Mass Fit results and btagging efficiency

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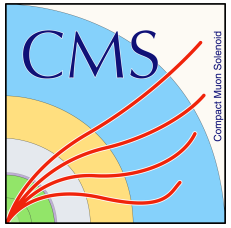


Simultaneous Fit in 3 regions

- 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 $0.9 N_{sub,MC}^{0}\ up\ to\ 1.1 N_{sub,MC}^{0}$
  - We assume that $N_{tt}^{(0)} = (1 - \mathrm{e_b})^2 \mathrm{N_{tt}}$, $\mathrm{N_{tt}^{(2)}} = \mathrm{e_b^2 N_{tt}}$ and $\mathrm{N_{tt}^{(1)}} = 2(1 - e_b) e_b N_{tt}$ where $\mathrm{e_b}$ is the b tagging efficiency and $\mathrm{N_{tt}}$ is the total ttbar yield.

  We can either have $\mathrm{e_b}$ and $\mathrm{N_{tt}}$ 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:
  - $e_b = \frac{\#subjets\ with\ flavour\ id\ requirement + deepCSV\ btagged}{\#subjets\ with\ flavour\ id\ requirement\ (b)}$ where all selected events pass baseline + parton selection

    - With mass restriction loose (50,300) GeV: $\mathrm{e_b}$ = 0. 0.629909
    - With mass restriction tight (120,220) GeV $\mathrm{e_b}$ = 0.656748

Overview

- Extension of Signal Region → SR_A = SR – Mass Selection cuts
- Selection:
  - Jet Matching
  - Parton cuts:
    - partonPt[0],[1] > 400
    - |partonEta[0],[1]| < 2.4
    - mTTbarParton > 1000
- Reco cuts:
  - nJets > 1
  - nLeptons = 0
  - mJJ > 1000
  - jetPt[0],[1] > 400
  - |jetEta[0],[1]| < 2.4
  - bTagging cut (mediugm 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

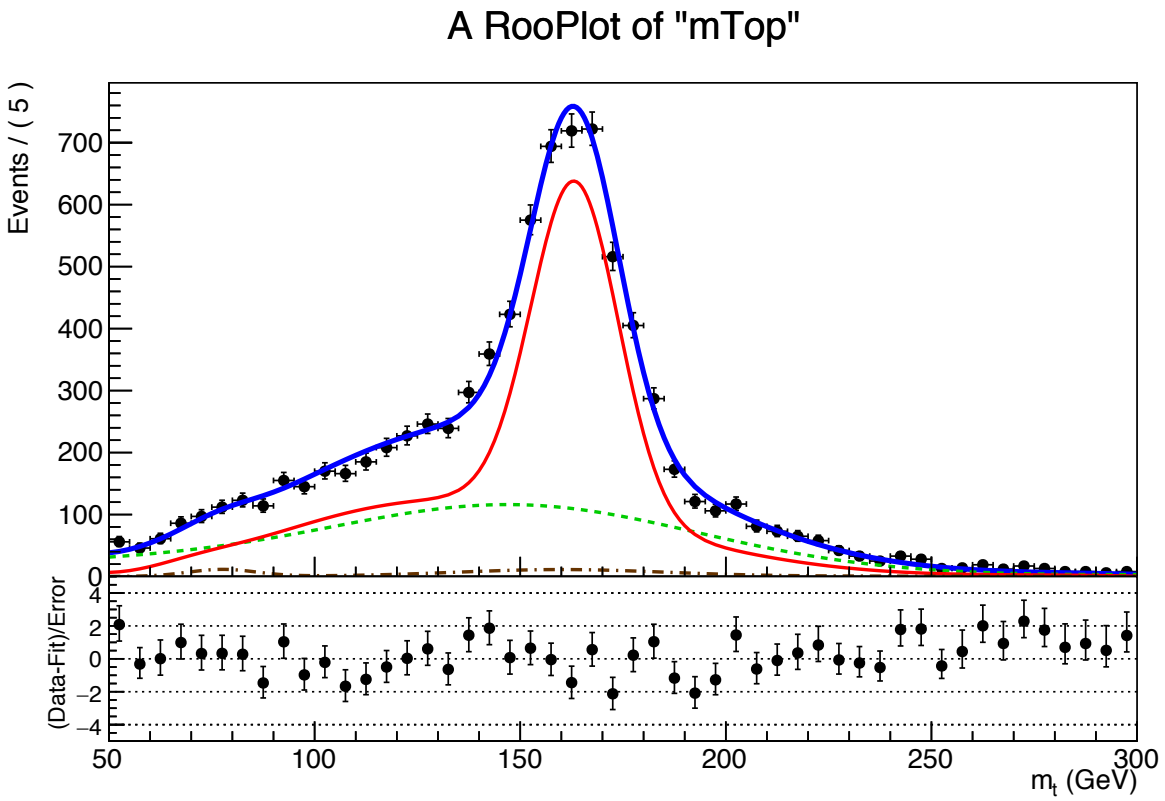
- Results:
  - Method A: r = 0.85347 with Ntt expected = 16351 and Ntt observed = 13955
  - Method B: r = 1.02045 with Ntt expected = 16351 and Ntt observed = 16686

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

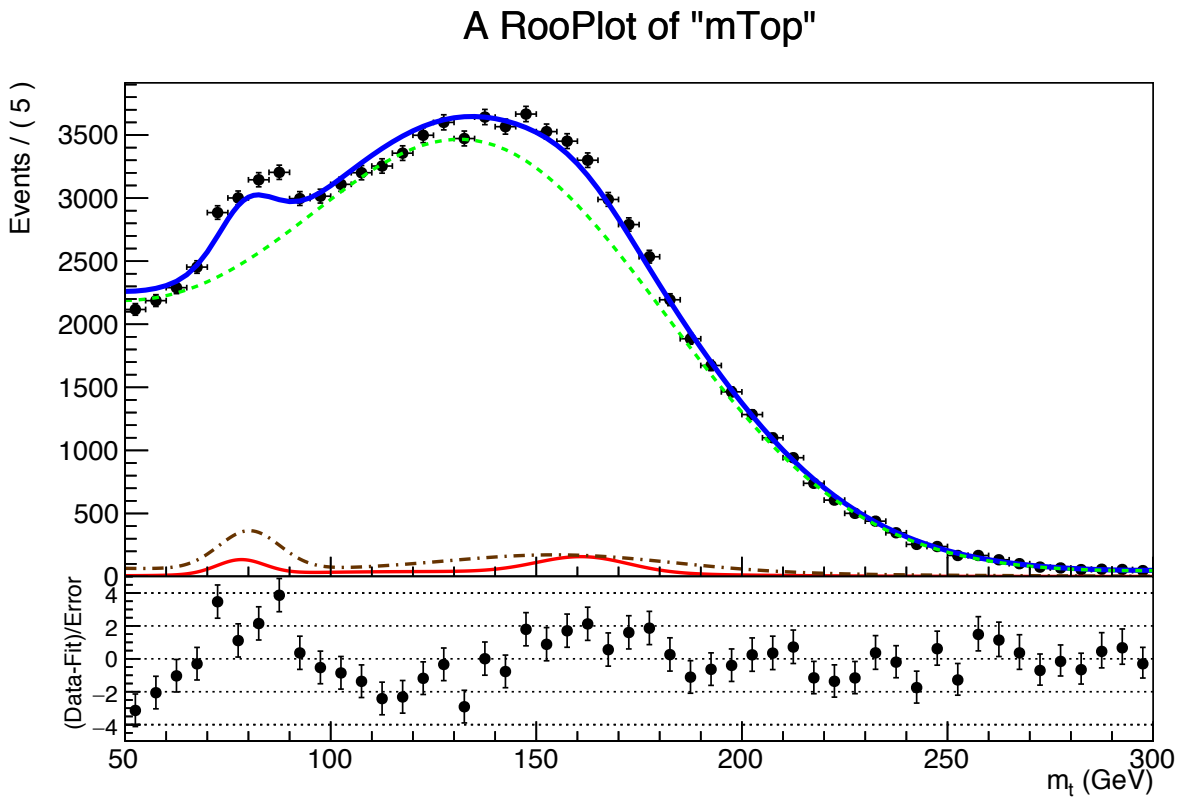
Floating Parameter	FinalValue +/- Error
btagEff	5.6029e-01 +/- 1.17e-02
kMassResol	9.6557e-01 +/- 2.29e-02
kMassScale	1.0020e+00 +/- 1.60e-03
kQCD_1b	5.8296e-03 +/- 4.50e-04
kQCD_2b	7.7313e-02 +/- 4.98e-02
nFitBkg_0b	4.5269e+03 +/- 5.63e+01
nFitBkg_1b	2.3159e+03 +/- 4.02e+02
nFitBkg_2b	2.3726e+02 +/- 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)

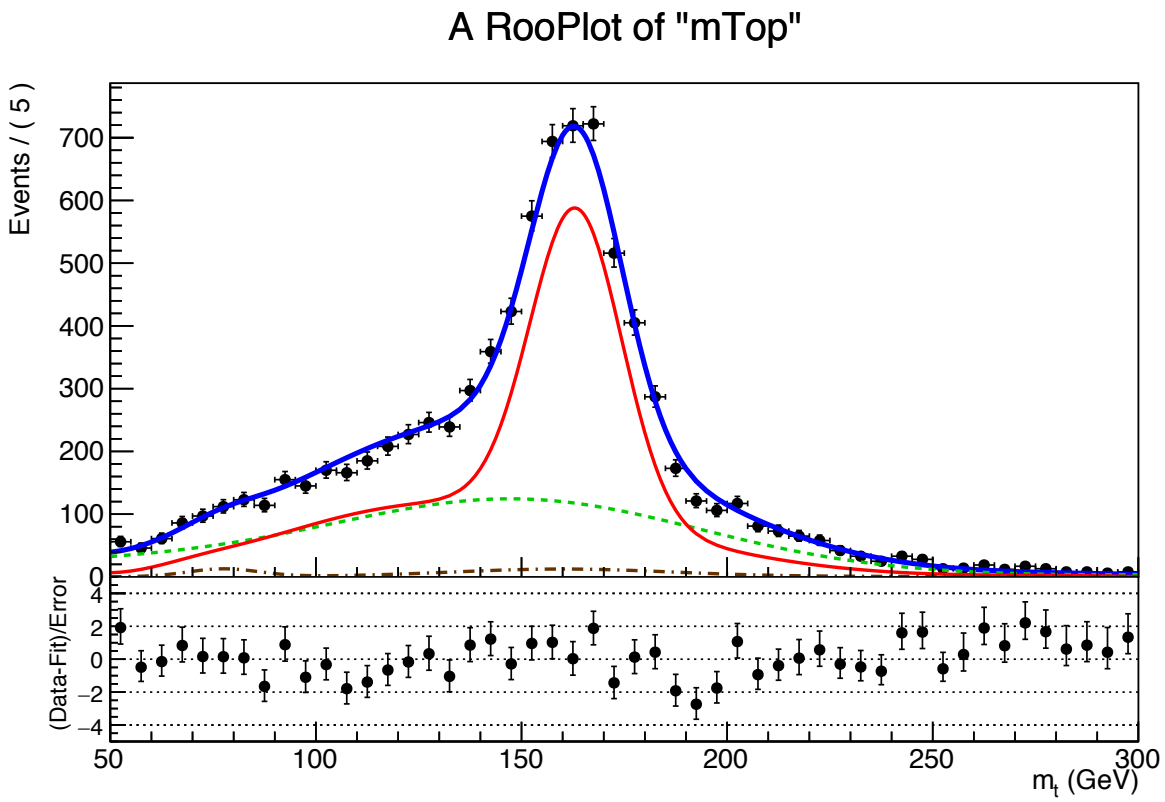


Control Region (0btag)

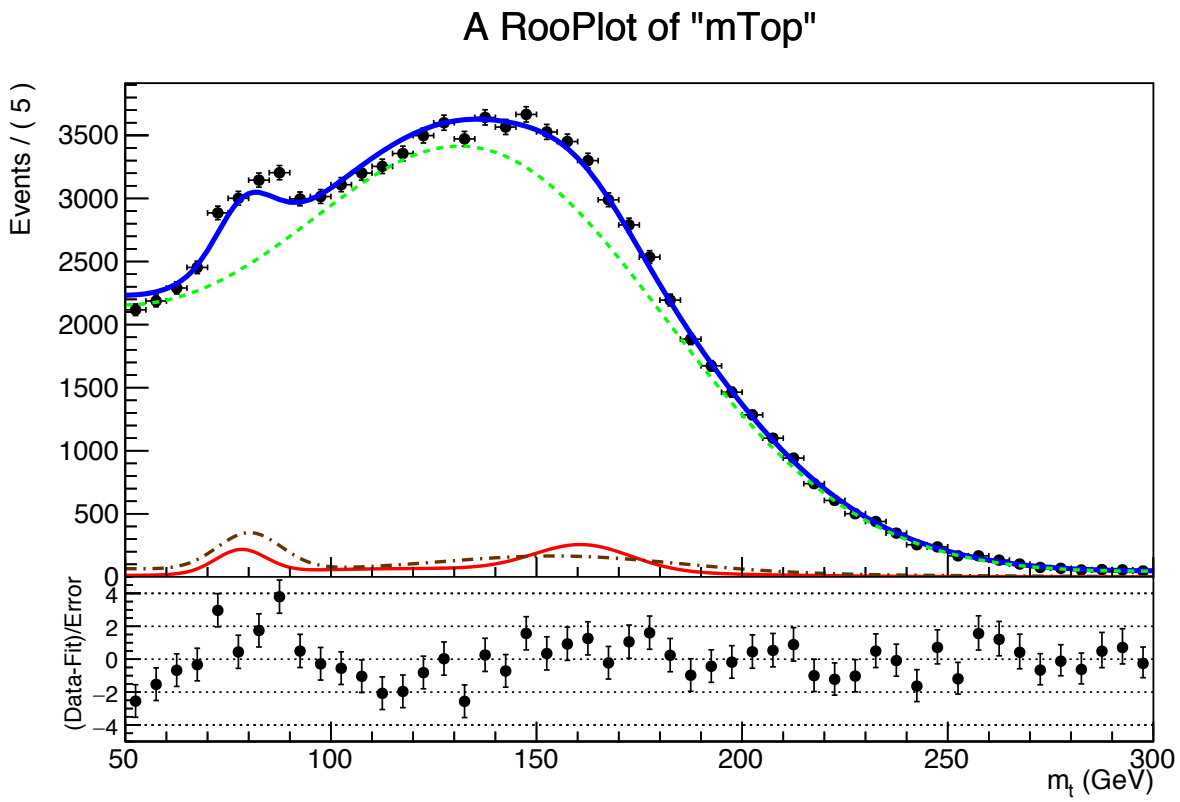


Simultaneous Fit in 3 regions Method B

Signal Region (2btag)

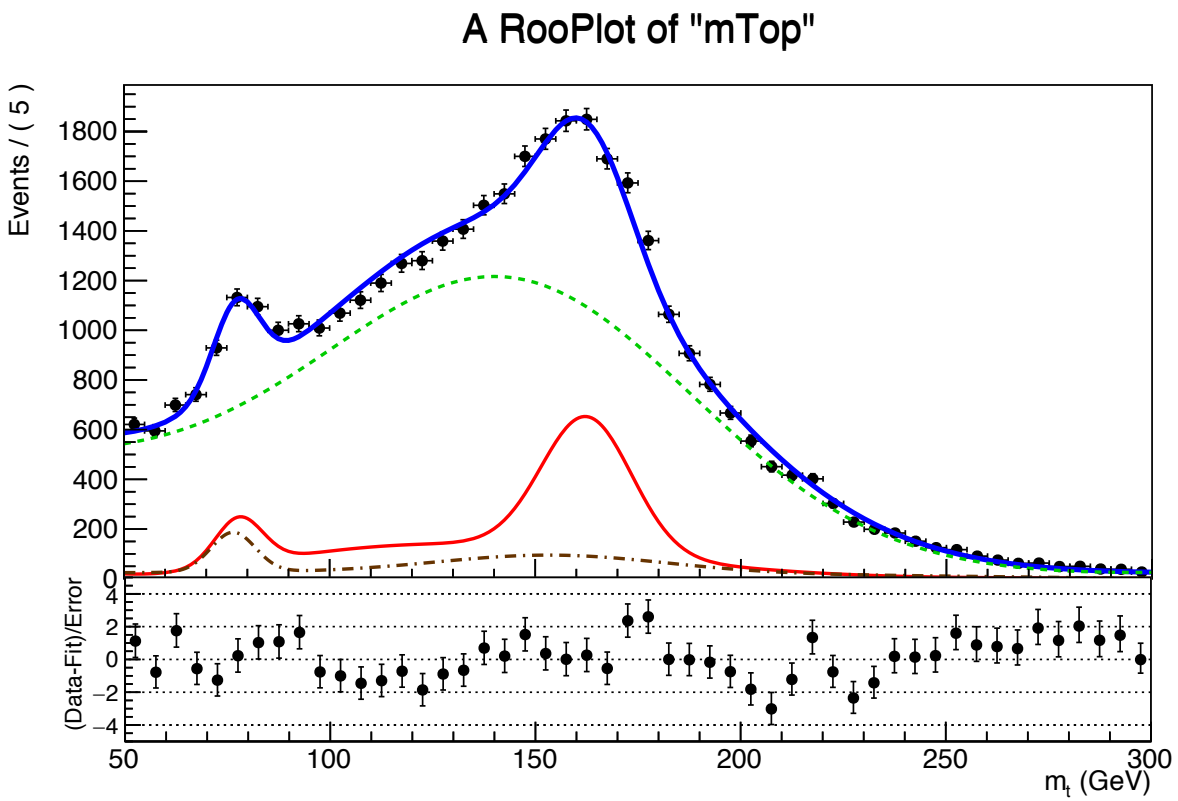


Control Region (0btag)

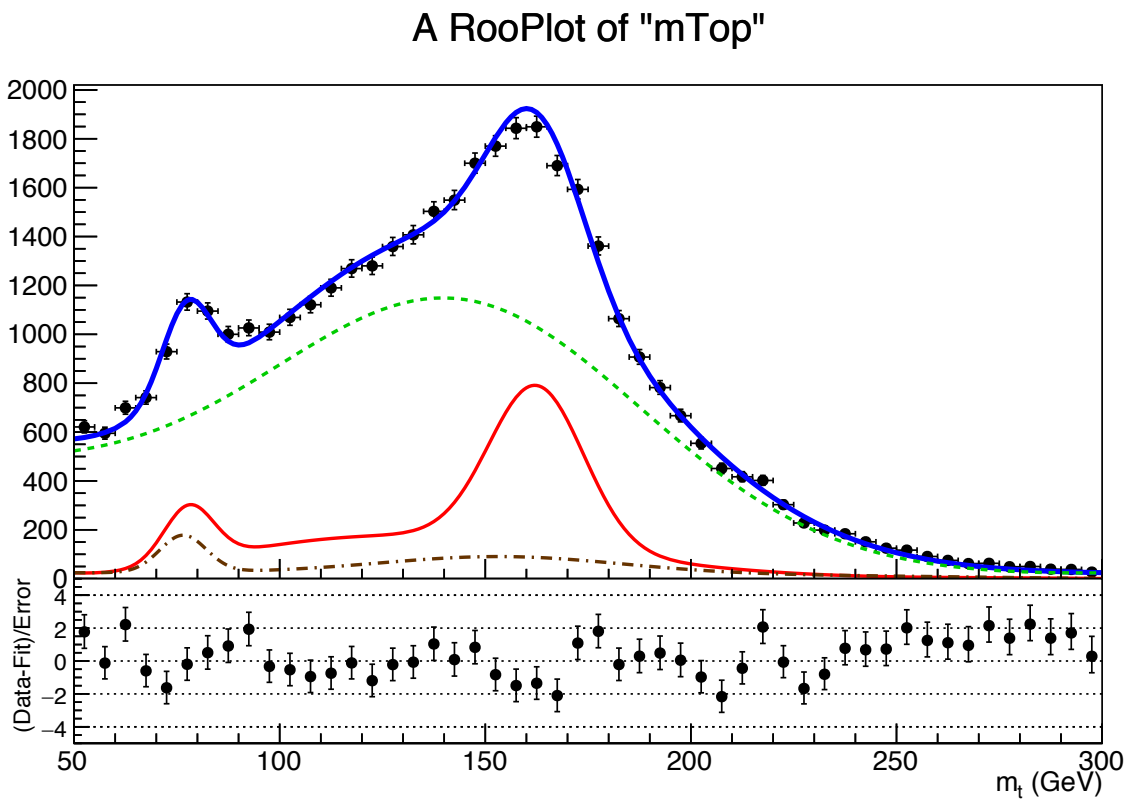


Simultaneous Fit in 3 regions (1btag Region)

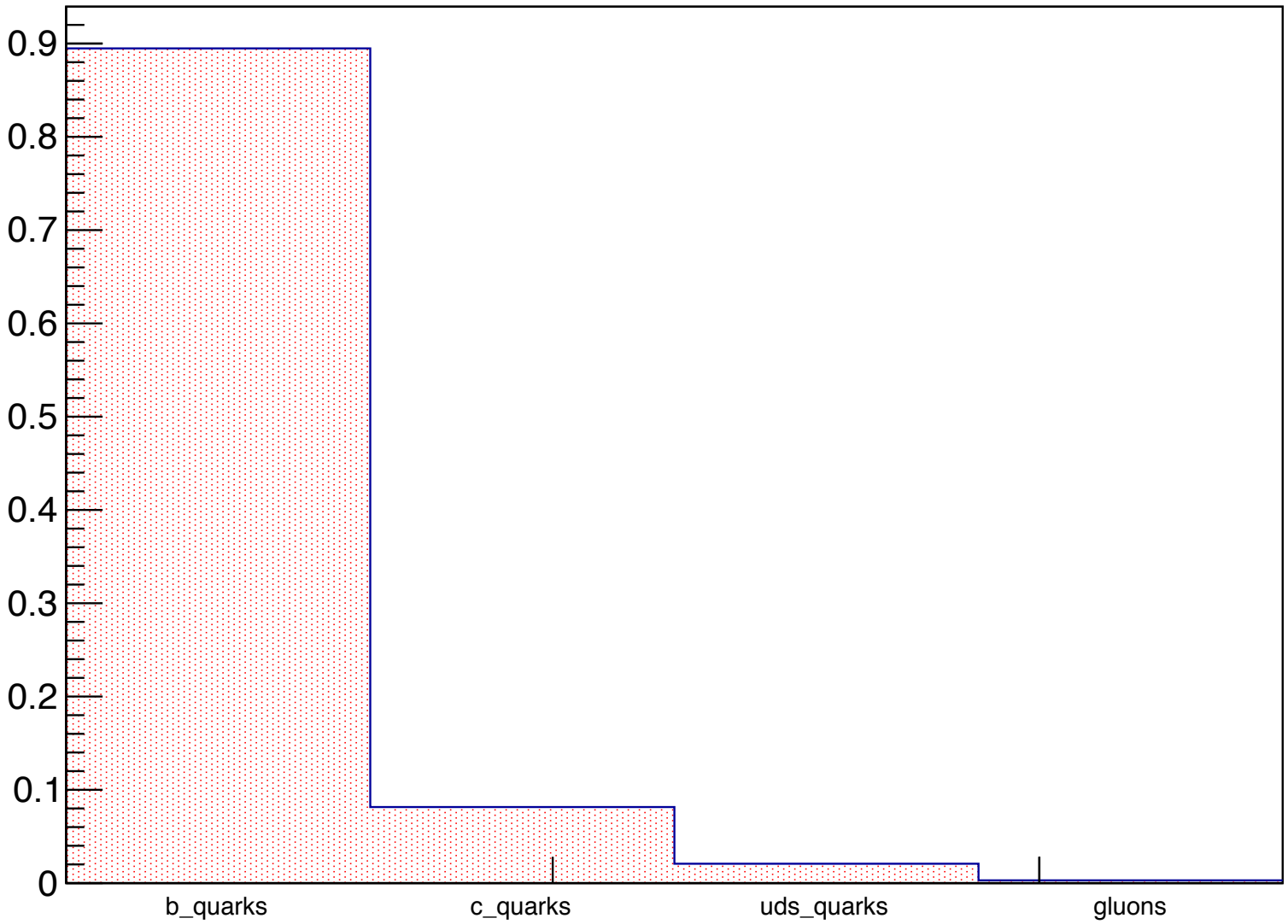
Method A



Method B



b-tagging Purity



b-tagging Efficiency