$\frac{\text{Energy}}{\text{Momentum}}$ Central Calorimeter Tuning Update

JERG group Mini-Workshop
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with
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Introduction & Outline

- Reminder: Tuning E/p of high momentum tracks in the central calorimeter.
- Datasets we used in this study
- New Gflash parameterizations and new MC generated
- Comparison between data and MC

Definitions

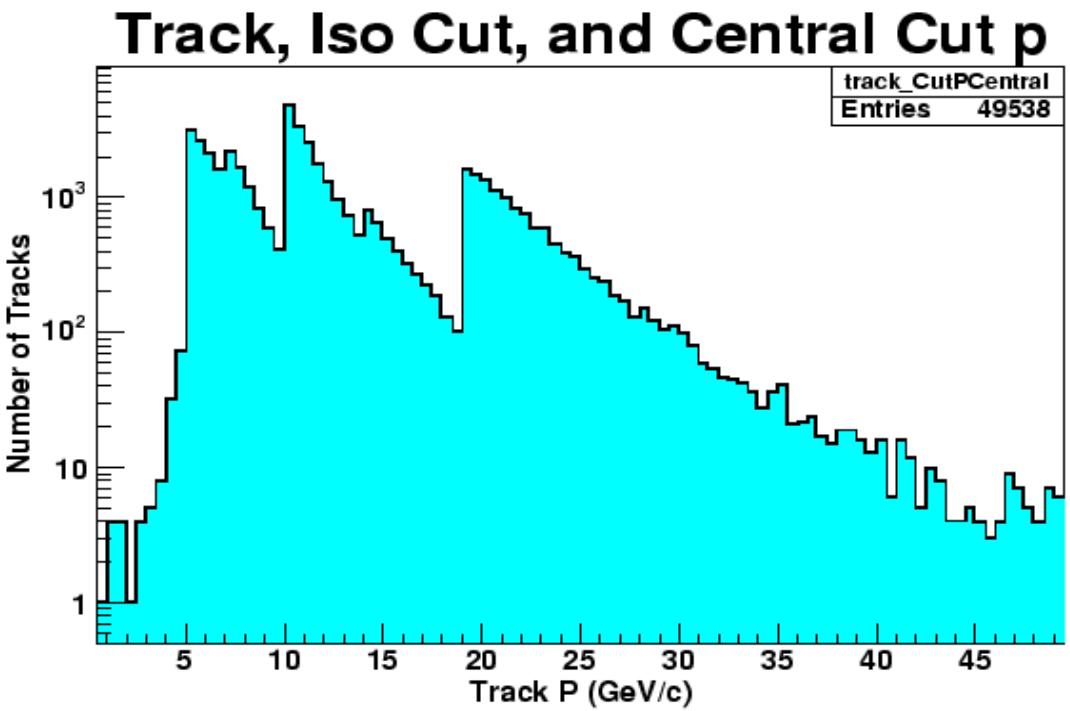
- Plot the E/p for the EM(2x2) and Hadron(3x3) compartments for isolated tracks in the central calorimeter.
  - Background is 1x2 and 1x3 strip respectively.
  - See previous talk(s) for all the details.
- In addition, plot the total of the two (EM+HAD) and minimum ionizing particles (MIP).
  - MIP defined a track with EM < 670 MeV.
- Normalize all the plots to unit area to compare data to MC.
- Fit each histogram
  - Used “converging” Gaussian fits.
  - Fit range is 3s around mean of previous Gaussian until the fit converges.
- Extract the mean and sigma of the the Gaussian fits.
  - Plot the mean E/p (signal) as a function of momentum.
  - Subtract the average background to obtain the Corrected Mean.

Datasets

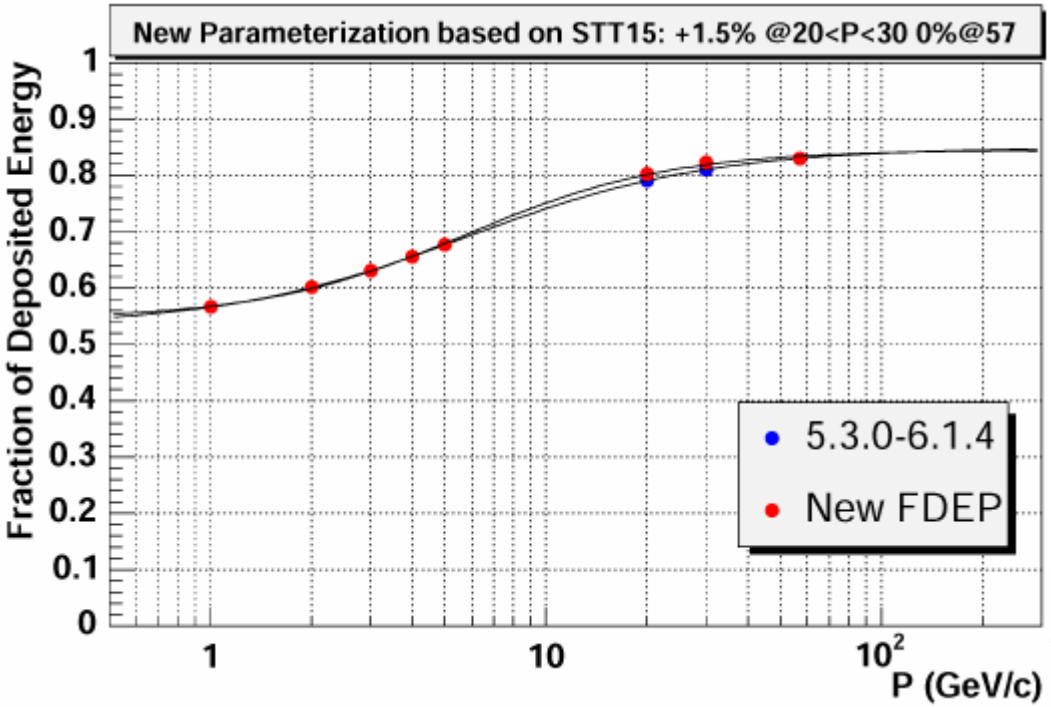
- 15 GeV/c Single Track Trigger (15 STT) ~ 6 million events
  - Dataset: gjtc0h_stt15
  - Dataset taken over summer 2005 which I have been using to compare calorimeter response to MC.
- 10 GeV/c Single Track Trigger (10 STT) ~ 4 million events
  - Dataset: gjtc0h_stt10
  - Dataset taken before 15 STT with same trigger but with lower pT threshold.
- Jet Calibration Data – multiple trigger thresholds: 3, 4, 7, and 10 GeV/c ~17 million events
  - Dataset: gjtc0d and gjtc01
  - Older data collected in 2004

Combined Dataset

- Combined all data into one large sample.
- In doing so introduced logic to select tracks away from the trigger thresholds.
  - e.g. for the 10 GeV/c trigger threshold we demanded the target track has greater than 14 GeV/c.
  - Although this lowers our total statistics it helps create a “cleaner” sample of good data from 6 GeV/c all the way up to 36 GeV/c.



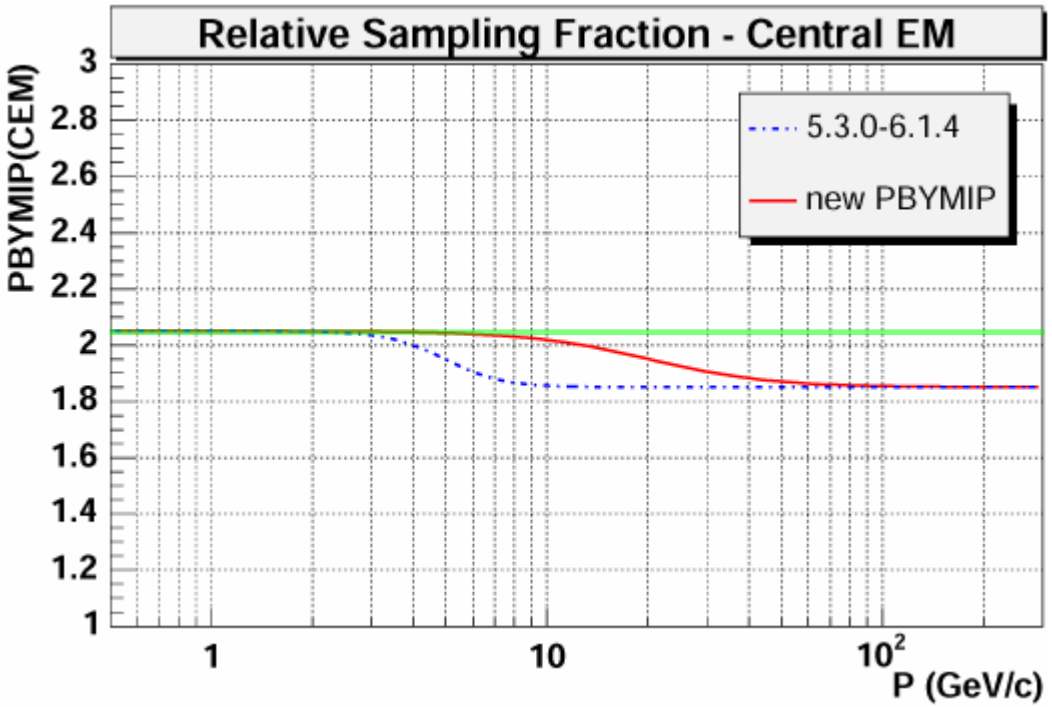
Gflash Parameterization



In both histograms:

- blue current Gflash param.
- red new Gflash param.

Upper Left - “Hadron tuning” is based on the discrepancy in the MIP signal.
Lower right - “EM tuning” an additional EM discrepancy at high p



- “MCv6 C”

Based on out results from MCv6 A in previous talk. Red curve in Rel. Sampling Fraction

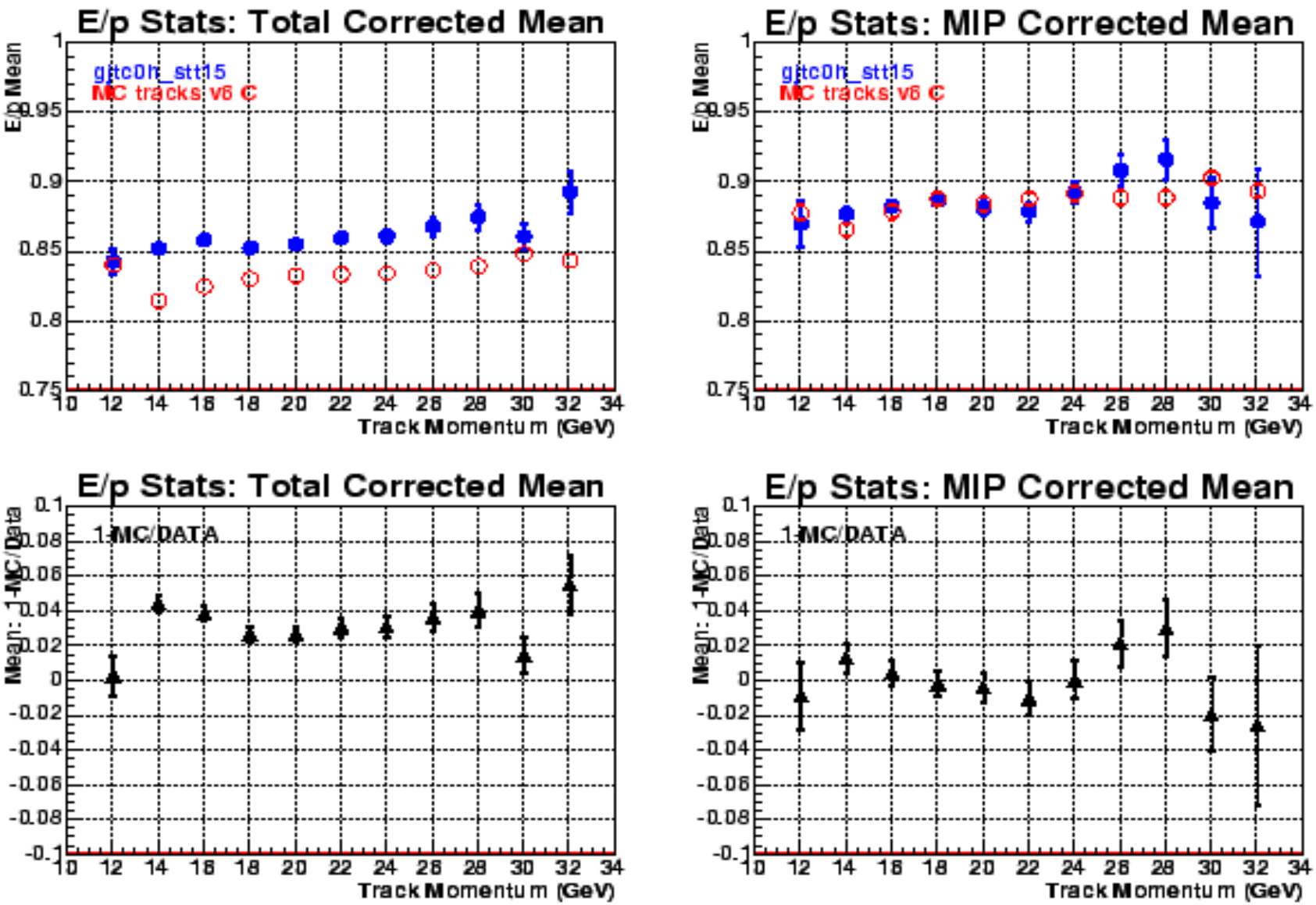
- “MCv6 D”

Green increase in Rel. Sam. Frac. to adjust MCv6 C results

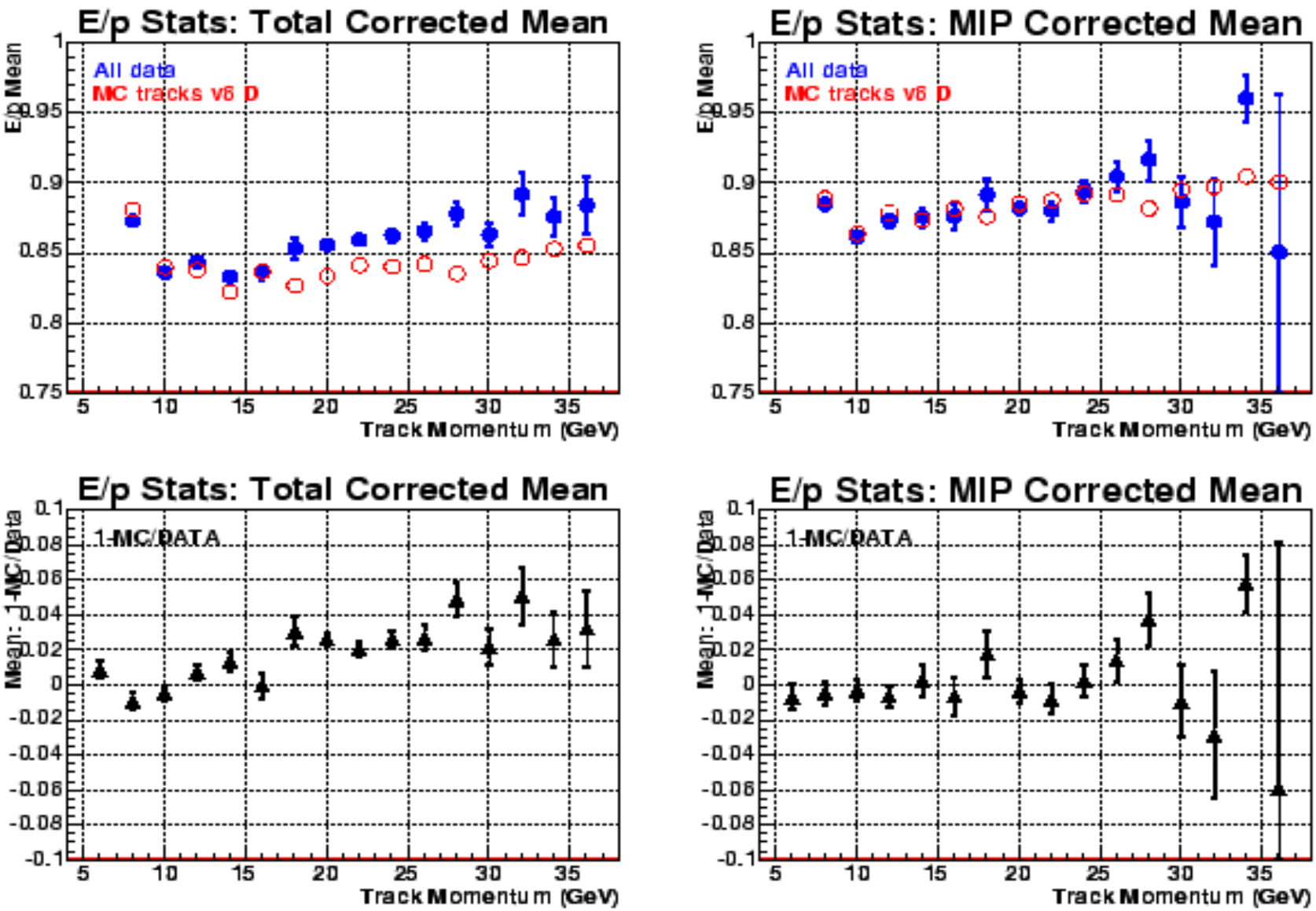
MC Samples

- MCv6 C
  - New tuning based on what we saw in MCv6 A
  - 550,000 fake events generated with 6.1.4_int1: cdfSim and ProductionExe
  - Processed with Stntuple 6.1.2
  - Pythia Tune A minimum bias added as an underlying event
  - Pions, Kaons, and protons generated in a 6:(2.91):(1.09) ratio
  - flat momentum spectrum from 8 to 42 GeV/c
- MCv6 D
  - Changed the EM Relative Sampling Fraction based on MCv6 C
  - 1,000,000 fake events generated with 6.1.4_int1
  - Processed with Stntuple 6.1.2
  - Pythia Tune A minimum bias added as an underlying event
  - Pions, Kaons, and protons generated in a 6:3:1 ratio
  - flat momentum spectrum from 0 to 42 GeV/c

15 STT vs MCv6 C



All Data vs MCv6 D



Conclusion

- MIP response looks very good.
- There remains a 2% response in the Total compartment around 20 GeV.
  - This final 2% may or may not be “easily removed.”
  - So far our adjustments have been with the easy knobs on our simulation parameters. This may be a more complex discrepancy.
- Ongoing Work
  - Working on estimated the correlated background using the 15 STT data.
  - To set a systematic uncertainty to our E/p measurement.
  - Recheck E/p below 6 GeV/c with Minimum Bias data.