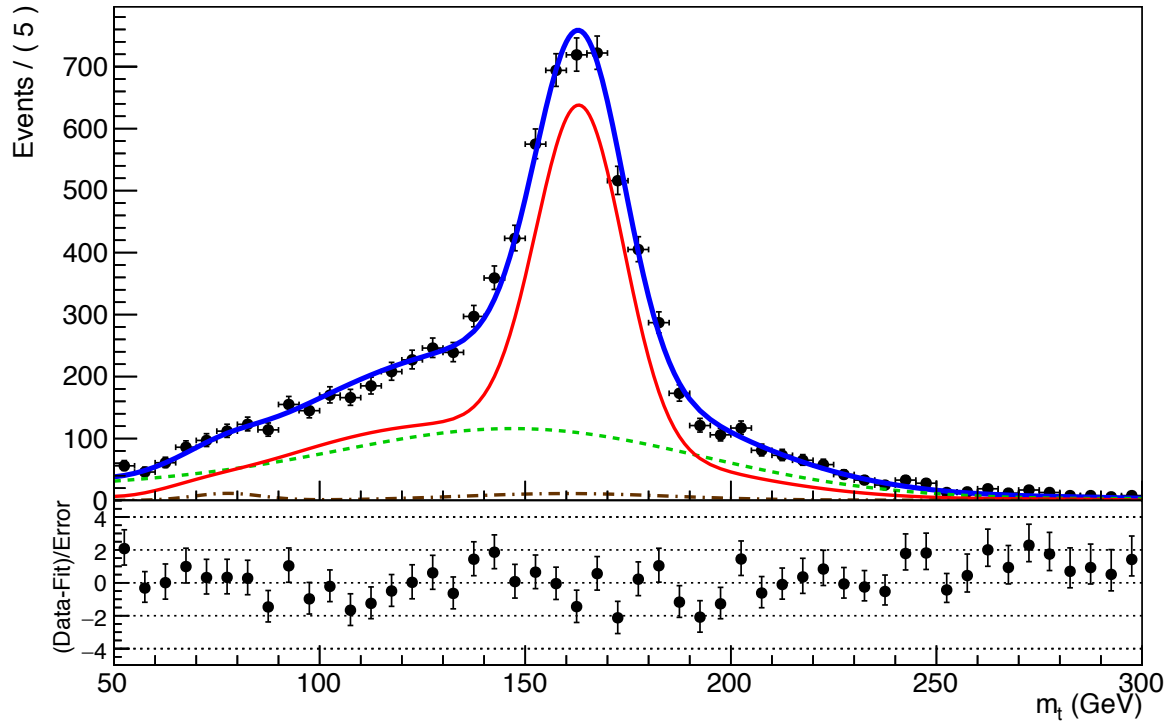
Floating Parameter	FinalValue	+/-	Error
btagEff	5.6029e-01	+/-	1.17e-02
kMassResol	9.6557e-01	+/-	2.29e-02
kMassScale	1.0020e+00	+/-	1.60e-03
kQCD_1b	5.8296e-03	+/-	4.50e-04
kQCD_2b	7.7313e-02	+/-	4.98e-02
nFitBkg_0b	4.5269e+03	+/-	5.63e+01
nFitBkg_1b	2.3159e+03	+/-	4.02e+02
nFitBkg_2b	2.3726e+02	+/-	4.25e+01
nFitQCD_0b	8.7019e+04	+/-	4.15e+02
nFitQCD_1b	2.8973e+04	+/-	3.93e+02
nFitQCD_2b	2.9980e+03	+/-	1.43e+02
nFitSig	1.6686e+04	+/-	6.56e+02



# Simultaneous Fit in 3 regions Method A

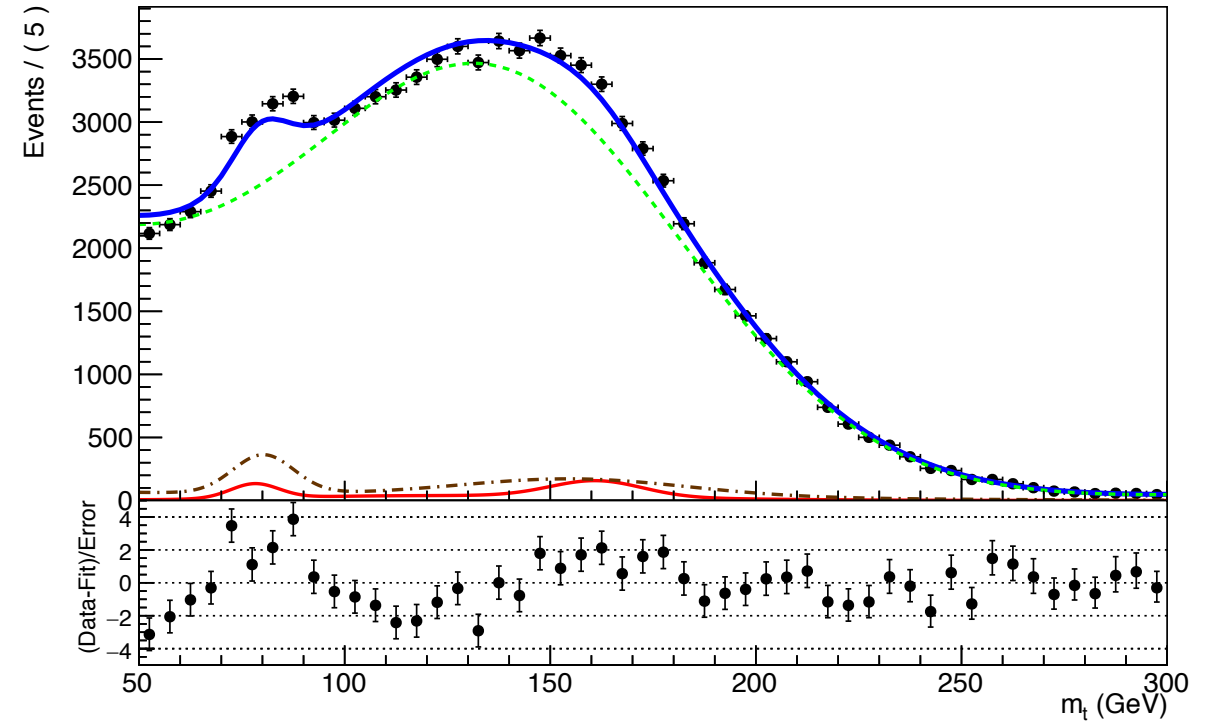
Signal Region (2btag)

A RooPlot of "mTop"



Control Region (0btag)

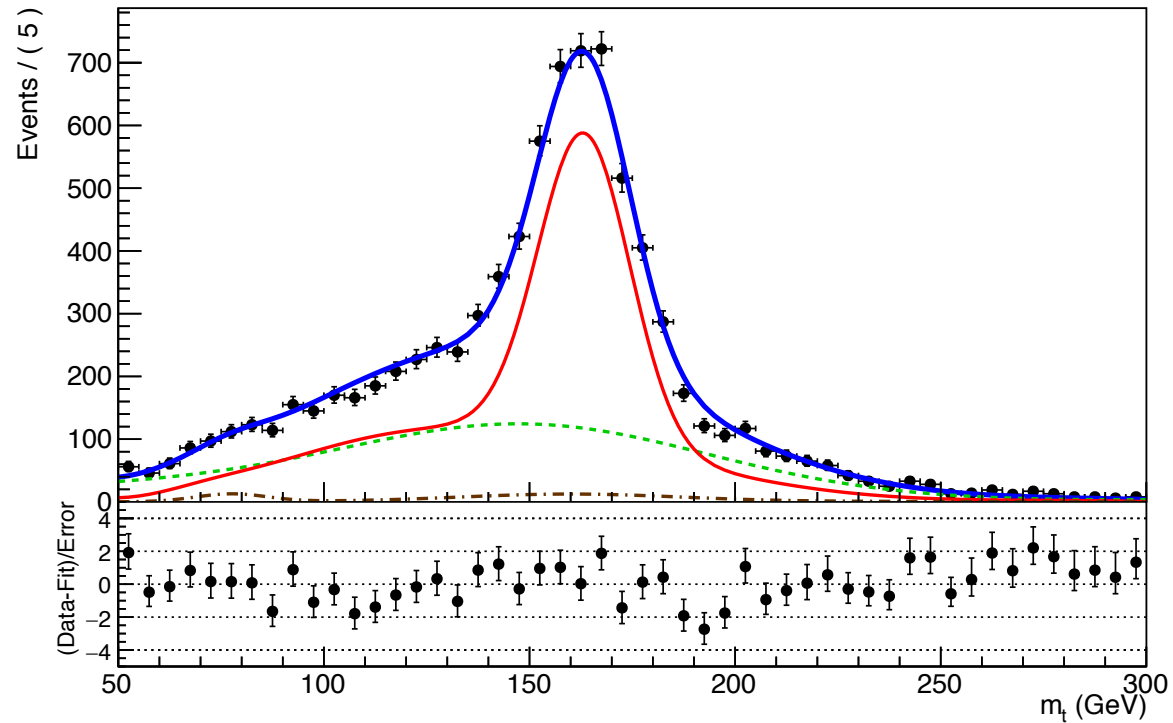
A RooPlot of "mTop"



# Simultaneous Fit in 3 regions Method B

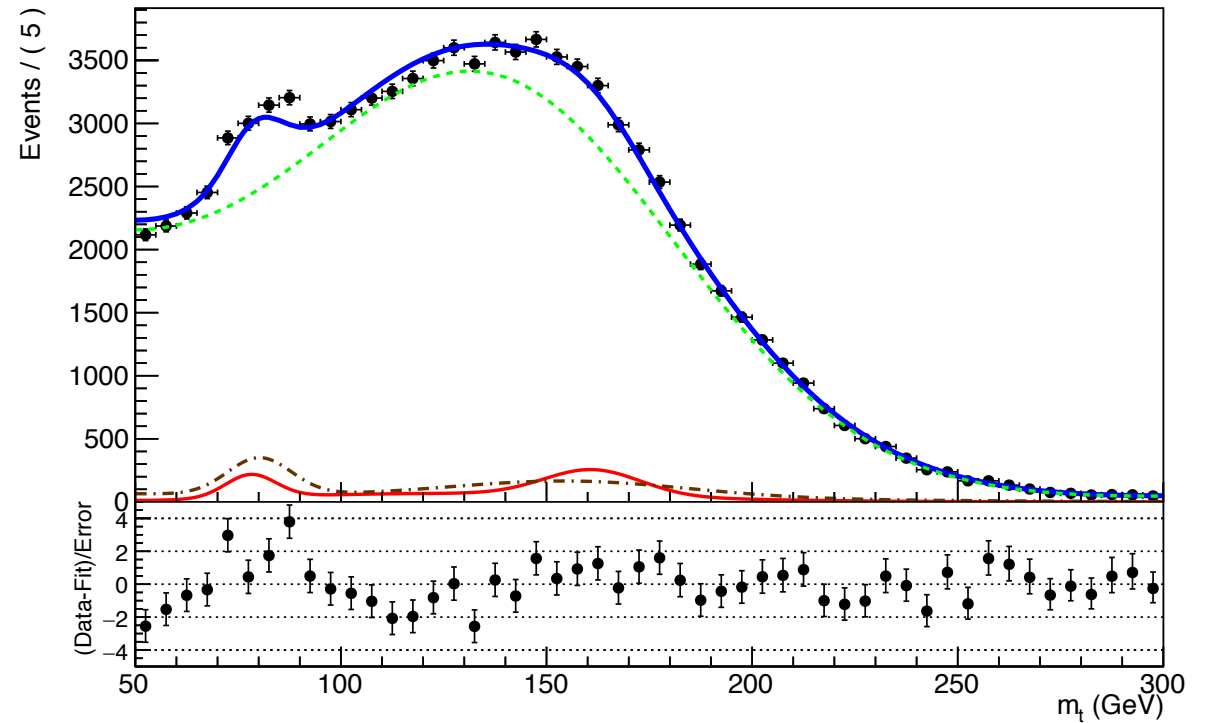
Signal Region (2btag)

A RooPlot of "mTop"



Control Region (0btag)

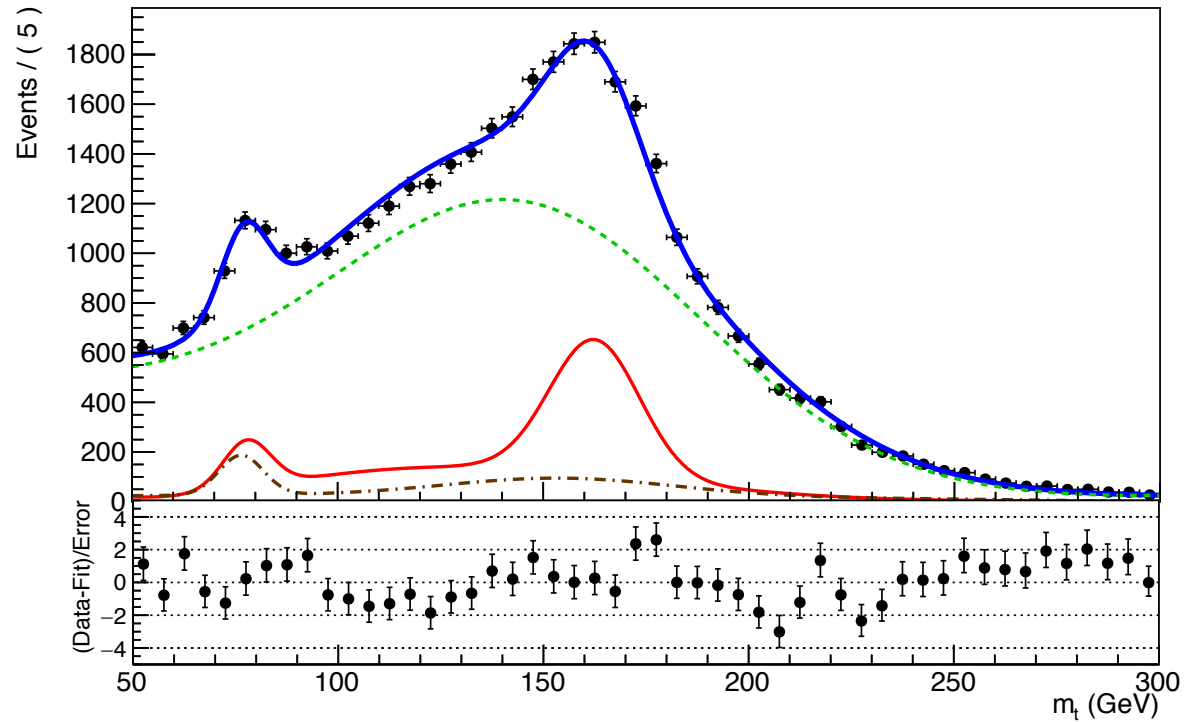
A RooPlot of "mTop"



# Simultaneous Fit in 3 regions (1btag Region)

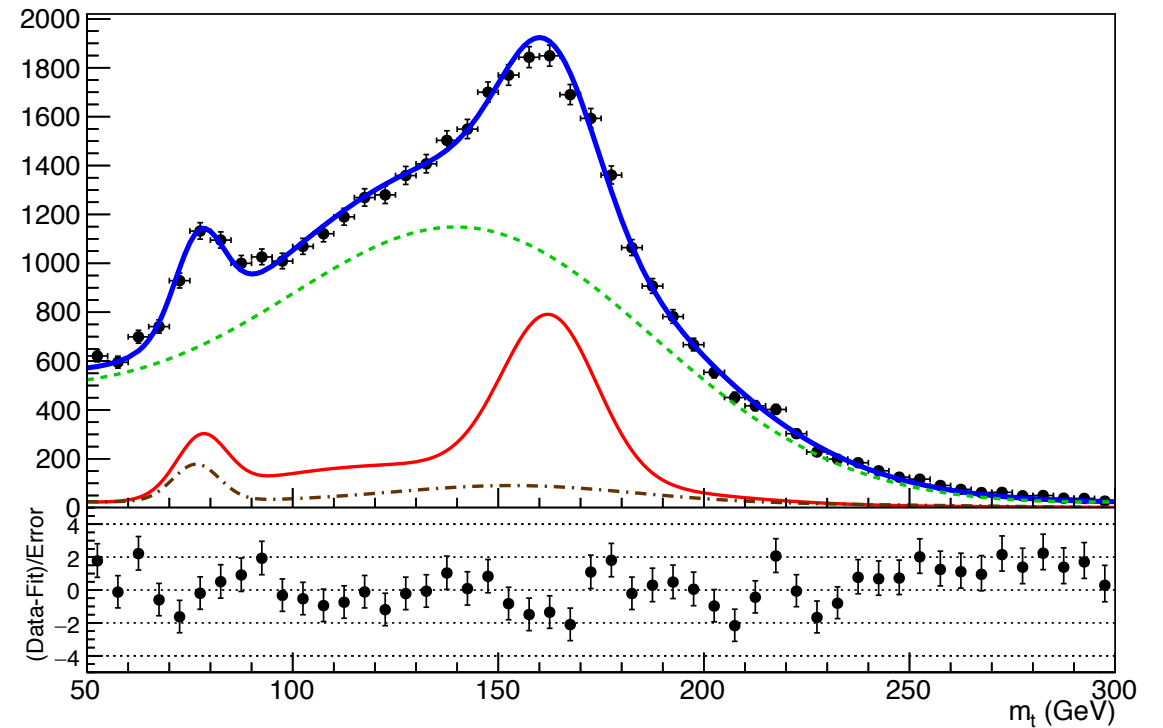
Method A

A RooPlot of "mTop"

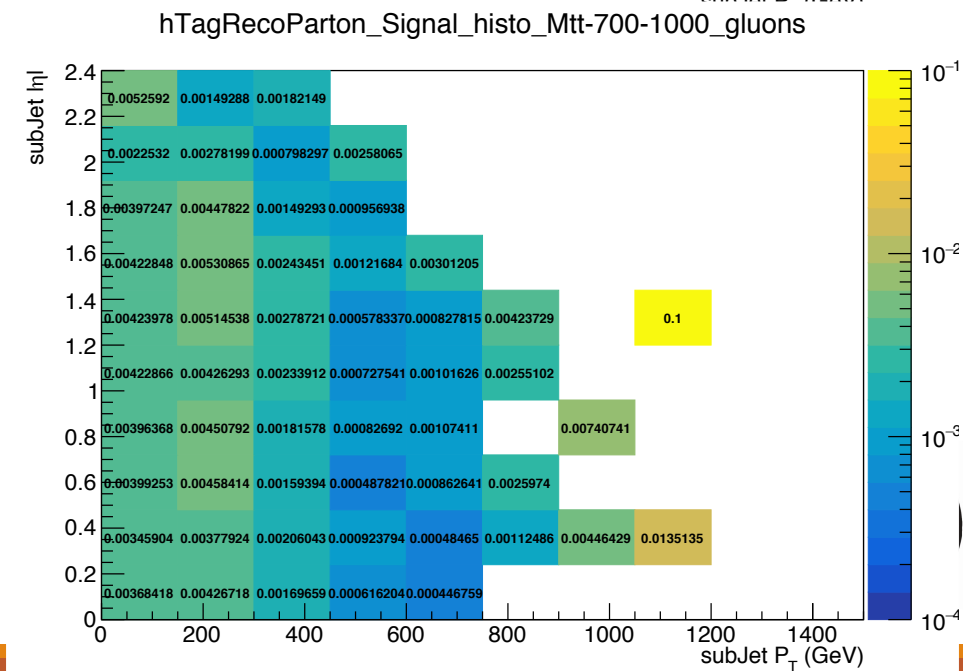
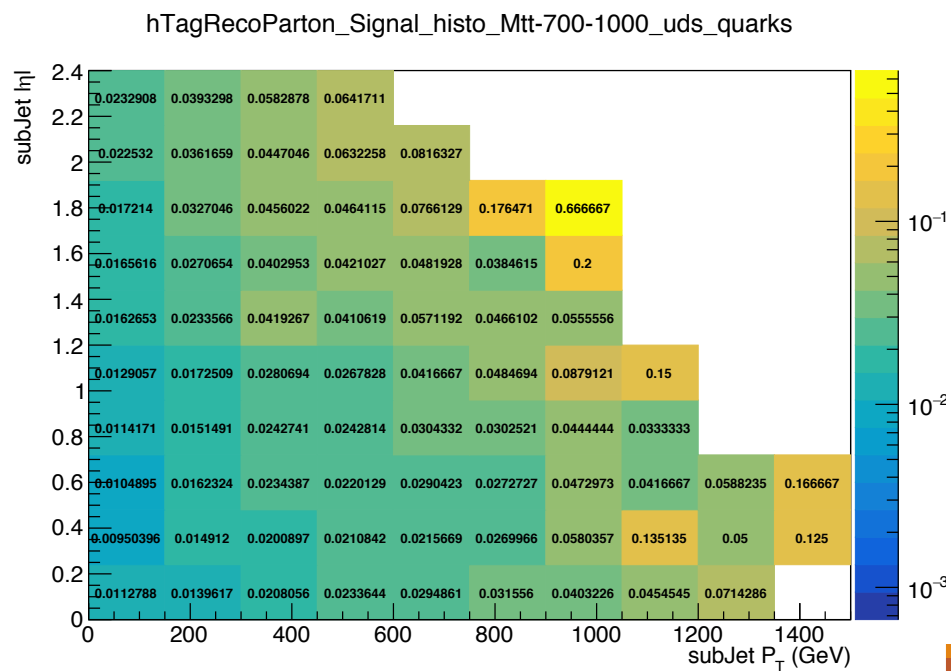
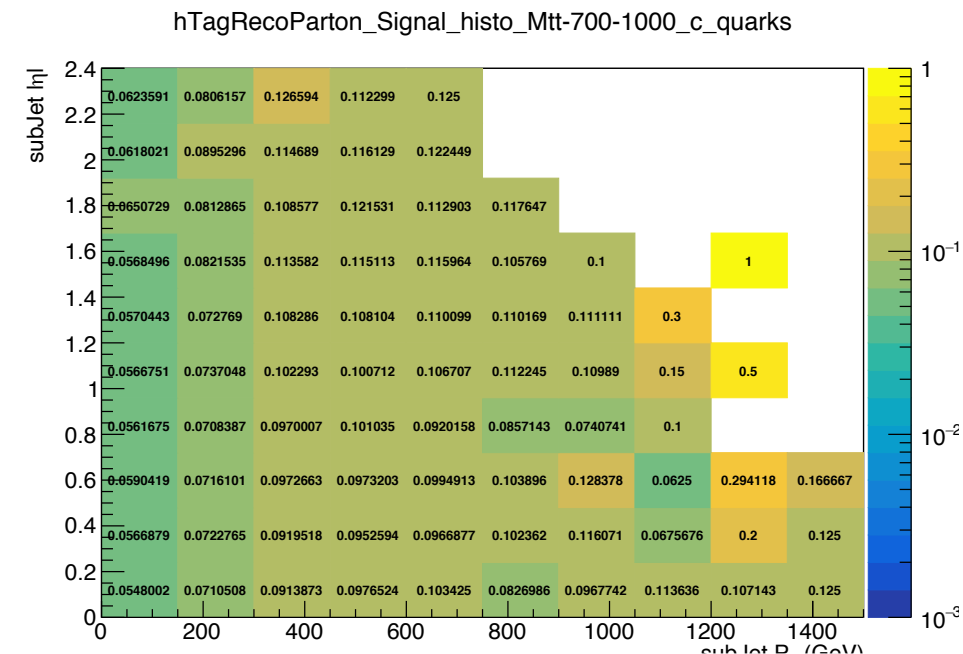
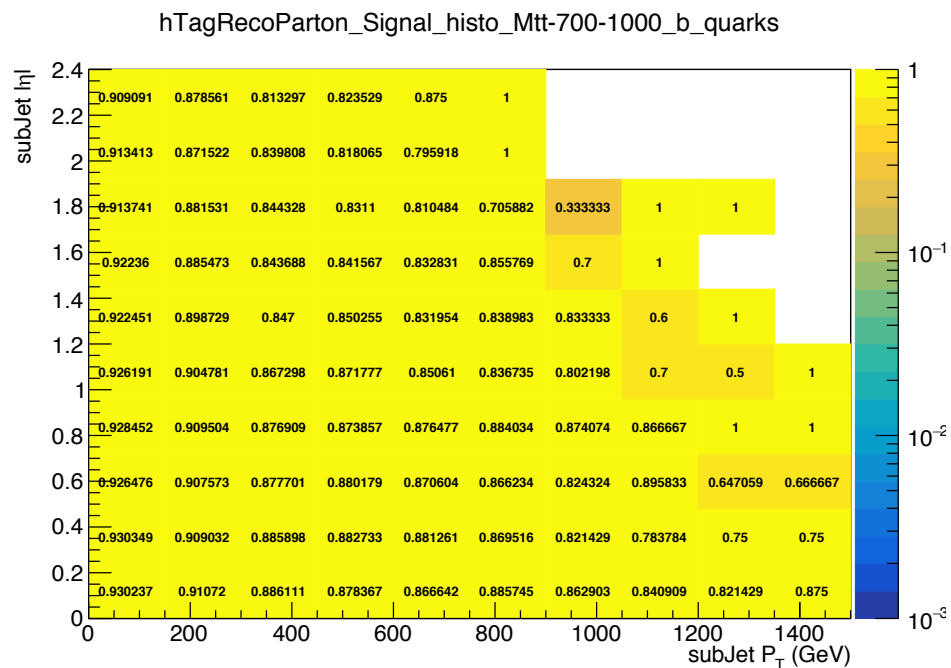


Method B

A RooPlot of "mTop"



# b-tagging Efficiency





# hAcceptance

b-tagging Purity

