Single hardon E/p performance using minimum bias events

N.Davidson, Supervisor: E. Barberio
The Univeristy of Melbourne

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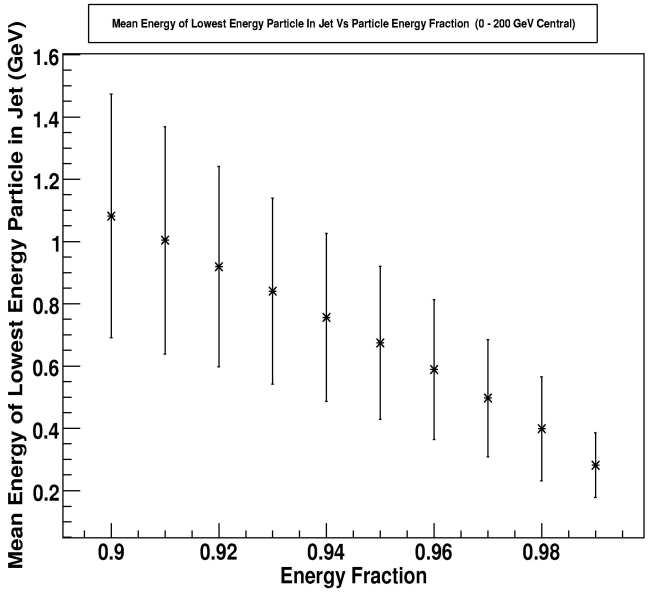
Motivation

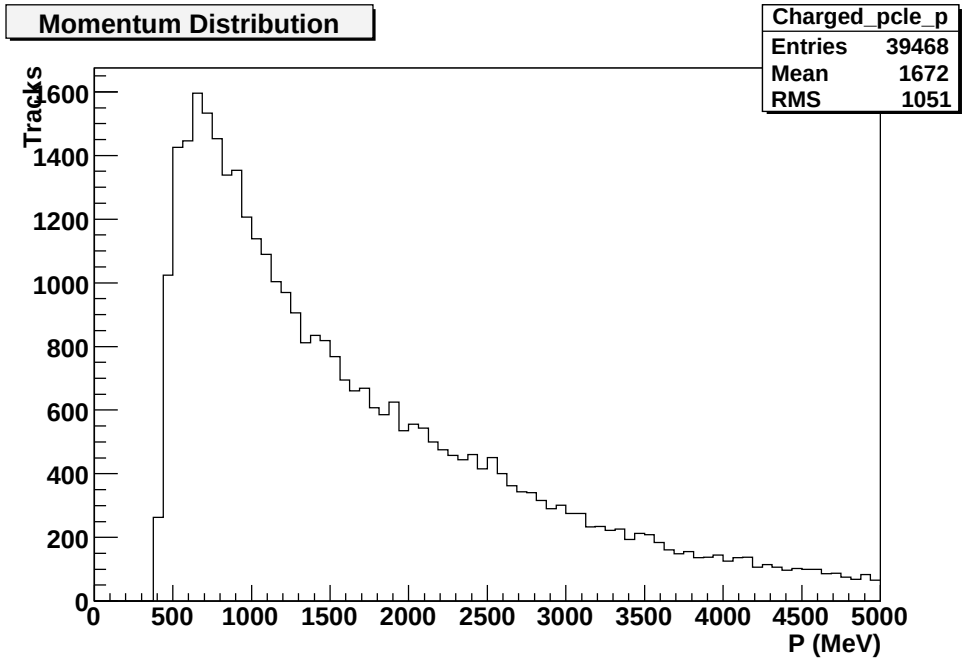
- An in situ calibration of single hadrons is important for improving the jet energy scale resolution.
- E/p method:
  - Look for isolated charged particles.
  - Measure p from the inner detector (resolution 0.5%)
  - Measurment of E from calorimeter (resolution 5-10%) should give E/p=1 for $\pi^{\pm}$.
- E/p for $\pi^{\pm}$ from τ decay under study (J. Lu, D. M. Gingrich)
- However coverage of the low momentum range: 400 MeV - 15 GeV is desirable for jet calibration.



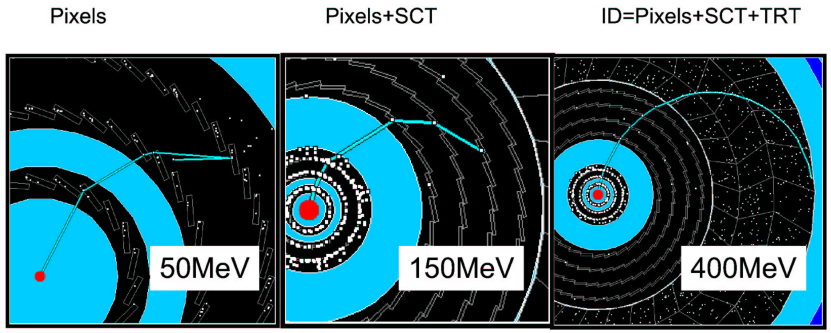
From M. Hodgkinson. Energy of the lowest energy particle in jet, in central region for 0-200GeV J1 jets

Track Characteristics from Minimum Bias Events

- Examined 2000 TrackParticleCandidate objects from AOD csc minimum bias events. (csc11.005001.pythia_minbias.recon.AOD.v11004201, Athena 11.0.42).
- Momentum range - lower limit 400 MeV is due to particles not reaching the calorimeter

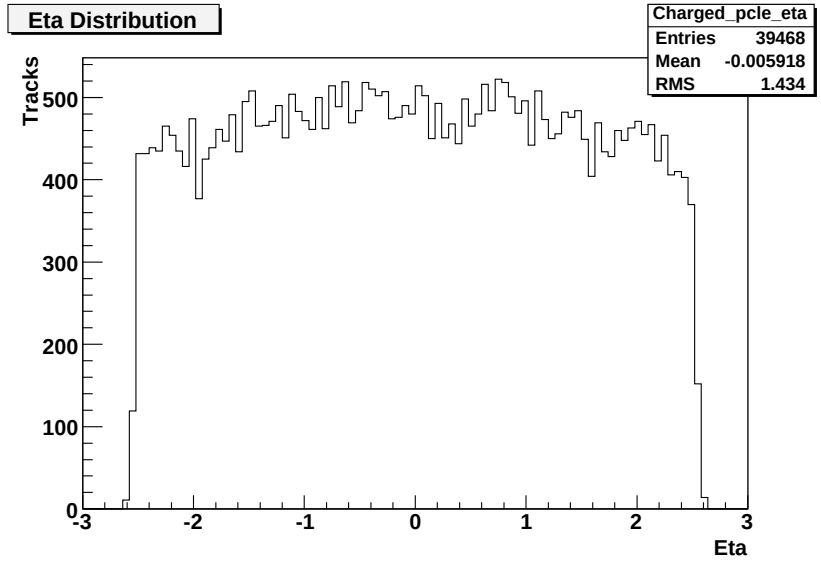


P distribution for minimum bias tracks



From C. Buttar. Momentum limit of inner detector

- Eta range - mostly flat and extends between $-2.5 < \eta < 2.5$ due to range of tracker



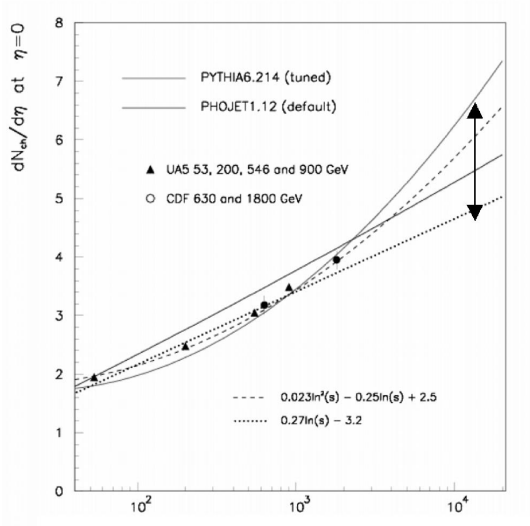
η distribution for minimum bias tracks

Characteristics from Minimum Bias Events cont.

- Approx. 20 tracks per event. Number of neutral particles (taken from SpclMC TruthParticleContainer) is of the same order.
- Charge Particle types (from truth match):
  - $\approx 2.5\%$ - leptons
  - $\approx 75\%$ - $\pi^{\pm}$
  - $\approx 14\%$ - $K^{\pm}$
  - remaining - heavy hadrons (> 1 GeV)
- For low energy particles, $m_{\pi^{\pm}} \approx 140 MeV$ is significant:
  - eg. p = 500 MeV E/p=1.08
  - eg. p = 2 GeV E/p=1.005

Direction of work

- E/p will be studied for the 900 GeV starting energy as well as 14 TeV
- Match tracks to topoClusters using track extrapolation tool (TrackToCalo?)
- Study shower profile of neutral contaminantes vs $\pi^{\pm}$s in calorimeters to determine seperation variables
- Compare calibrated vs non-calibrated topoClusters
- Explore pile-up effects for high luminosity
- Compare E/p for Minimum Bias MC generators Pythia vs Phojet



From C. Buttar. Extrapolation of min. bias charged particle density for the LHC

- Hope to have some result by the Calorimetry Calibration Workshop in Sep.
- Study will contribute to the CSC Jet 8 note on Single Hadron Energy Scale