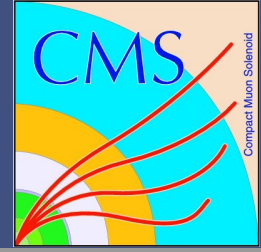


TopQuark Meeting

Comparing ParticleFlow and Calorimeter Jets

Michael Maes

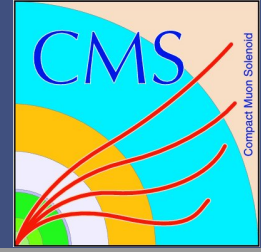
May 6, 2009

1 Introduction

2 Jet Resolution
- p_T-resolution
- Bugs?

3 TopMass
- Mass resolution
- Top Counts

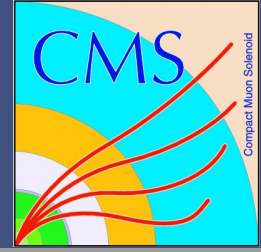
Aim of the project



- Compare Calorimetry Jets (CaloJets) and Particle Flow Jets (PFJets)
- First stage: compare them by the jet resolutions.
- Second stage: use both Jet types to construct m_{Top} and compare their performance[1] in this context.

[1] Mass resolution, bias

Sample and matching description



- TauolaTTBar_Summer08_IDEAL_V9_v1 REDIGI in CMSSW_2_2_3. (Skimmed for FULL-HADRONIC events)
- PFJets and CaloJets are matched to a GenJet (without ν) via $\Delta R < 0.3$
- Only when the GenJet gets a PFJet AND a CaloJet matched the three are used in the analysis.
- I applied a p_T-cut on the CaloJets and PFJets of 20GeV. This cut is applied after the matched jets are L2L3 corrected.
- All b-jets containing a global muon are rejected. This case will be treated separately.

Jet corrections

- CaloJets and PFJets are corrected with L2L3Summer08 redigi corrections.

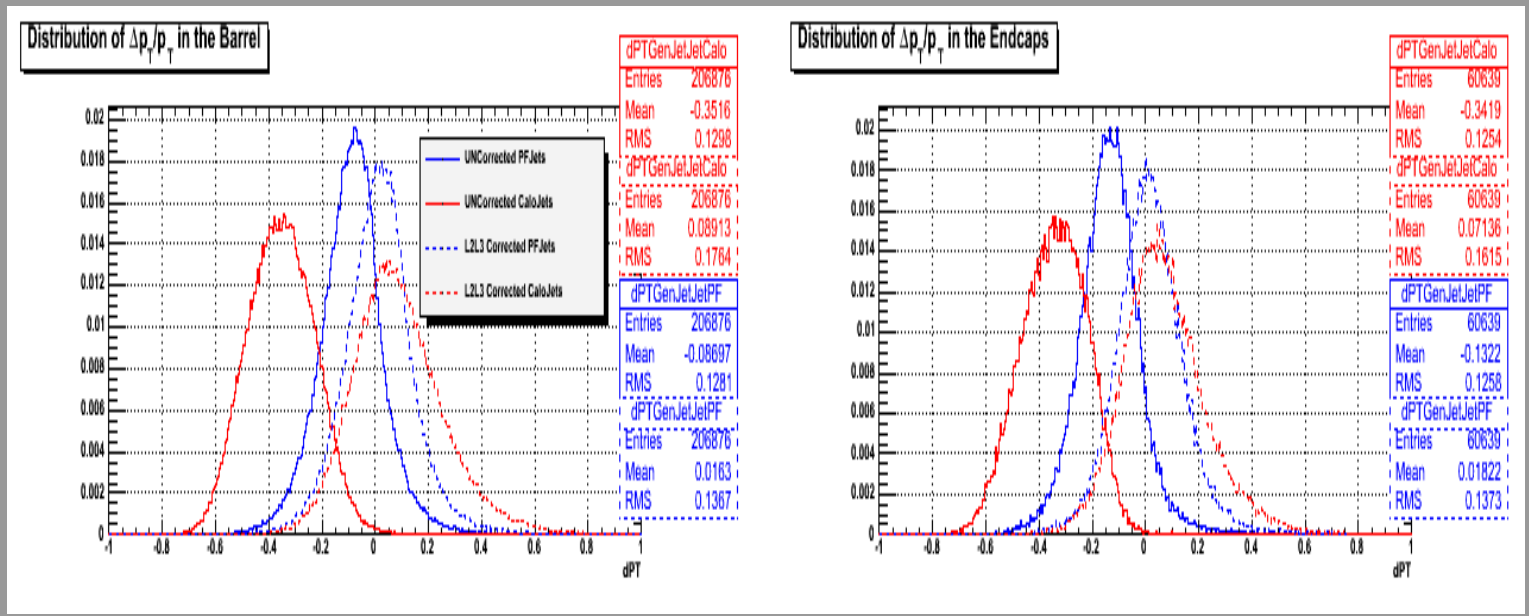


Figure: $\frac{\Delta p_T}{p_T}$

Jet corrections

- L5 and L7 corrections are not applied because they are not needed for PFJets and L5 corrections even deteriorate PFJets.

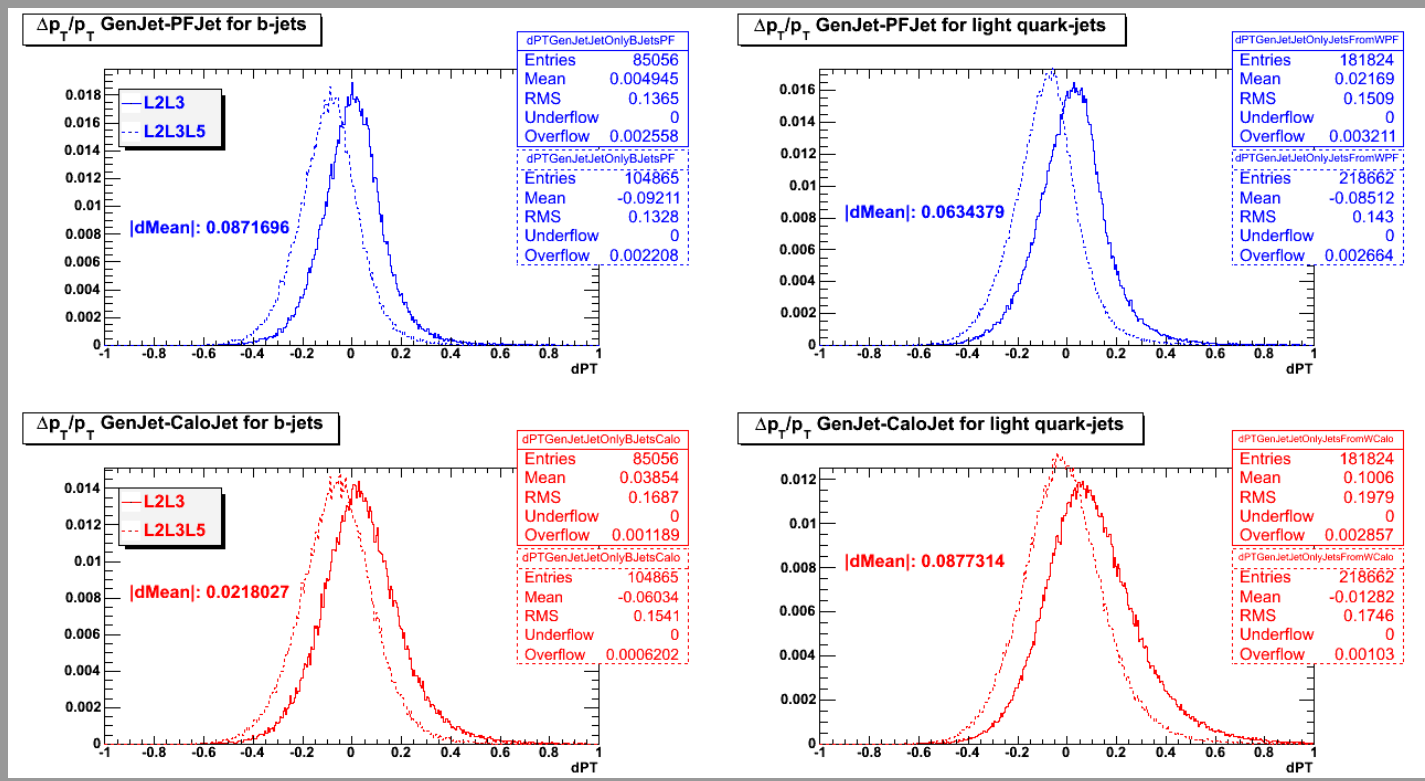
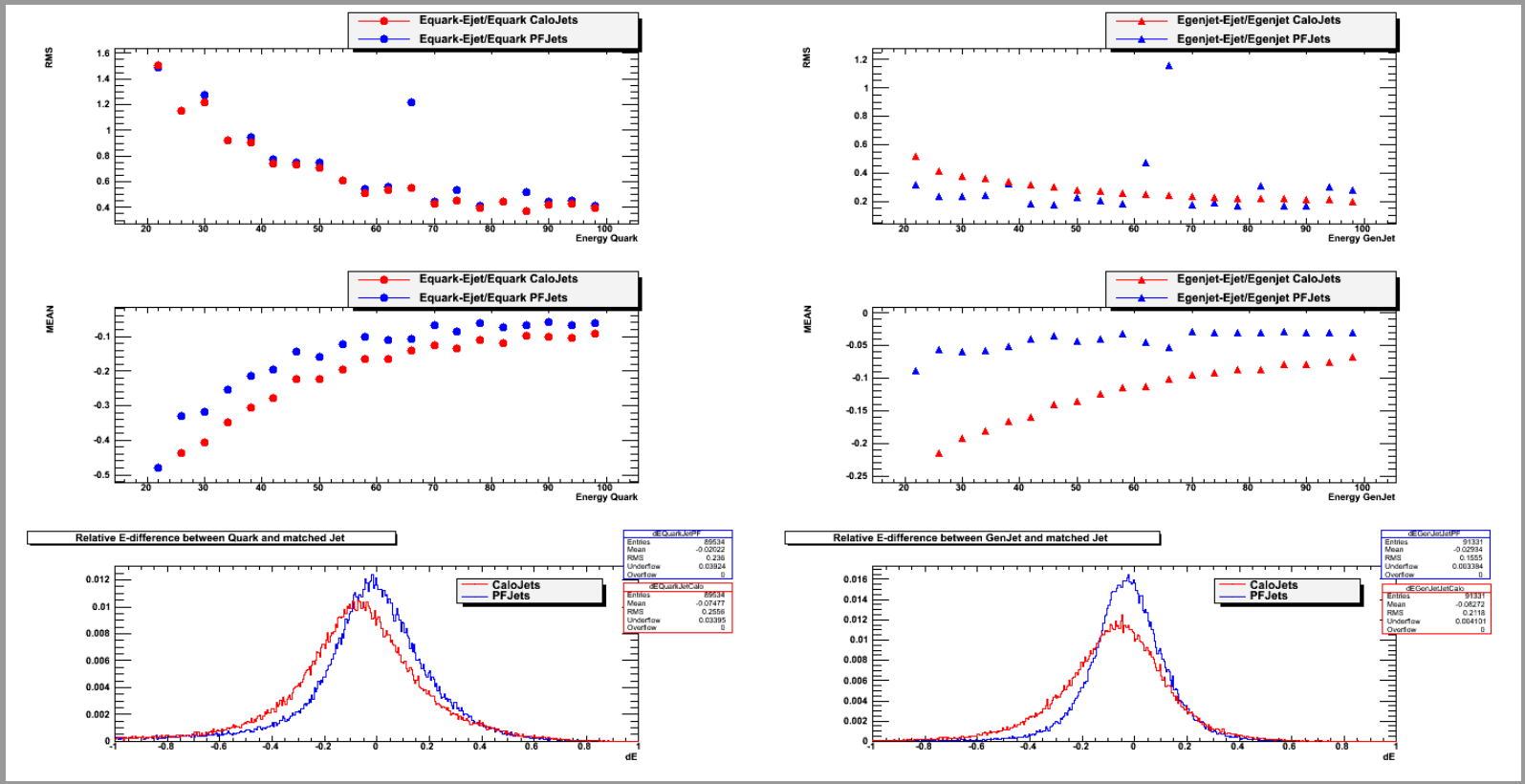


Figure: $\frac{\Delta p_T}{p_T}$

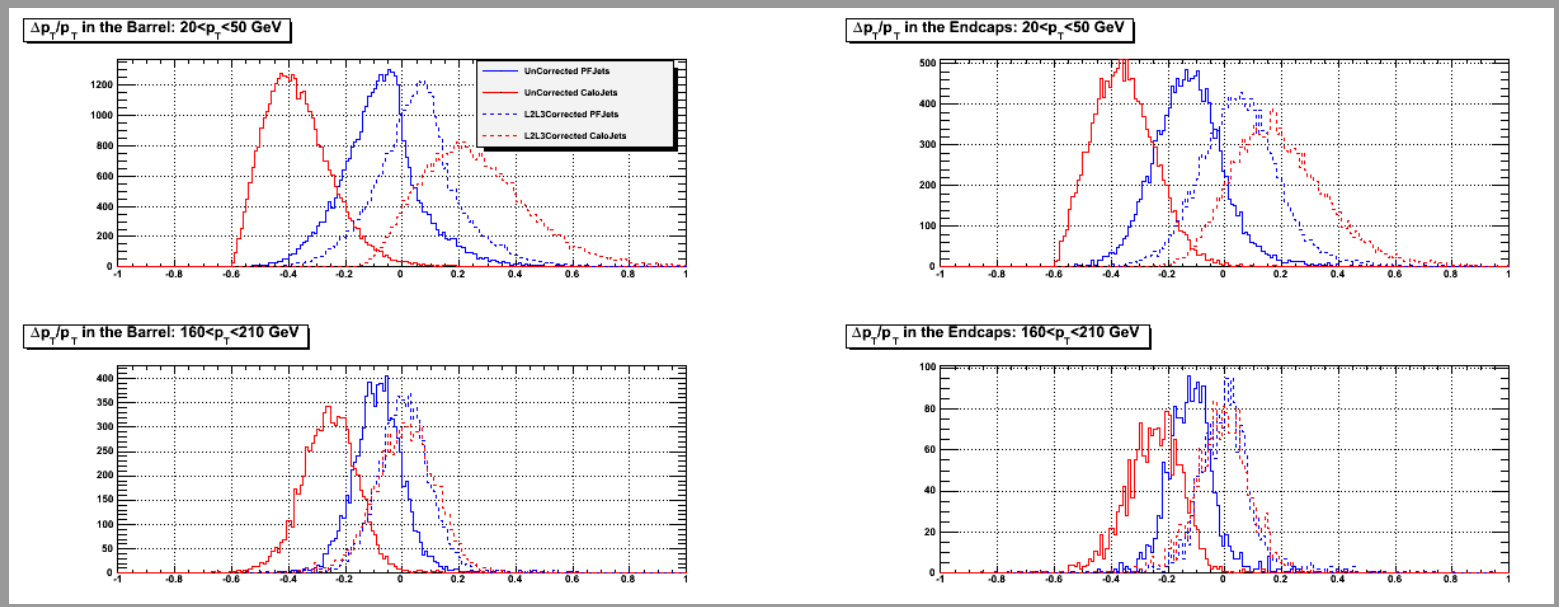
Old resolution plot



- This plot was made by just calculating RMS and mean in each bin of $E^{GenJet/Quark}$.
- Not really conclusive.

Using a gaussian fit

- Some definitions:
  - Jet p_T-resoluion: σ of $\frac{p_T^{rec} - p_T^{gen}}{p_T^{gen}}$ (gaussian fit)
  - Jet p_T-response: mean of $\frac{p_T^{rec} - p_T^{gen}}{p_T^{gen}}$ (gaussian fit)



- Two fits where performed: Full range (-1 to 1 and 20 bins around maximum bin). Results are similar!

Barrel-Endcap p_T-resolution VS p_T^{GenJet}

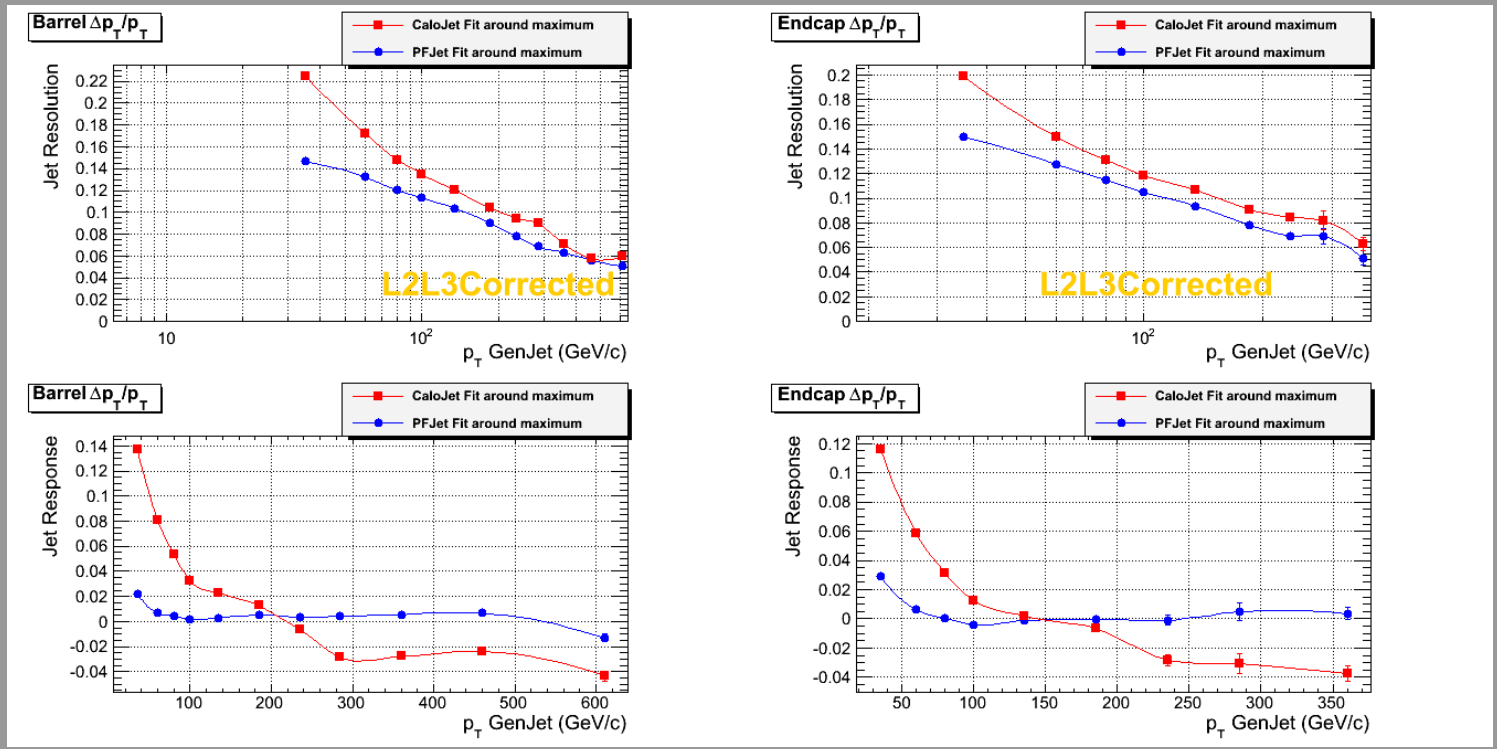
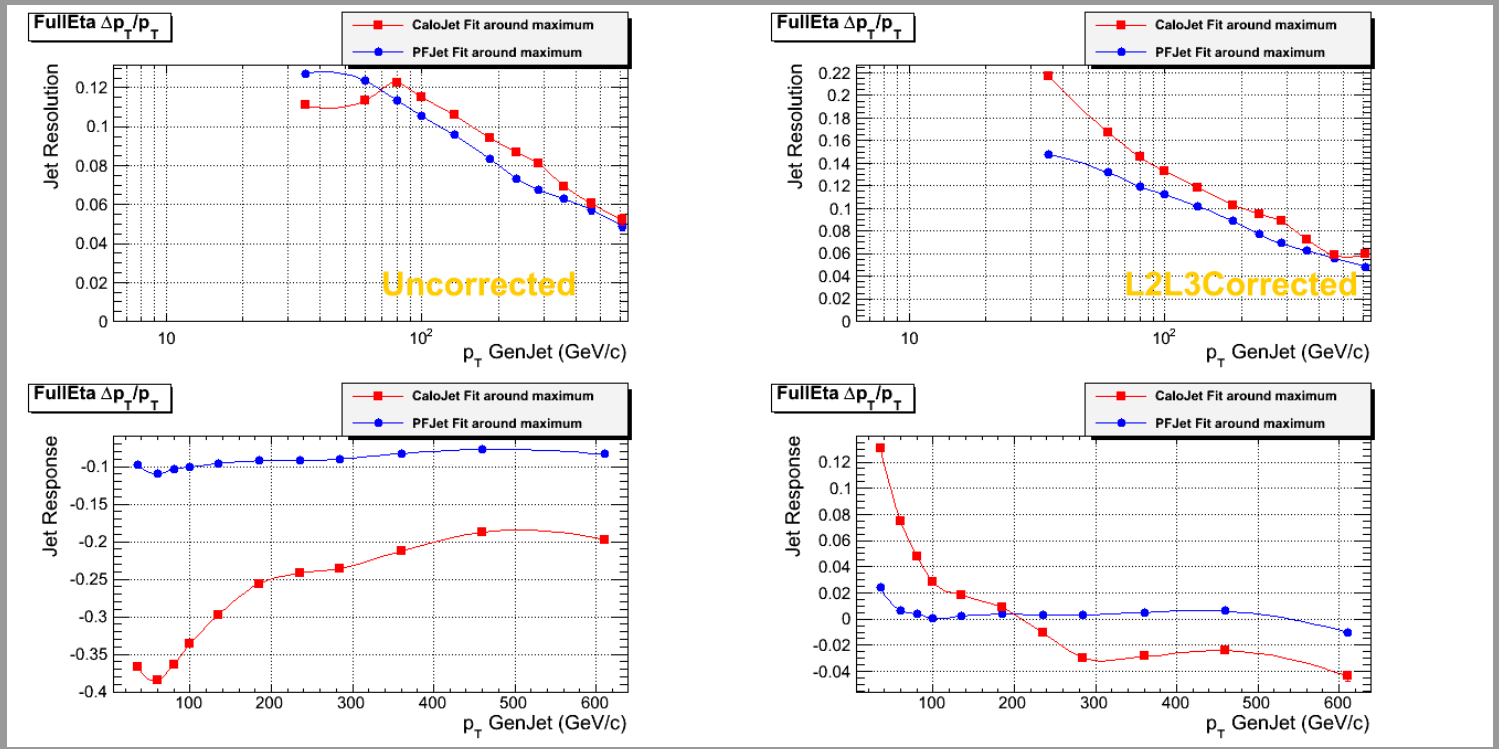


Figure: p_T-resolution VS p_T^{GenJet}

FullEta p_T-resolution VS p_T^{GenJet}



- FullEta: $-2.4 < \eta < 2.4$

FullEta ϕ-resolution VS p_T^{GenJet}

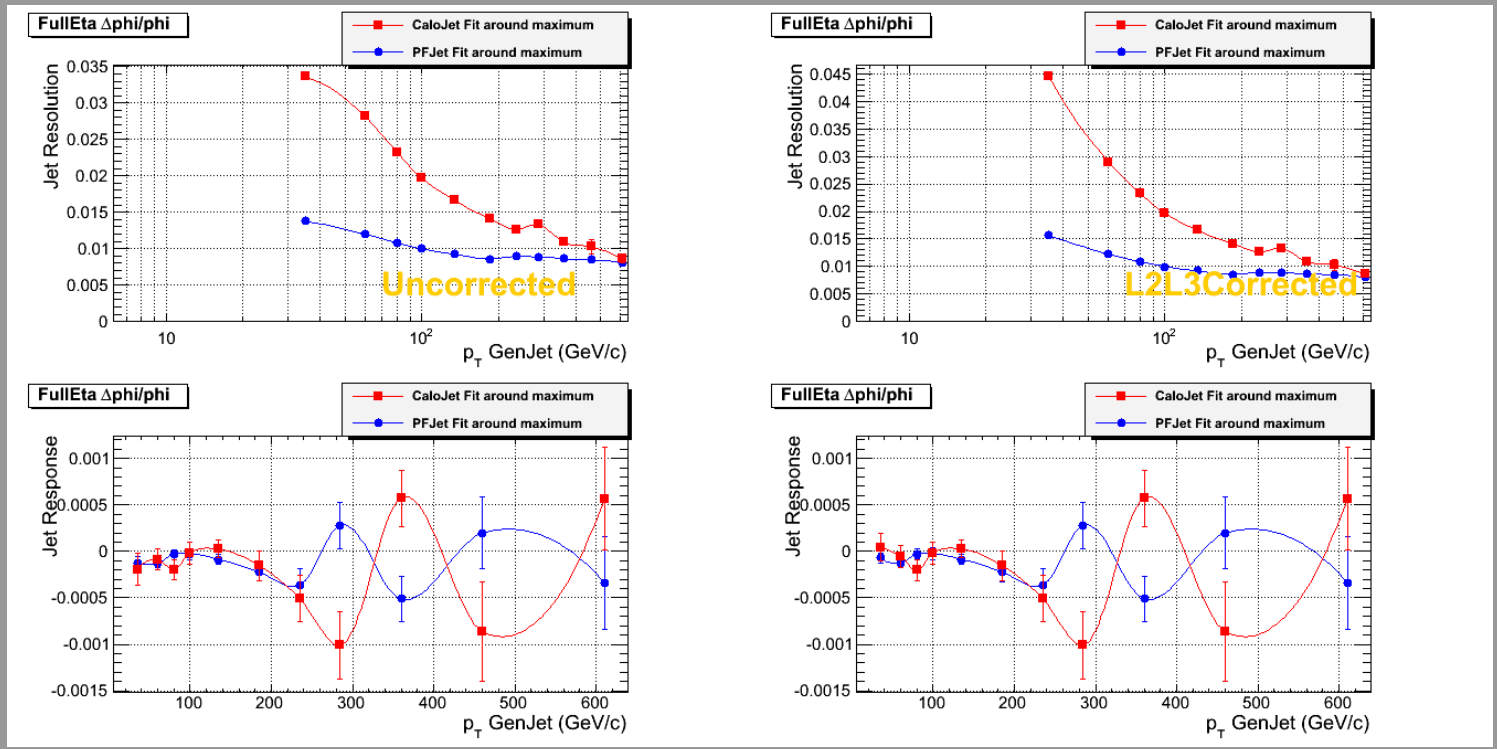


Figure: p_T-resolution VS p_T^{GenJet}

FullEta p_T-resolution VS #jet constituents

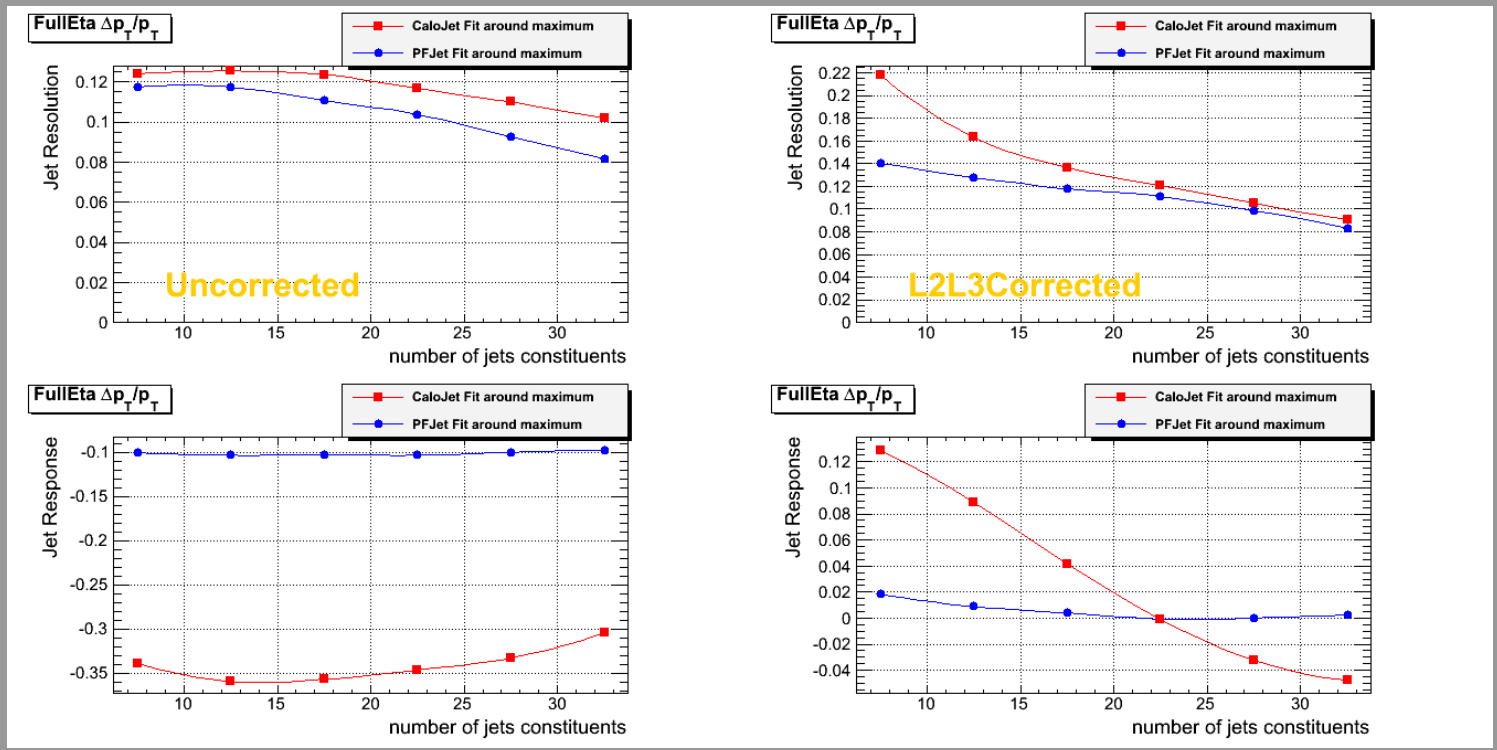


Figure: p_T-resolution VS #jet constituents

FullEta η-resolution VS p_T^{GenJet}

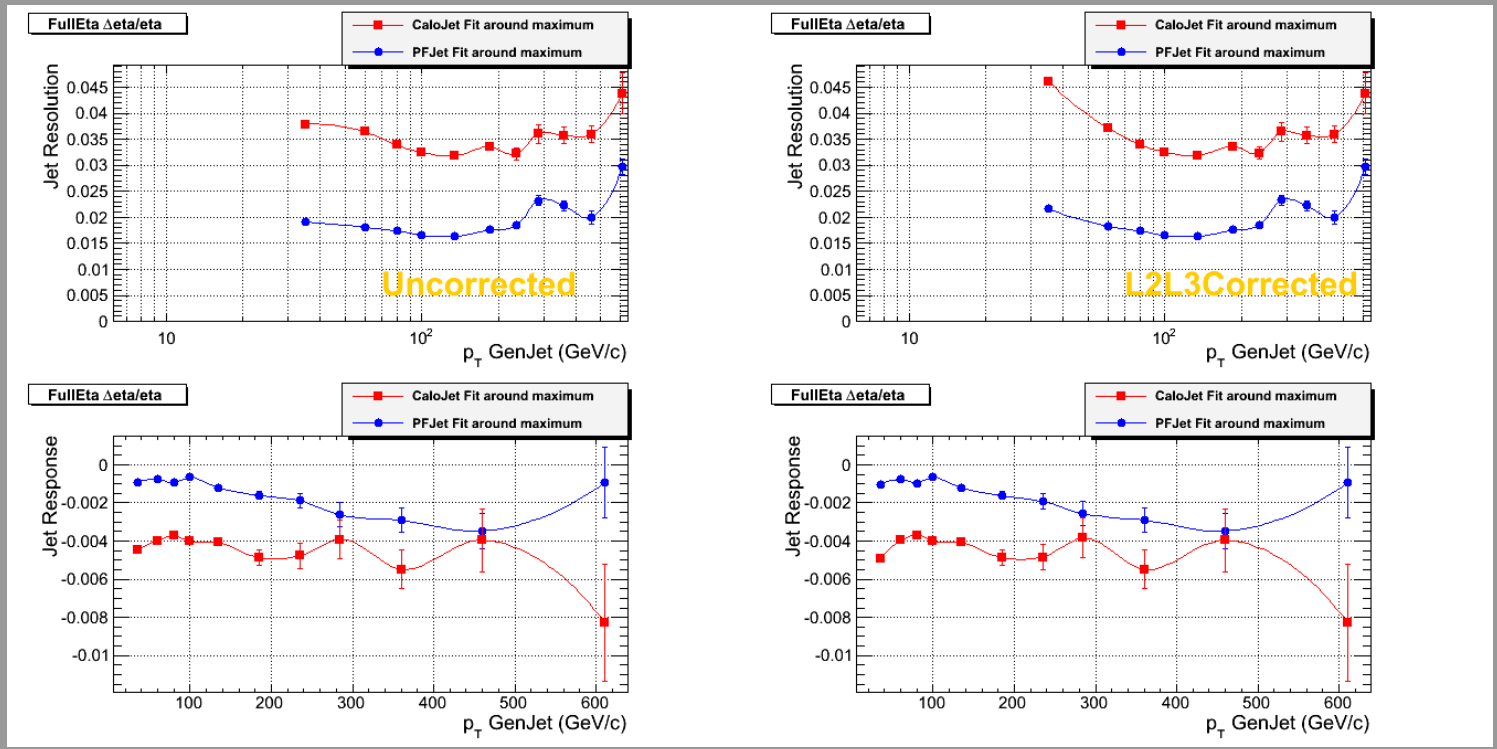


Figure: p_T-resolution VS p_T^{GenJet}

η Asymmetry

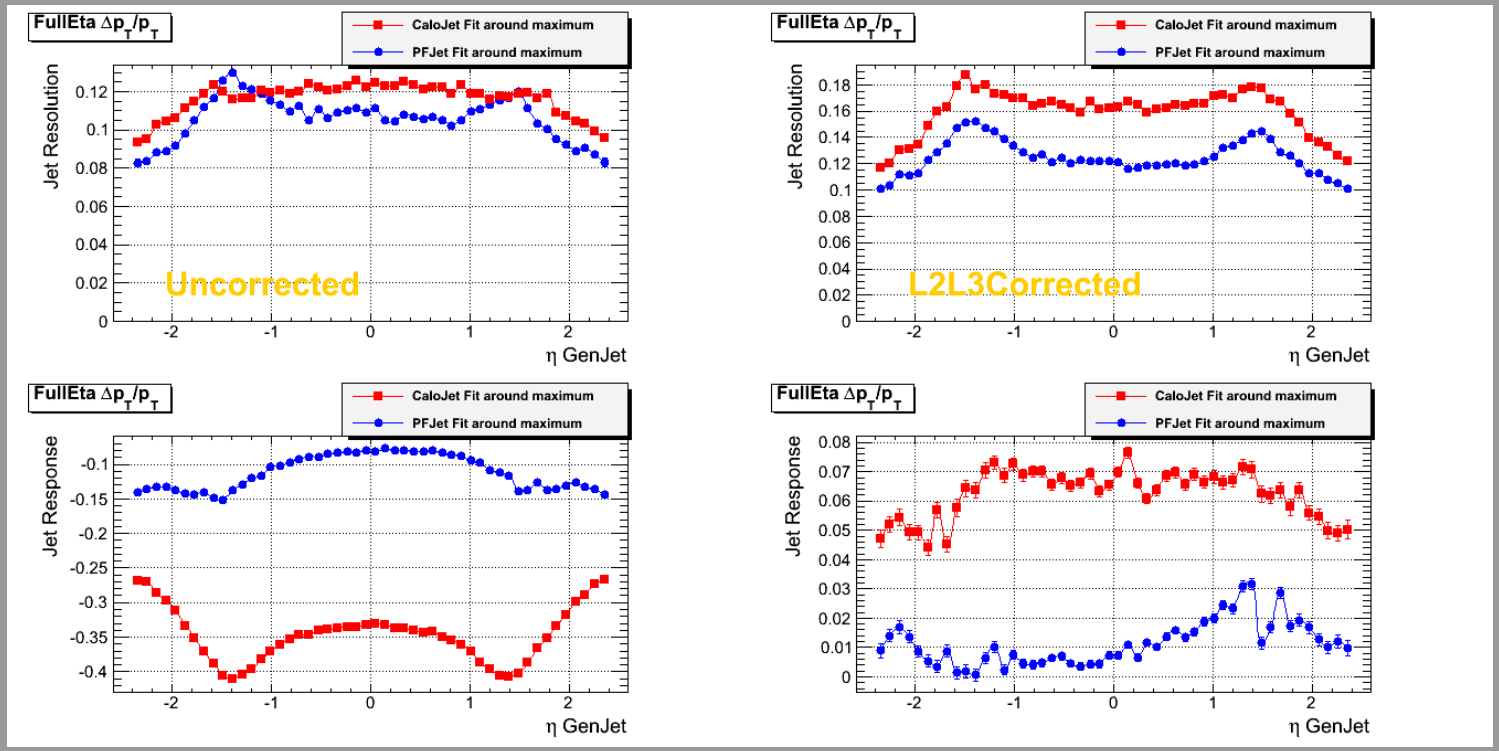
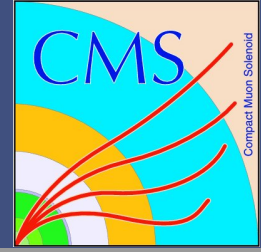


Figure: p_T-resolution VS η

- The eta-dependence is not symmetric (not even for uncorrected jets).

η Asymmetry



- The asymmetry is not dependent on the level of correction. To check this I drew a first plot (shown on next slide) for different correction levels + uncorrected jets. In this plot I flipped the points on the negative side of η to possitive η, labeling them η^+ and η^-. Then I took the difference between the two.
- For CaloJets it is clear that there is no asymmetry, but for PFJets there is.

η Asymmetry

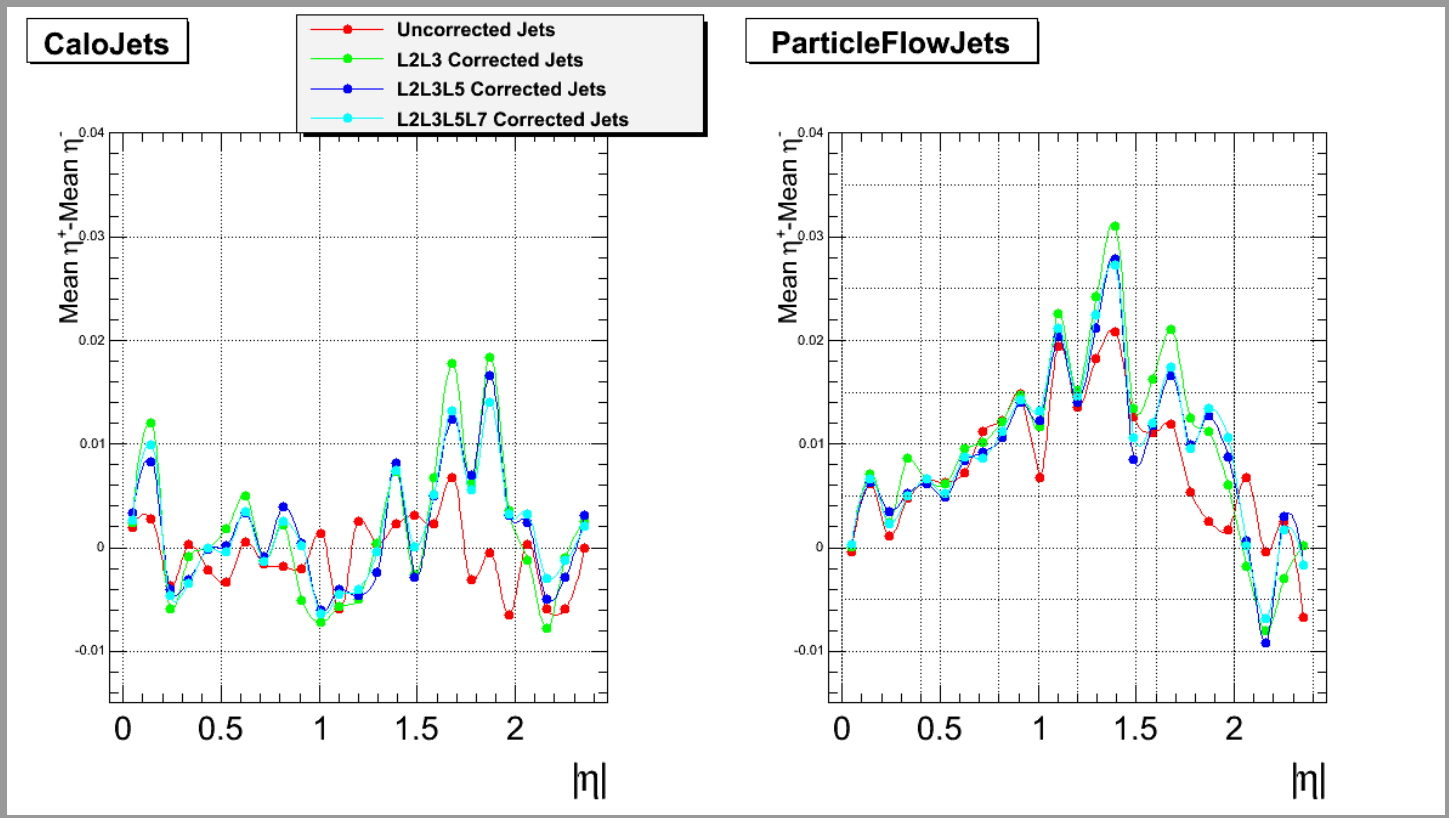


Figure: Asymmetry plot

η Asymmetry

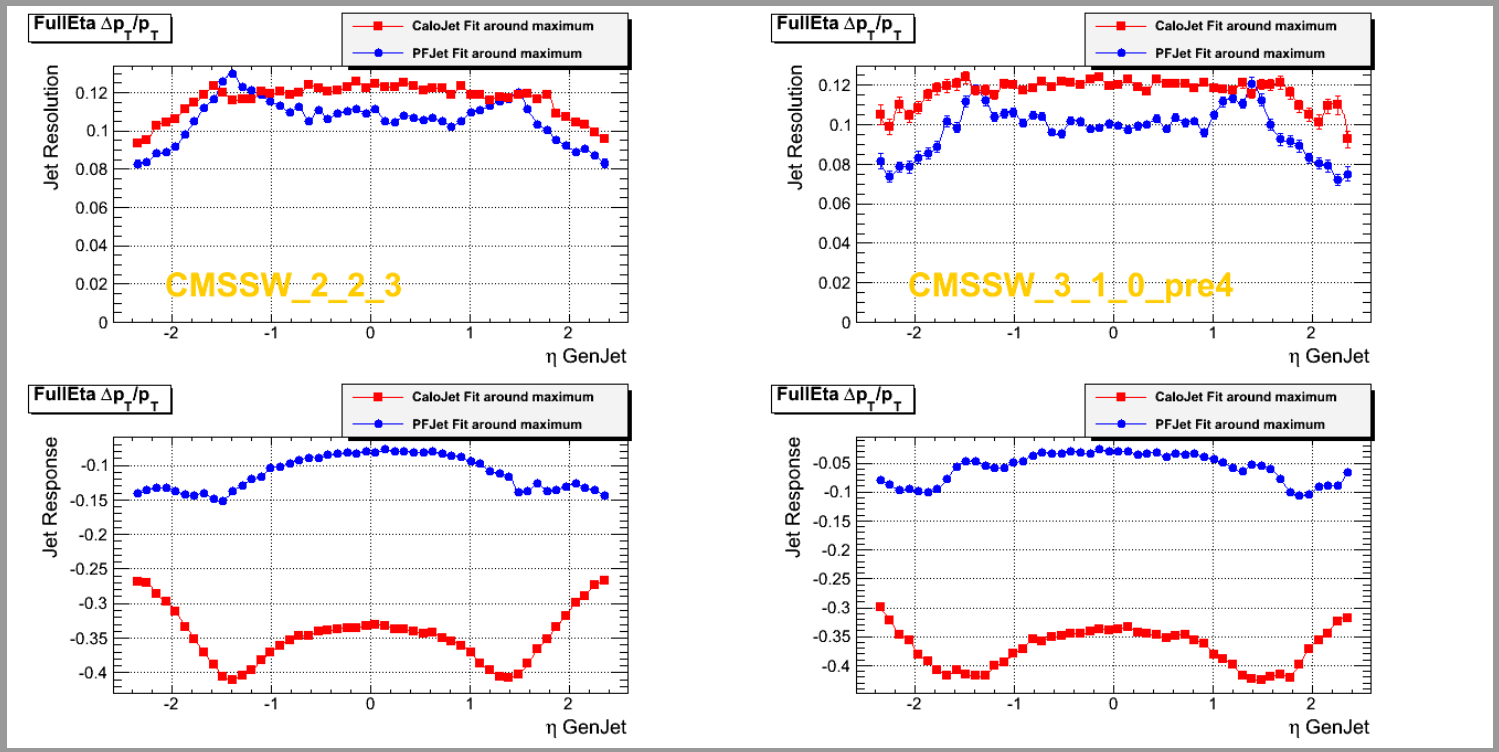


Figure: p_T-resolution VS η

- The "η-bug" seems to be solved in the new PFlow code.

Related bug?

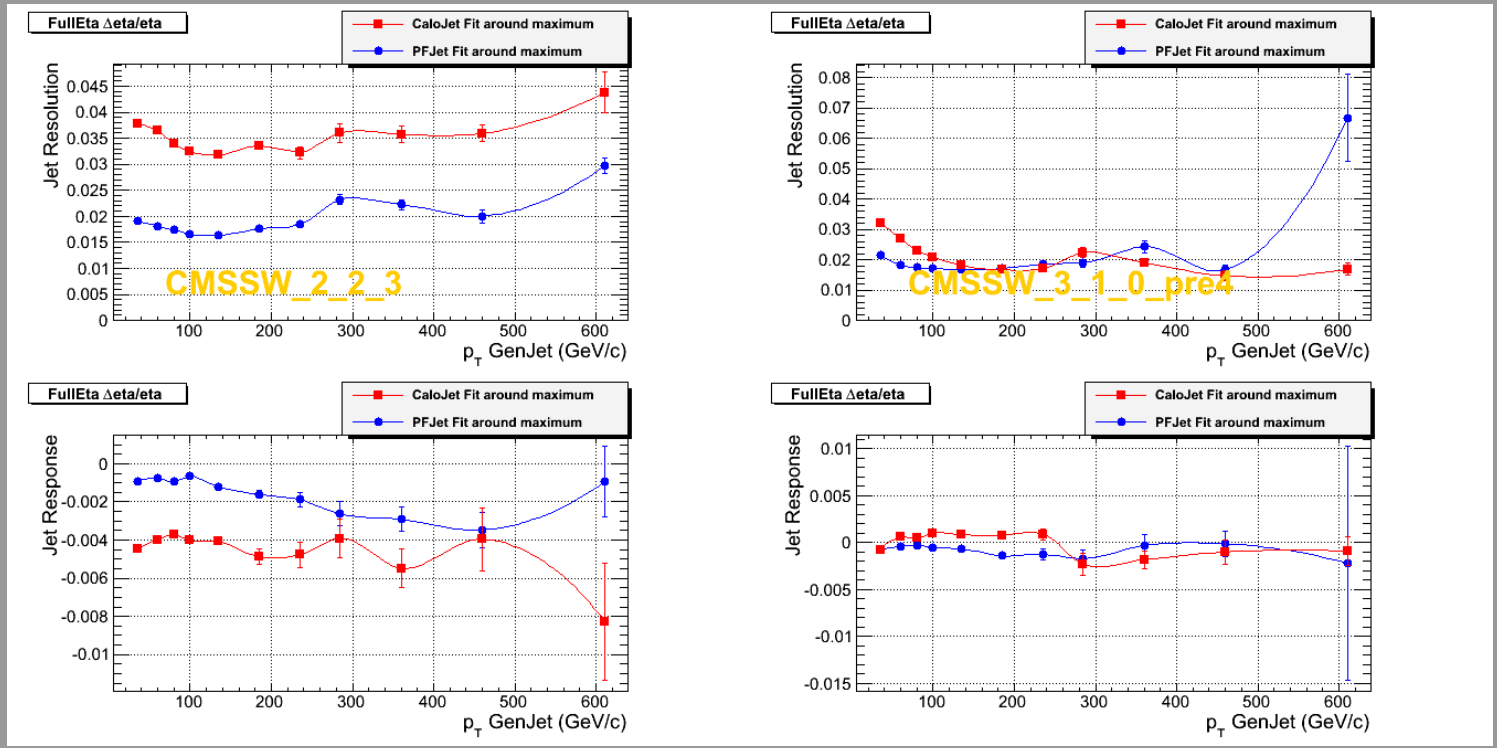


Figure: η-resolution VS p_T

η Asymmetry

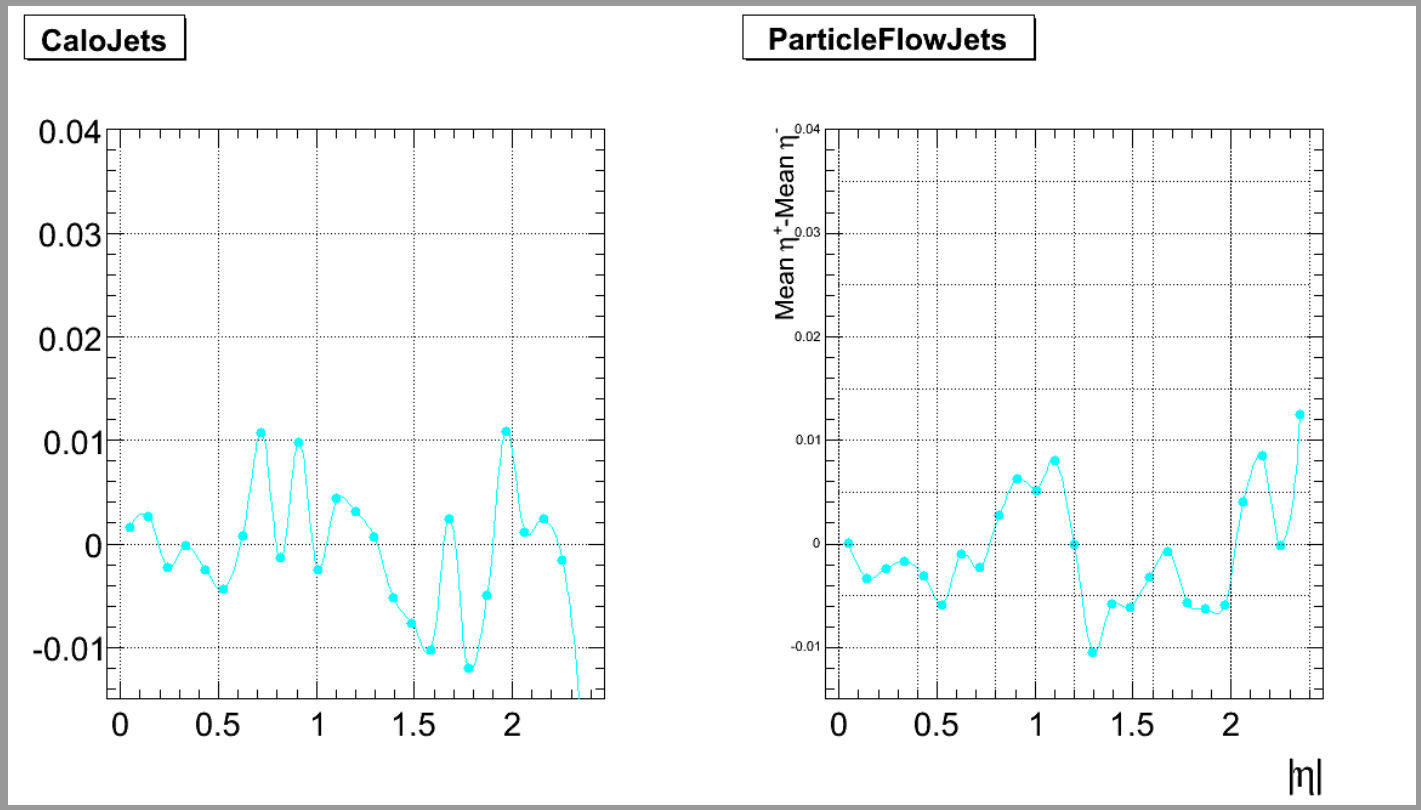


Figure: CMSSW_3_1_0_pre4 Asymmetry plot (just to be shure)

ϕ Bumps

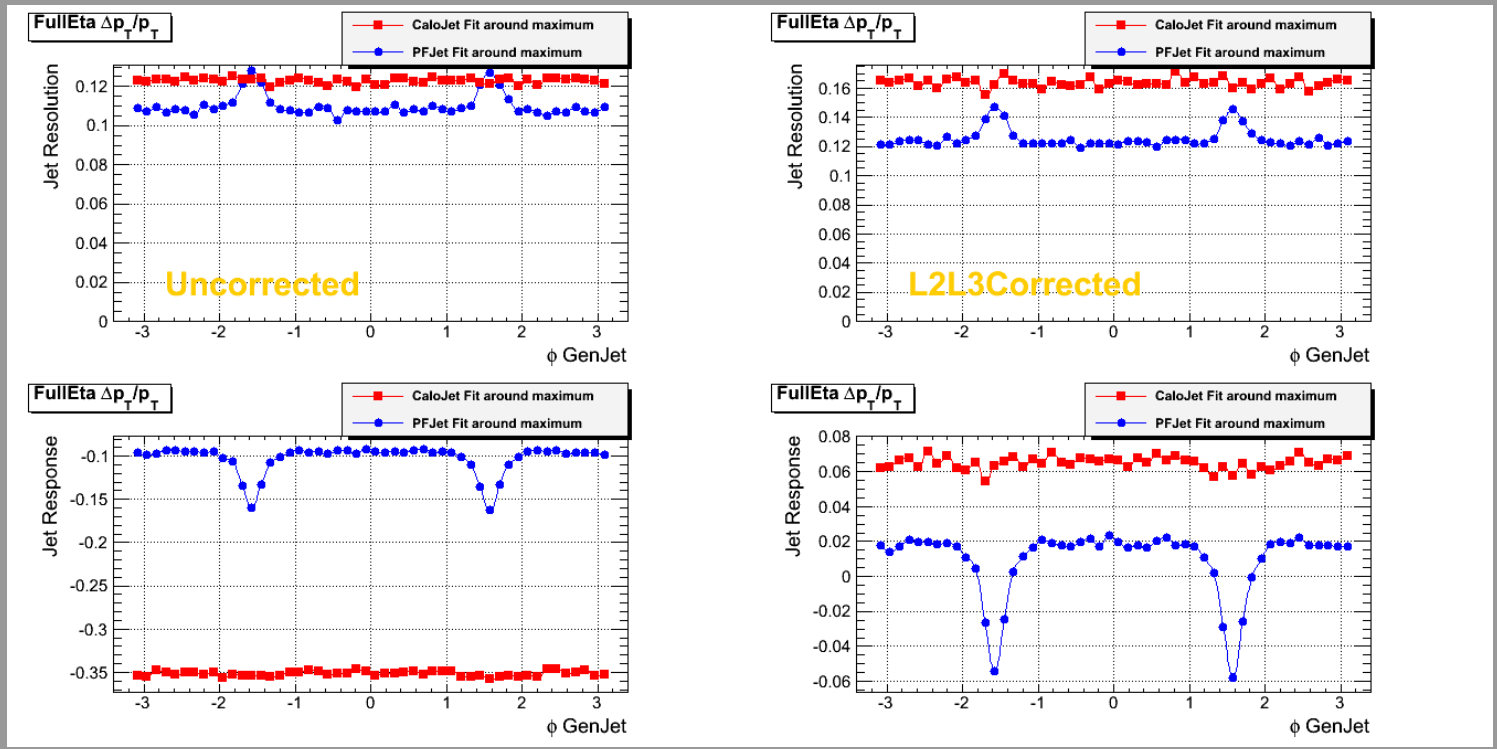


Figure: p_T-resolution VS ϕ

- Unexpected "bumps" around $\phi = \pm\pi/2$.

ϕ Bumps

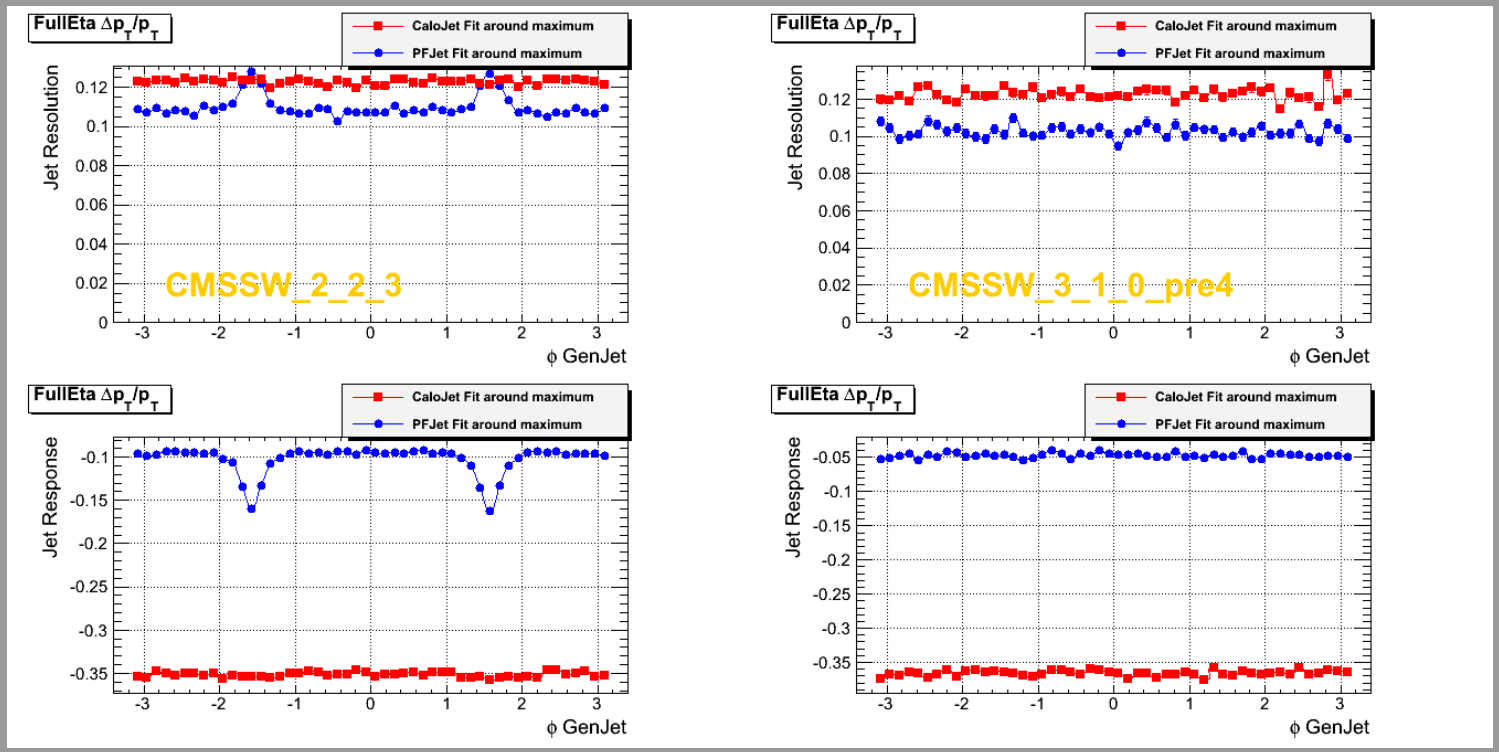
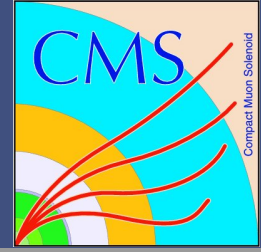


Figure: p_T-resolution VS ϕ

- This bug seems to be solved.

TopMass Reconstruction



TopQuark Meeting
Michael Maes
Introduction
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- m_{Top} is reconstructed using only the 6-jets final state of the $t\bar{t}$.
- Here the previous matching is applied. Only events are used where 3 jets for $t/\bar{t}$ (or both) are matched to one CaloJet and one PFJet.
- A cut on the jet-p_T of 20GeV was applied after L2L3 Corrections.

TopMass

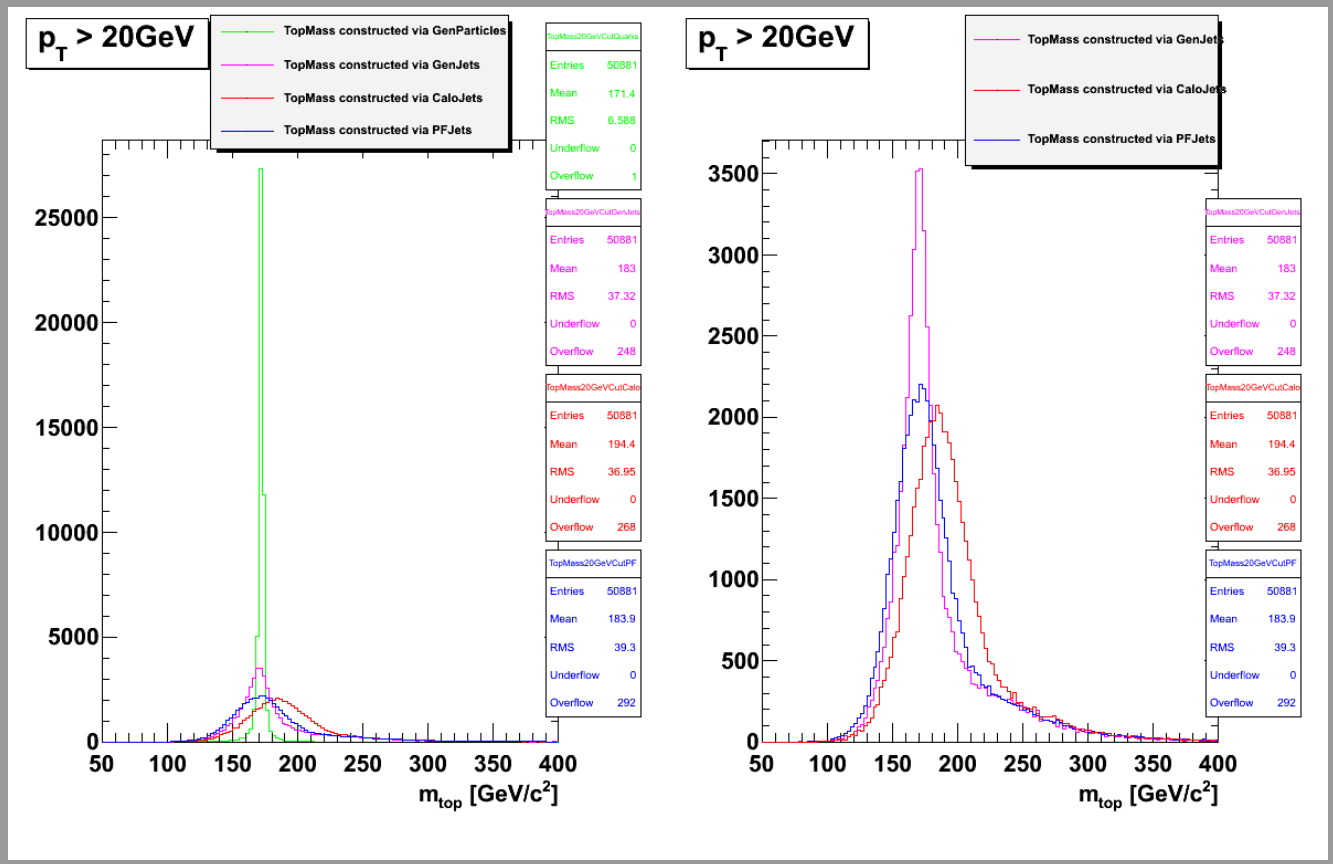

Figure: m_{Top}

TopMass Fit

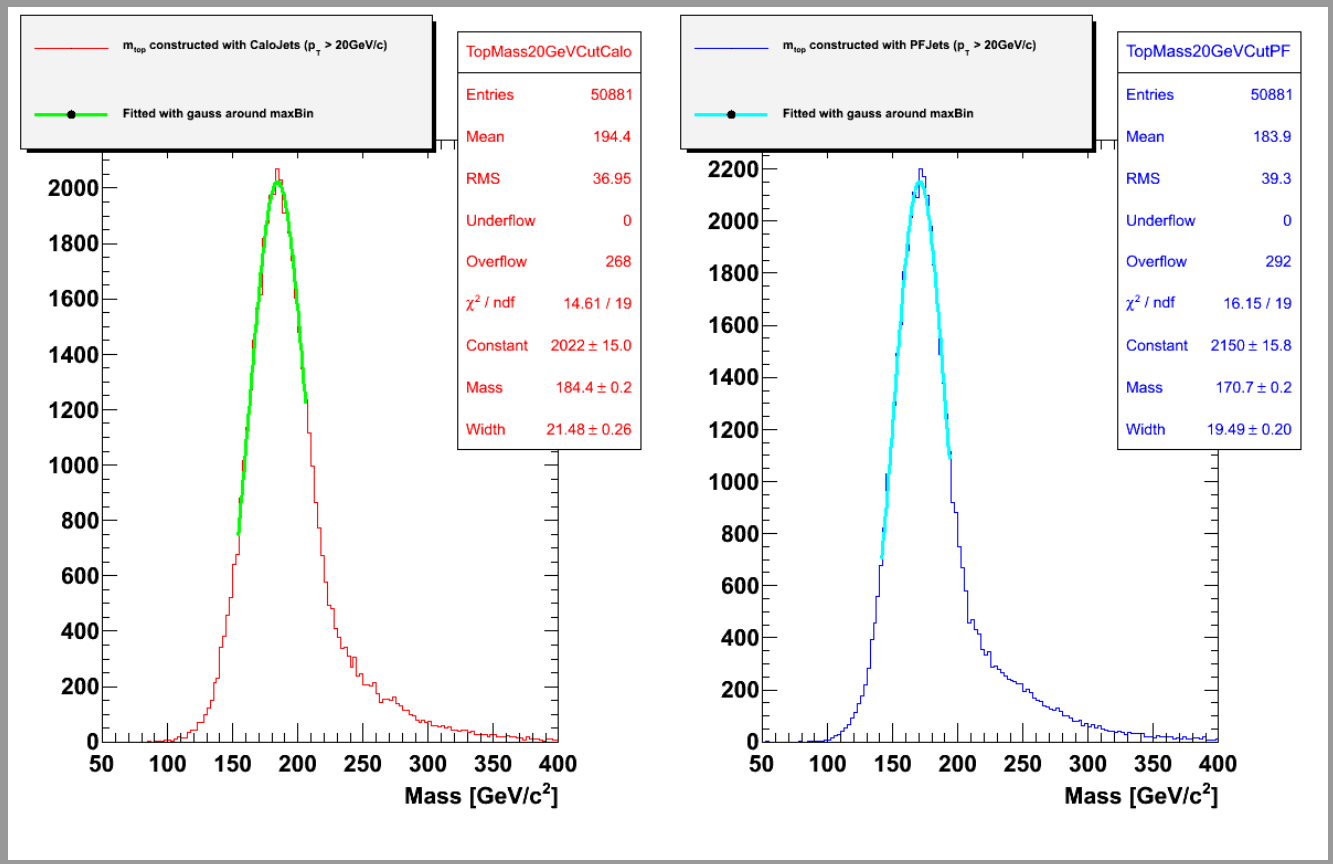

Figure: Fitted m_{Top}

$\Delta m_{Top}/m_{Top}$ VS Scalar Sum E_T of 3 jets

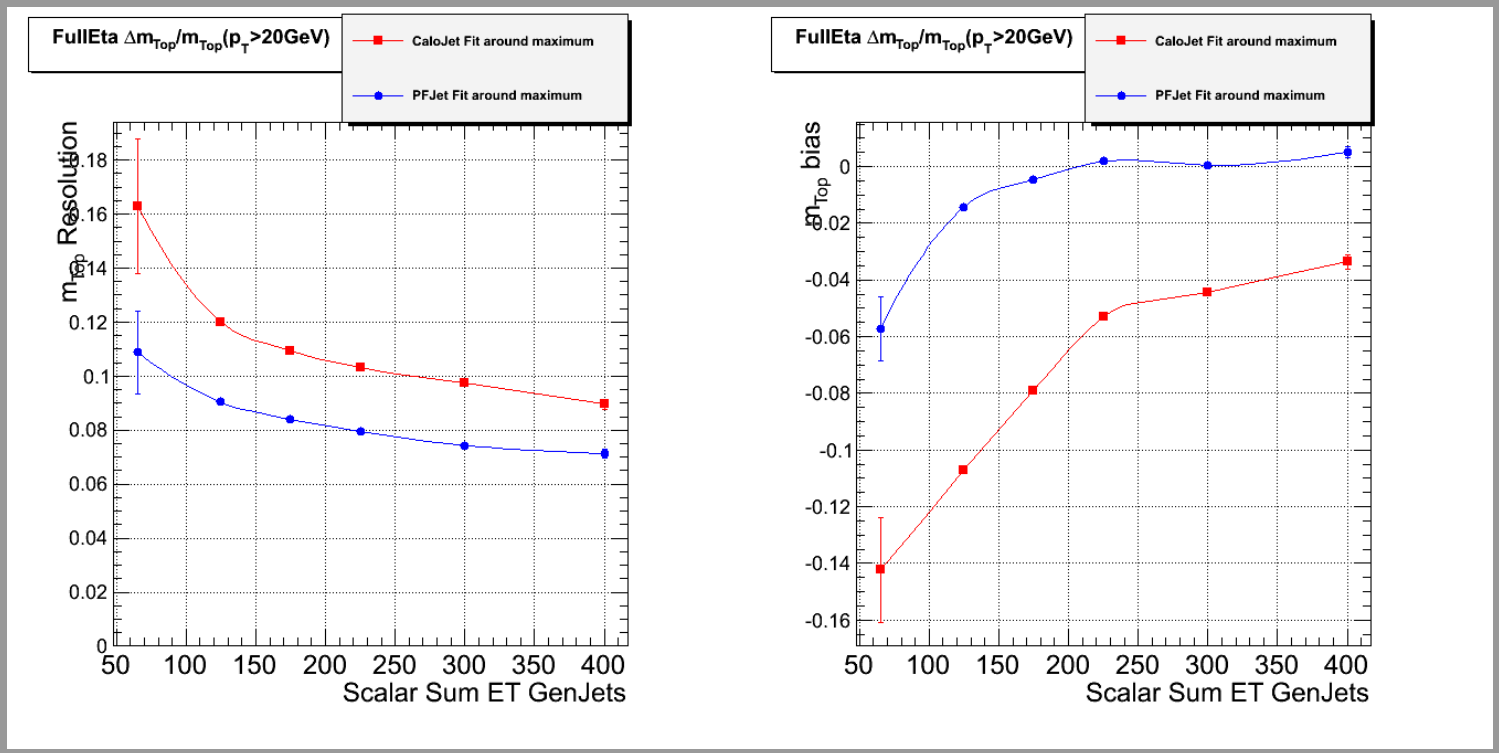

Figure: $\Delta m_{Top}/m_{Top}$ VS Scalar Sum E_T of 3 jets

$\Delta m_{Top}/m_{Top}$ VS Sum # constituents of 3 jets

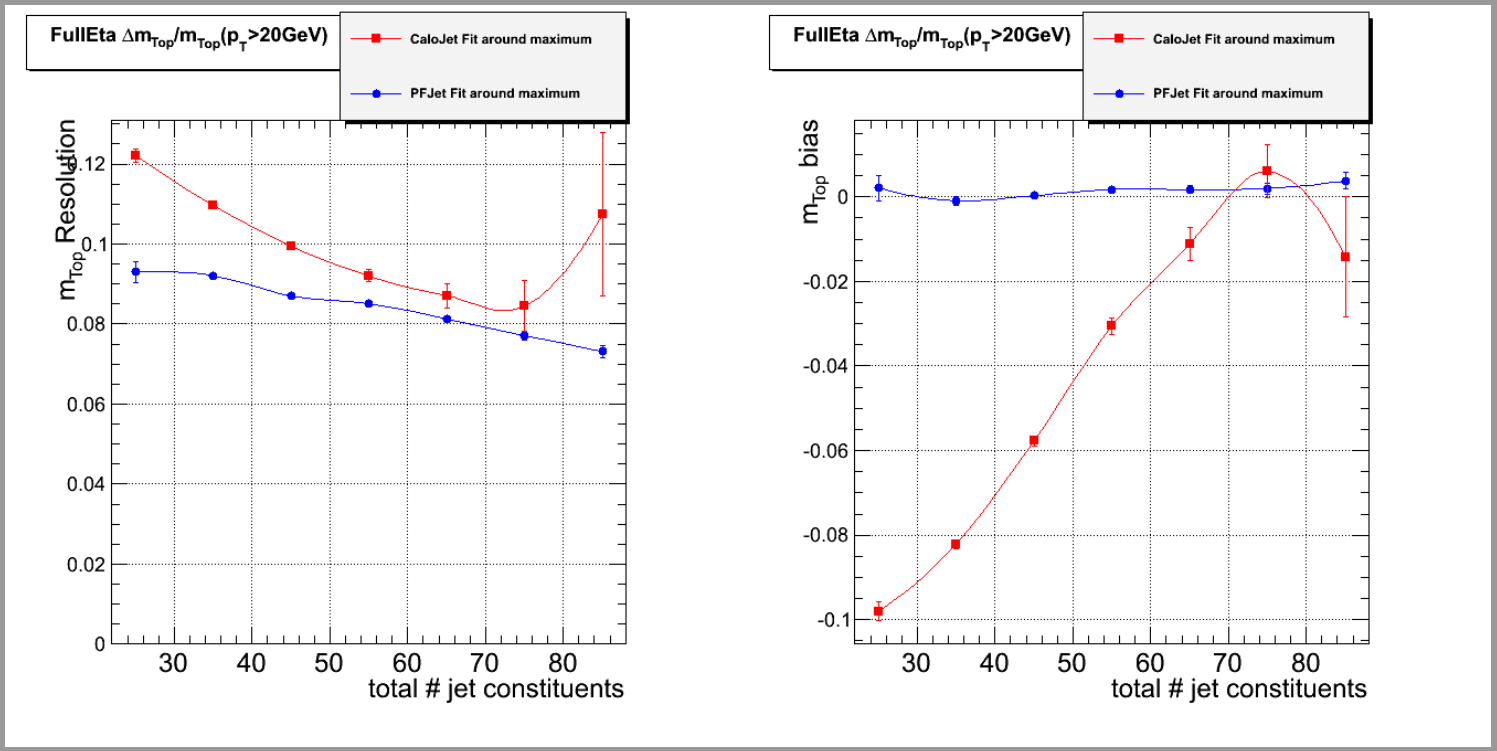

Figure: $\Delta m_{Top}/m_{Top}$ VS Sum # constituents of 3 jets

Efficiency the top-quark identification

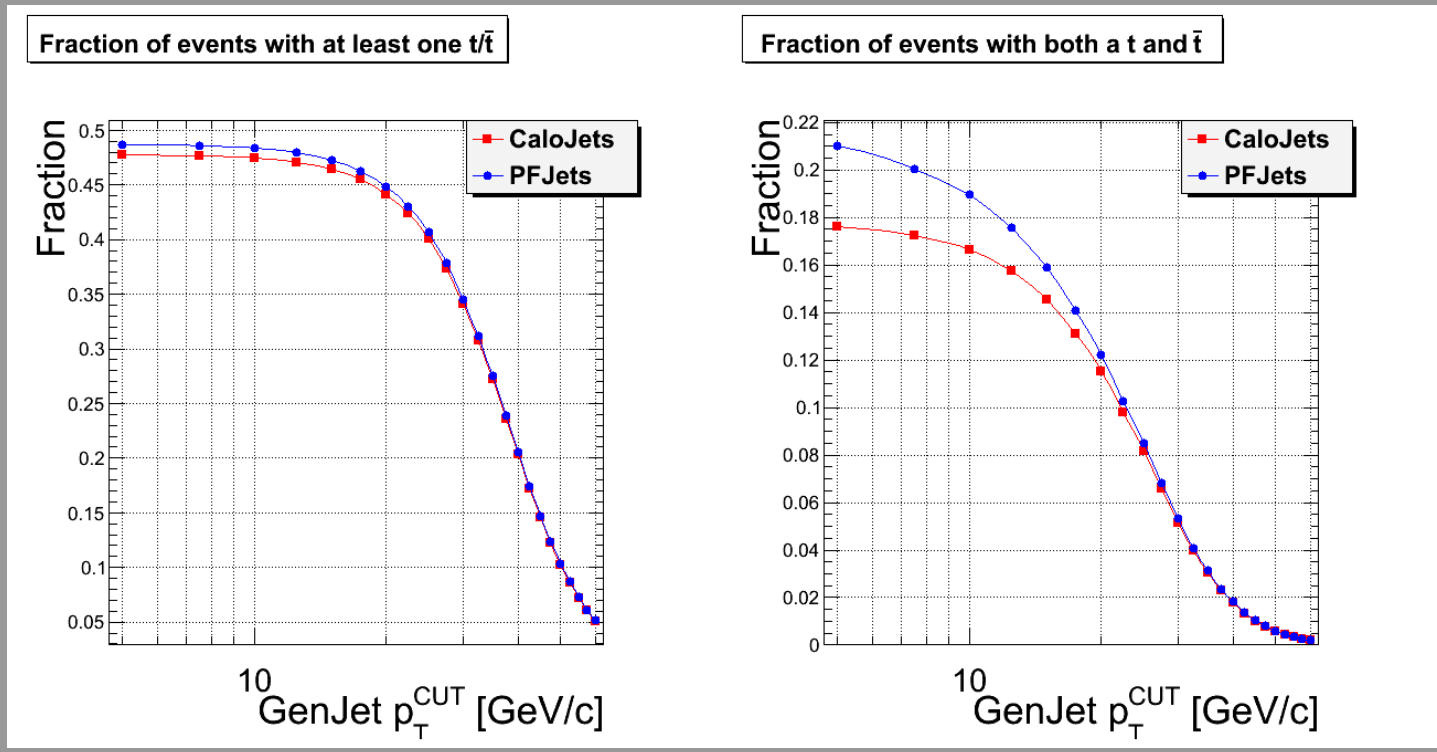

Figure: Fraction of total events that have a reconstructed $t/\bar{t}$ or $t\bar{t}$

Efficiency the top-quark identification

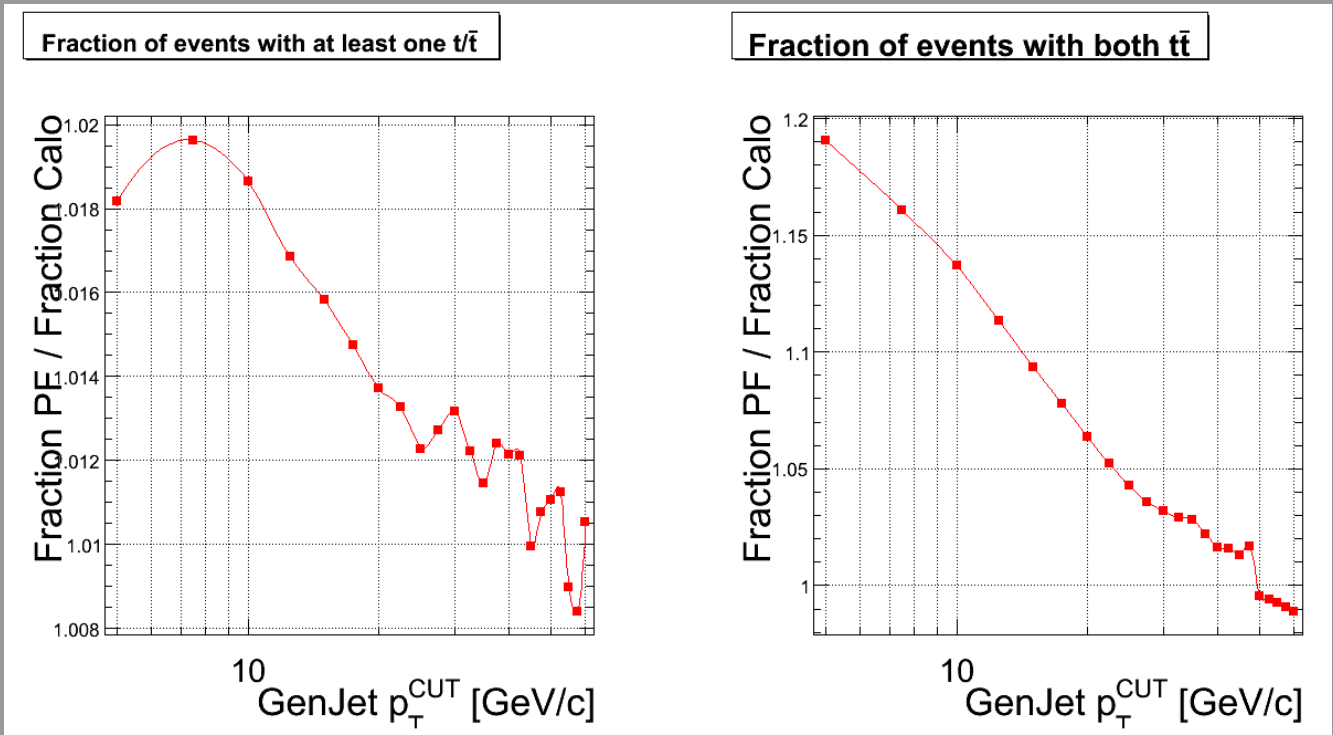

Figure: Ratio of the previous fractions