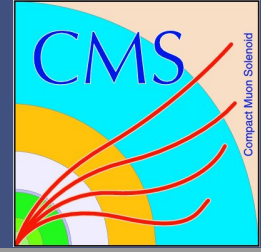
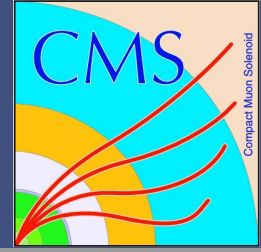


TopQuark Meeting

Comparing ParticleFlow and Calorimeter Jets

Michael Maes

24 November 2008

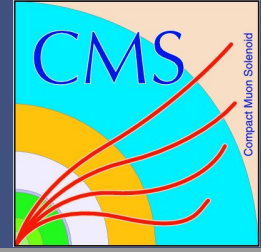


1 Introduction

2 Current Status

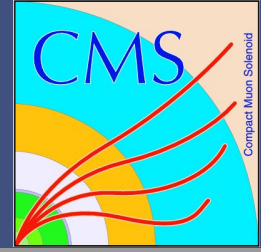
- Datasamples
- First comparison PFJet-CaloJet
- Profile η vs ΔE
- Quark-Jet Plots
- JetObservables

Aim of the project



- Compare Calorimetry Jets (CaloJets) and Particle Flow Jets (PFJets)
- First stage: compare them by simple variables like angles, energies, constituents, ...
- Second stage: use both JetReconstruction methods to construct physics objects (e.g. TopMass) and compare their performance in this context.

ParticleFlow Reconstruction (1)

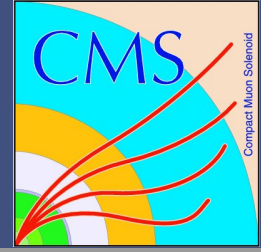


- For Particle Flow reconstruction, all subdetectors of CMS are used!
- Each particle in an event is identified and reconstructed (e.g e^{-}, γ, μ, hadrons,...)
- For each reconstructed particle, the energy and direction is determined along with calibration and correction factors.
- Finally the Jets are constructed from these reconstructed particles.

ParticleFlow Reconstruction (2)

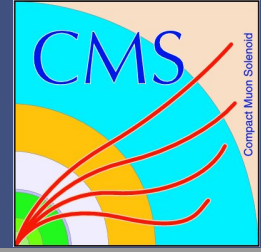
- A global calibration must still be applied on the PFJets because the whole energy can't be collected due to tresholds, magnetic field, efficiencies, ...
- The global calibration factor is expected to be smaller for PFJets than for CaloJets!
- PFJets are expected to have a better energy and angular resolution than CaloJets.

Datasamples (1)



- Find a good "recipe" for PAT under CMSSW_2_1_9.
- Production of patLayer1 objects from the TauolaTTBar_Summer08_IDEAL_V9_V1_GEN-SIM-RECO dataset via CRAB.
- Production via PhysicsTools/PatAlgos/test/patLayer1_fromAOD_PFJets_full.cfg.py
- Total of $\approx$ 150k events

Datasamples (2)



- Problem: New RecoParticleFlow code since September. All samples before that time contain untrustable PFJets.
- Solution: Did the Reconstruction of the raw-data myself using the latest and greatest tags for the ParticleFlow packages in CMSSW_2_1_11 with a config file based on Configuration/Examples/python/RecoExample_cfg.py.
- New patLayer1 objects produced from this reco-sample.

Old vs New PFjests: P_t and η

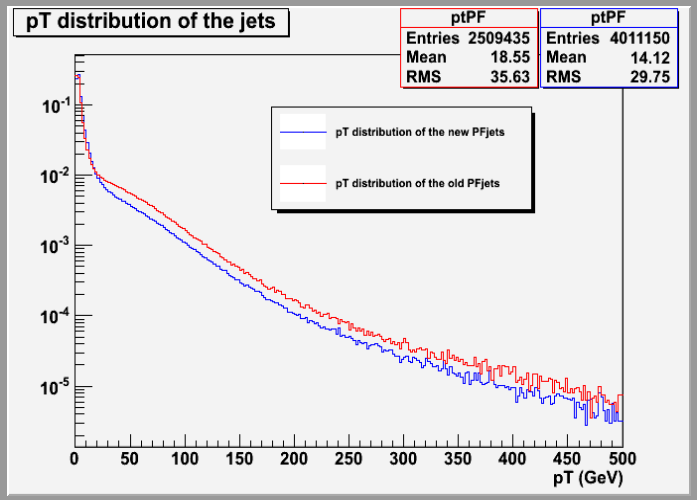


Figure: Pt of the PFJets

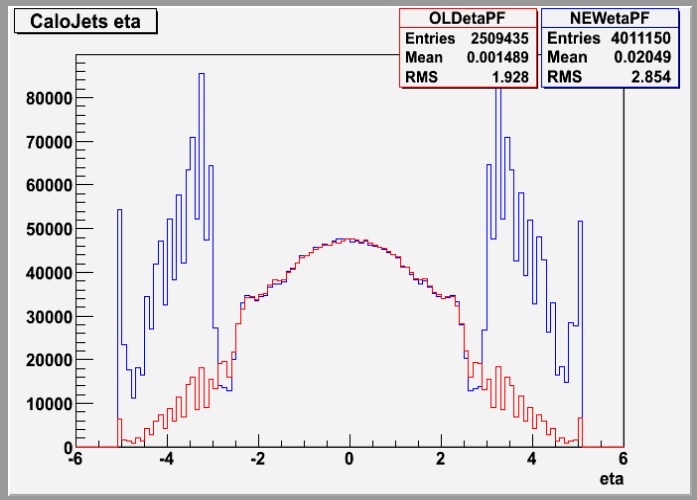
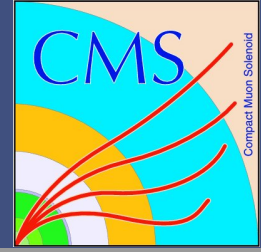


Figure: Eta of the PFJets

- For the new PFJets the distribution peaks for $\eta < -2.4$ and $\eta > 2.4$. In this region there is no tracker info, so what is a PFJet at that point?
- For now I placed a cut on η to use only the barrel-part of CMS.

Some basic variables (1)



- For the following plots, I started from quarks comming from the recoGenParticles collection and matched these to a CaloJet and a PFJet.
- Matching criteria for quark-Jet:
  - ΔR Jet - quark < 0.3
  - The PDGID of jet$\rightarrow$genParticle must be equal to that of the quark.
  - The momentum components of jet$\rightarrow$genParticle must match these of the quark.
- Without matching it would have no sense comparing the PFJets and CaloJets.

Some basic variables (2)

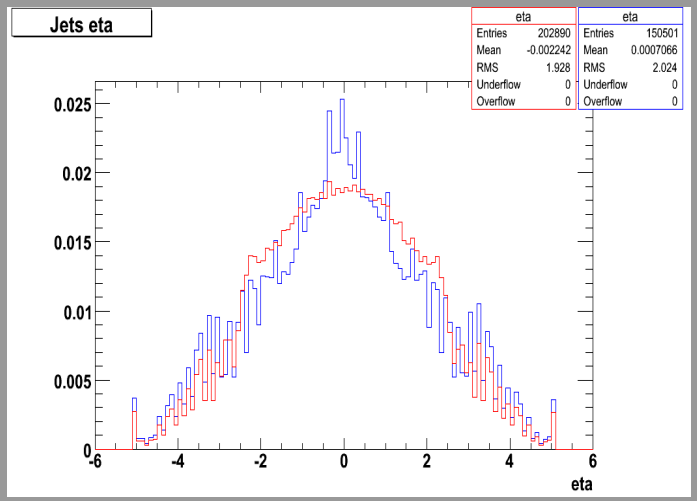


Figure: η of the jets: red: PFJets blue: CaloJets

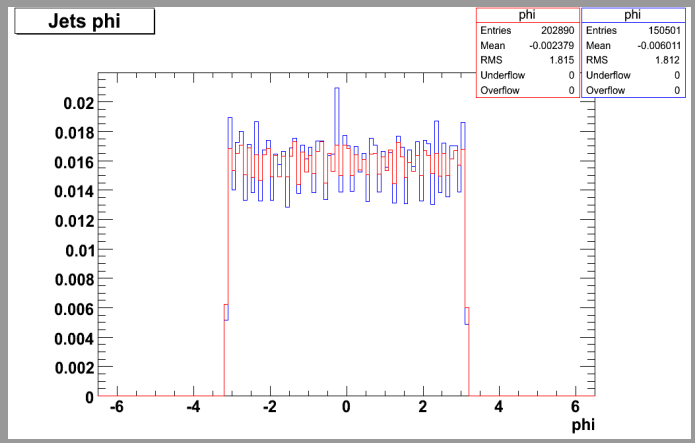


Figure: ϕ of the jets: red: PFJets blue: CaloJets

Some basic variables (3)

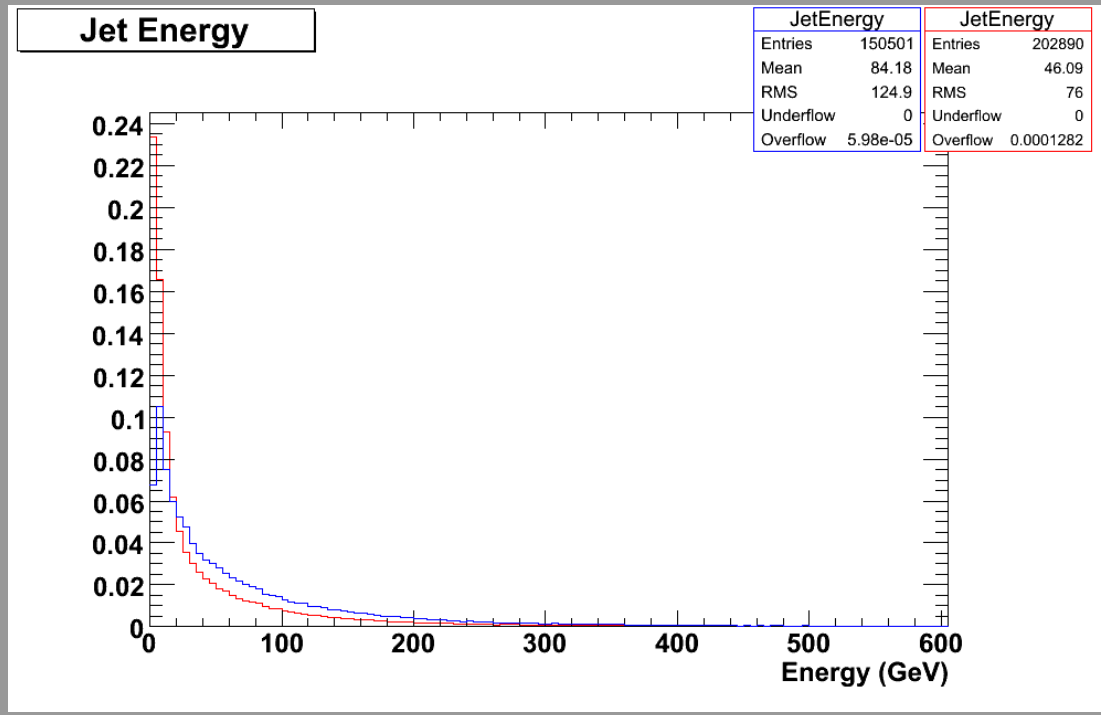


Figure: Energy distribution of the jets: red: PFJets blue: CaloJets

Some basic variables (4)

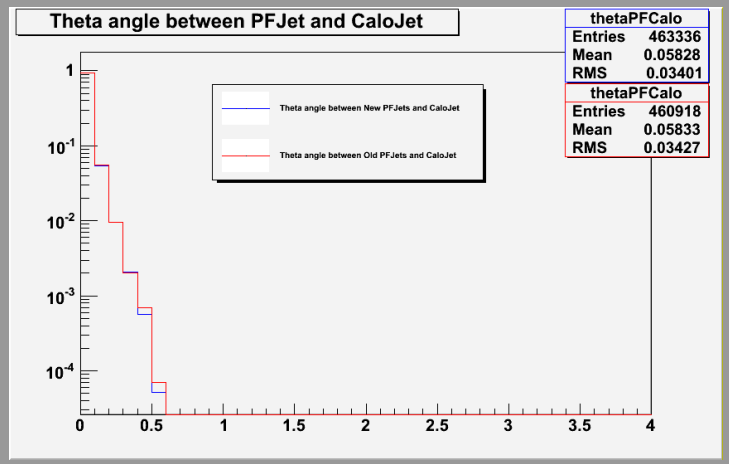


Figure: Angle between PFJets and CaloJets

- Angle between the two types of jets (with the matching mentioned above).
- This angle is small as expected from the strict matching of the jets.

Profile η vs ΔE

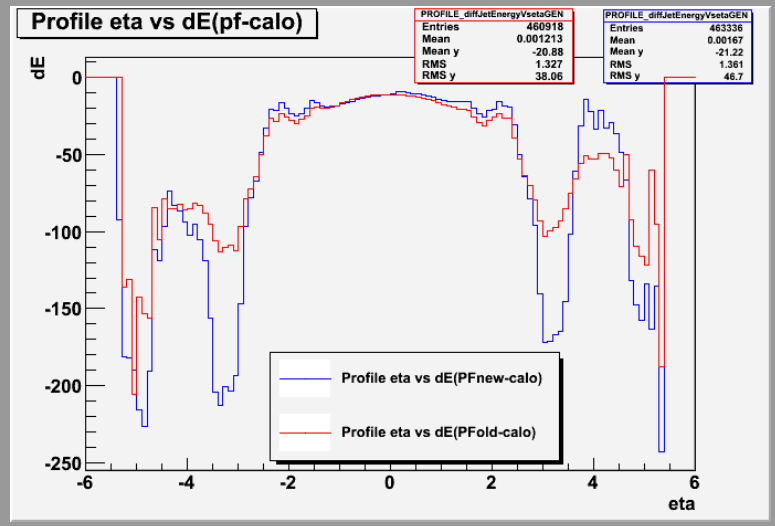


Figure: Profile η vs ΔE

- For this plot no η-cut was applied. Matching was done in the same way as the previous plots.
- In the region -2.4$<\eta<$2.4 the energydifference is small compared to the regions outside.

Angles quark-Jet

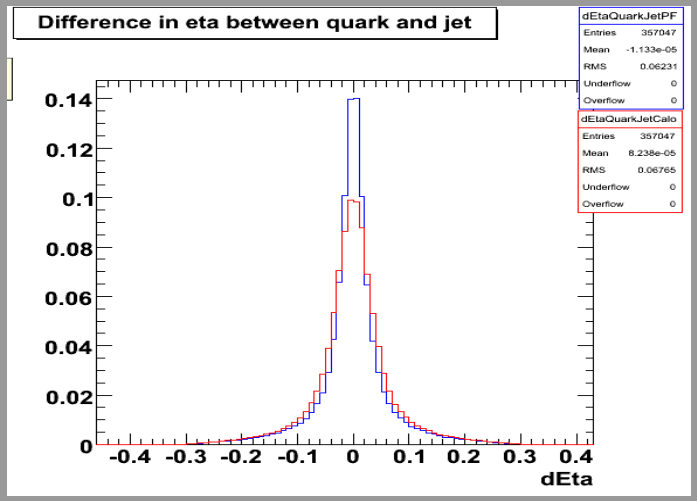


Figure: η quark-jet: blue: PFJets red: CaloJets

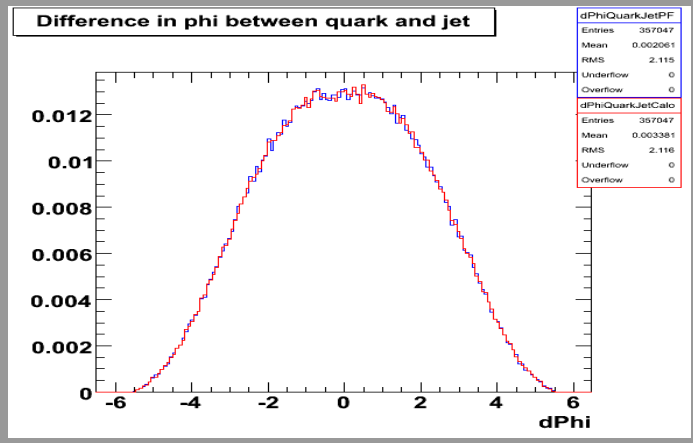


Figure: ϕ quark-jet: blue: PFJets red: CaloJets

- These are last-minute plots so results must be checked. Matching Jet-Quark is done as mentioned earlyer.
- The angular resolution of the PFJets should be better but at first sight this is not the case here. (To be checked)

Energy quark-Jet

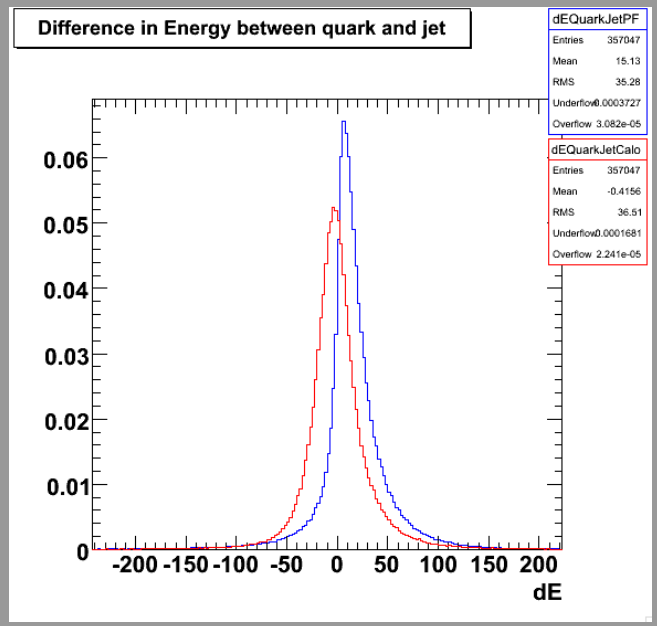


Figure: Energy quark-jet: blue: PFJets red: CaloJets

- Matching Jet-Quark is done as mentioned earlyer.
- The Energy resolution of the PFJets should be better but at first sight this is not the case here. (To be checked)

Jet Observable 2

- Jet observables from "Performance of the JetRejector tool - Jet Algo Meeting 12 Feb 2008"
- Observable 2: $\frac{EMCalEnergyFraction+HadCalEnergyFraction}{EMCalEnergyFraction-HadCalEnergyFraction}$

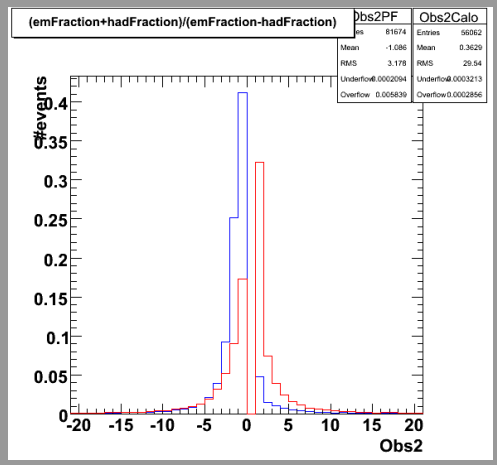


Figure: Observable 2: blue: PFJets red: CaloJets

- There is a nice separation between the peaks.

Other JetObservables

- Among others the following observables will be tested:
  - Obs13: α=Sum(Pt TrackPV)/Pt Jets
  - Obs14: β^2=Sum(Pt TrackPV)/$Sum(PtTrack)^2$
- Determination of PV is ok, but still some problems with Jet-Track Association.