# - Status of Gflash Tuning
# - E/p Studies in the Plug

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Simulation Group Meeting

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# Overview

- Hadronic lateral shower profile
  - Central calorimeter (tower 1-4), p = 2...24 GeV/c
  - 1st tuning iteration: see JER talk of July 20
  - 2nd tuning iteration:
    Require $|z_{vertex}| < 6.0$ cm instead of 60cm for p<8GeV/c in order to minimize disagreement between MC and data in HAD profiles due to shower extrapolation effects...

    ...still on the way (but can show some preliminary results)

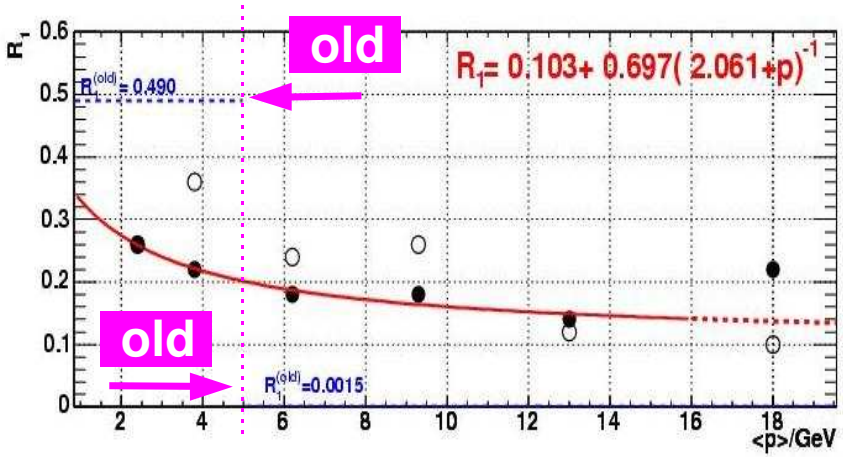
- Plug calorimeter: before any tuning can be done here,
  - need to improve E/p measurement
  - need to understand systematics in data and MC

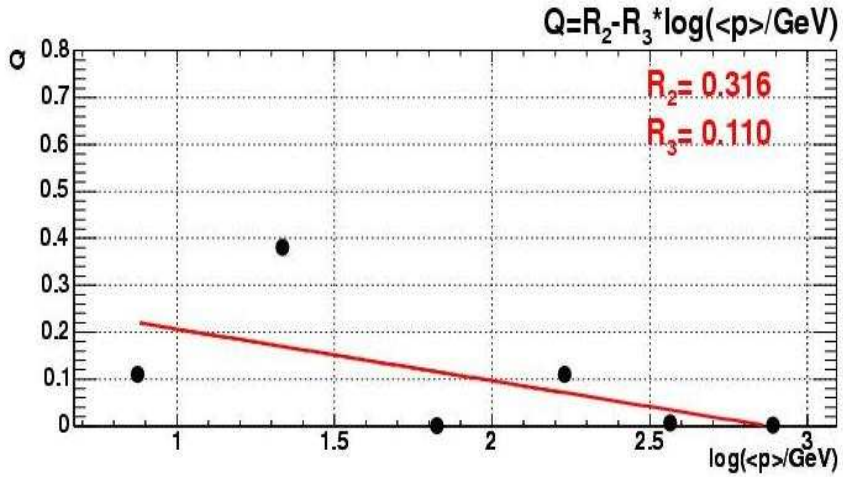
# Tune Results (to be completed)

## Hadronic lateral profile

$$f(r)=\frac{2\,r\,R_0^2}{(r^2+R_0^2)^2} \qquad \langle R_0(E,x)\rangle = R_1 + Q\,x \qquad Q = R_2 + R_3 \log p$$

- Core term $R_1$ derived from EM and HAD now in better agreement at p<8 GeV/c due to tighter z vertex cut.
- EM provides cleaner way to determine $R_1$.
- $R_1$ is actually not supposed to be p dependent but can nevertheless introduce some p parametrization.
- Spread terms $R_2$ and $R_3$ can only be derived from HAD, but constraint proves to be very weak.
- Higher statistics tune samples for p<8GeV/c still in progress.



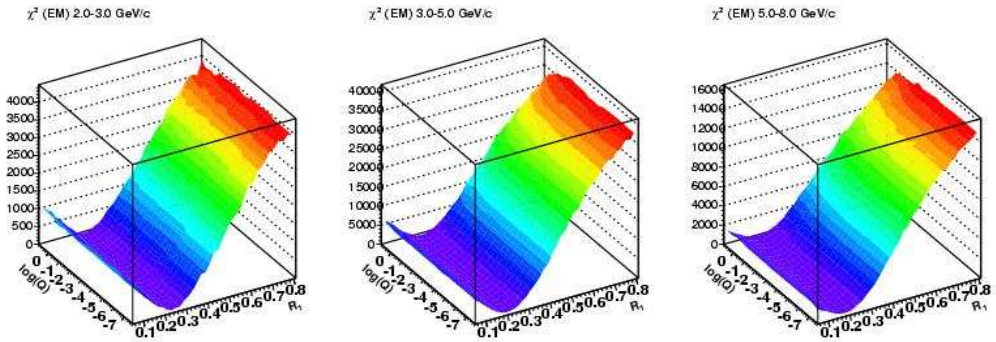




Old values:

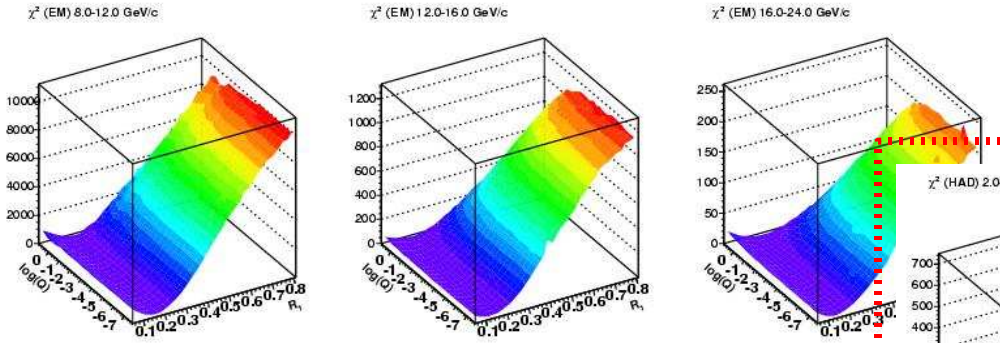
p<5GeV/c: ($R_1$, $R_2$, $R_3$) = ( 0.49, 0.407, 0.065)

p>5GeV/c: ($R_1$, $R_2$, $R_3$) = (0.0149, 0.407, 0.061)

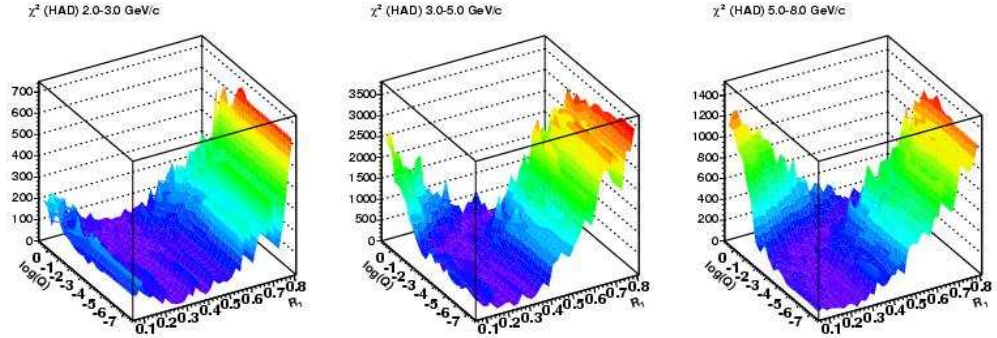
# ($R_1$,Q) - Scans



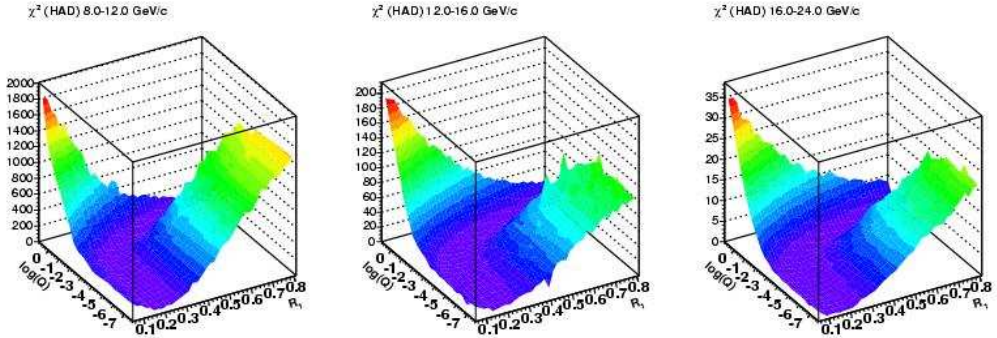

**EM compartment**



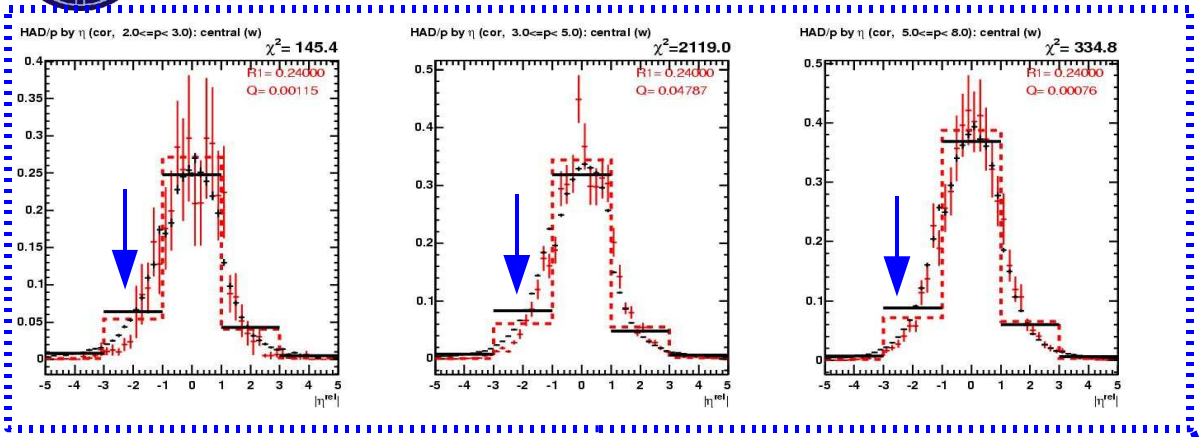

$|z_{vert}|<6cm$

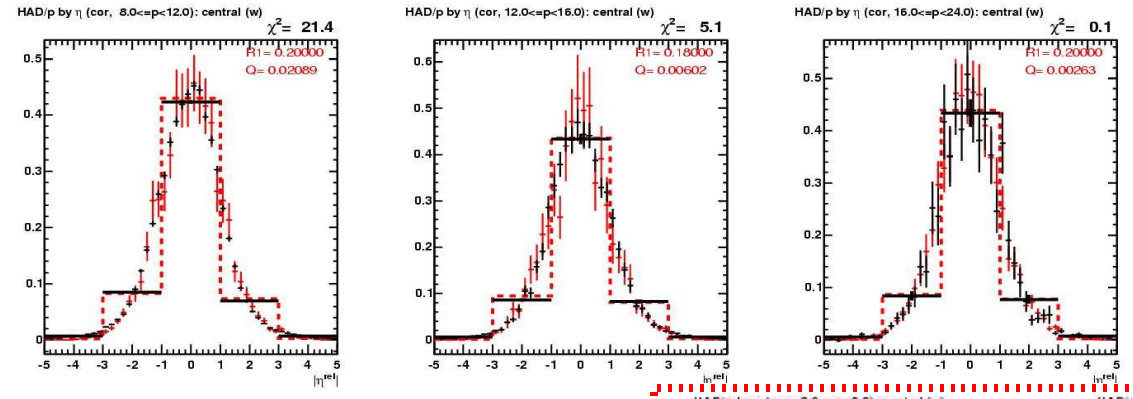



**HAD compartment**



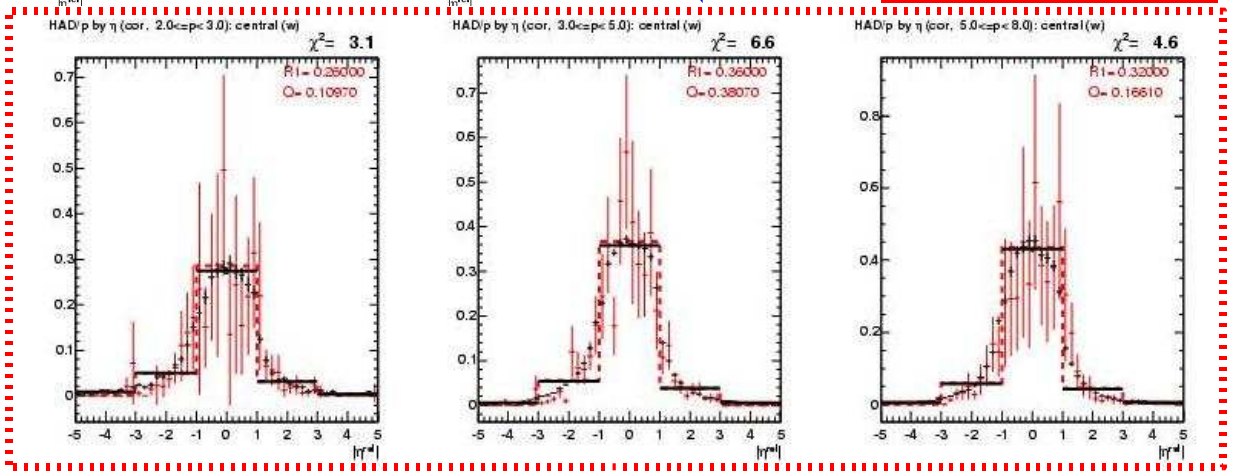
# HAD Tuned Profiles (w/ EM constraint)




Extrapolation effect in HAD profiles (different for MC and data, see JER talk of May 25) reduced by requiring more central tracks.

$|z_{vert}|<6cm$



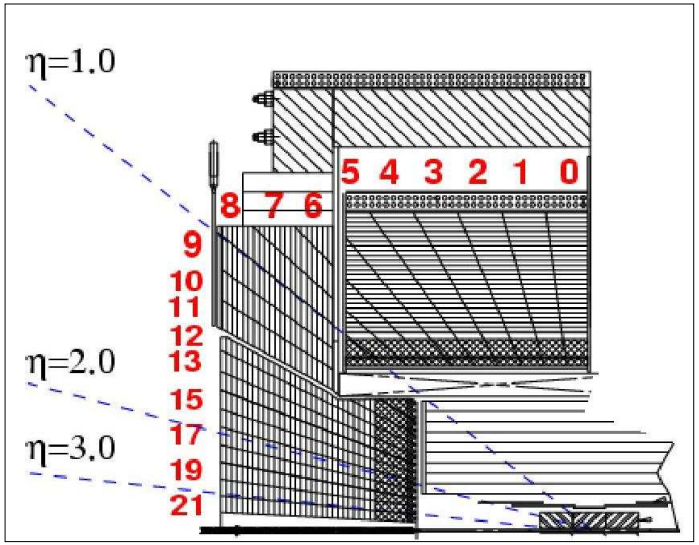
# Improved E/p Measurement in the Plug

- We need to use IO tracks to improve momentum resolution.
  Huge distorting migration effects in E/p plots based on SISA tracks!
  (see my JER talk of July 20)
- Is there a way to select higher quality SISA tracks?

| tower | COT | | Silicon | | |
|---|---|---|---|---|---|
| | axial | stereo | axial | stereo | z |
| 12 | 18 | 20 | 4 | 2 | 2 |
| 13-15 | 7 | 7 | 4 | 2 | 2 |
| 16-21 | — | — | 4 | 2 | 2 |

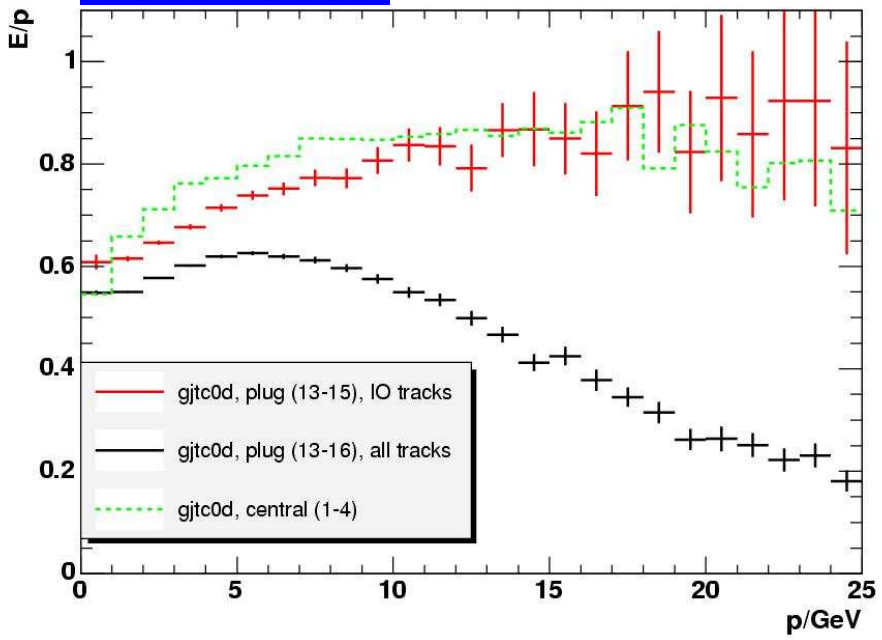
gjtc0d (16M events):

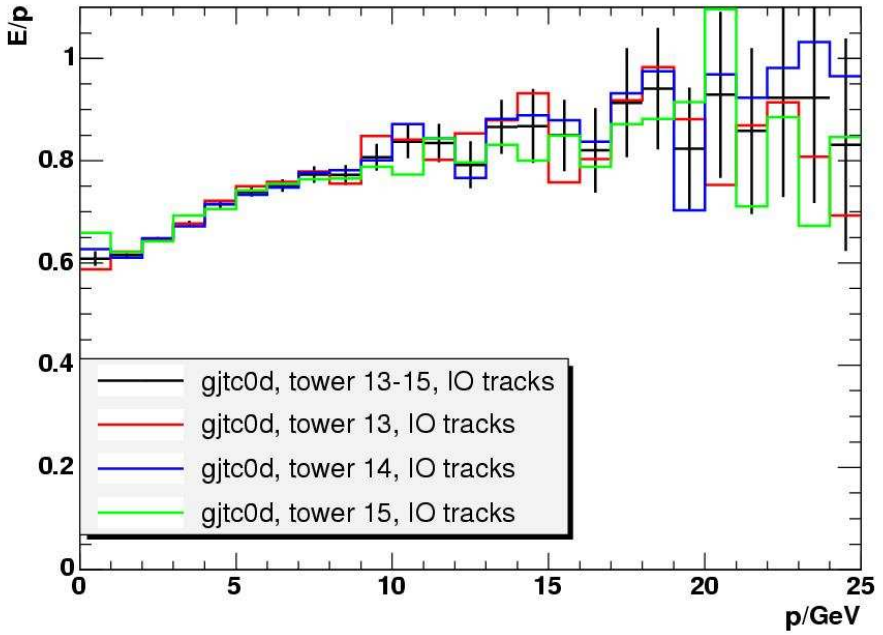
| | tower number | momentum range (GeV/c) ≥ 2 | 0.5-2 | 2-3 | 3-5 | 5-8 | 8-12 | 12-16 | 16-24 | >24 |
|---|---|---|---|---|---|---|---|---|---|---|
| IO | 12 | 55123 | 155289 | 33863 | 16738 | 3703 | 639 | 124 | 43 | 10 |
| IO | 13 | 60042 | 69551 | 29681 | 21791 | 6617 | 1492 | 307 | 119 | 35 |
| IO | 14 | 146406 | 117826 | 68410 | 54821 | 18081 | 3916 | 778 | 297 | 97 |
| IO | 15 | 55311 | 26977 | 22454 | 21606 | 8462 | 2106 | 451 | 191 | 37 |
| SISA | 16 | 746687 | 588297 | 352425 | 257514 | 92407 | 26494 | 7335 | 4645 | 4579 |
| SISA | 17 | 673458 | 280253 | 282987 | 234674 | 99846 | 32762 | 9707 | 6256 | 5750 |
| SISA | 18 | 548953 | 72329 | 198249 | 190427 | 94730 | 36800 | 12247 | 8002 | 6851 |
| SISA | 19 | 263477 | 414 | 56147 | 95123 | 58986 | 27702 | 10204 | 7463 | 6495 |
| SISA | 20 | 12478 | 0 | 40 | 4217 | 3680 | 2046 | 910 | 715 | 712 |
| SISA | 21 | 178 | 0 | 0 | 14 | 46 | 43 | 22 | 20 | 23 |



# E/p in the Plug: Data

gjtc0d (9M)

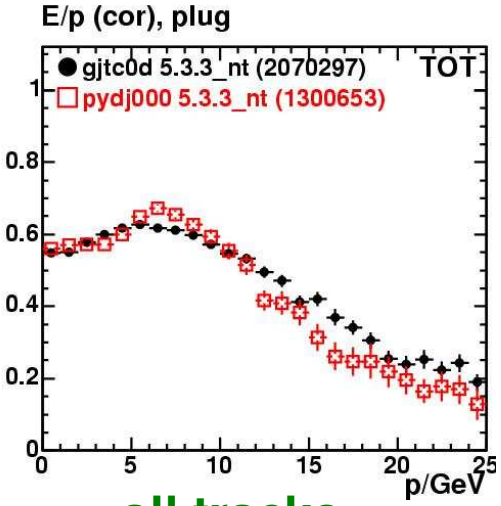


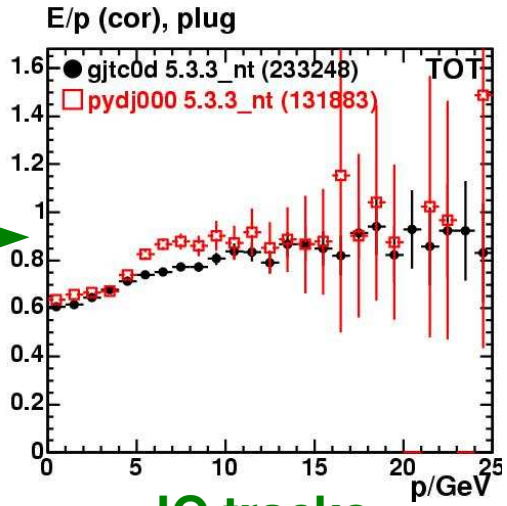

- 10-20% effect within 0-5 GeV/c. What is the impact on the results of the various plug tunings performed in this momentum region in the past?
- Statistics of IO tracks is sufficient for lateral profile tuning up to 24 GeV
- Remaining resolution effects have to be accounted for by using variable bin widths increasing with track momenta.

# E/p in the Plug: MC

plug (pydj000)

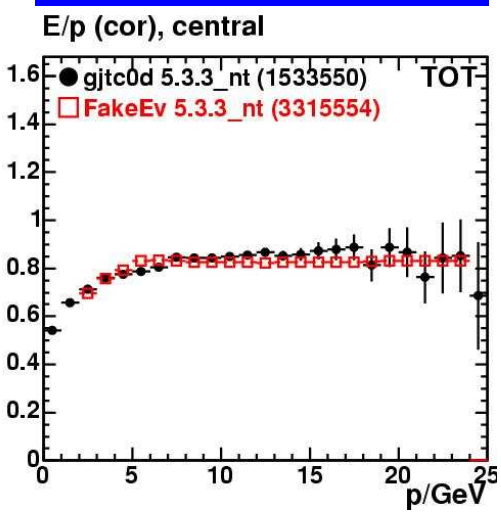



all tracks




IO tracks

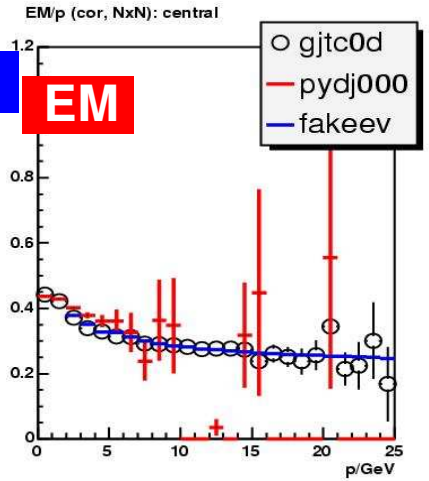
central (FakeEv)

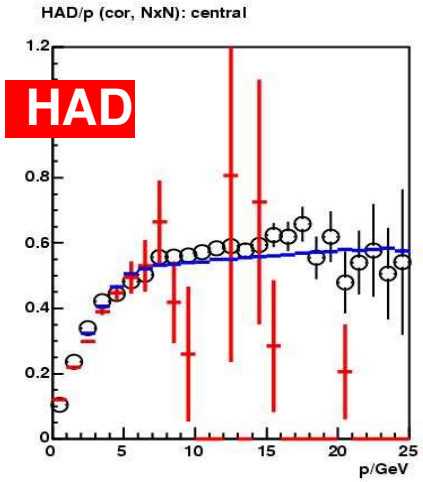


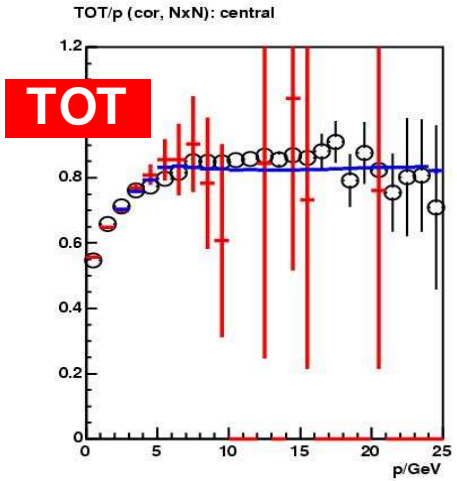

- "Reasonable" agreement between plug and central response.
- Pythia MB bump around 5-10 GeV/c in the plug may be related to suboptimal optimization of Gflash parametrization of FEDP, HAD/MIP, EM/MIP which were tuned in the past using in situ data at very low p and test beam data at very high p.
- Now that we have enough statistics to control the intermediate region we perhaps can get rid of test beam data, in particular after the recent special calibration run become available for single track analysis.

# Pythia MB vs. FakeEv (1)

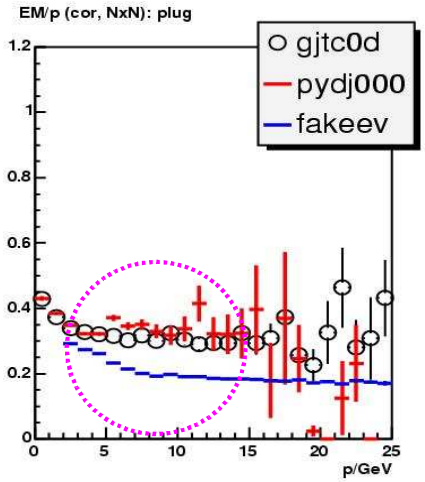
central

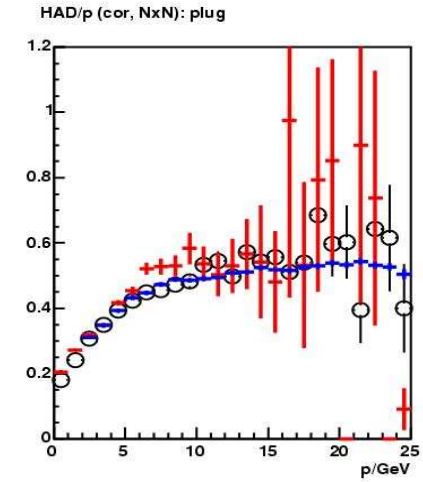


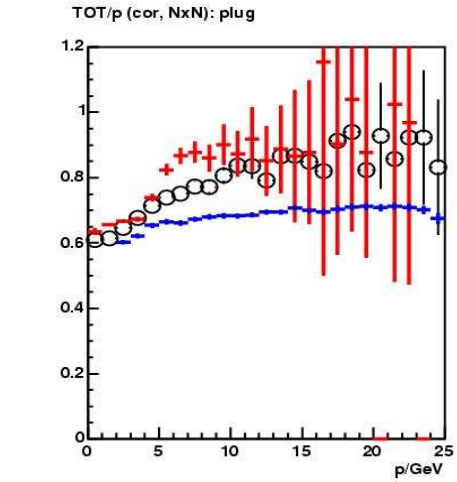




plug



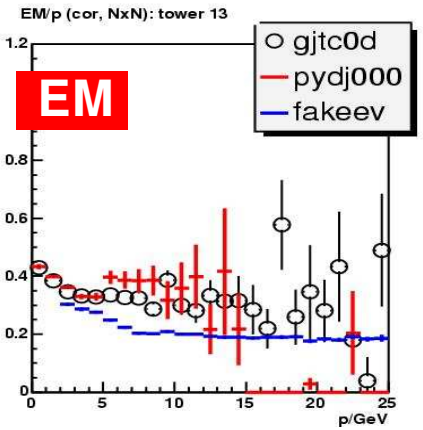



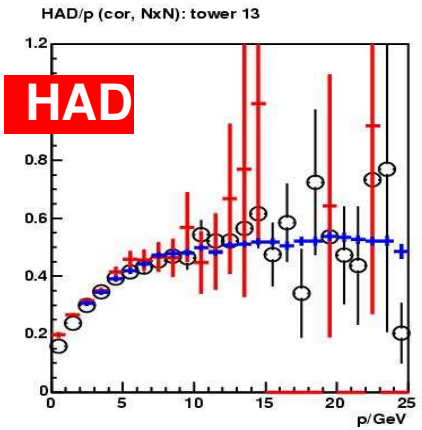

- FakeEv in the plug: need at least 3 tracks per event to define a z-vertex used by the track reconstruction.
- What causes the discrepancy in the EM compartment???
- FakeEv shape fits better to data than Pythia MB, no bump.

# Pythia MB vs. FakeEv (2)

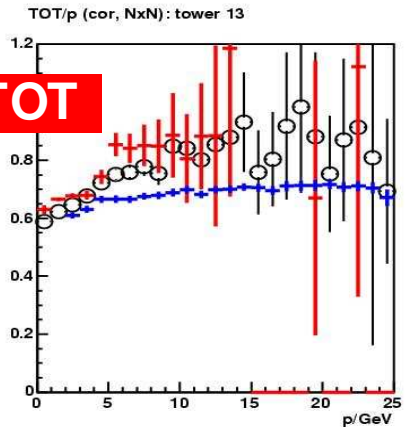
tower 13




EM



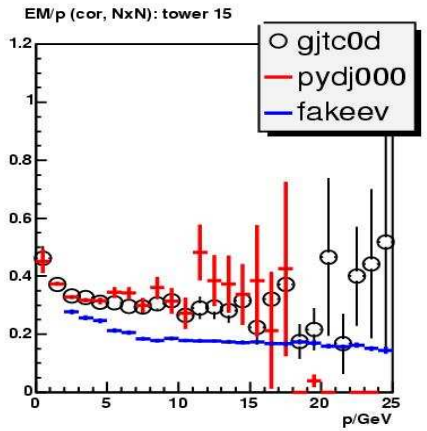

HAD

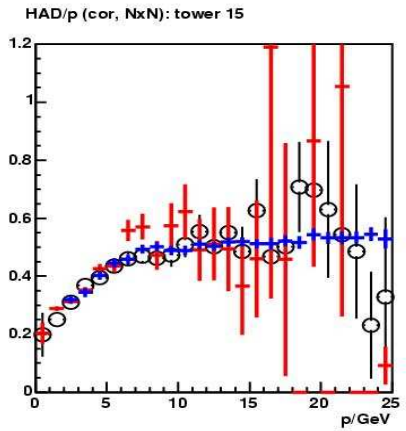


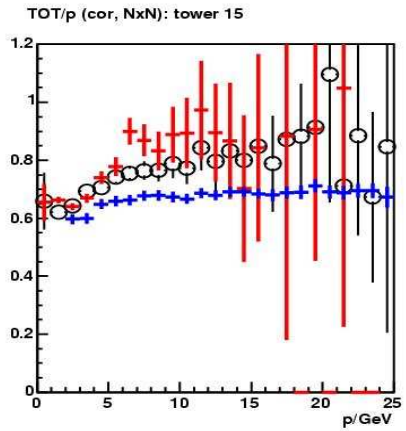

TOT

IO tracks

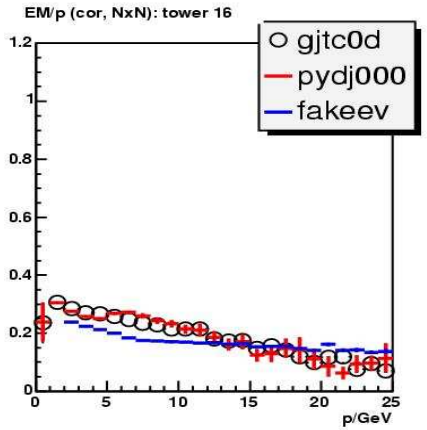
tower 15

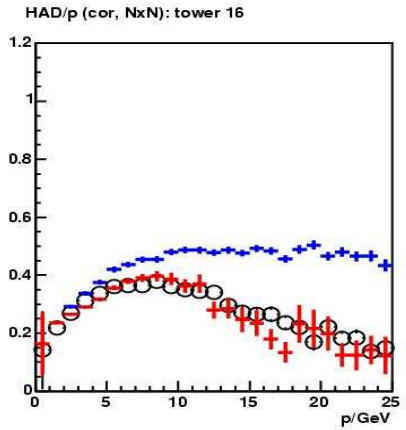


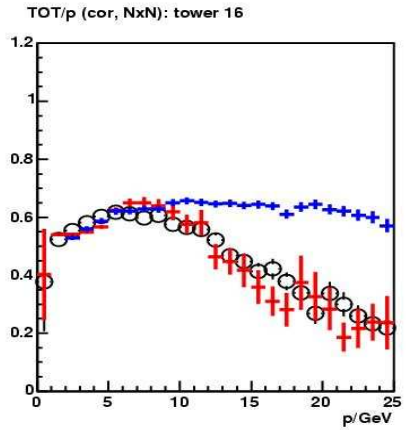




tower 16



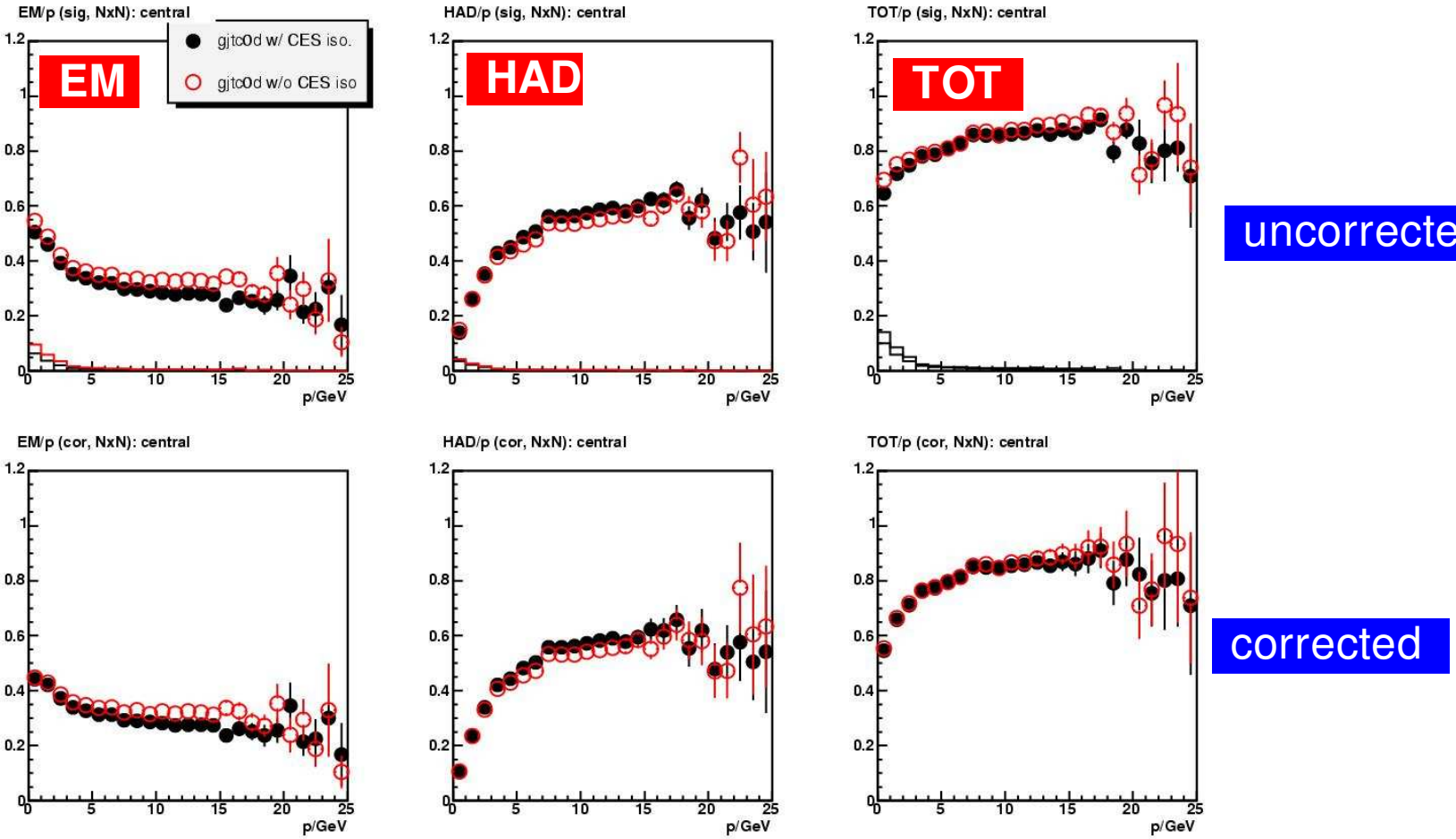




SISA

# FakeEv in the Plug

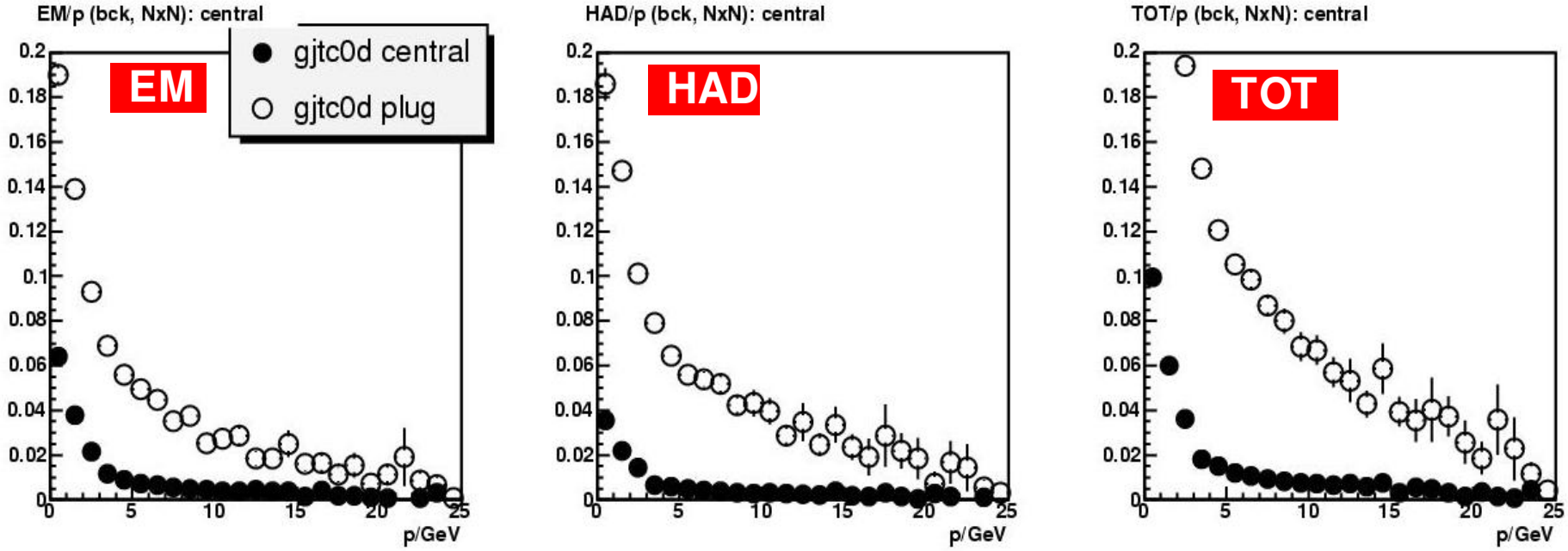
- Comparison of HAD with EM compartment as well as IO only analysis with IO+SISA analysis suggest that the FakeEv problem is probably not a momentum reconstruction problem.
- Have also checked dependence on flavor composition, track multiplicity per event, mixture of opposite sign particles in one event, but didn't find anything obvious.
- Background content?
  - FakeEv samples do not have $\pi^0$ component, which is different from Pythia MB and data.
  - Plug analysis don't use PES isolation cut as yet, which is different from central analysis that uses CES.
- Quick check: How does E/p in the central change when disregarding CES requirement?

# E/p in Central w/o CES Isolation




- There is a CES related contribution increasing with p that is not covered by the correction procedure.
  - How does the background contribute to this?
- Effect is small in the central but may be significantly larger in the plug due to higher background.

# E/p Background Central vs. Plug




- PES might be important for plug analysis.
- Work on improvement of PES simulation for Gen 6 in progress.

# Conclusions

- Second tuning iteration for central part on the way.
  - Provides Gflash optimization up to 24 GeV/c homogenously determined using CDF data.
  - No discontinuities anymore.

- Plug analysis is tricky:
  - Can we trust FakeEv here?
  - Systematics of IO tracks?
  - Need better understanding of background contribution.
  - Impact of PES?