Gflash Lateral Shower Profile Tuning

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Overview

- Preliminary results for tuning of the hadronic lateral shower profile:
  - central calorimeter
  - track momentum range 0.5-24.0 GeV/c
  - parametrization in Gflash: see gfinha.F, gfshow.F
- Single particle response dependence on data/MC type:
  - data: JET_CALIB, Minbias
  - MC: FakeEv, PYTHIA Minbias (current tuning)
- Tuning samples:
  - data: JET_CALIB (gjtc0d), 16 M events
  - MC: FakeEv, 1 track/event, flat spectrum, $\pi^{\pm}/K^{\pm}/(p,\bar{p})$=60%/30%/10% , weighted with data spectrum

Track Selection

Quality cuts

- $N_{vtx} = 1$
- $|z_{vtx}| < 6cm$, $|z_0| < 6cm$ (0<p<8 GeV/c)
- $|z_{vtx}| < 60cm$, $|z_0| < 60cm$ (8<p<24 GeV/c)
- 7x7 isolation
- CES isolation

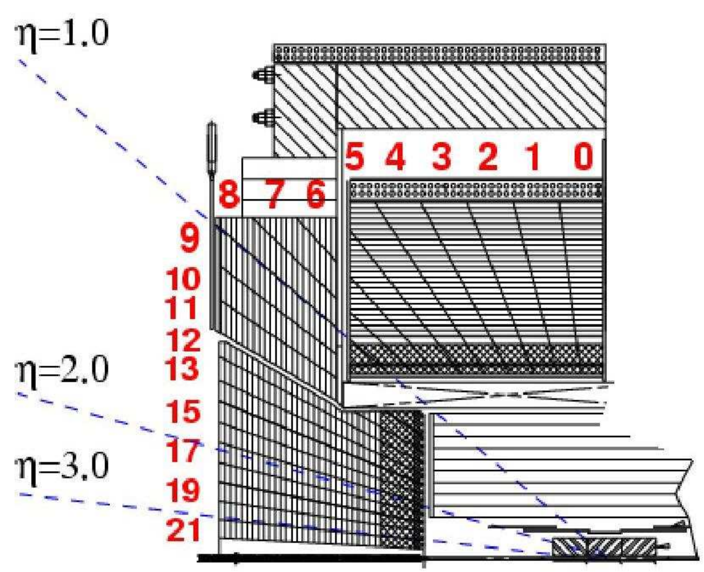
- Number of hits

COT		Silicon	
ax	st	ax	
30	30	-	tower 1-8
25	25	-	tower 9
20	20	4	tower 10-11

tower number	momentum range (GeV/c) ≥ 2	0.5-2	2-3	3-5	5-8	8-12	12-16	16-24	>24
0	101906	329537	11846	64676	16578	8015	629	116	45
1	109072	345385	12726	68439	17704	9262	754	147	39
2	114259	359959	13951	69419	18595	11170	914	169	41
3	115352	365974	15181	65847	19720	13125	1195	245	37
4	114795	366485	16870	59926	21898	14185	1582	280	52
5	118292	380410	20126	53818	26544	15038	2242	463	61
6	119588	388367	23670	47028	30777	14460	2977	597	76
7	126830	427403	30812	42726	34770	13728	3907	802	85
8	96483	445245	38401	26230	21509	7066	2636	566	72
9	55529	439577	38101	14241	2607	444	90	38	7
10	78510	501283	52699	21349	3754	570	94	32	8
11	121194	552756	78114	34826	6926	1050	195	65	13

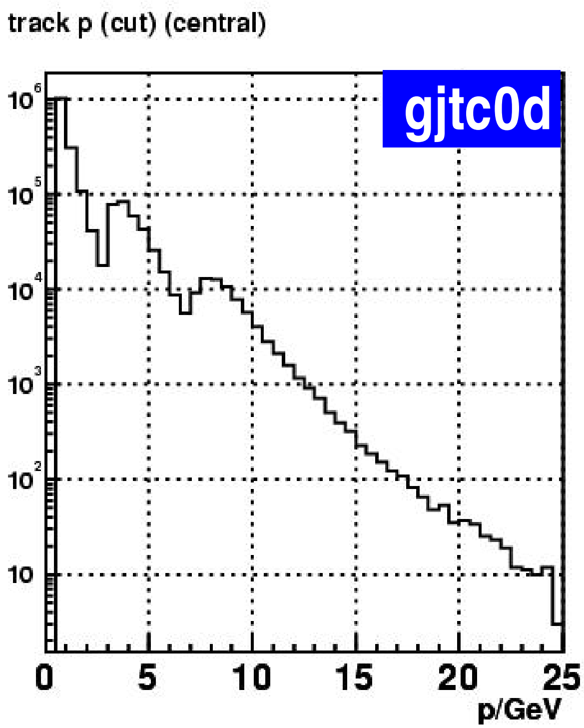
used for tuning

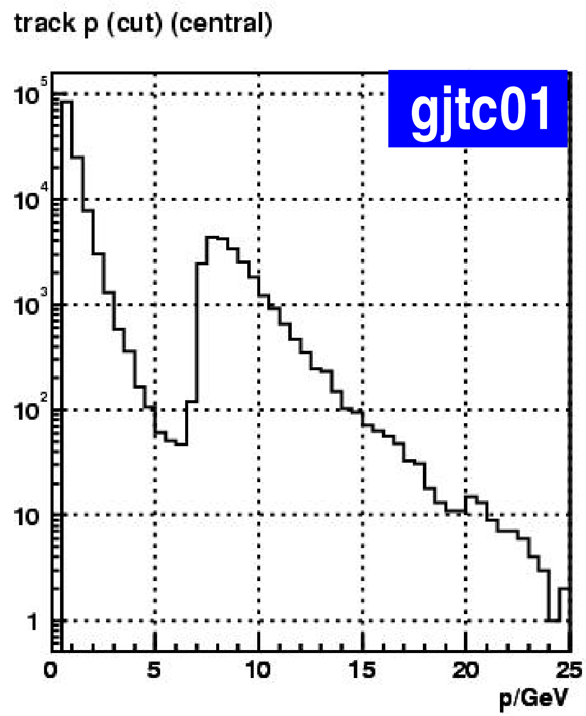
gjtc0d

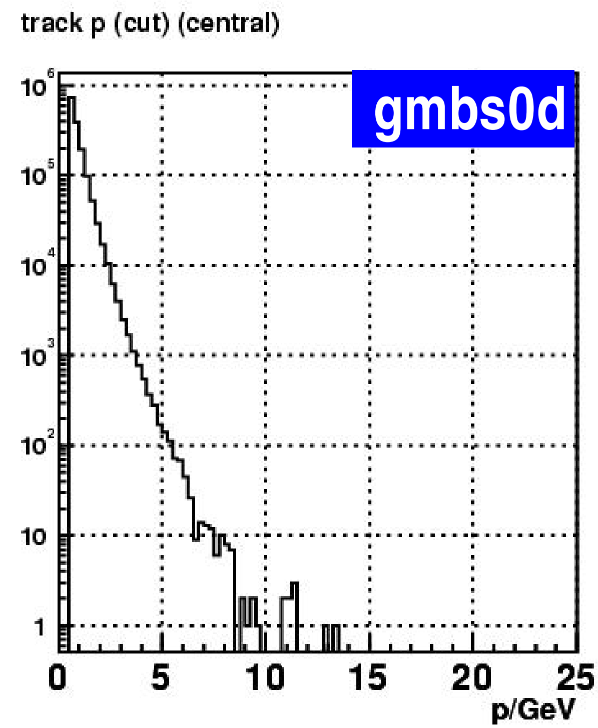


- plus contour cut for lateral profile:
  require track within inner 0.6x0.6 of target tower

Track Spectra (Central)



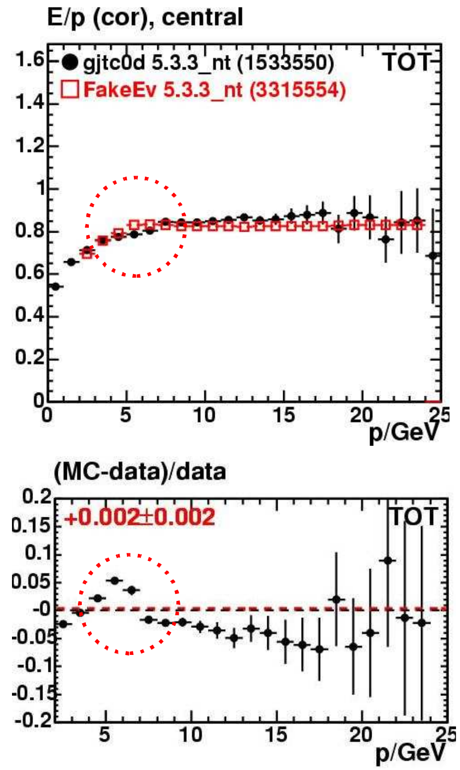




- w/o reweighting discrepancies between data samples around JET_CALIB trigger thresholds 4, 7 GeV/c expected

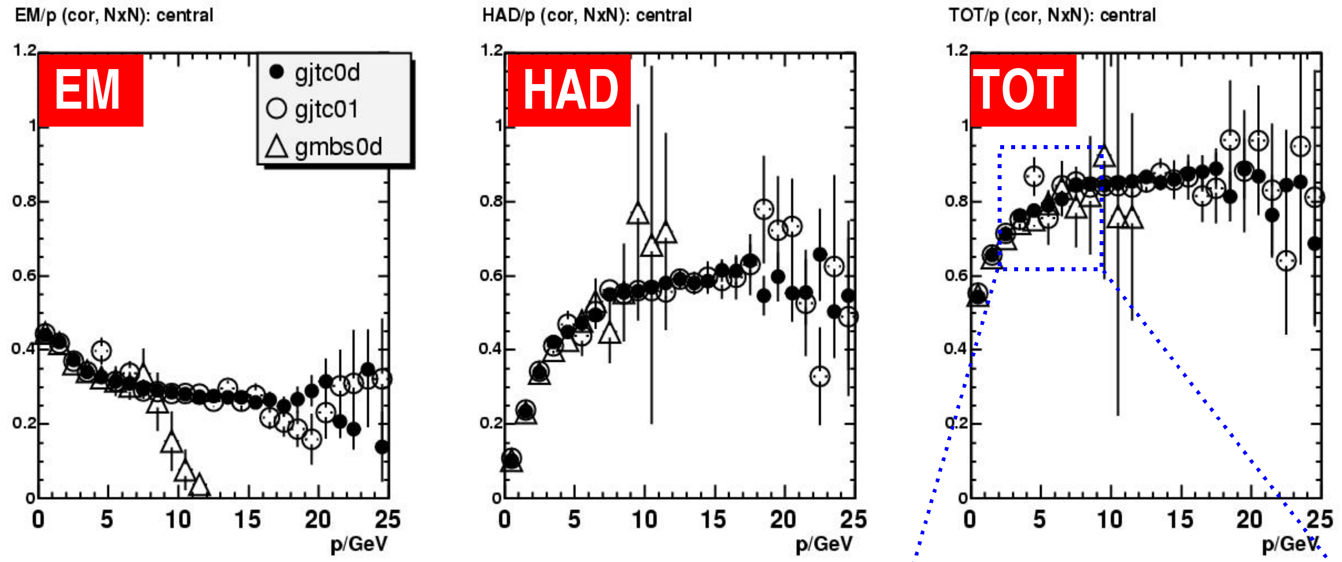
Cross Check of Data Samples (1)

FakeEv / gjtc0d

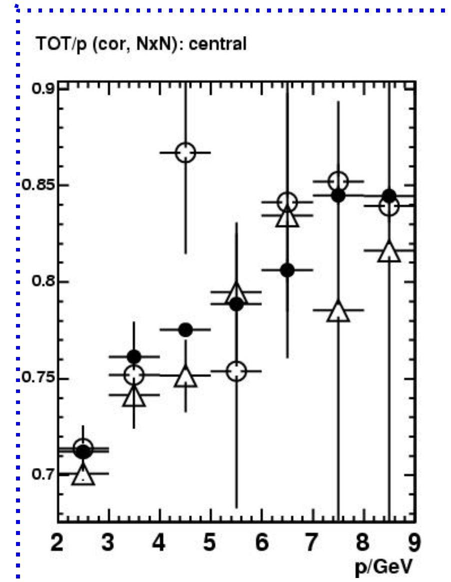


- Remember: Gen-5 JES uncertainty for p<12GeV/c claimed to be 2%.
- FakeEv does not follow the structure in the data around 6 GeV.

gjtc0d / gjtc01 / gmbs0d



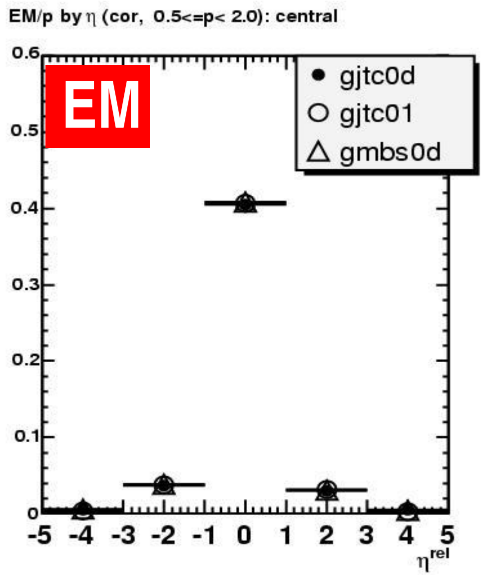
- JET_CALIB: gjtc0d (16M), gjtc01 (1.3M)
- Minbias: gmbs0d (13M of 21M) suffer from too low single track statistics at p>6GeV/c
- Reasonable agreement within statistical uncertainties. Structure in gjtc0d around 6GeV/c "consistent" with other data samples.

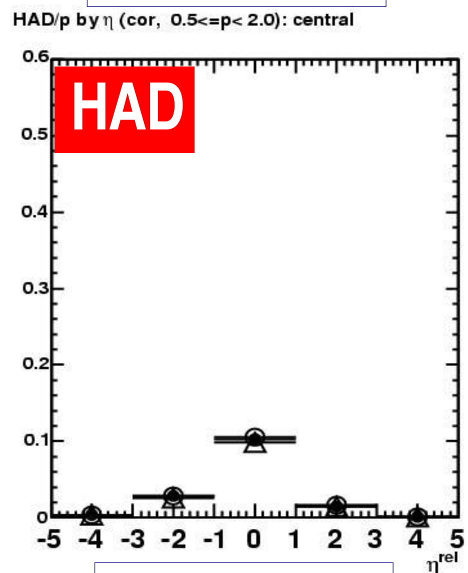


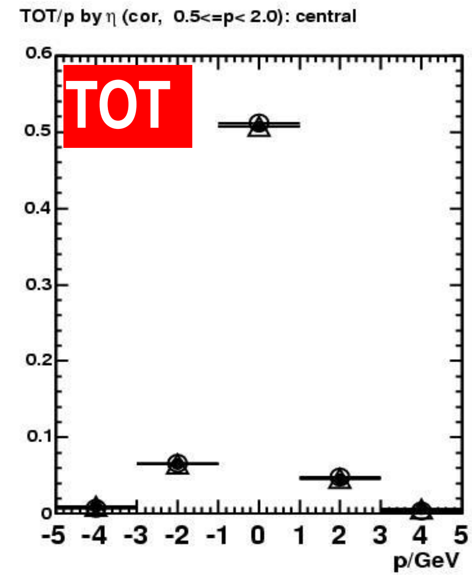
Cross Check of Data Samples, Central (2)

Unweighted lateral profiles:

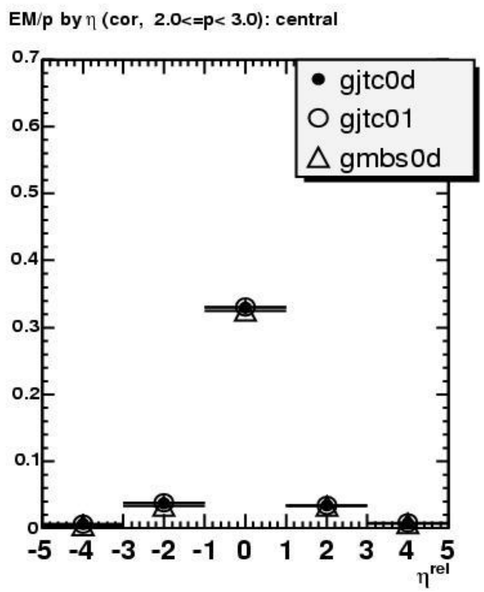
0.5-2.0 GeV/c

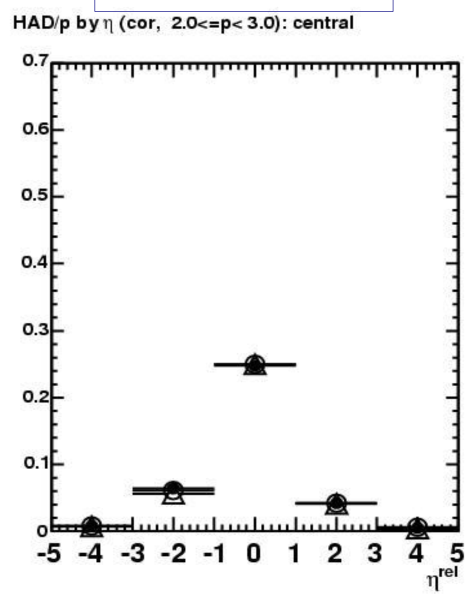


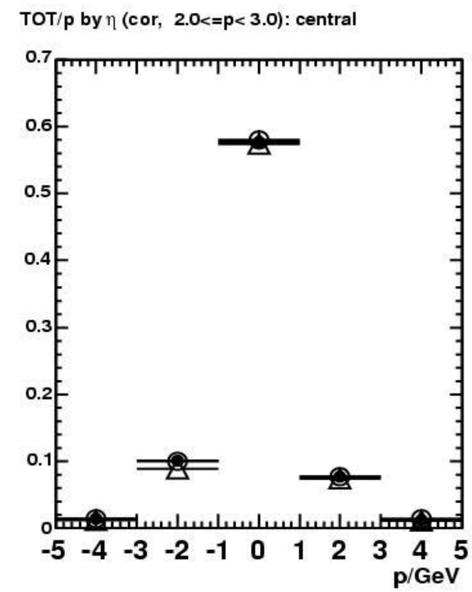




2.0-3.0 GeV/c

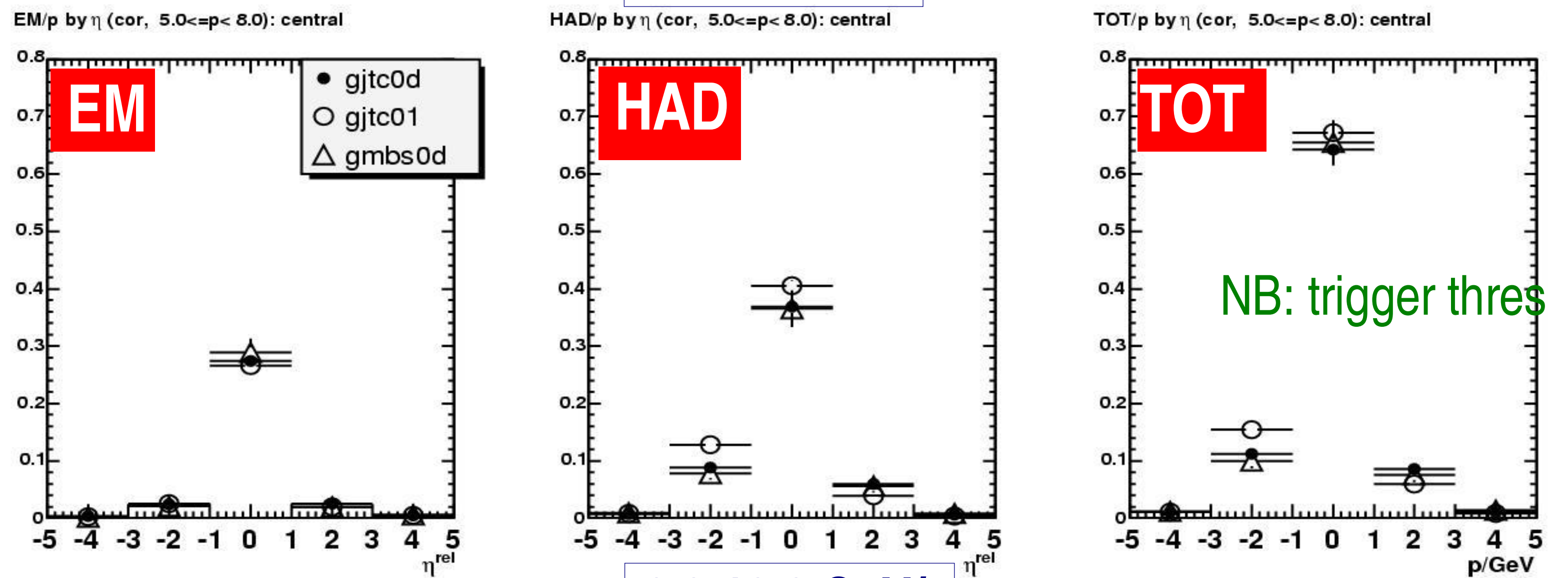






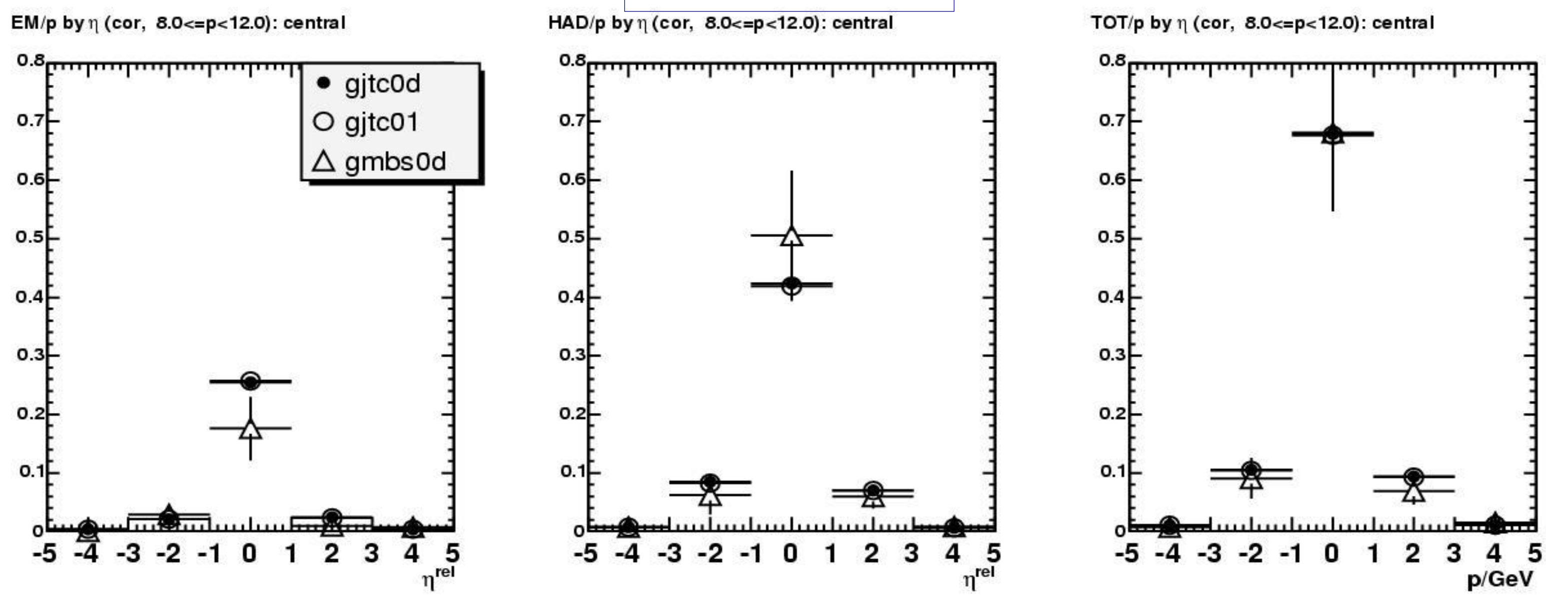
Cross Check of Data Samples, Central (2)

5.0-8.0 GeV/c



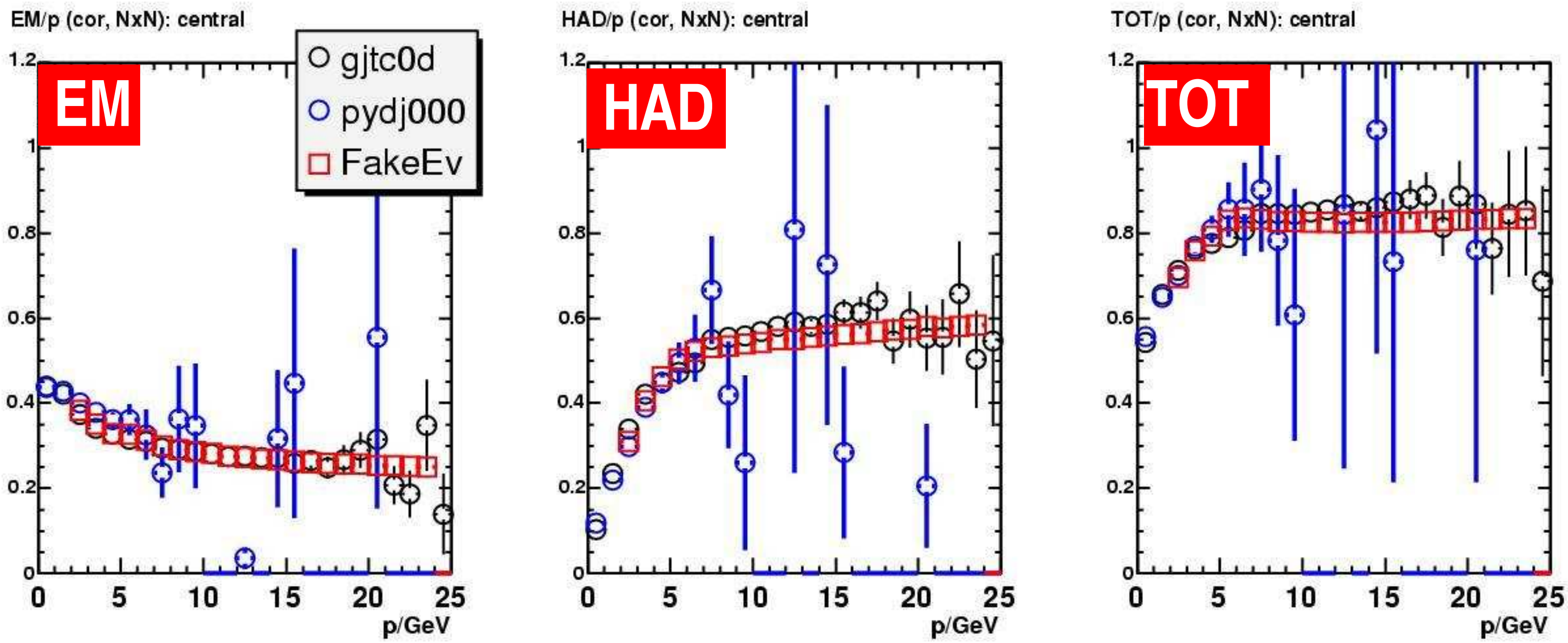
NB: trigger thresholds

8.0-12.0 GeV/c



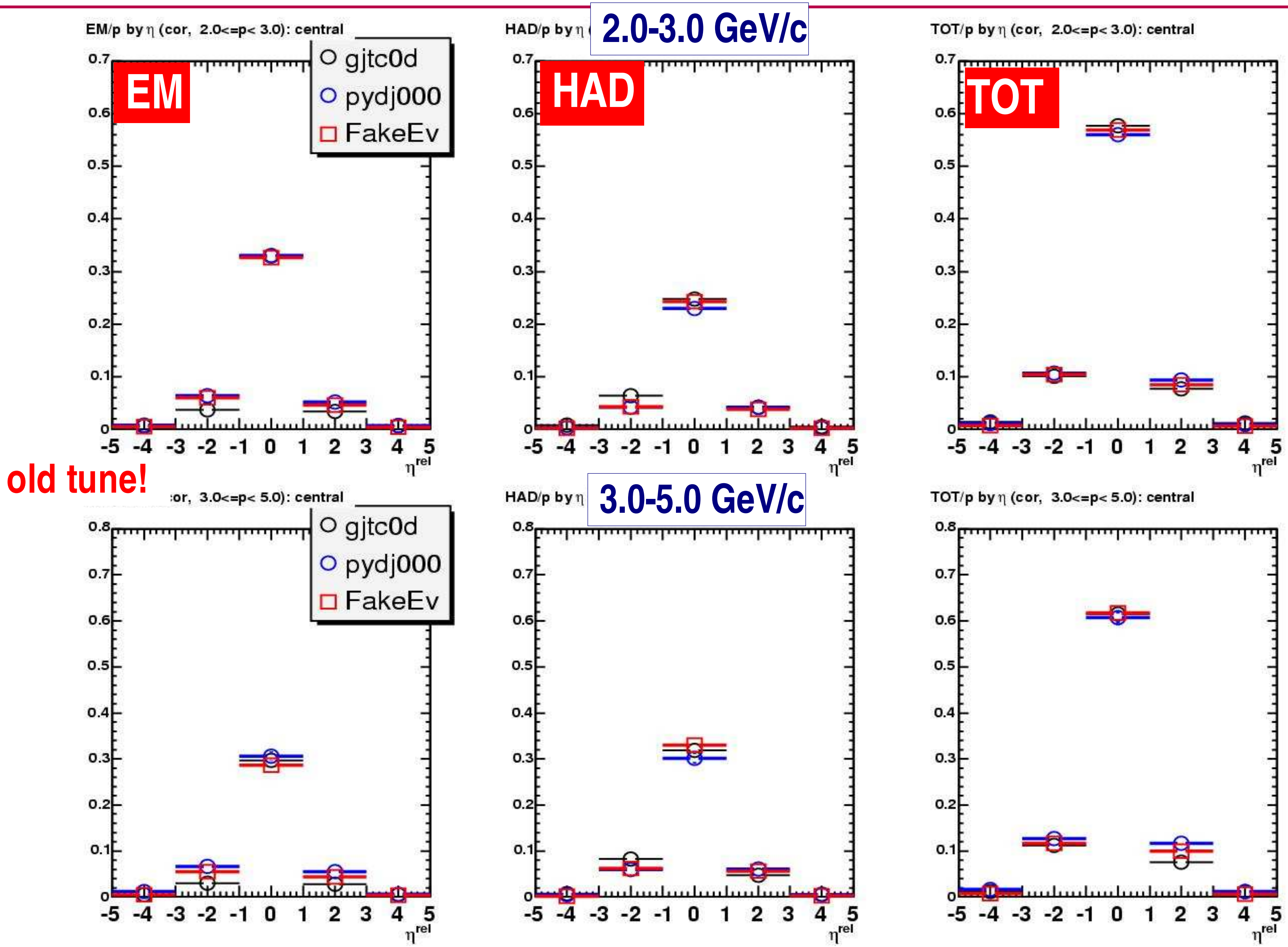
Cross Check of MC Samples, Central

FakeEv(weighted) / Pythia Minbias (pydj000)

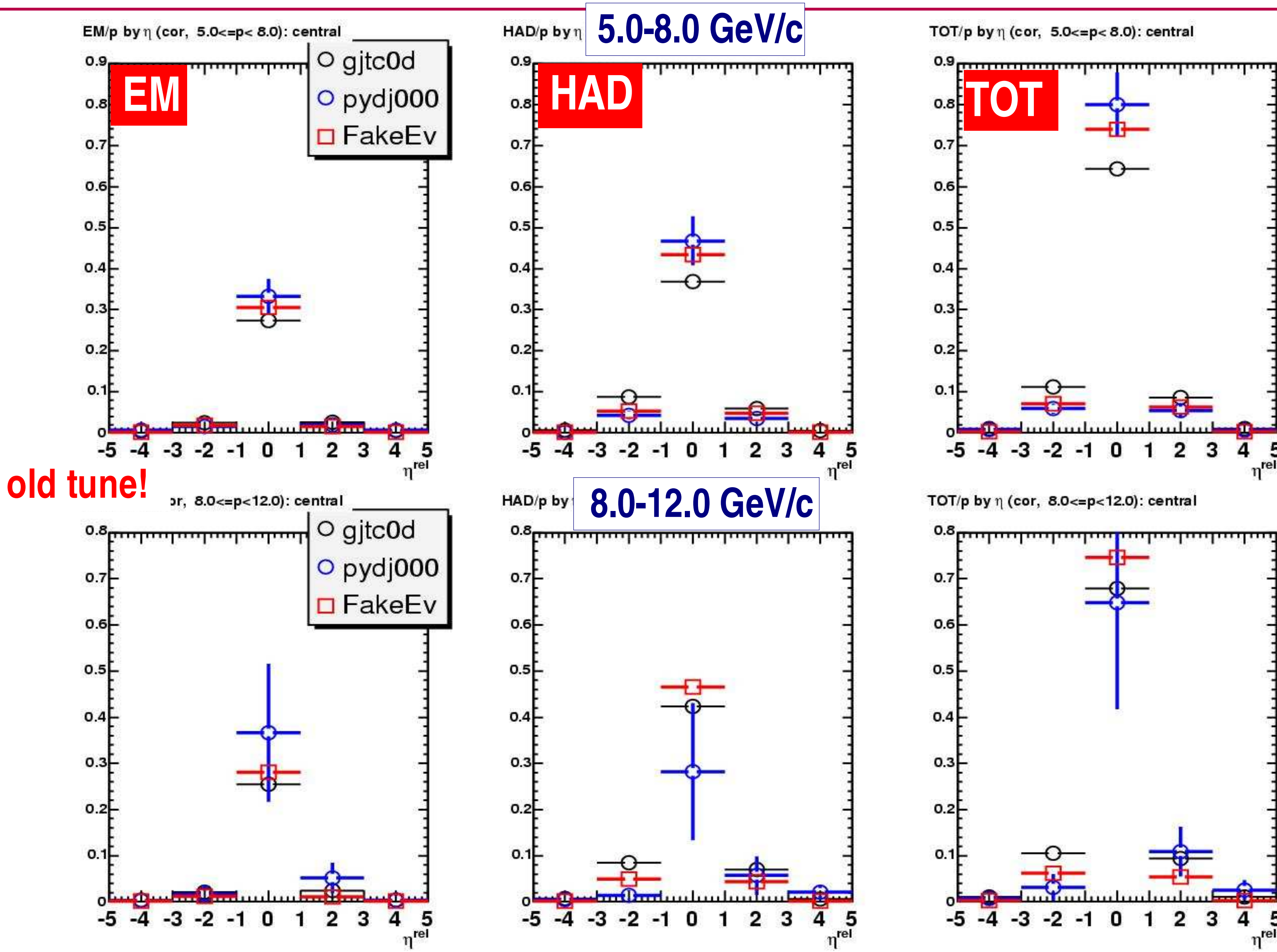


- Reasonable consistency within statistical uncertainties.
- FakeEv somewhat better than Pythia MB (probably due to due to reweighting).
- PYTHIA Minbias sample suffer from too low statistics at p>6GeV/c.

Cross Check of MC Samples, Central (2)



Cross Check of MC Samples, Central (3)

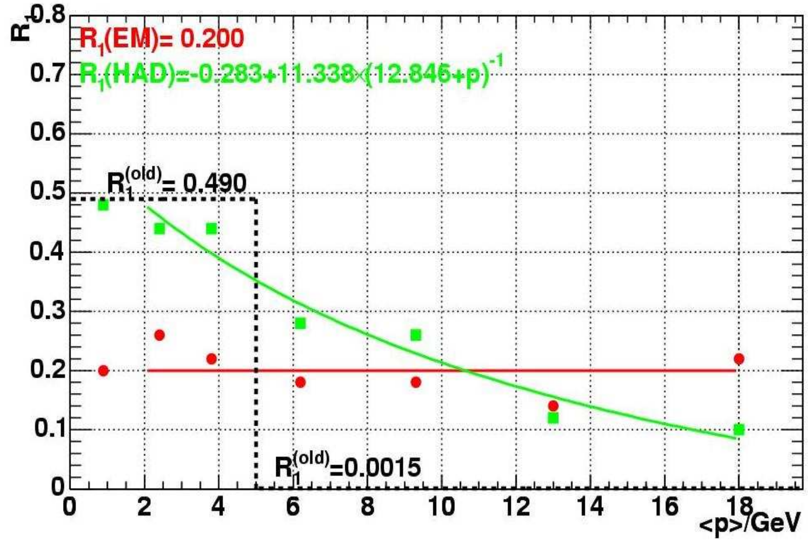


Lateral Profile Tuning Results

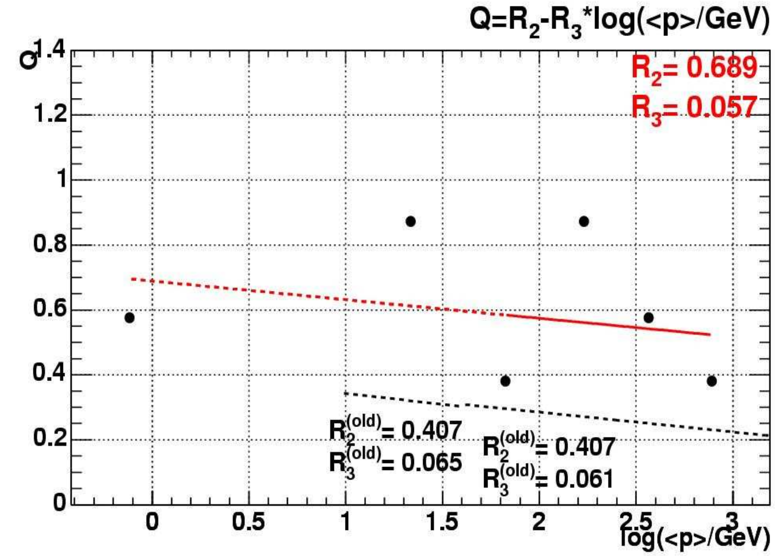
Hadronic lateral profile

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

- Cutoffs used: $R_0^{max}<1.4$, $x^{max}<2.0$
- Shower core R_1(HAD) at p<2.5 GeV/c consistent with old tune.
- EM and HAD give different optimal R_1 values for p<5GeV/c.
  - Shower extrapolation effects?
  - Cutoff artefacts?
- Consistent picture at higher momenta.
- Need to "combine" green and red curve reasonably.
- Subdominant spread term Q(p) is very weakly constrained: moderate shift of R_1 to higher values necessary to extract some p dependence.

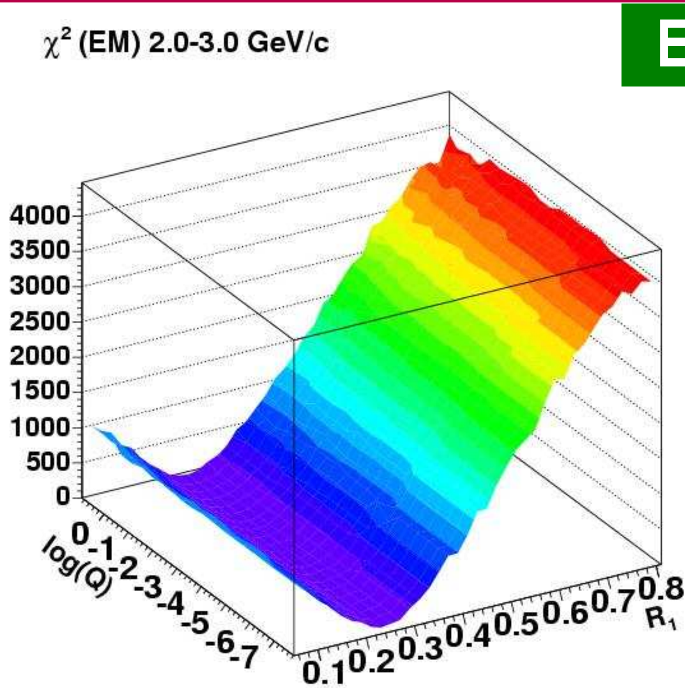


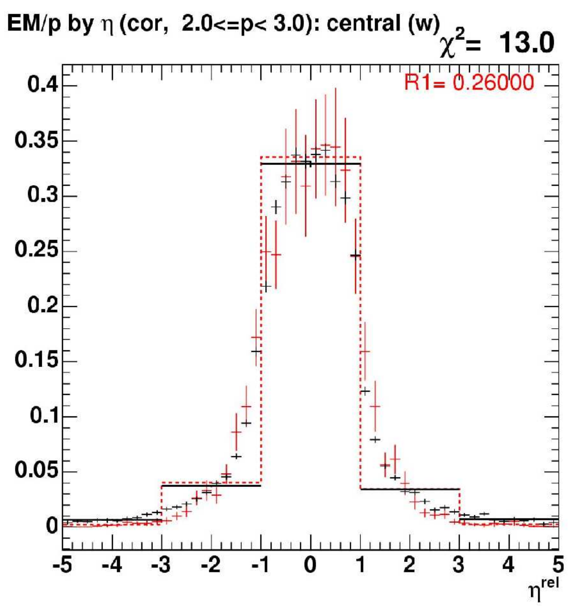
weighted momentum bins



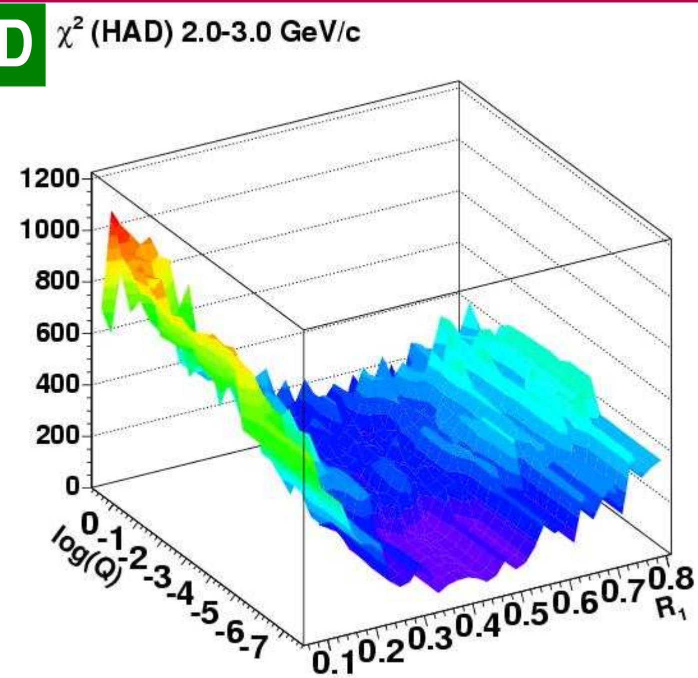
(R1,Q)-Scans 2-3GeV/c

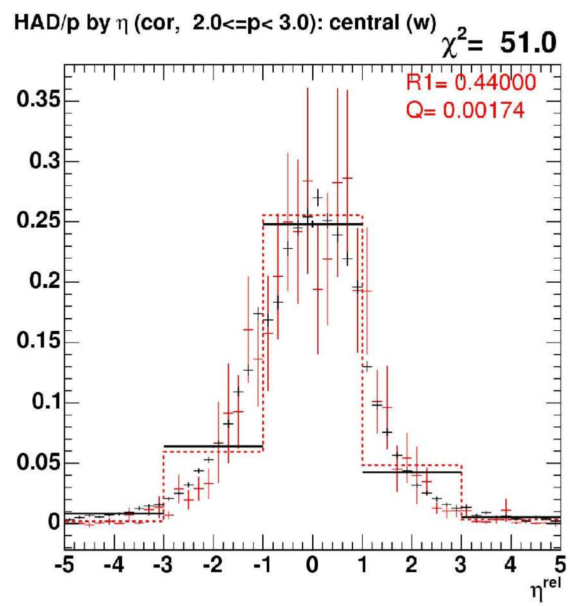
EM





HAD

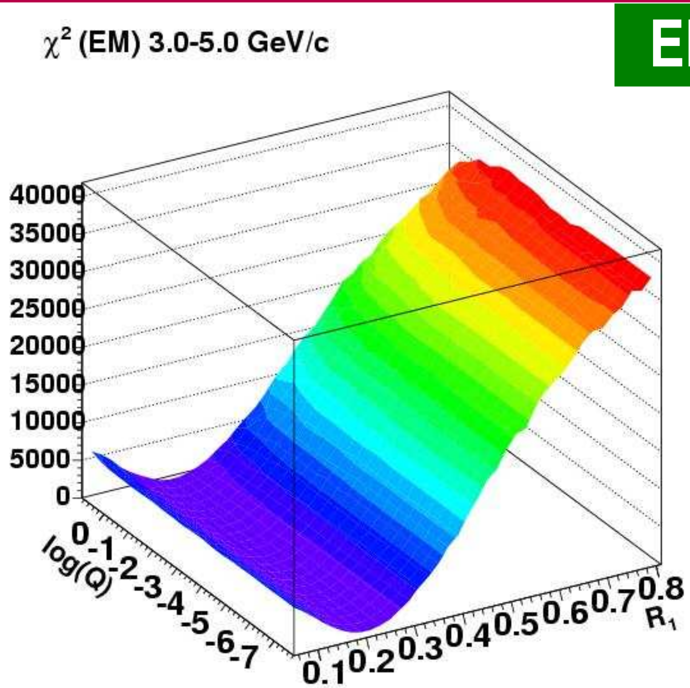


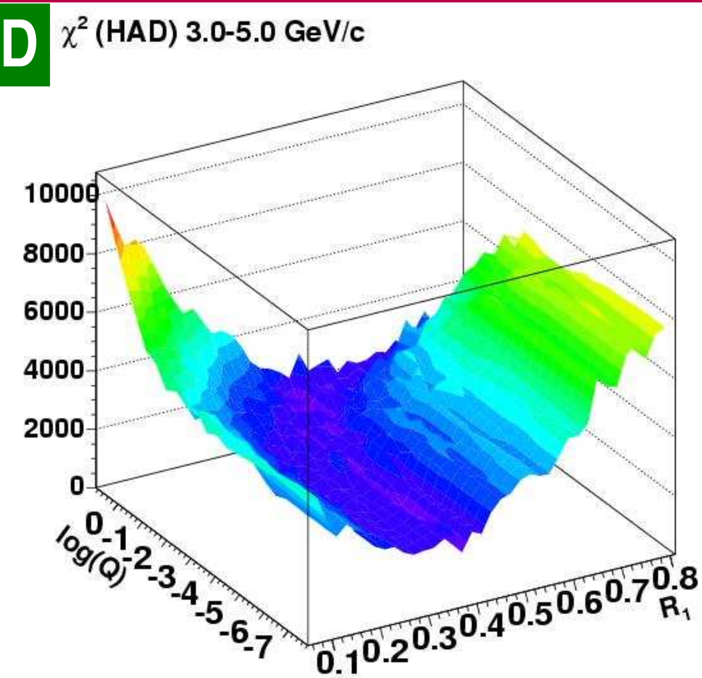


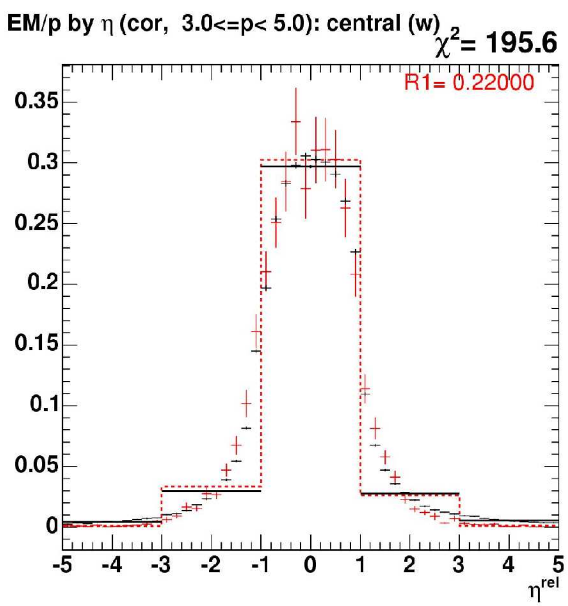
(R1,Q)-Scans 3-5GeV/c

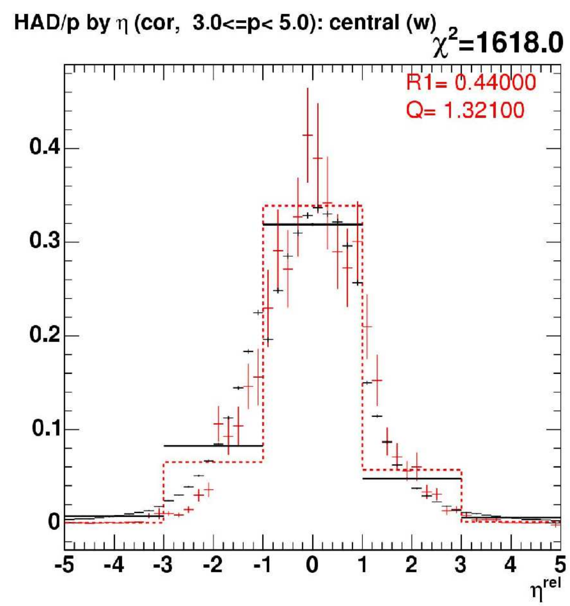
EM

HAD



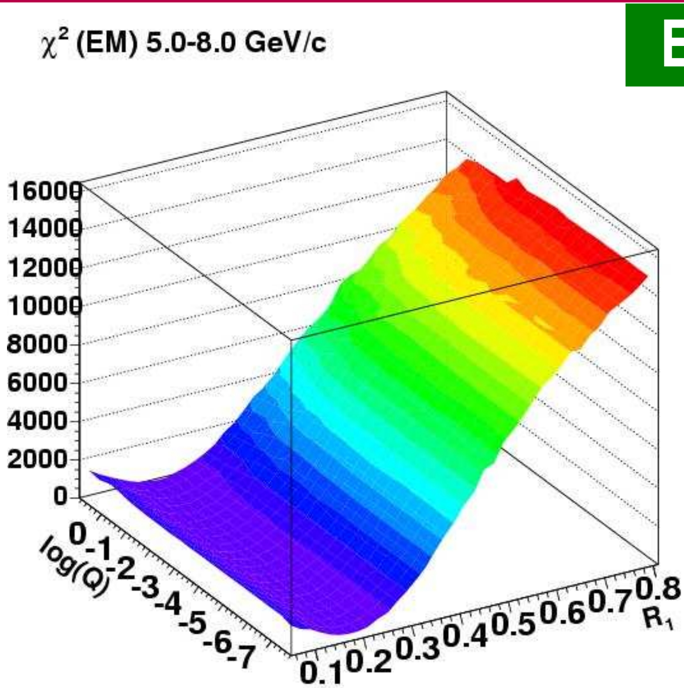


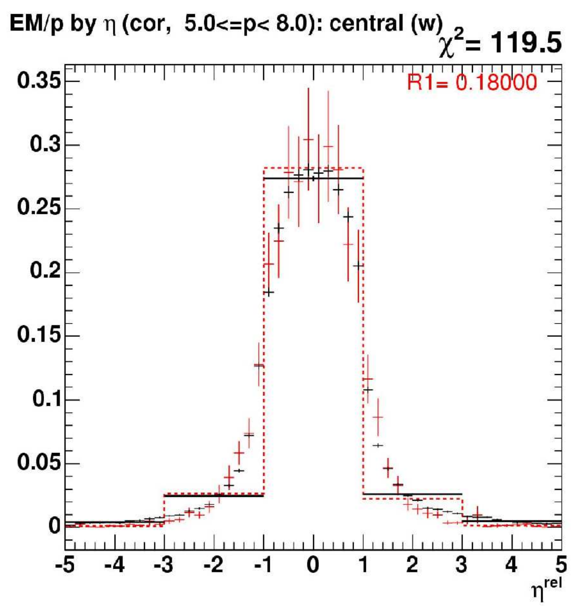




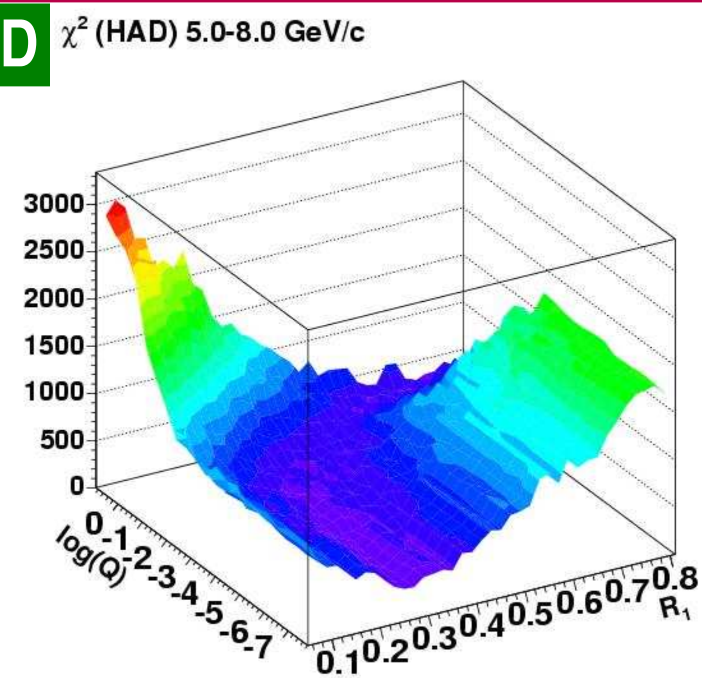
(R1,Q)-Scans 5-8GeV/c

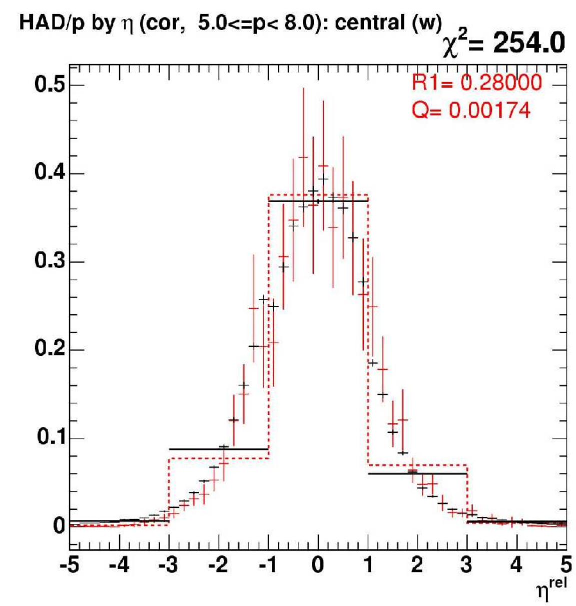
EM





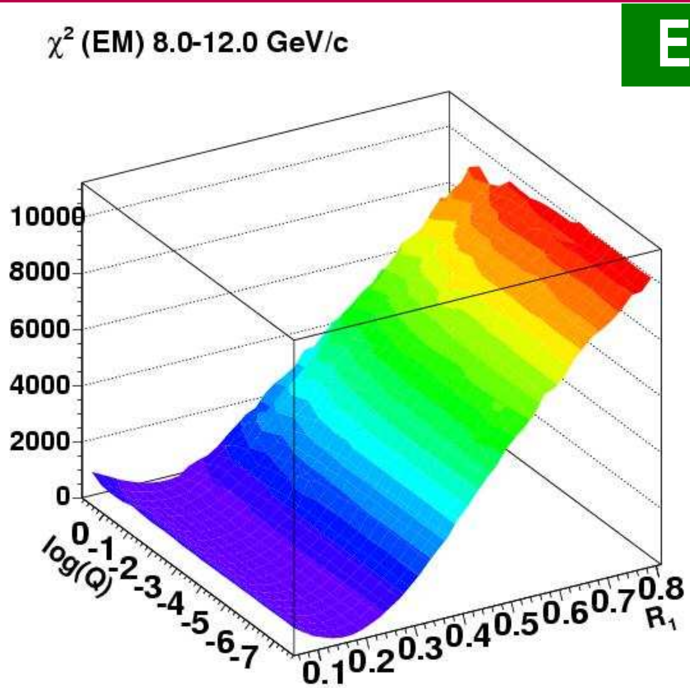
HAD

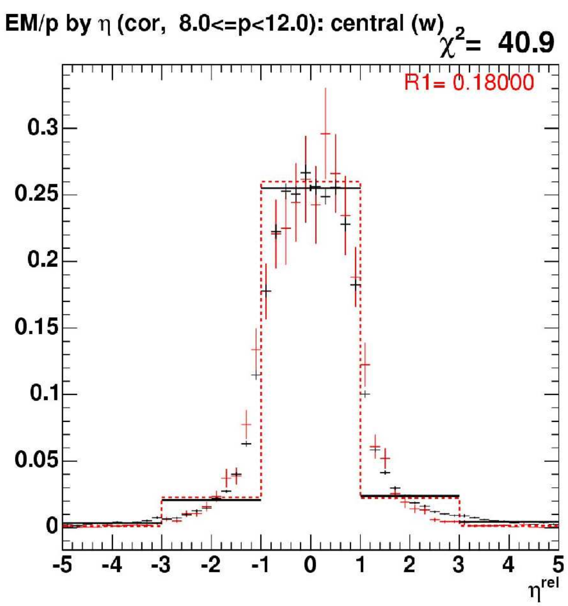




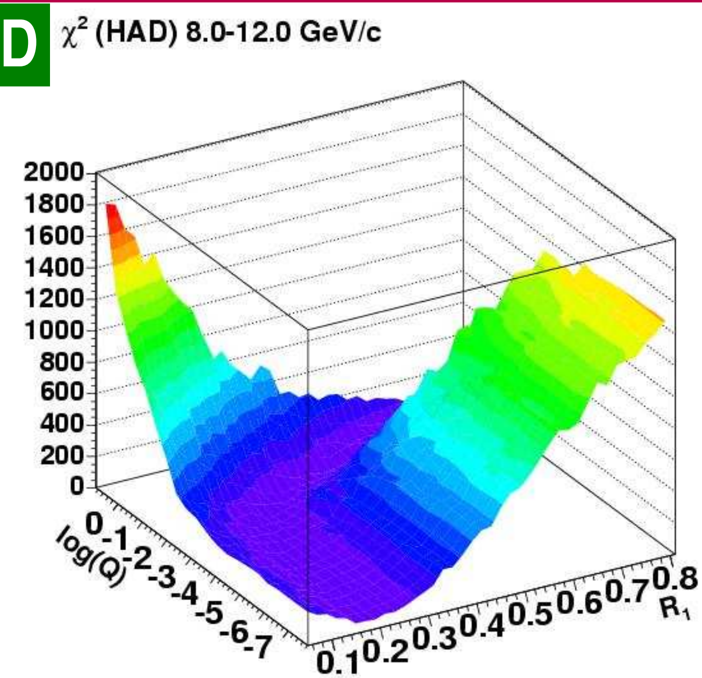
(R1,Q)-Scans 8-12GeV/c

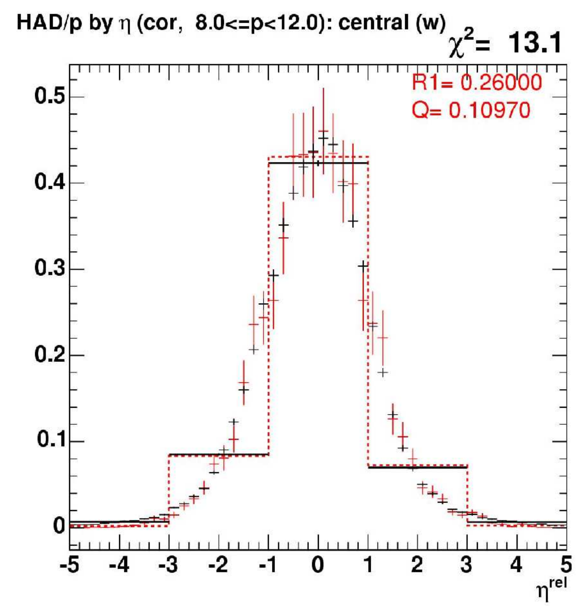
EM





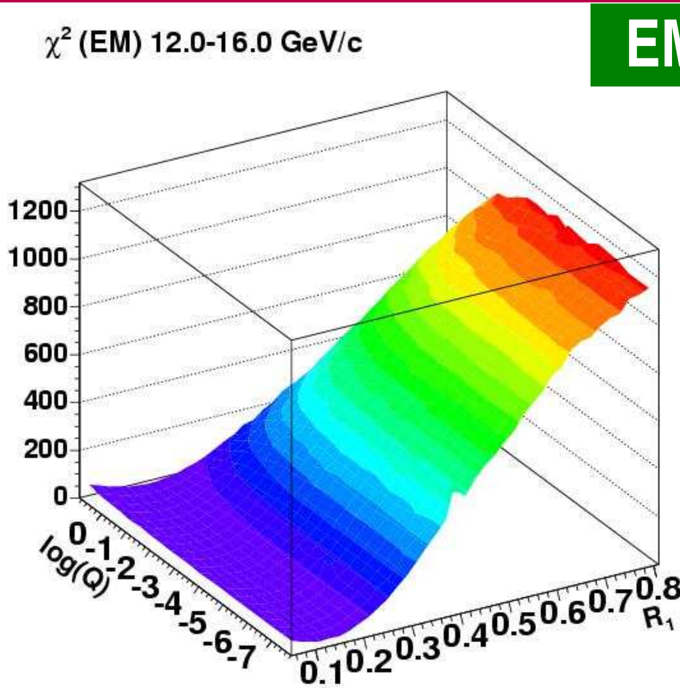
HAD

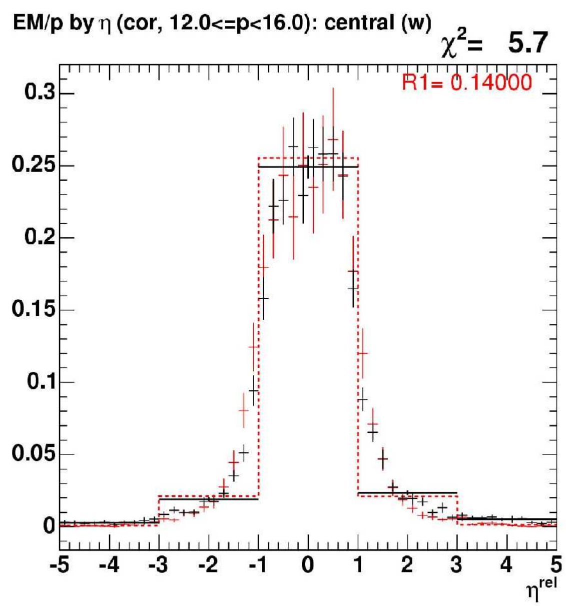




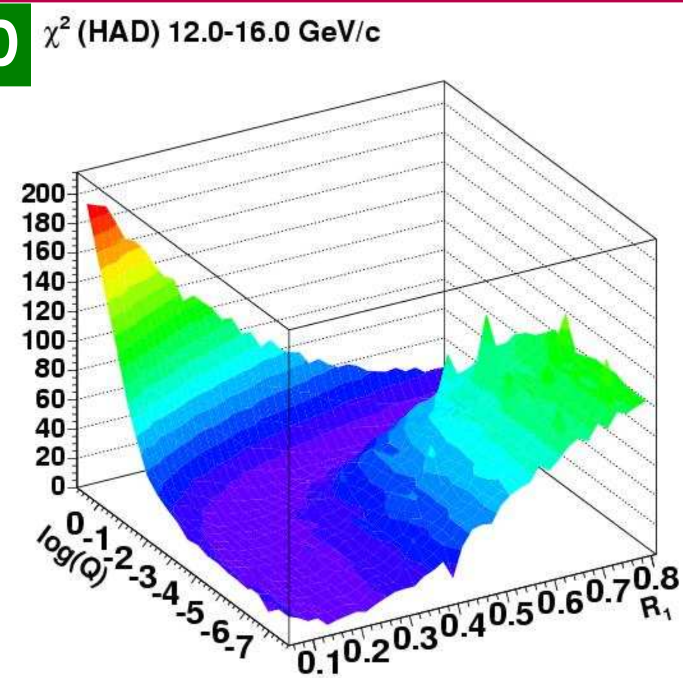
(R1,Q)-Scans 12-16GeV/c

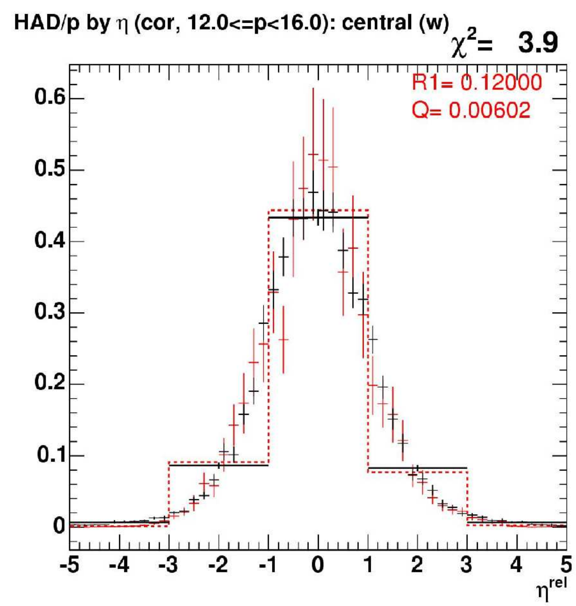
EM





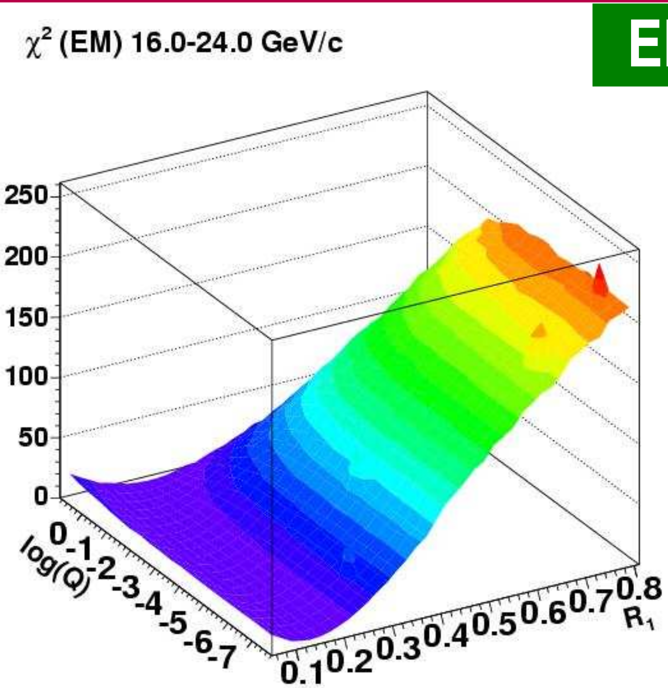
HAD

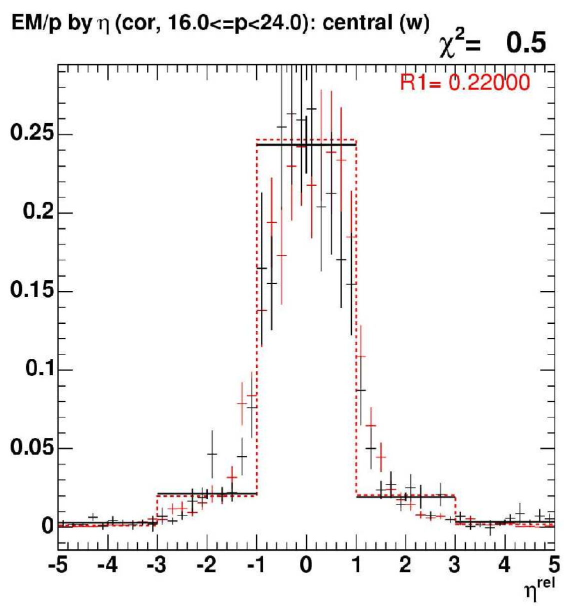




(R1,Q)-Scans 16-24GeV/c

EM





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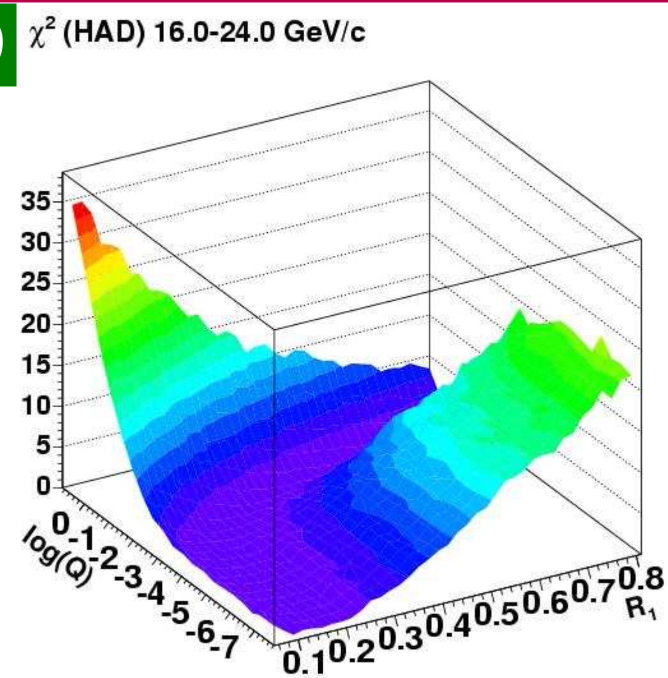

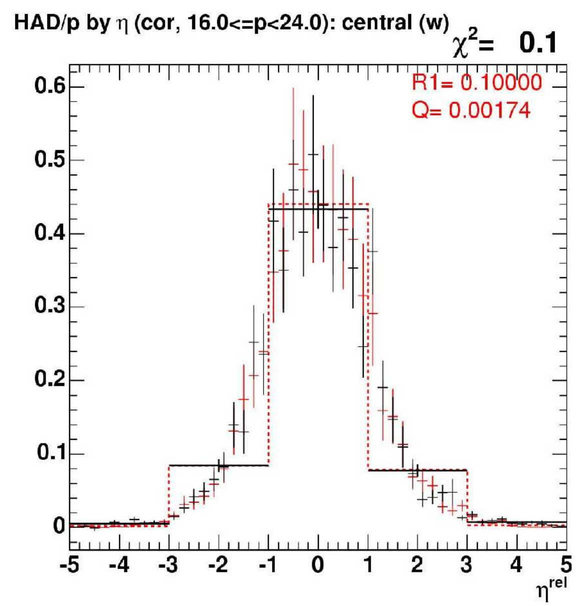

Conclusions

- Cross checked E/p responses (absolute, lateral) with different data and MC samples – expectedly no surprises.
- Second tuning iteration already gives improvement of simulated lateral profiles in the central part up to 20 GeV/c. Will provide a usable parametrization soon.
- Have to check impact of Gflash shower cutoffs on disagreement between EM and HAD results at low momentum.
- Will start plug tuning soon (same philosophy).
- Further refinements as we get new data from recent/ongoing single track trigger runs.