$\frac{\text{Energy}}{\text{Momentum}}$ Tuning of High Momentum Single Track Particles

CDF Simulation Meeting
January 12, 2006

Shawn Kwang
with
Soon Yung Jun and Mel Shochet

Introduction & Outline

- We are now in the process of tuning E/p response at momentum greater than 5 GeV/c with the latest lateral parameterization (by Pedro).
- Data is 15 GeV/c single track trigger ~ 6 million events
  - Also used Jet Calibration Data and a 10 GeV/c track trigger.
- New MC generated over winter contains new tunings
- For each isolated tracks plot the:
  - EM (2x2), Hadron (3x3),
  - MIP (EM < 670 MeV), and Total (EM+Hadron) energy over momentum of track.
- Fit the Total and MIP distributions to a converging Gaussian
- Plot the mean (and sigma) of the Gaussian as a function of track momentum

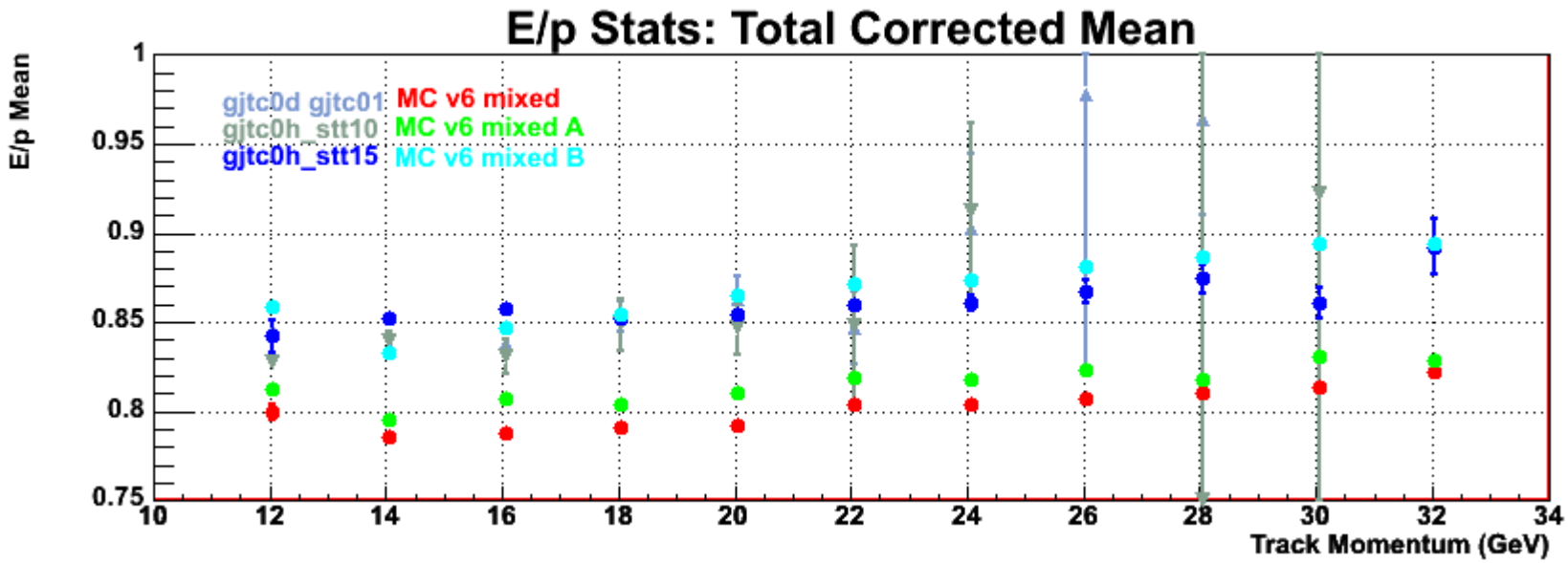
Different Datasets

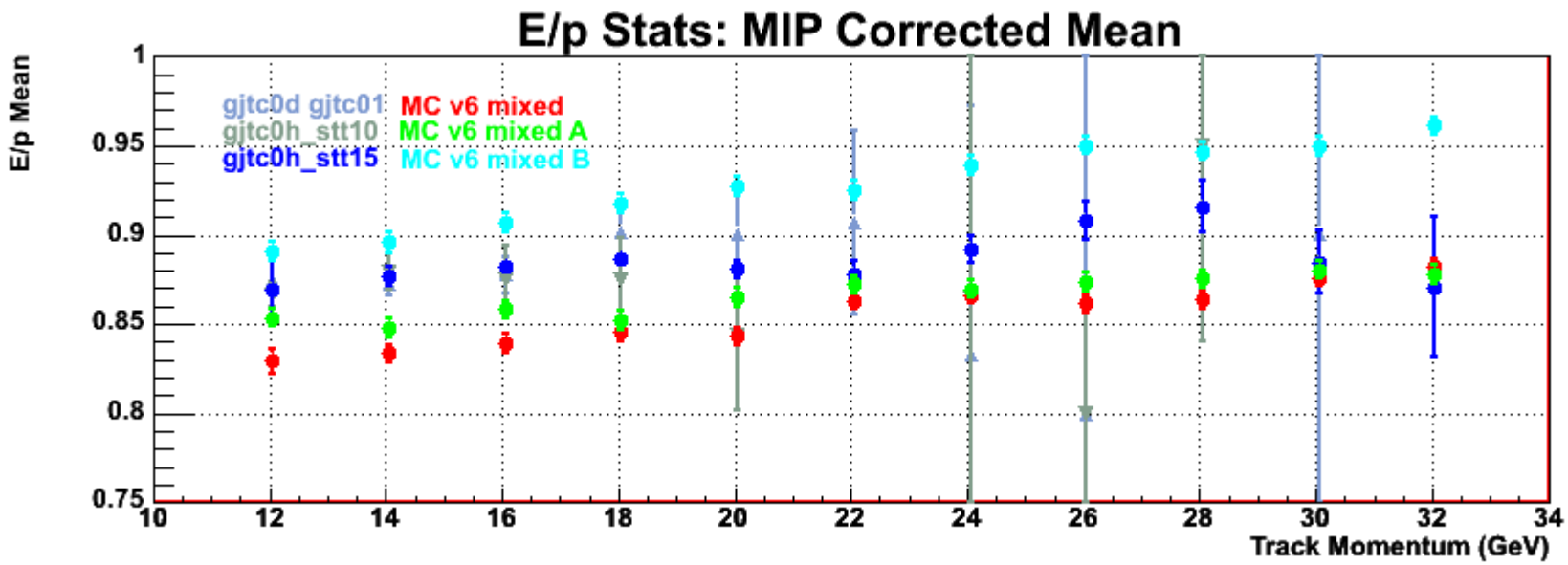
- Three different datasets used.
- 15 GeV/c Single Track Trigger (15 STT)
  - Dataset: gjtc0h_stt15
  - Dataset taken over summer 2005 which I have been using to compare calorimeter response to MC.
- Jet Calibration Data – multiple trigger thresholds: 5, 7, and 10 GeV/c
  - Dataset: gjtc0d and gjtc01
  - Older data collected in 2004
- 10 GeV/c Single Track Trigger
  - Dataset: gjtc0h_stt10
  - Dataset taken before 15 STT with lower threshold.
- The tuning has been using the 15 STT data sample.
  - To avoid the trigger turn on effects we use data around 20 GeV.
  - We want to use the later two datasets to “set a datapoint” at a lower Energy.

New MC Samples

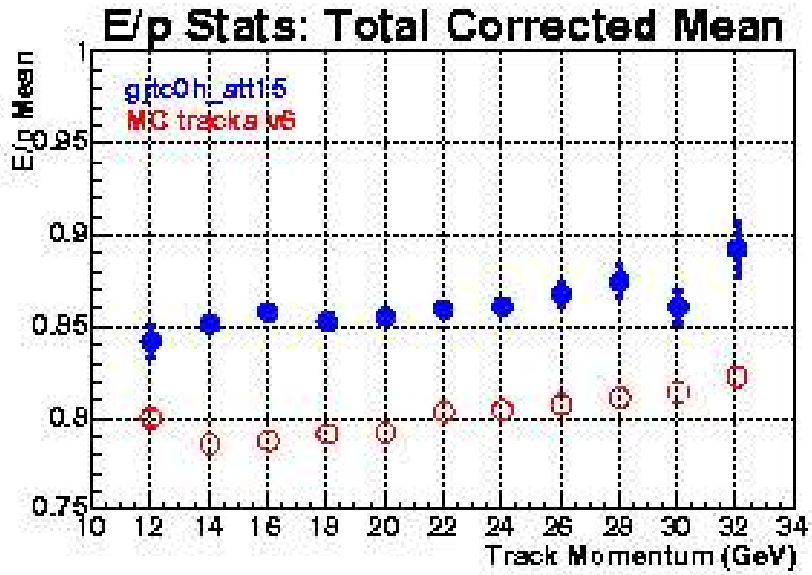
- Baseline Fake Event Monte Carlo (MC).
  - MCv6 – includes Pedro's preliminary (old) lateral tuning.
  - MCv6 A – Includes Pedro's latest lateral tuning.
  - MCv6 B – MCv6 A + preliminary longitudinal tuning based on Mcv6.
    - +4% in the average response in both EM and HAD compartments
    - +4% in the EM response only
- Fake events with two particles generated
  - 550,000 events generated with development cdfSim linked against 6.1.3
  - Processed with ProductionExe and Stntuple version 6.1.2
  - Pions, Kaons, and protons generated in a 6:(2.91):(1.09) ratio.
  - Particles and antiparticles were generated evenly.
  - Pythia Tune A minimum bias added as an underlying event.
  - Particles were generated with a flat momentum spectrum.
    - From 8 GeV to 42 GeV

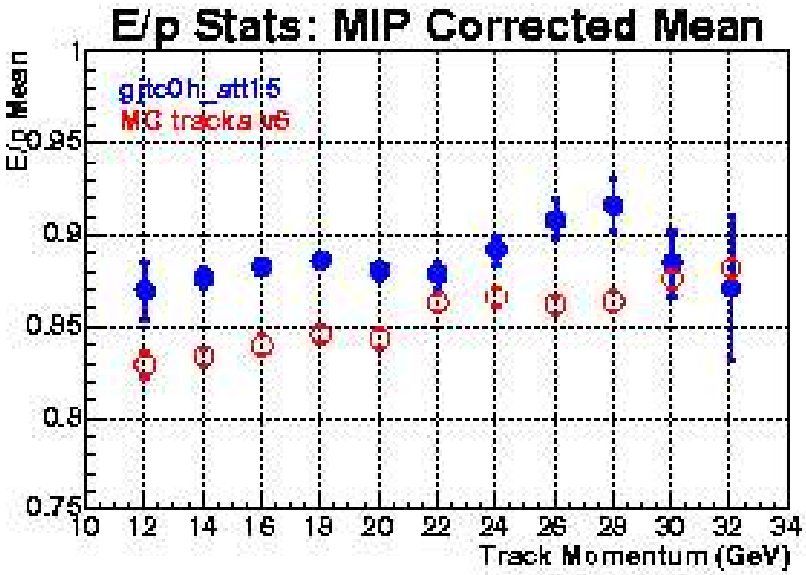
3 Datasets vs 3 MCs

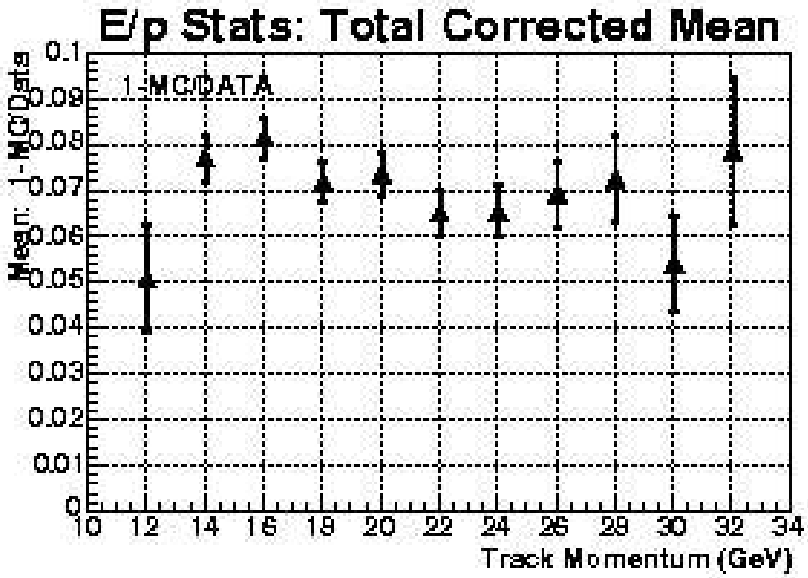


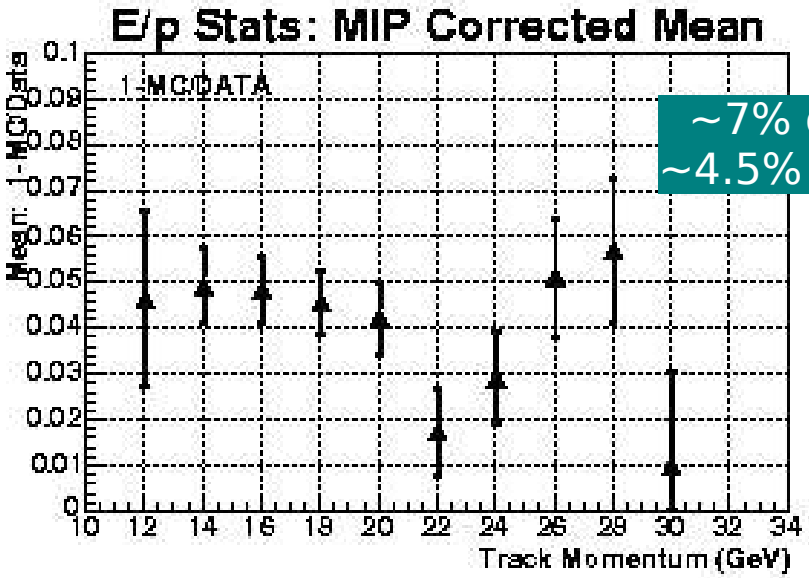


STT15 vs. MCv6



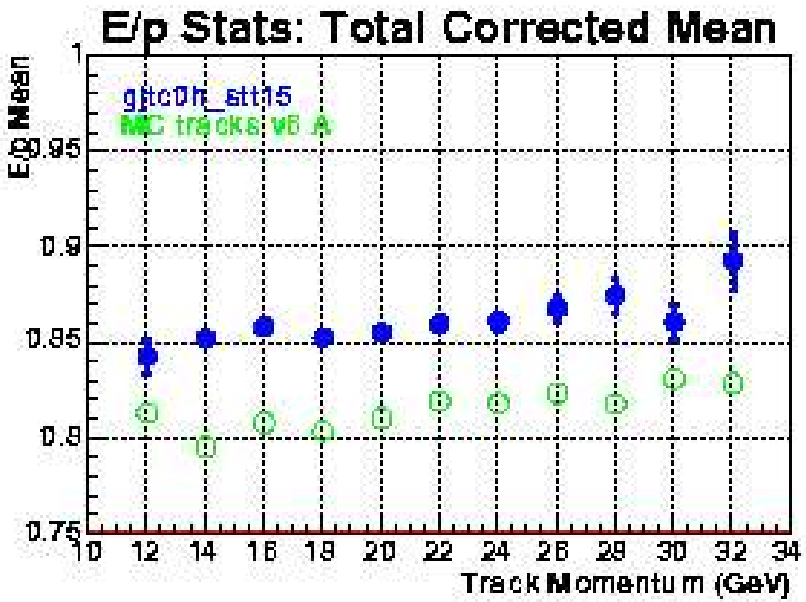


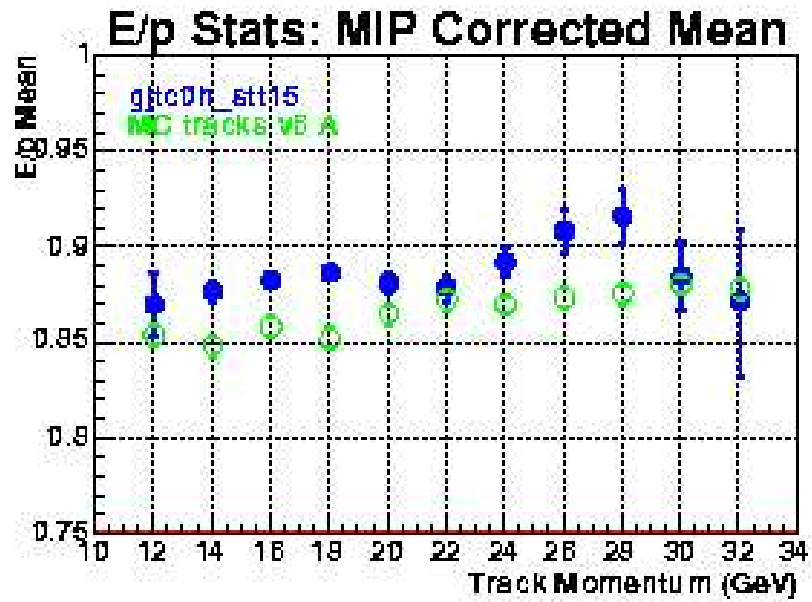


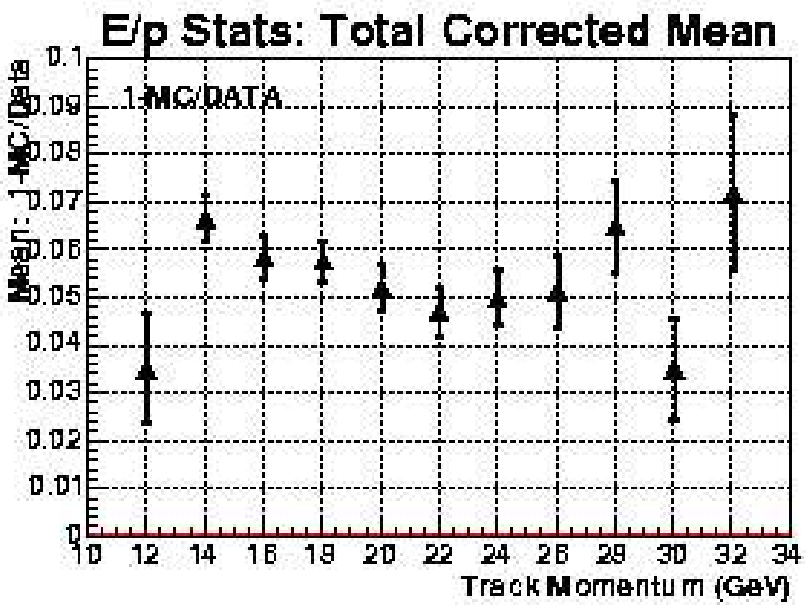


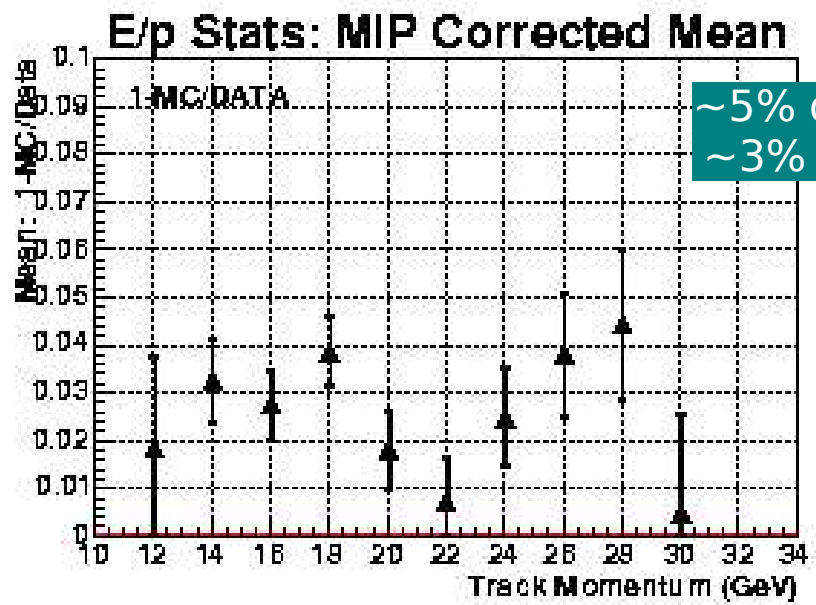
~7% diff in TOT
~4.5% diff in MIP

STT15 vs MCv6 A



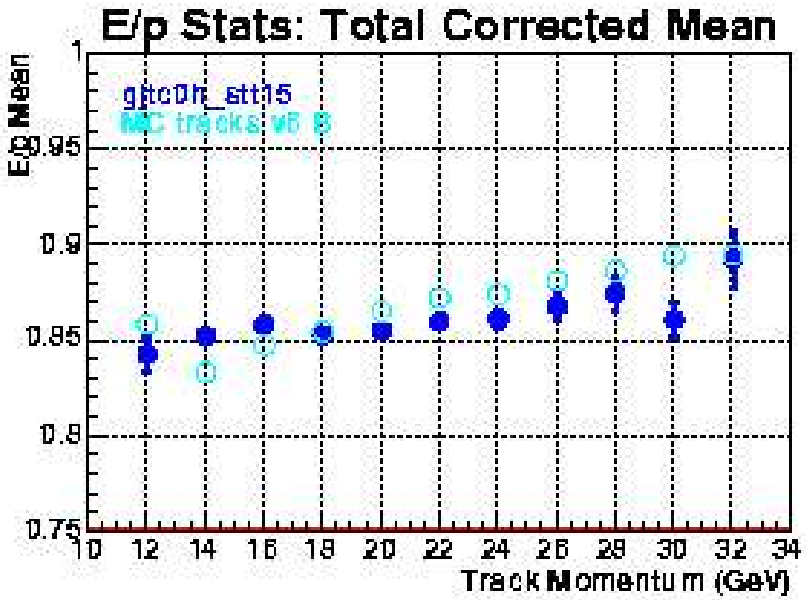


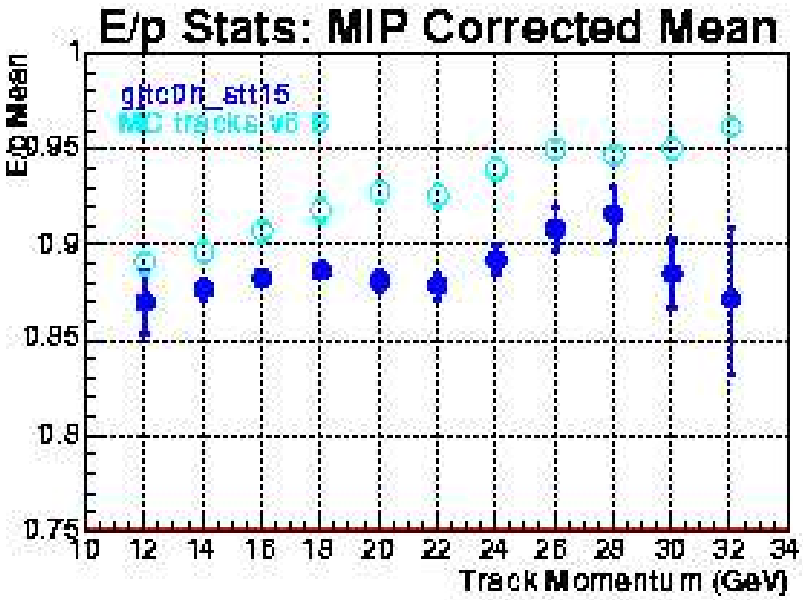


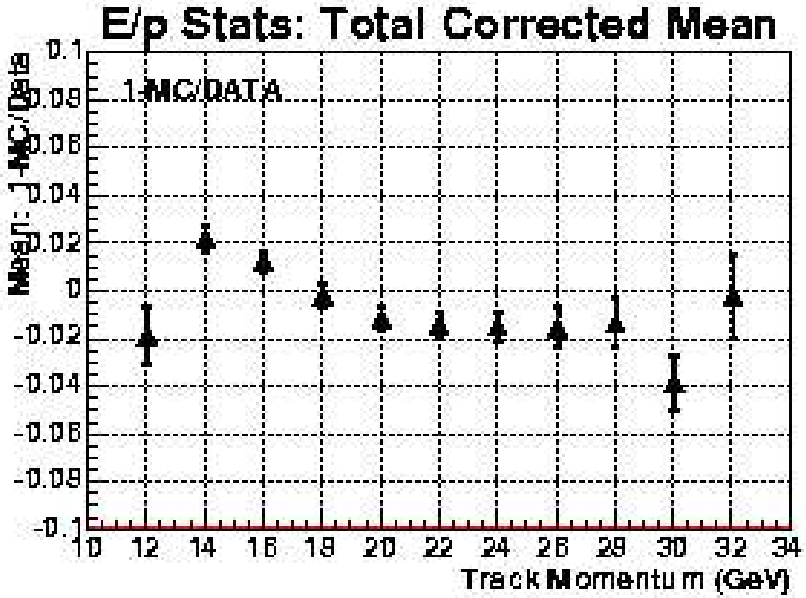


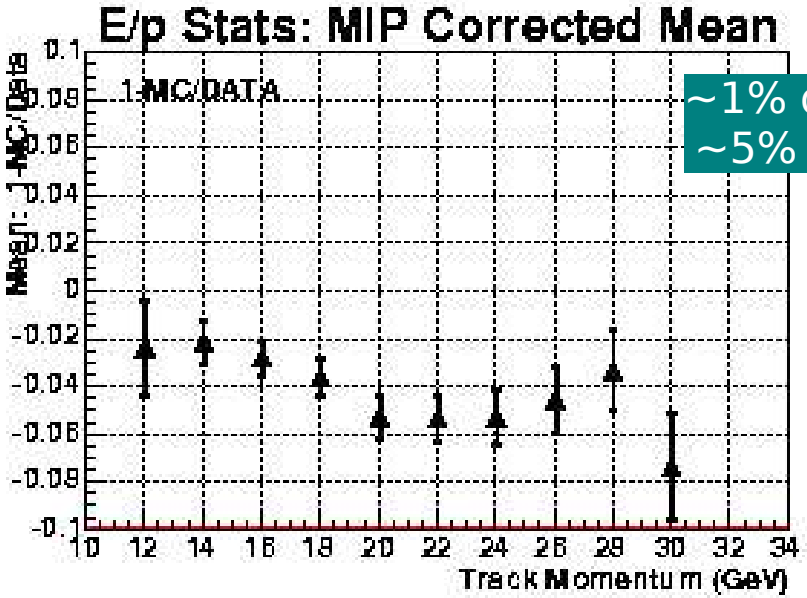
~5% diff in TOT
~3% diff in MIP

STT15 vs MCv6 B



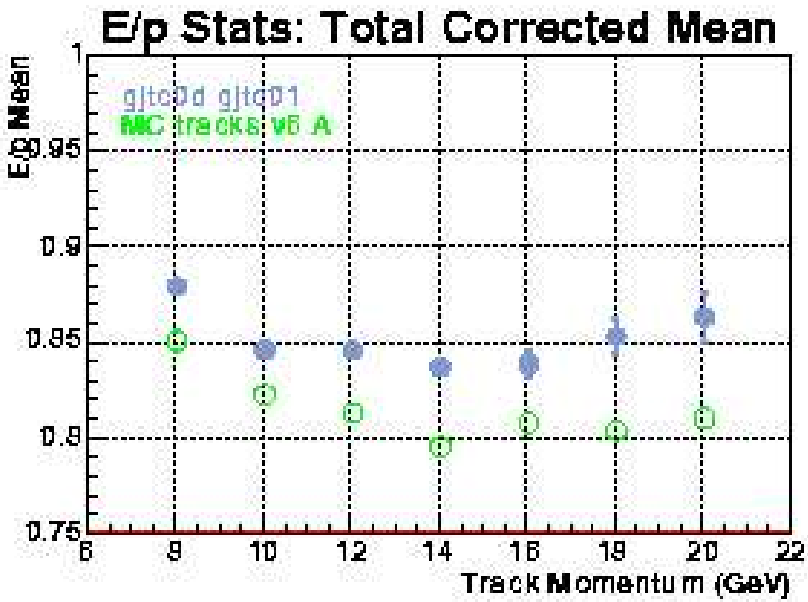


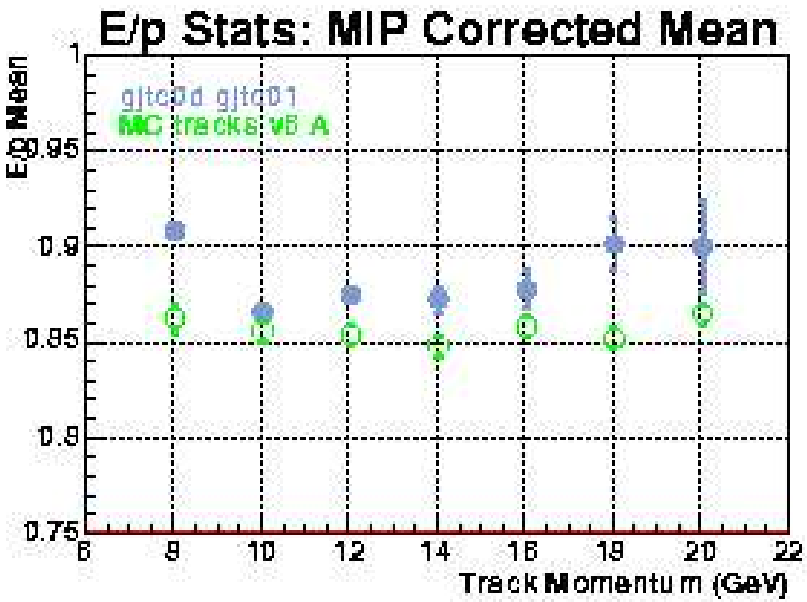


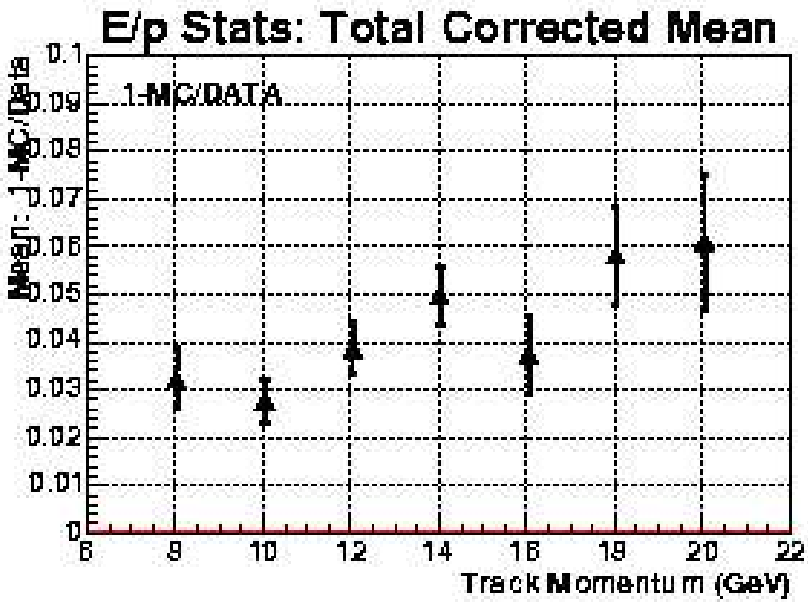


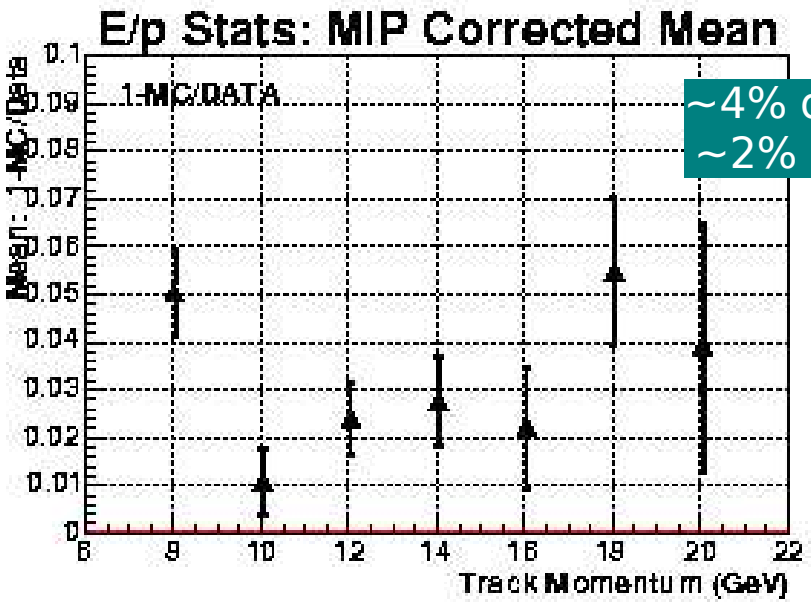
~1% diff in TOT
~5% diff in MIP

Jet Calibration vs MCv6 A



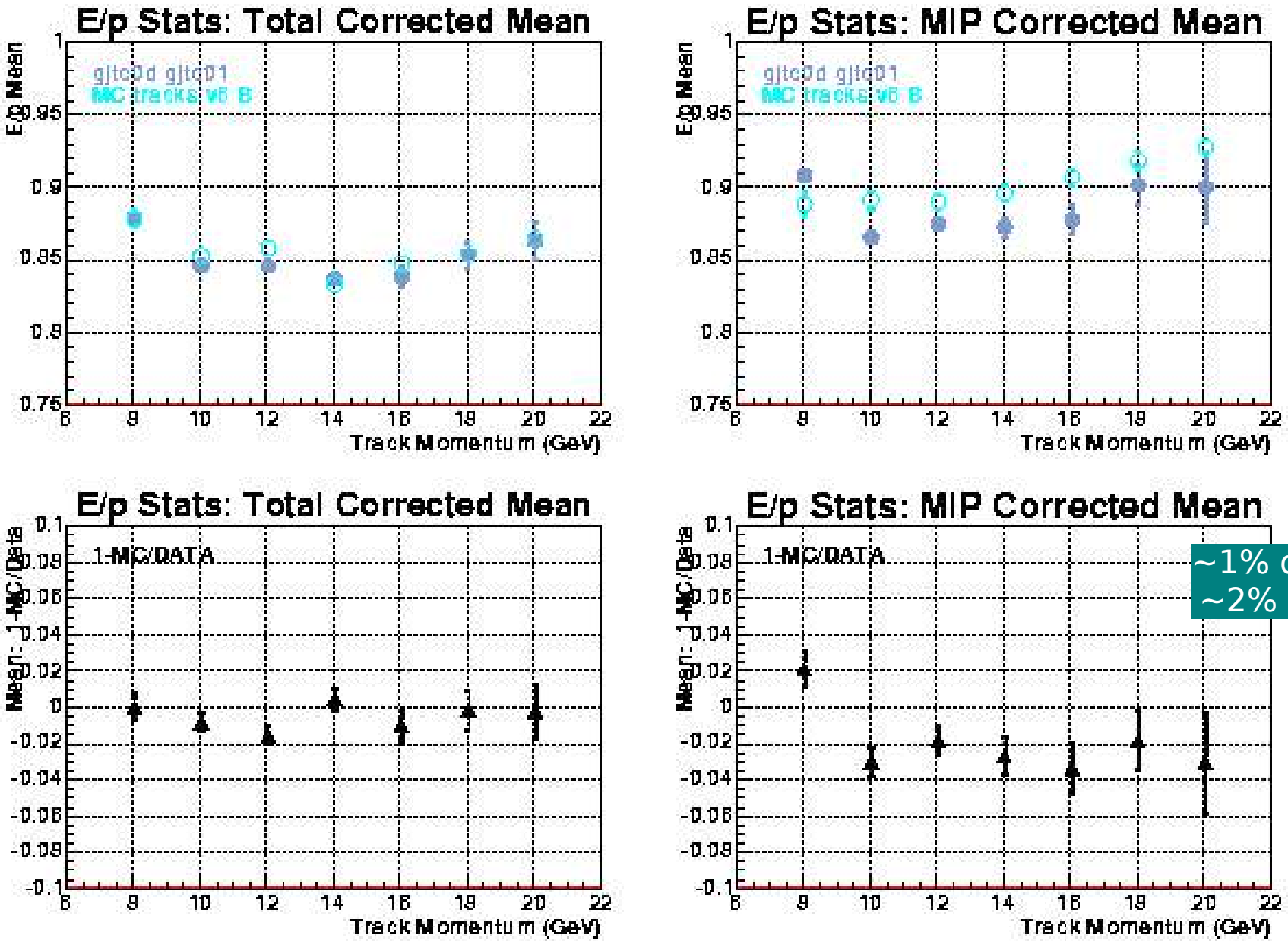






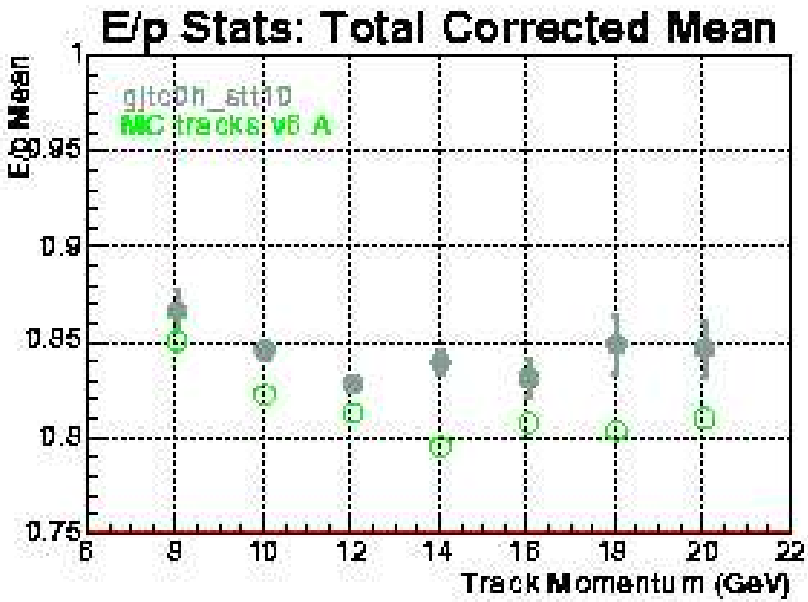
~4% diff in TOT
~2% diff in MIP

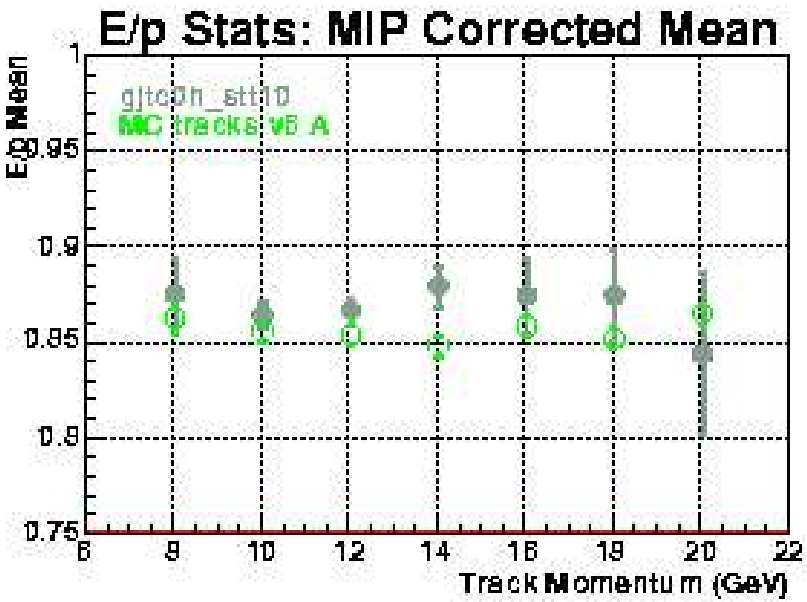
Jet Calibration vs MCv6 B

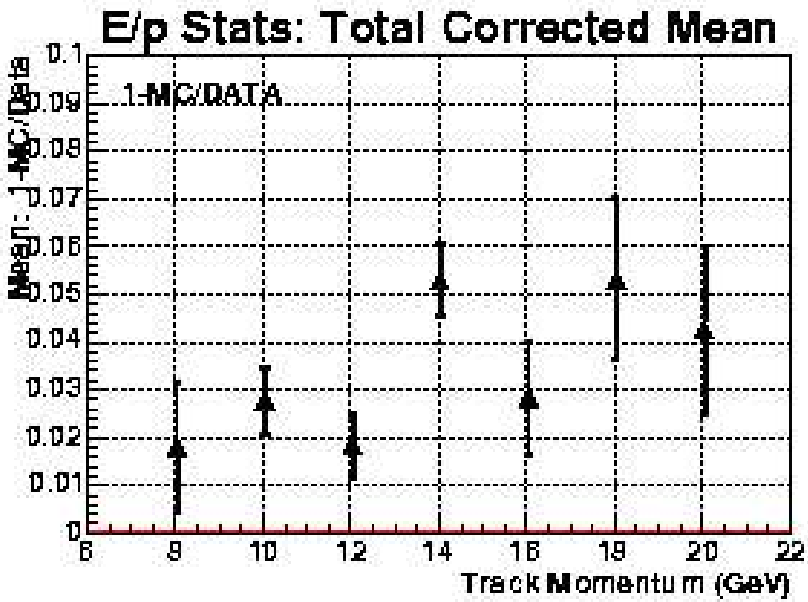


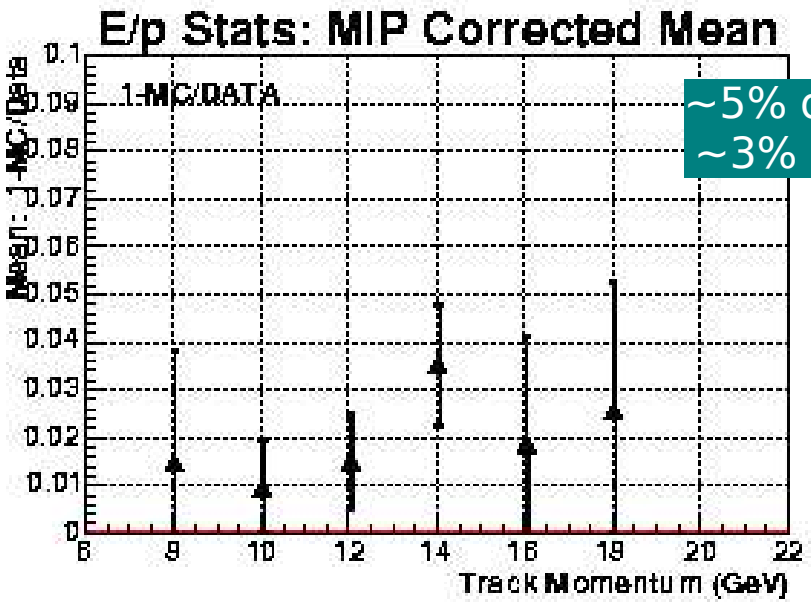
~1% diff in TOT
~2% diff in MIP

STT10 vs MCv6 A



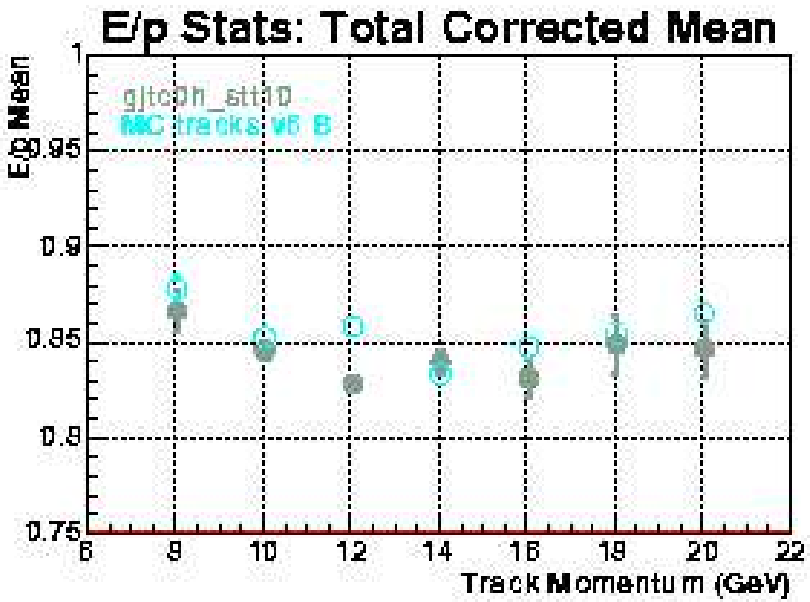


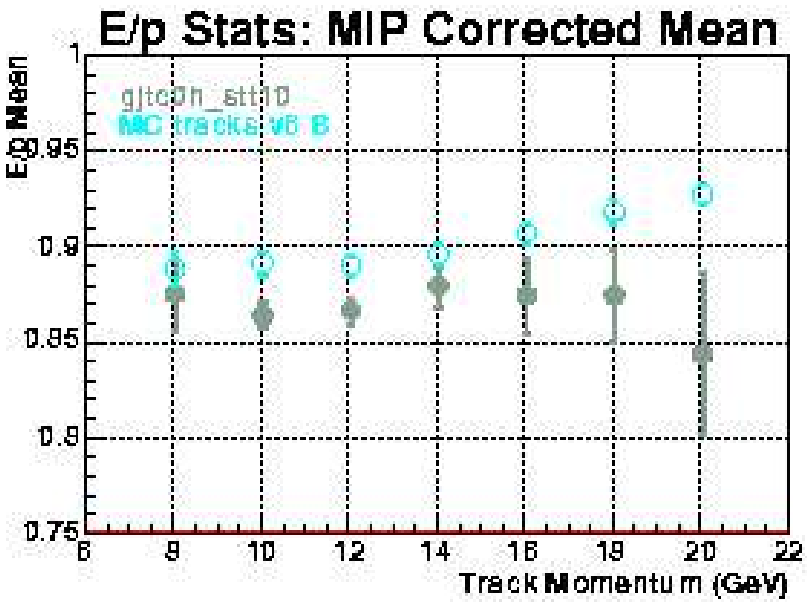


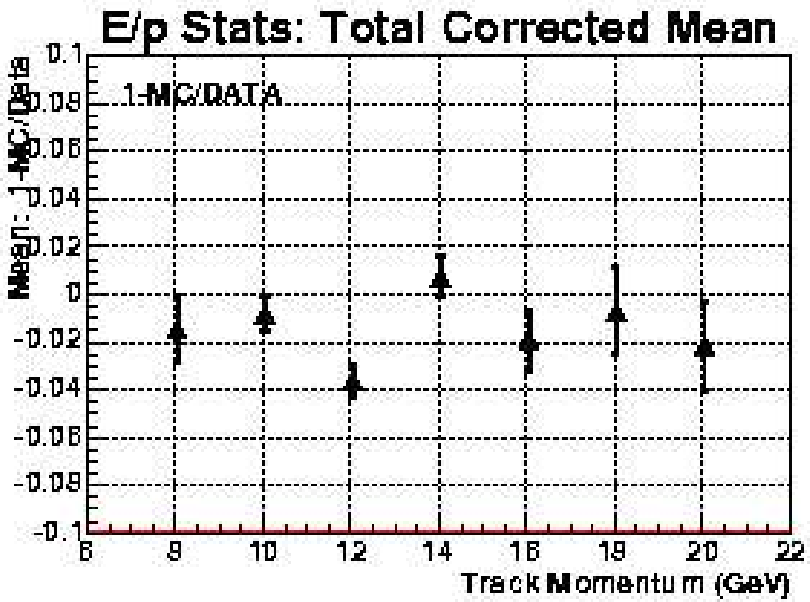


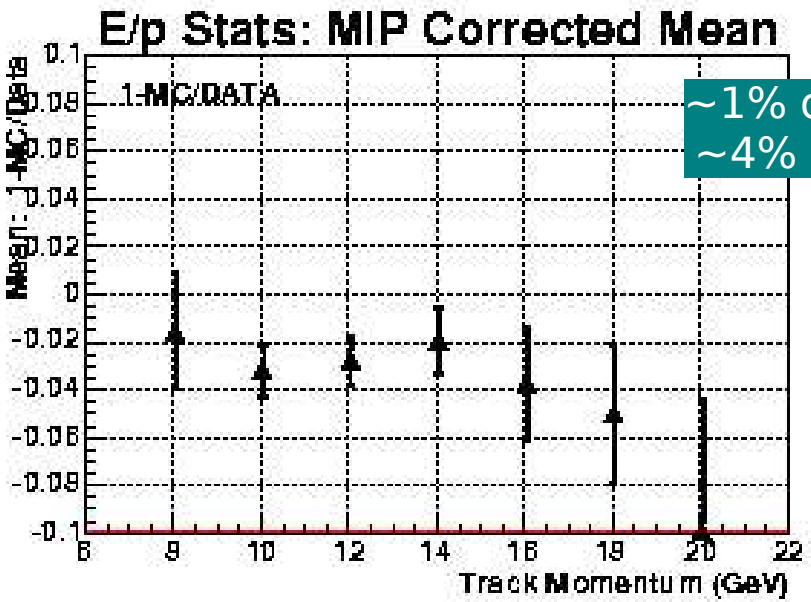
~5% diff in TOT
~3% diff in MIP

STT10 vs MCv6 B









~1% diff in TOT
~4% diff in MIP

Conclusion

- Both new tunings, A and B, straddle the 15 GeV STT data.
  - Another iteration of MC based on MCv6 A with the help of MCv6 B.
- Jet Calibration and the 10 GeV STT data can also be used in this MC tuning.
  - Similar corrections are needed for the intermediate E/p responses.