Calibration of b-quark jets containing a muon

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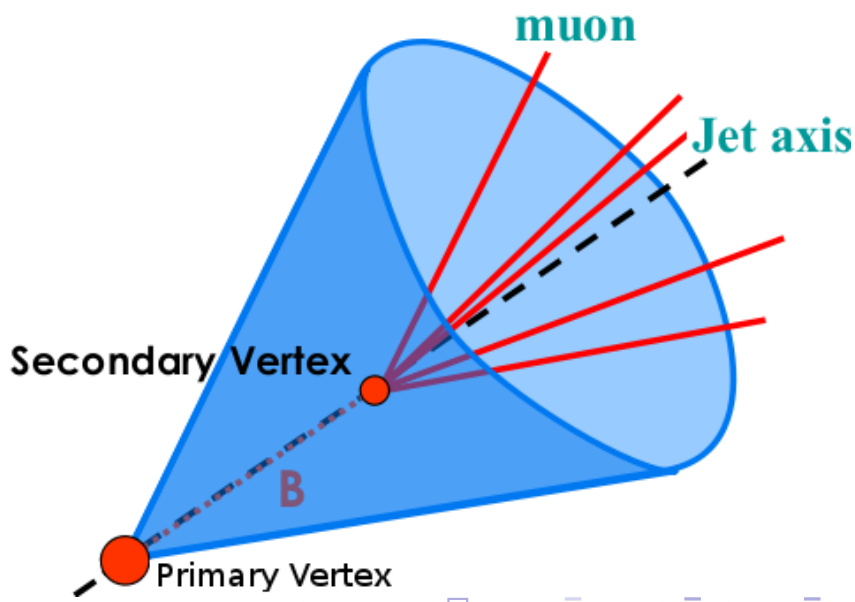
24-11-2008

Overview

Introduction

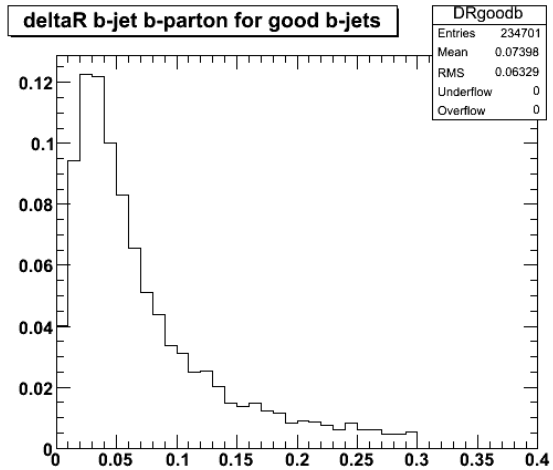
- Using a sample containing 155000 $t\bar{t}$–events
  - /TauolaTTbar/Summer08_IDEAL_V9_v1/GEN–SIM–RECO
- Using only b–jets from $t\bar{t}$–decay
  - $t\bar{t} \rightarrow W^+ b W^- \bar{b}$
  - All types of W–decay
    - leptonic ($l\ \nu_l$) & hadronic (2 quarks)

- Searching for muons inside the b-jet originating from the b-decay



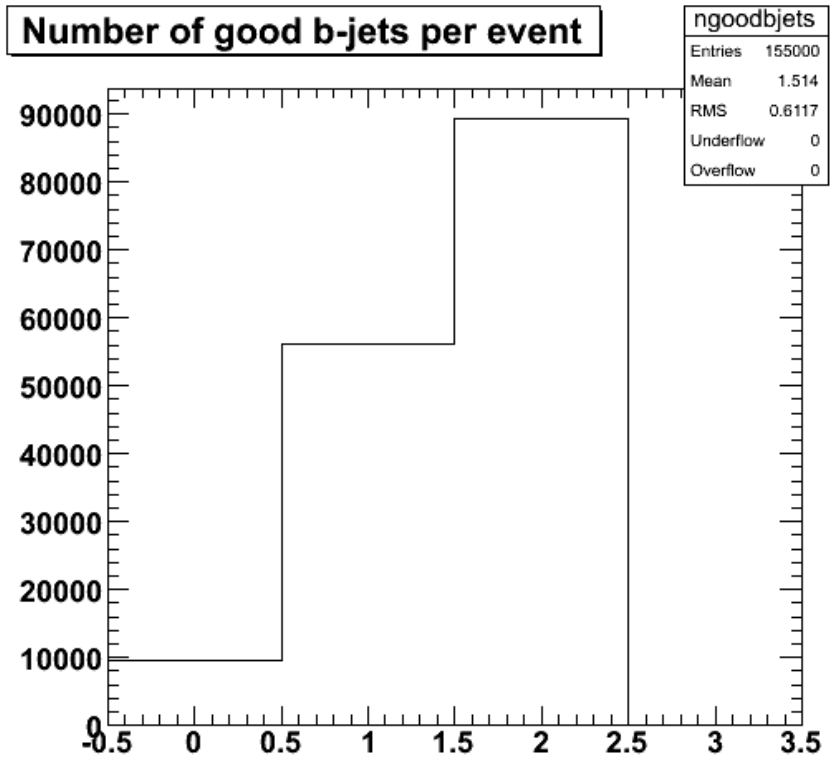
Initial cuts on the b-jets

- $p_T^{b-jet} > 20\ GeV/c$
- $|\eta_{b-jet}| < 2.4$
  - $\eta = -ln(tan(\theta/2))$
- $\Delta R(b-jet, b-quark) < 0.3$
  - $\Delta R(b-jet, b-quark) = \sqrt{(\eta_{b-jet} - \eta_{b-quark})^2 + (\phi_{b-jet} - \phi_{b-quark})^2}$



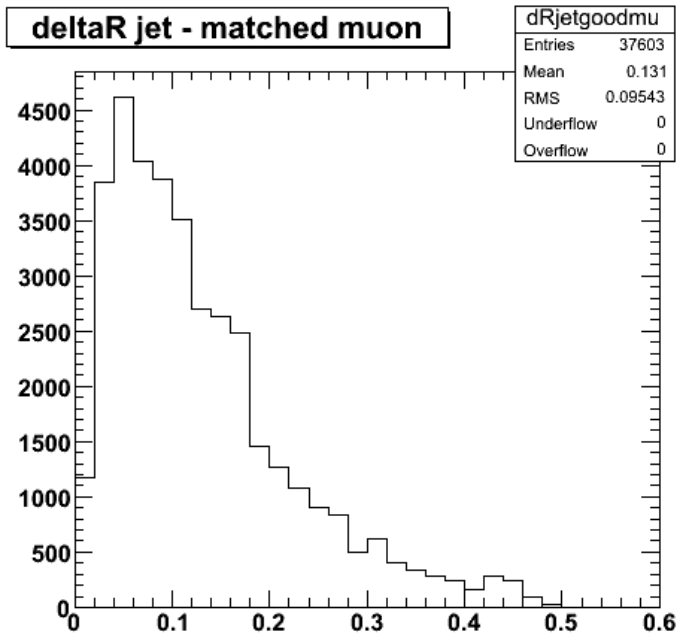
Initial cuts on the b-jets

- Number of b-jets per event after the initial b-jet cuts



Matching of muons with b-jets

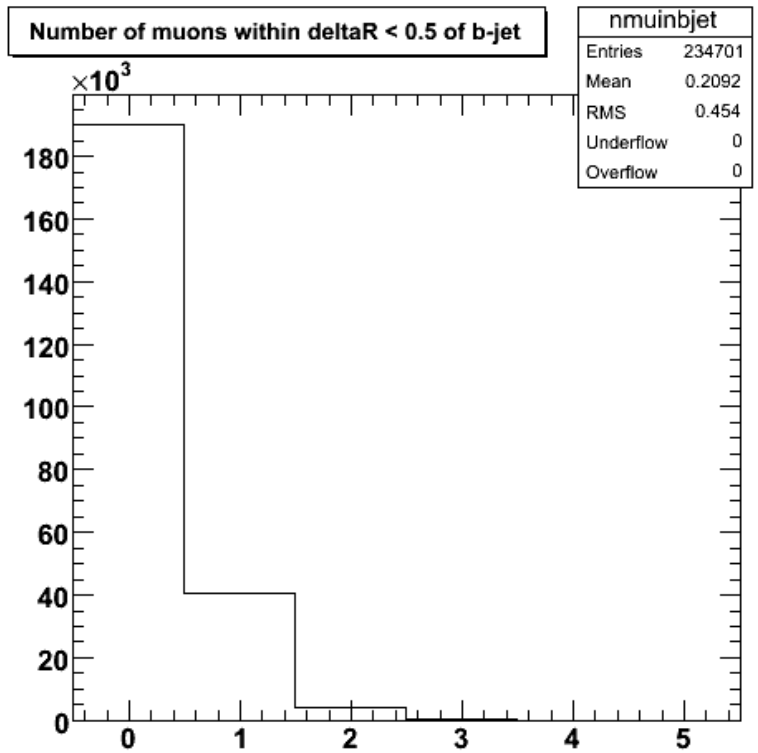
- Initial cuts on muons
  - Only GlobalMuons
    - Muons with hits in tracker & muon system
  - Exclude muons from W–decay which originates from top–decay
- Muon matched with b–jet if $\Delta R(b - jet, muon) < 0.5$



Muonplots

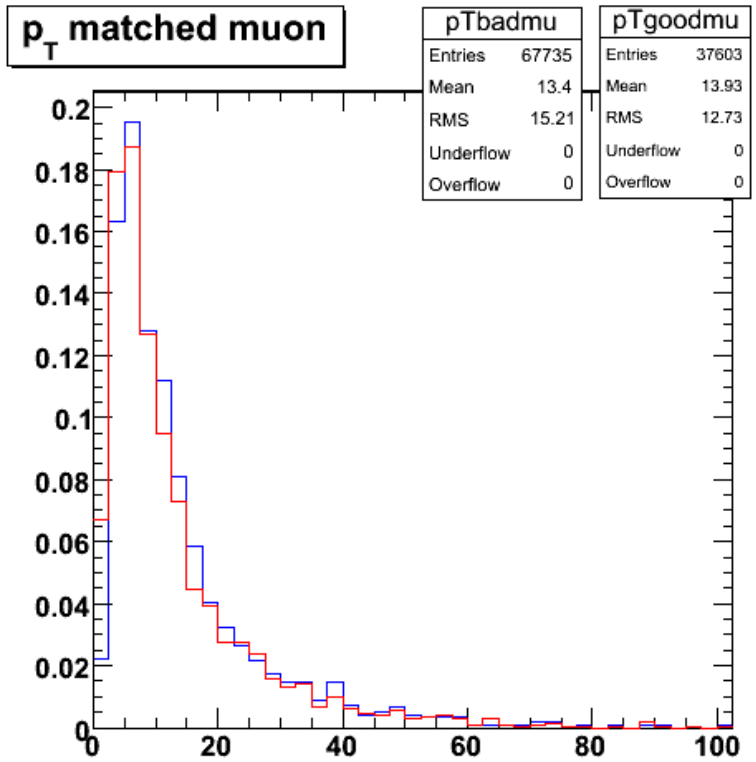
- Number of matched muons per b-jet

- ∼20 % of all b-jets contain one or more muons



Muonplots

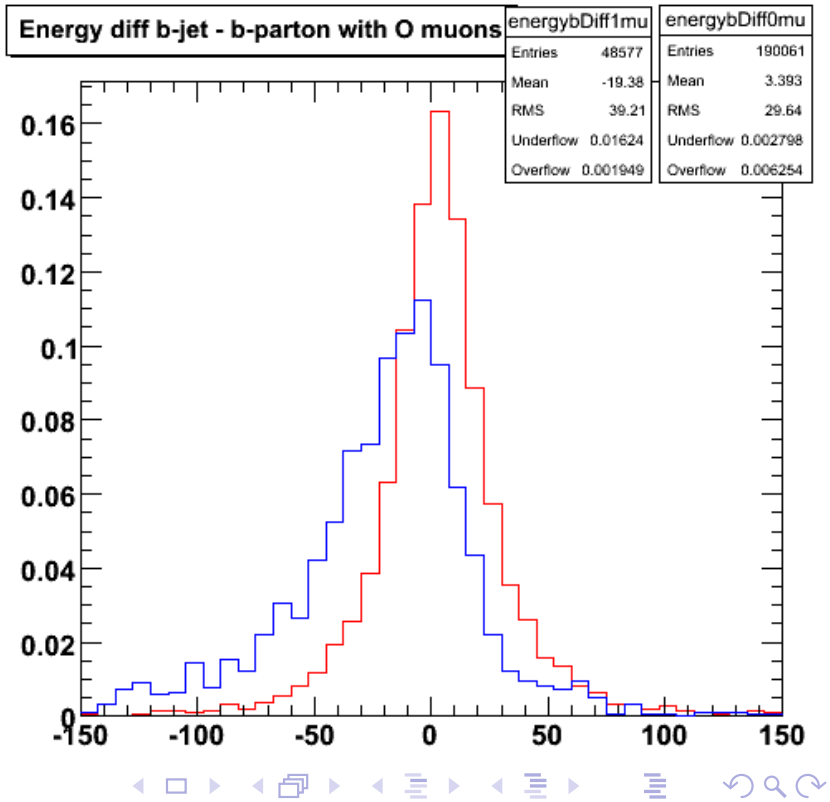
- p_T for muons matched and not matched with a b-jet
  - Blue = Muons matched with a b-jet
  - Red = Muons not matched with a b-jet



Muonplots

- $E_{b-jet} - E_{b-quark}$ for b–jets with and without muons
  - Blue = b-jets with at least 1 muon
  - Red = b-jets without muons

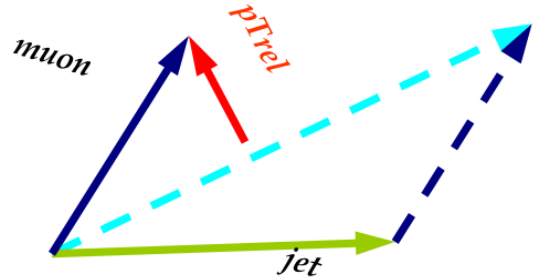
- Underestimation of the energy of a b–jet without a muon



Muonplots

- Other muon properties to look at
  - pTrel:

$$pTrel = \frac{\|\vec{p}_{mu} \times (\vec{p}_{mu} + \vec{p}_{jet})\|}{\|\vec{p}_{mu} + \vec{p}_{jet}\|}$$



  - 2D histograms or profile plots to look at relation between different muon variables, η–dependency of some variables,...
- Both are ready to run, but CRAB didn't want to work on a Sunday...

To do

- Apply cut on χ^2/ndf of fit of muon track
  - Exclude muons from decay of long-lived particles
  - These tracks contain a nod
- Apply L2L3 jet-calibration when it's available for PAT
- When things from previous slide are available, make corrections for b-jets containing muons with these things in mind