- 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

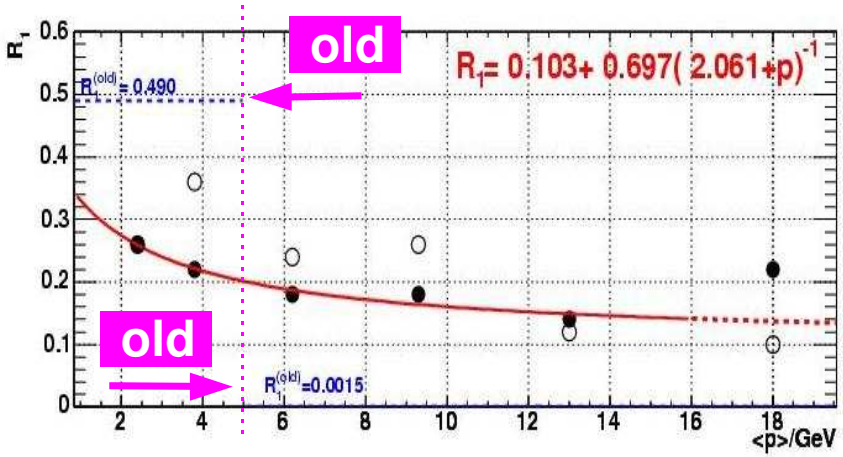
Tune Results (to be completed)

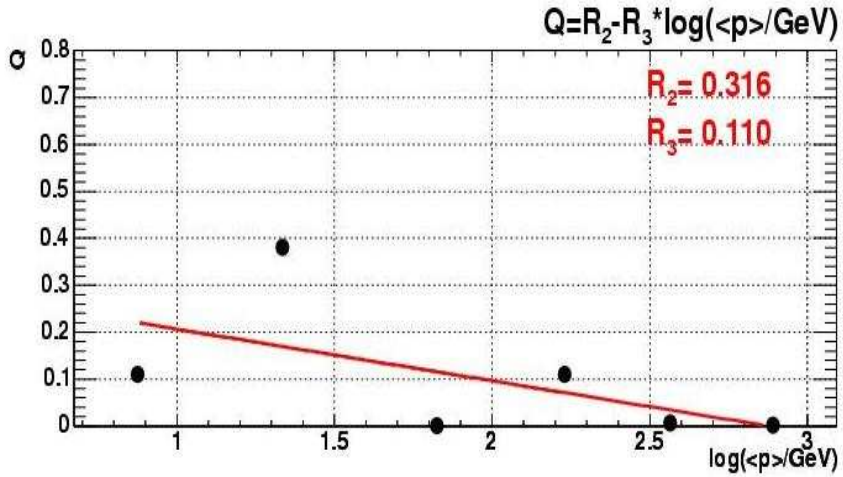
Hadronic lateral profile

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

$$Q = R_2 + R_3 \log p$$

- 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.



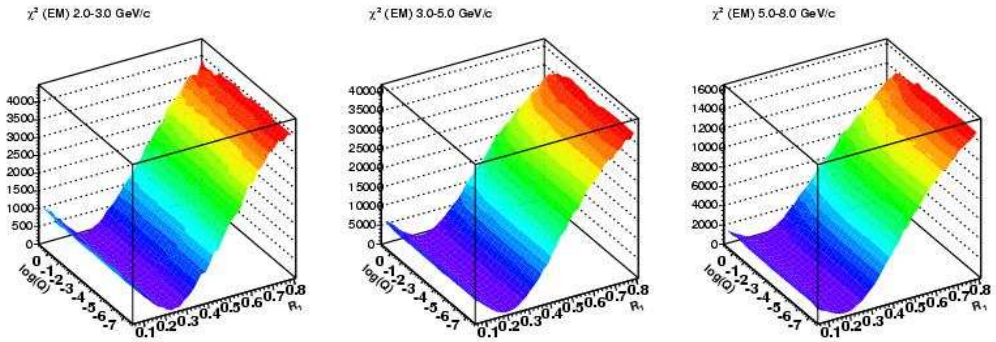


Old values:

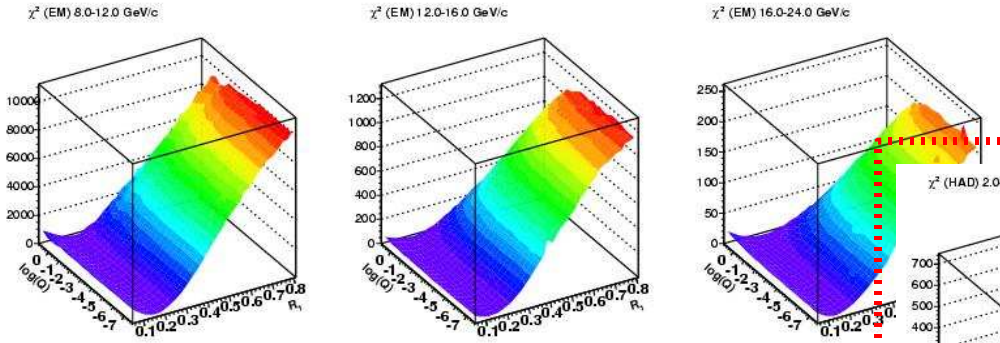
p<5GeV/c: (R_1, R_2, R_3) = (0.49, 0.407, 0.065)

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

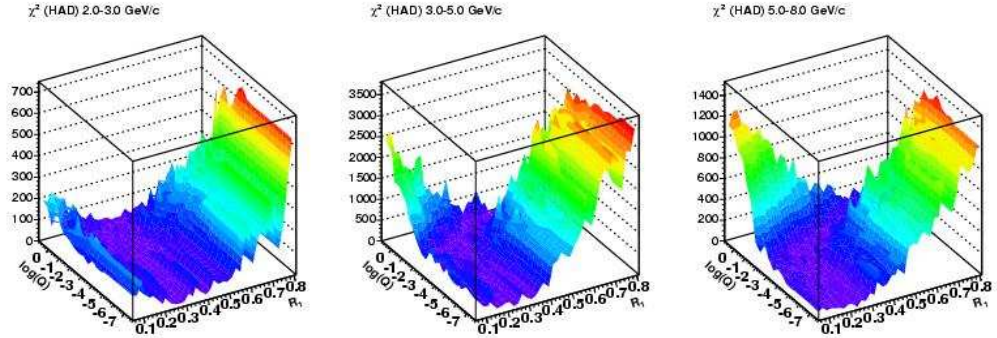
(R_1,Q) - Scans



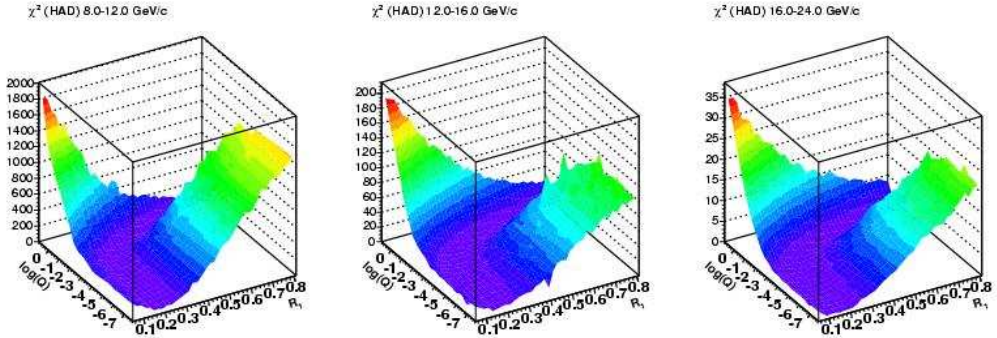
EM compartment



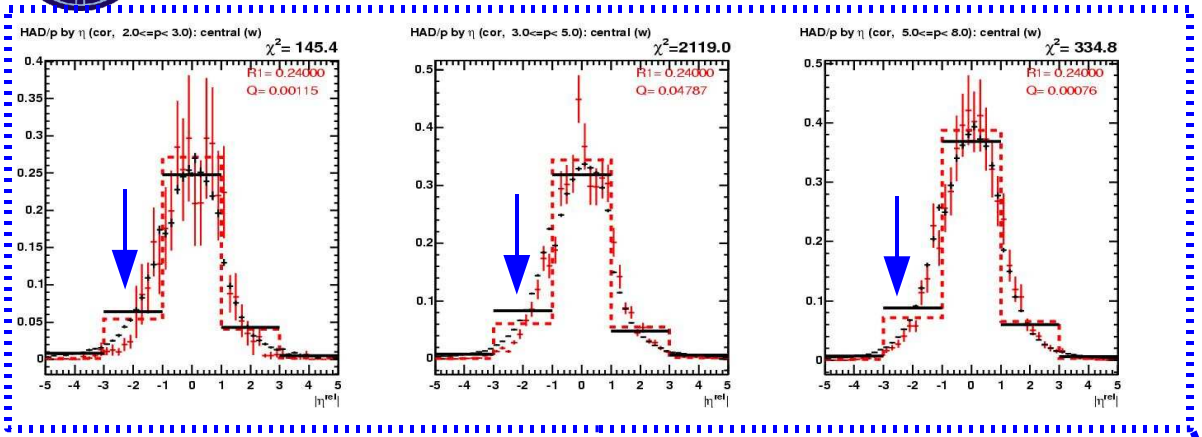
$|z_{vert}|$<6cm

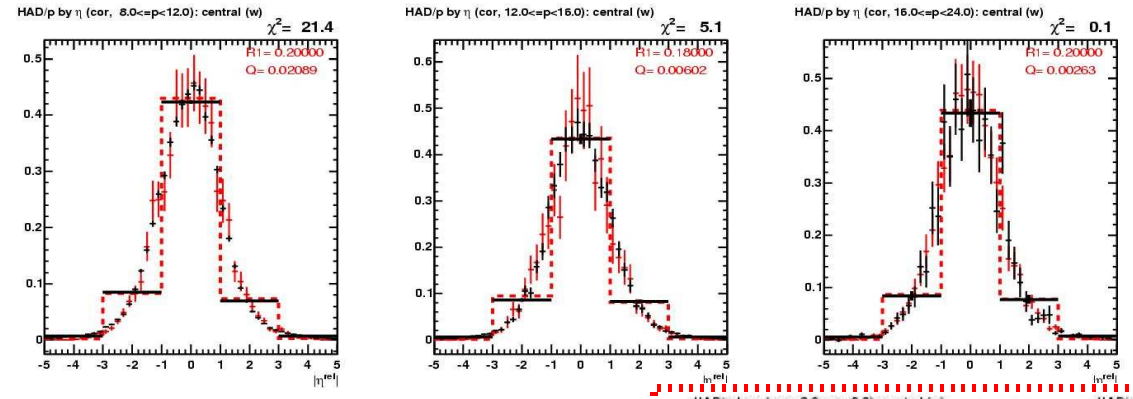


HAD compartment



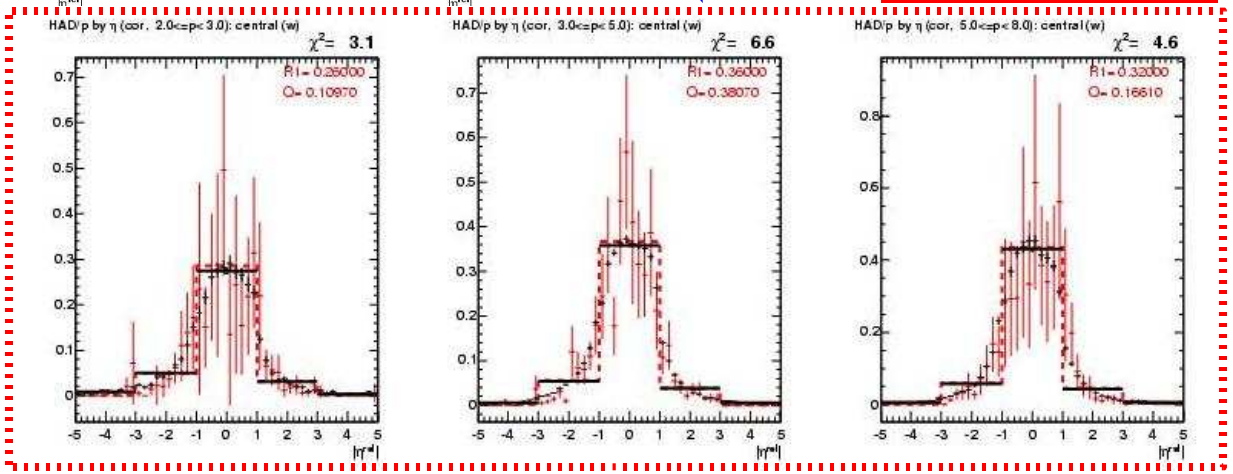
HAD Tuned Profiles (w/ EM constraint)





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

$|z_{vert}|<6cm$



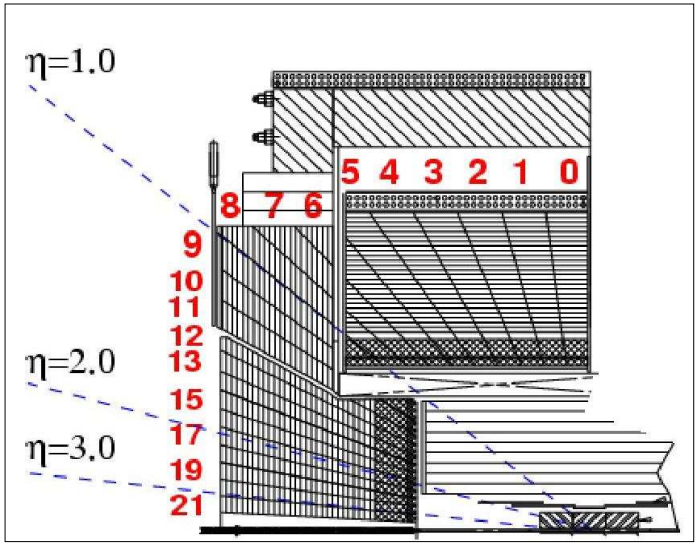
Improved E/p Measurement in the Plug

- 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

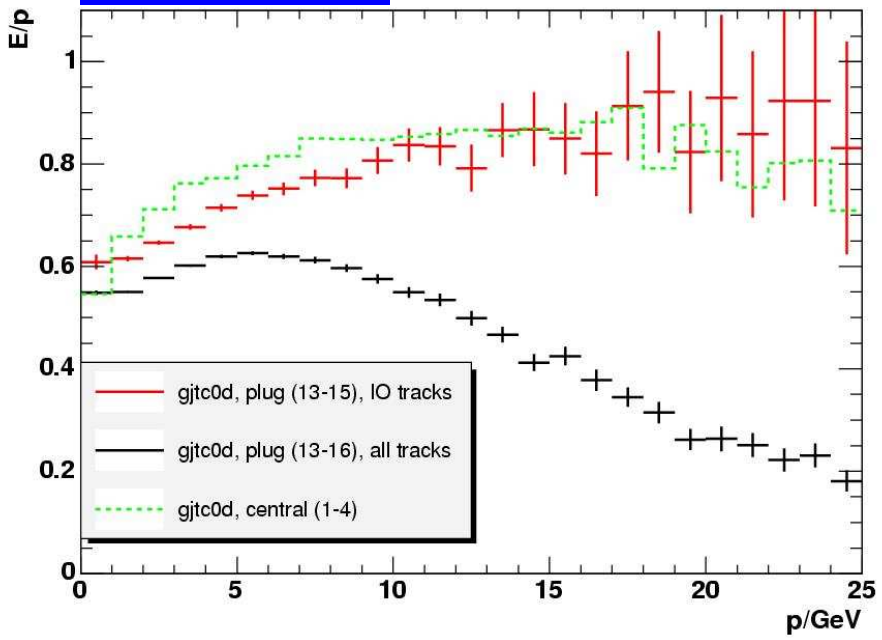
gjtc0d (16M events):

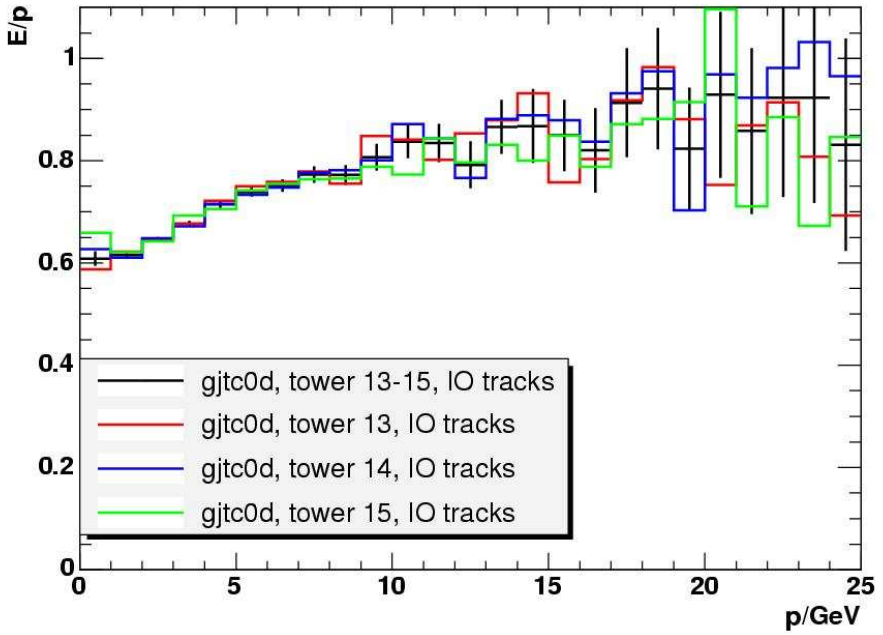
	tower number	momentum range (GeV/c) ≥ 2	0.5-2	2-3	3-5	5-8	8-12	12-16	16-24	>24
IO	12	55123	155289	33863	16738	3703	639	124	43	10
	13	60042	69551	29681	21791	6617	1492	307	119	35
	14	146406	117826	68410	54821	18081	3916	778	297	97
	15	55311	26977	22454	21606	8462	2106	451	191	37
SISA	16	746687	588297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



E/p in the Plug: Data

gjtc0d (9M)

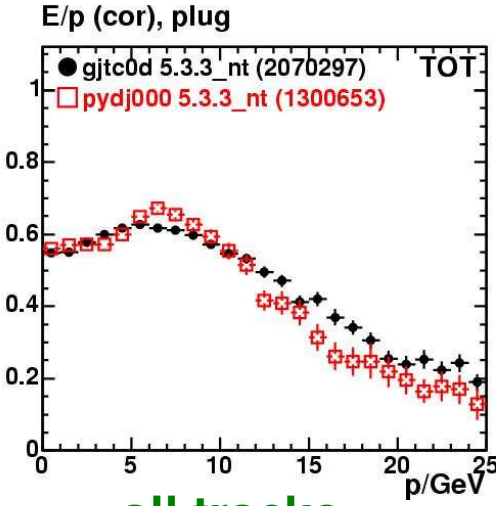




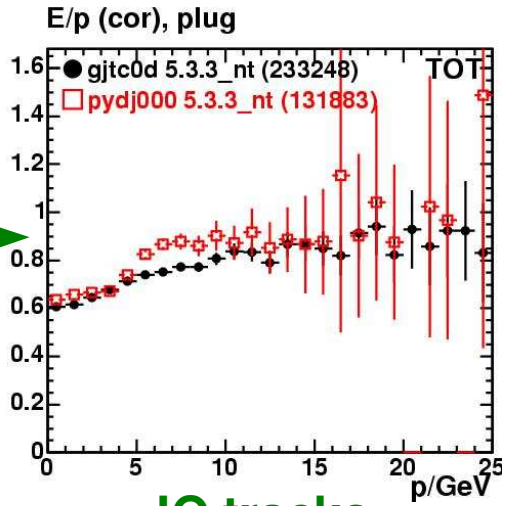
- 10-20% effect within 0-5 GeV/c. What is the impact on the results of the various plug tunings performed in this momentum region in the past?
- Statistics of IO tracks is sufficient for lateral profile tuning up to 24 GeV
- Remaining resolution effects have to be accounted for by using variable bin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

E/p in the Plug: MC

plug (pydj000)

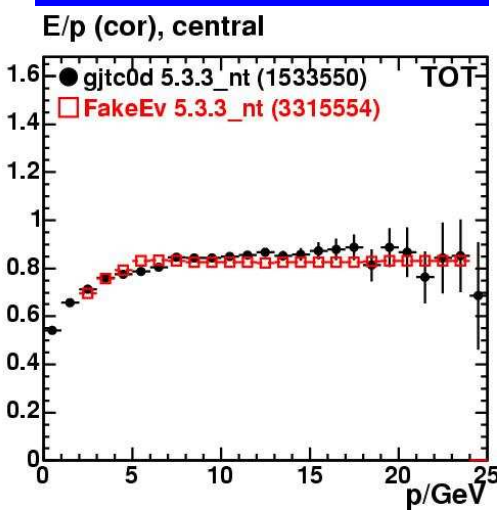


all tracks



IO tracks

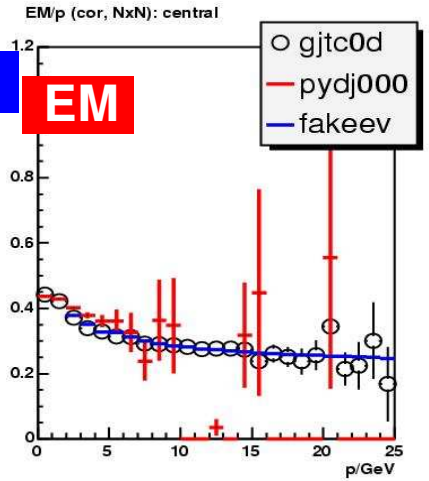
central (FakeEv)

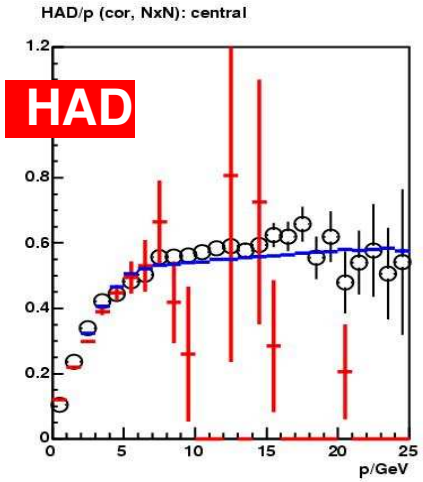


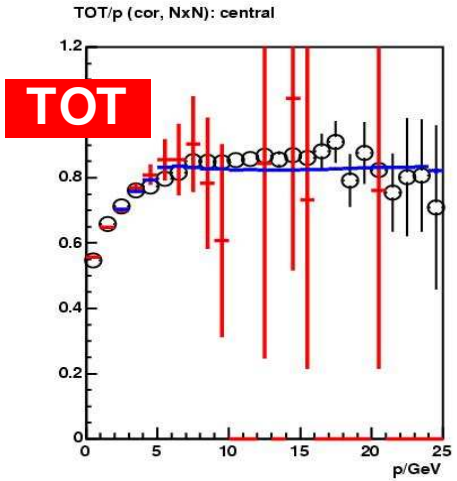
- "Reasonable" agreement between plug and central response.
- Pythia MB bump around 5-10 GeV/c in the plug may be related to suboptimal optimization of Gflash parametrization of FEDP, HAD/MIP, EM/MIP which were tuned in the past using in situ data at very low p and test beam data at very high p.
- Now 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)

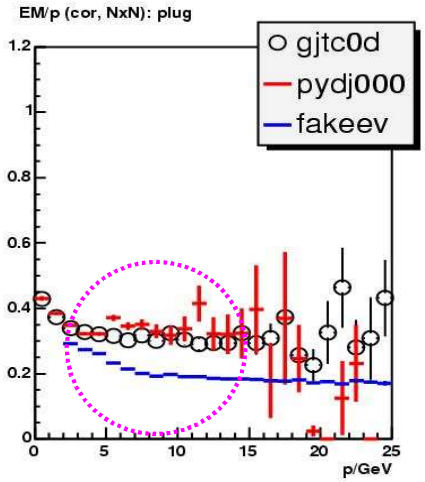
central

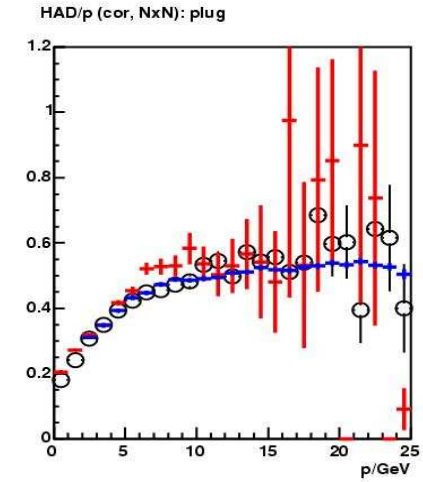


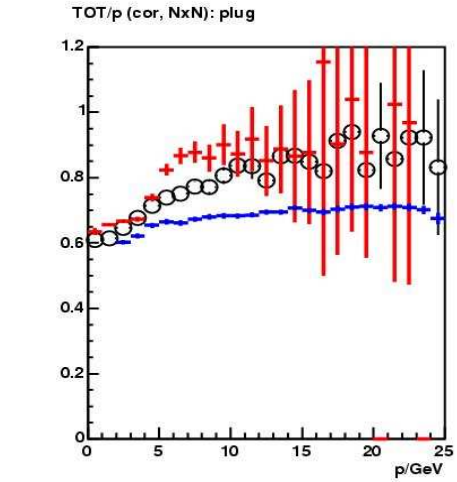




plug



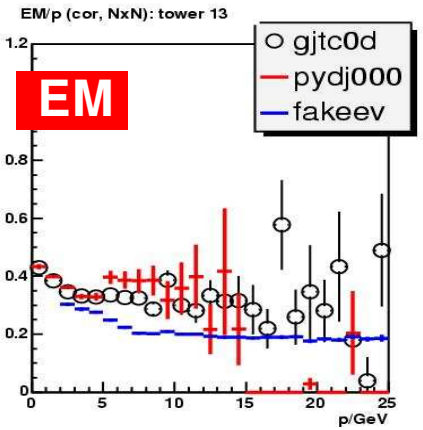




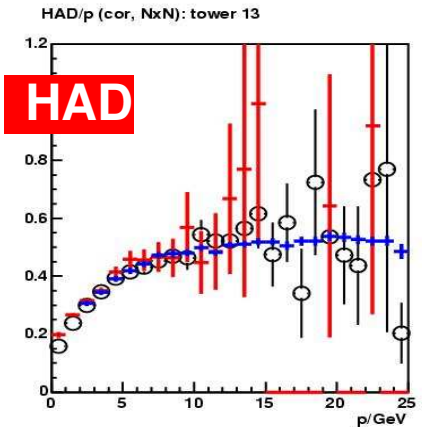
- FakeEv in the plug: need at least 3 tracks per event to define a z-vertex used by the track reconstruction.
- What causes the discrepancy in the EM compartment???
- FakeEv shape fits better to data than Pythia MB, no bump.

Pythia MB vs. FakeEv (2)

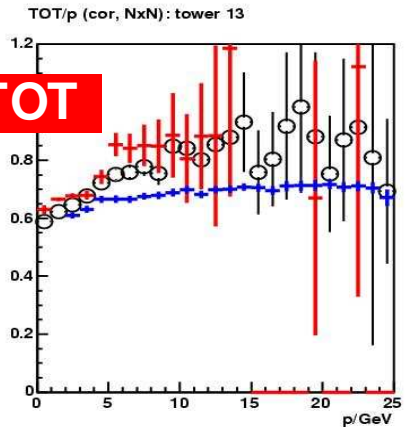
tower 13



EM



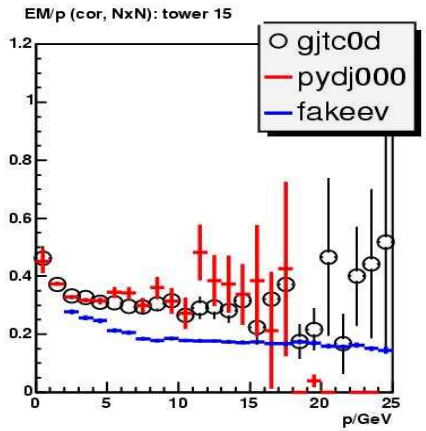
HAD

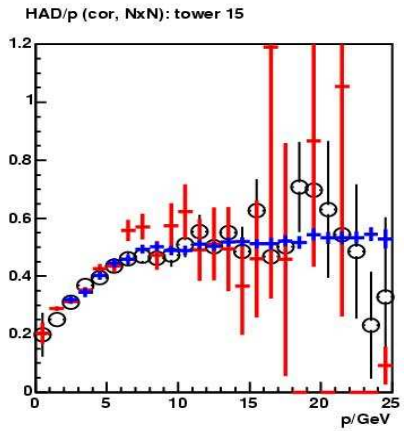


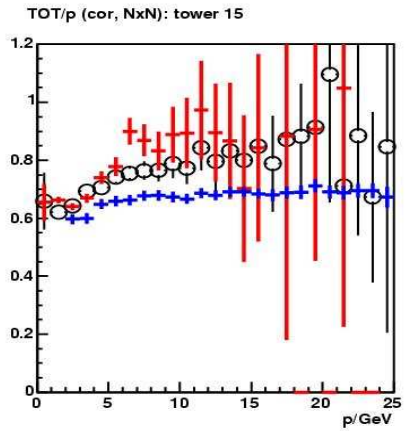
TOT

IO tracks

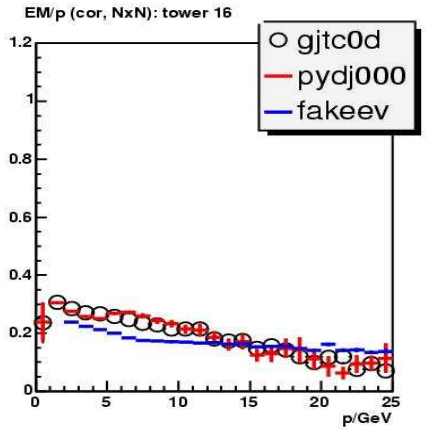
tower 15

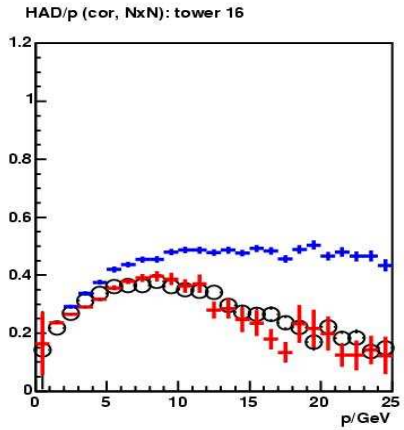


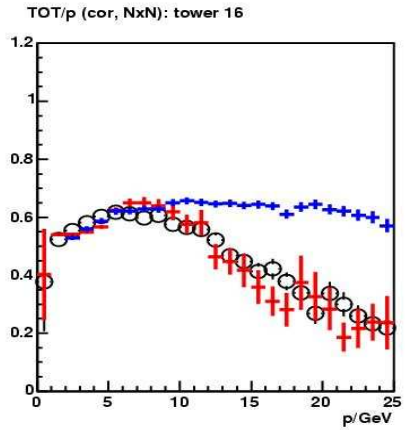




tower 16





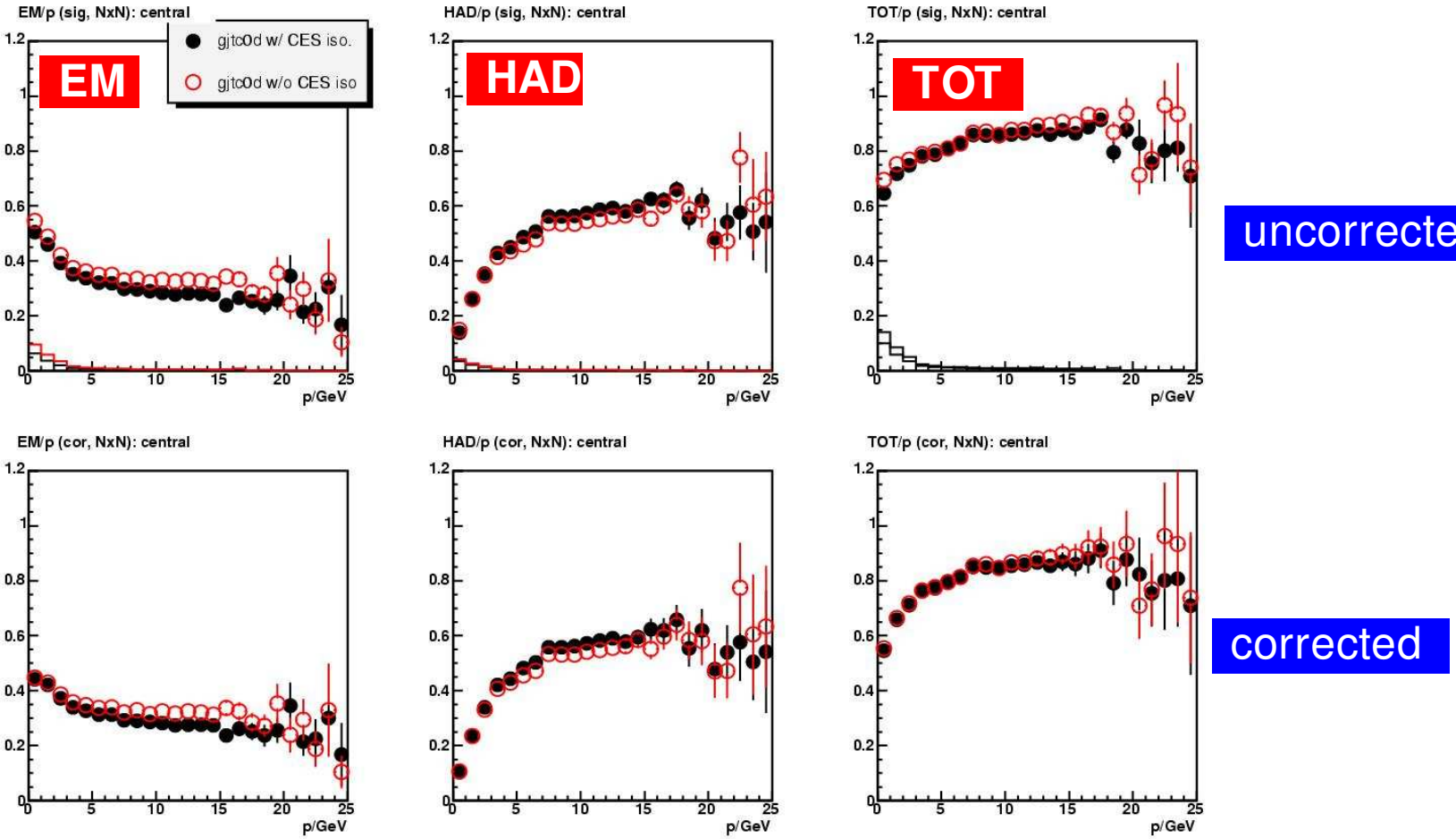


IO +SISA

FakeEv in the Plug

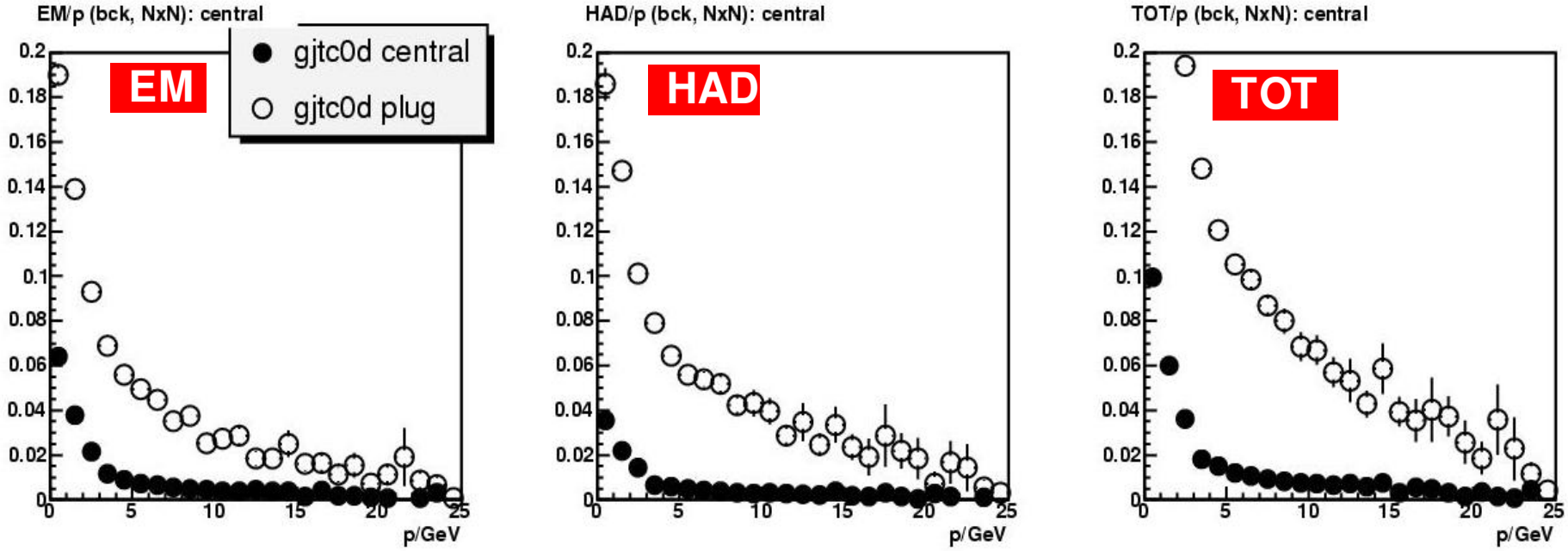
- Comparison of HAD with EM compartment as well as IO only analysis with IO+SISA analysis suggest that the FakeEv problem is probably not a momentum reconstruction problem.
- Have also checked dependence on flavor composition, track multiplicity per event, mixture of opposite sign particles in one event, but didn't find anything obvious.
- Background content?
  - FakeEv samples do not have π^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?