Absolute Single Particle Response

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Overview

Hadronic calorimeter response measurement:

- Further studies based on new STT data with 15 GeV/c trigger threshold (gjtc0h)
- At high momenta we need to introduce additional quality cuts to reduce contamination from photon conversion and muons from physics processes:

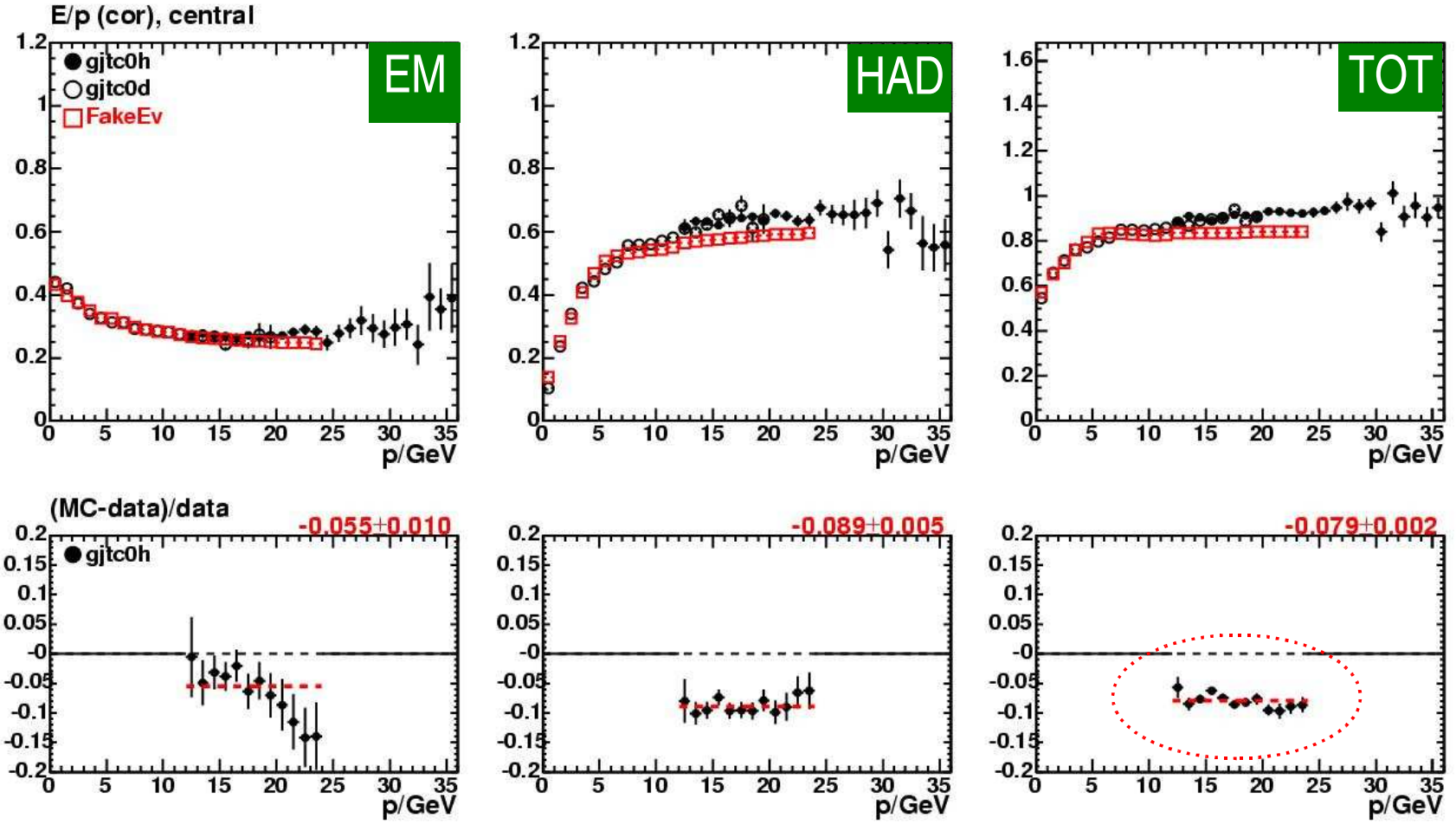
	central, p>12GeV/c	plug , p>16GeV/c
electron veto:	$E^{HAD}/E^{EM} > 0.02$	$E^{HAD}/E^{EM} > 0.02$
muon veto:	$E^{HAD}/p > 0.25$	$E^{HAD}/p > 0.10$

  Threshold and cut values are choosen such that hadronic peak is not truncated.
- Switch from simple to Gaussian means for <E/p> to improve MC/data comparisons
- MC/data discrepancy at p>12GeV/c re-evaluated and cross checked with number stated in the JES NIM draft

Plug simulation:

- Performed various mandatory cross checks with Pythia MB sample (pydj000) before starting tuning machinery for the plug.

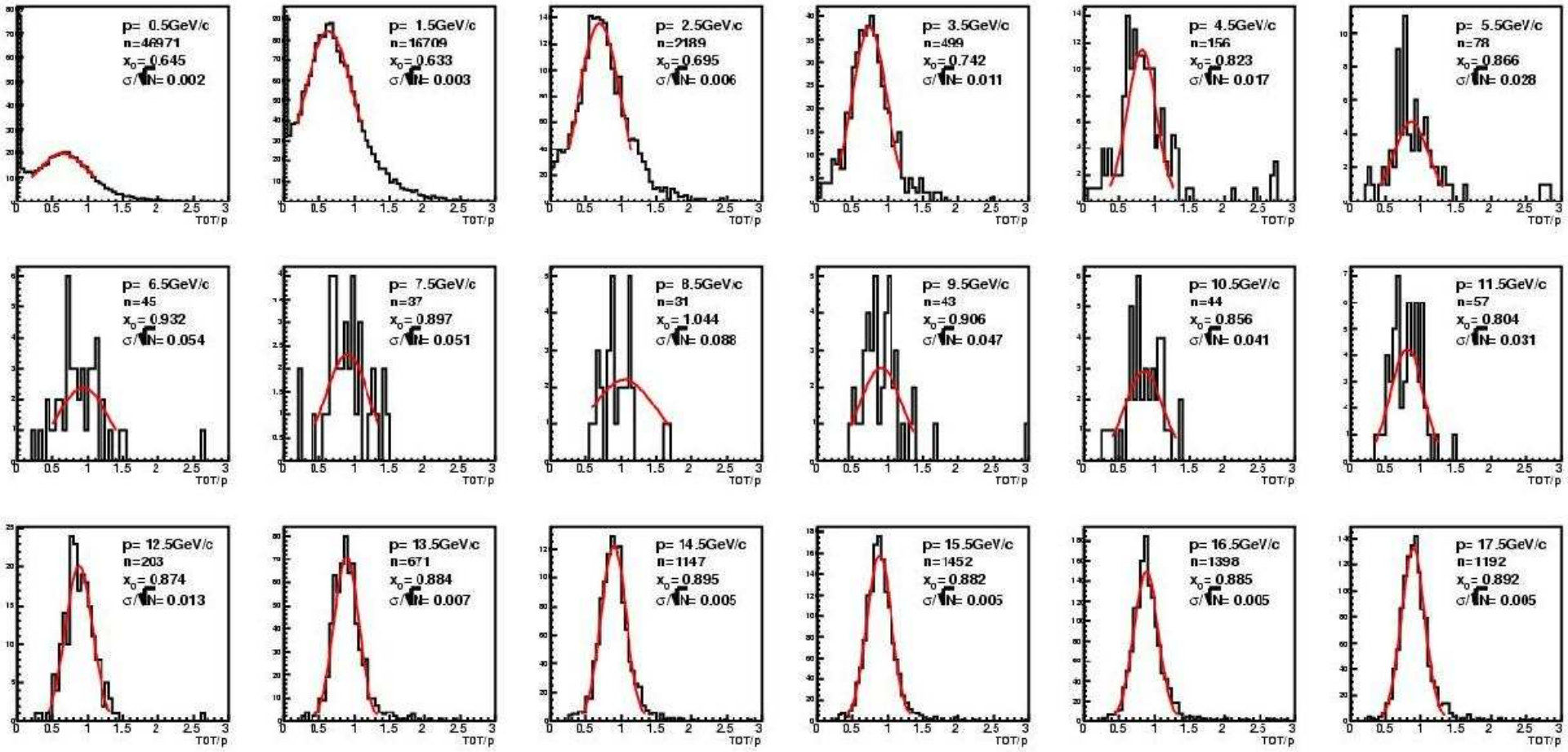
Absolute Central Response up to 36 GeV/c



- JETCALIB gjtc0d(5.3.3_nt) + gjtc0h(6.1.2) versus FakeEv (5.3.3_nt)
- EM response simulation pretty good up to 16 GeV/c.
  HAD and TOT ok up to 5 GeV/c, moderate quality up to 12 GeV/c .
  (NB: momentum range 0-5GeV/c subject of previous Gen-5 tuning.)
- Simulation at p=12..24GeV/c underestimates TOT/p by 8%. Discrepancy increases with p.

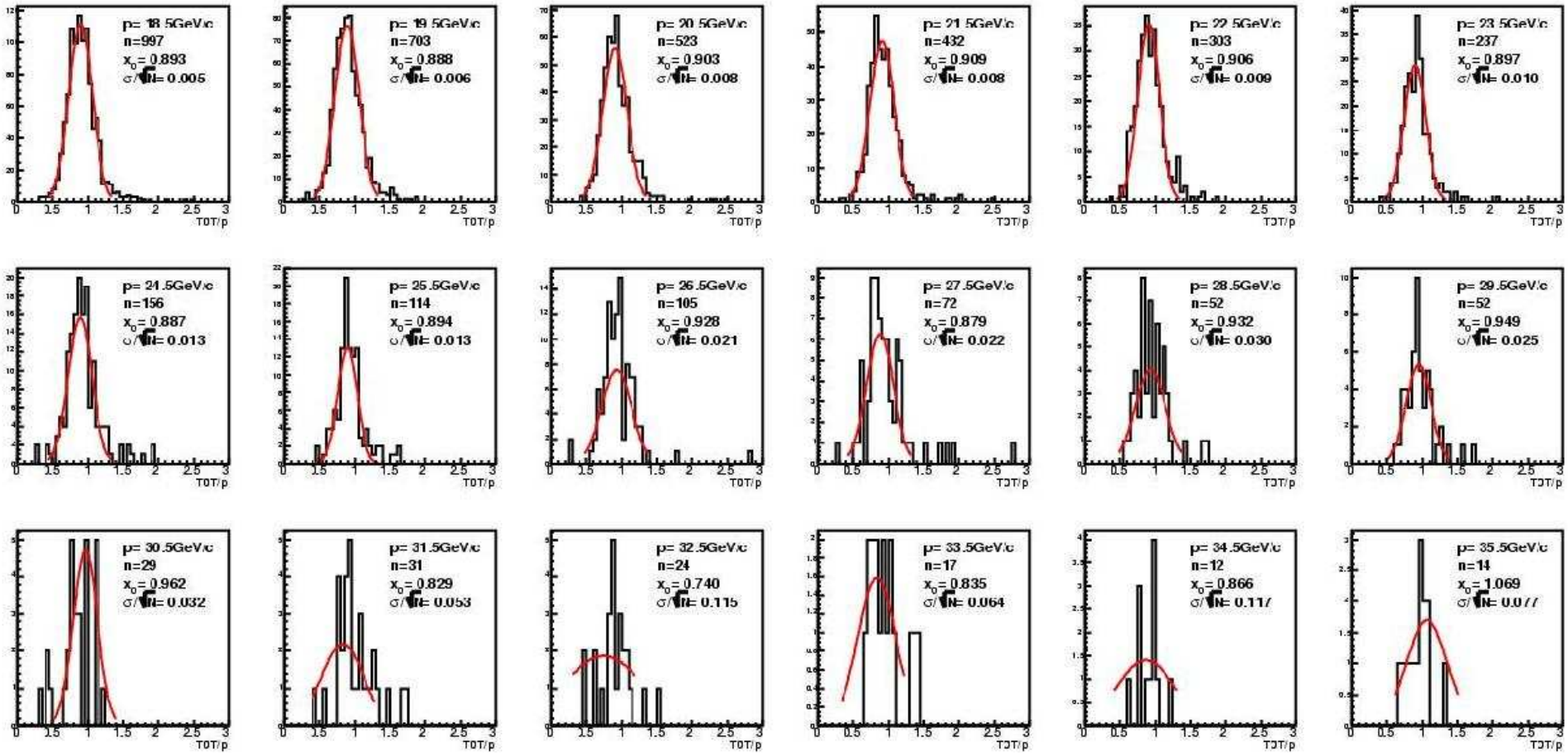
...using Gaussians (1)

gjtc0h, TOT response, 0.5-18.0 GeV/c



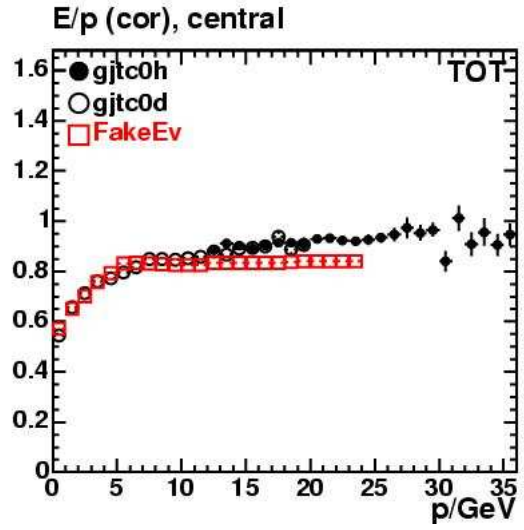
...using Gaussians (2)

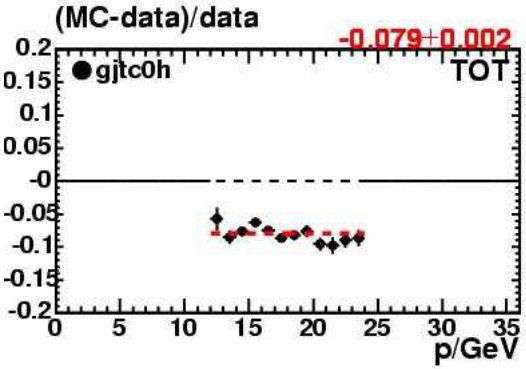
gjtc0h, TOT response, 18.0-36.0 GeV/c



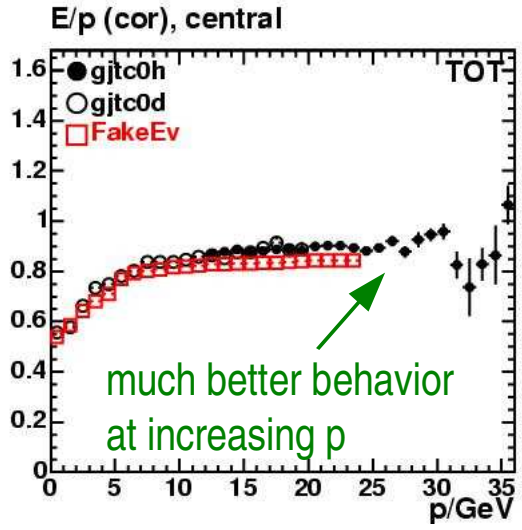
Absolute Central Response (2)

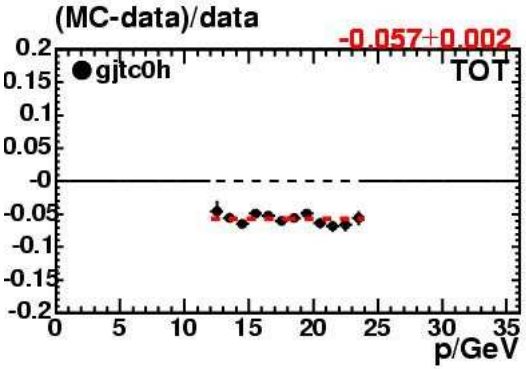
simple means



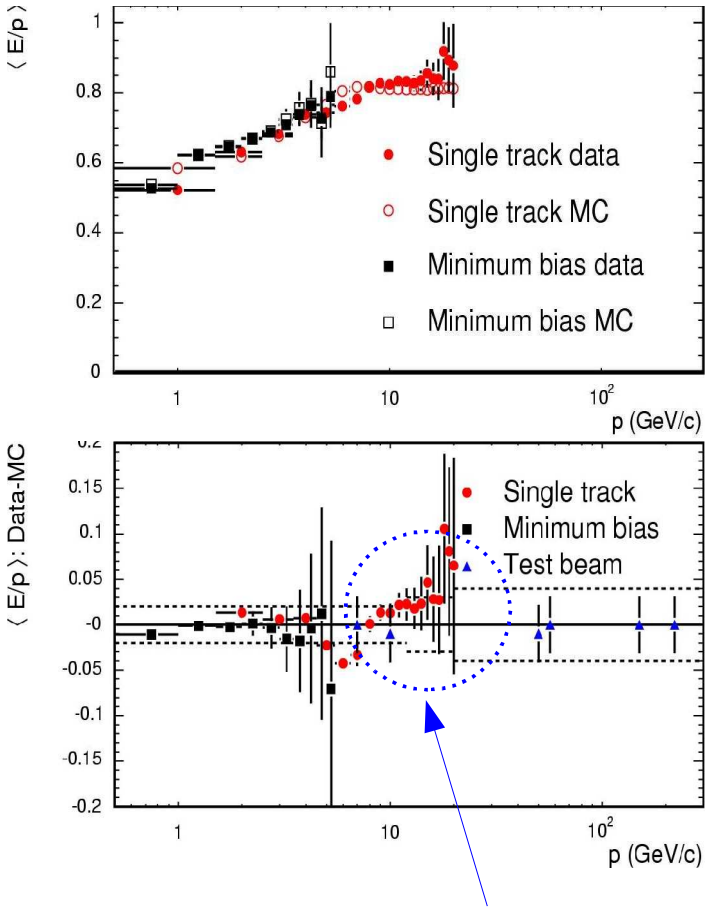


Gaussian means





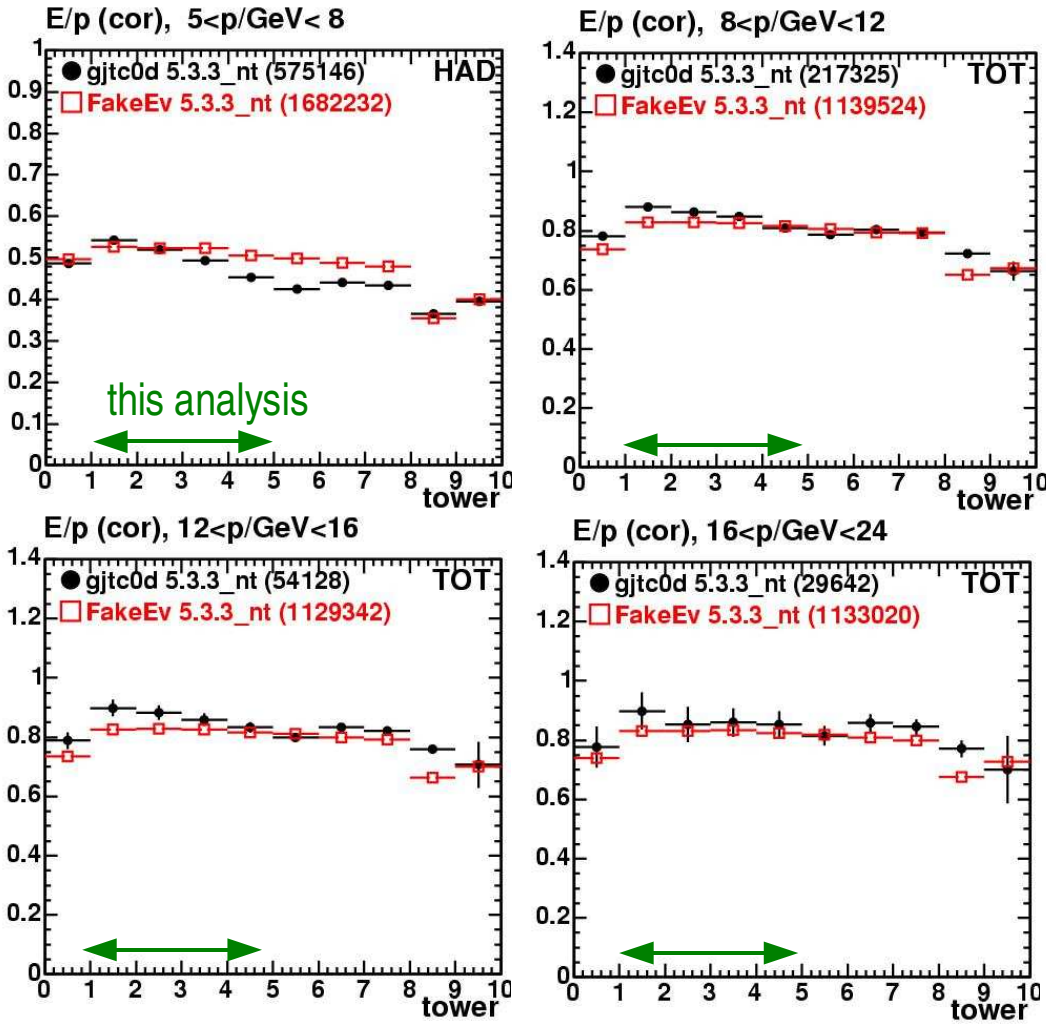
Status JER NIM Draft



- Gaussian means more appropriate for MC/data comparison.
- Still sizeable average discrepancy of 5.7% at 12-24 GeV/c
- NB: - Introducing lepton veto increases the difference
  - Excess of data over MC dependent on tower groups

Claimed uncertainanty for 12-20GeV/c: 3%

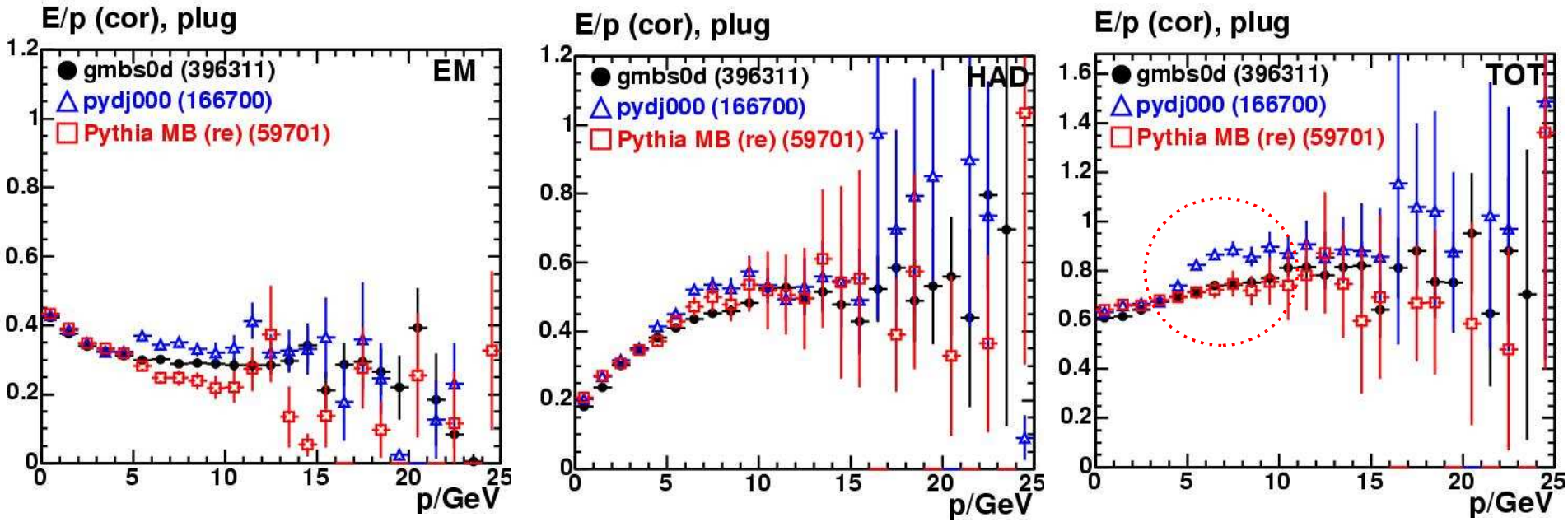
Tower Group Dependence



- Dependence of absolute response on tower is different for data and MC
- For p>8GeV/c, excess of the data over MC decreases towards plug region. Extending tower region would therefore reduce the discrepancy in average absolute response.
- Plug response measurement presented here focuses on target tower group 1-4 (instead of 0-8 in the past)
  - ensures that E/p signal region is well covered by CHA + no adjacent cracks
  - is consistent with η region ($0.2<|\eta|<0.6$) used to evaluate absolute correction uncertainties from the E/p difference between MC and data

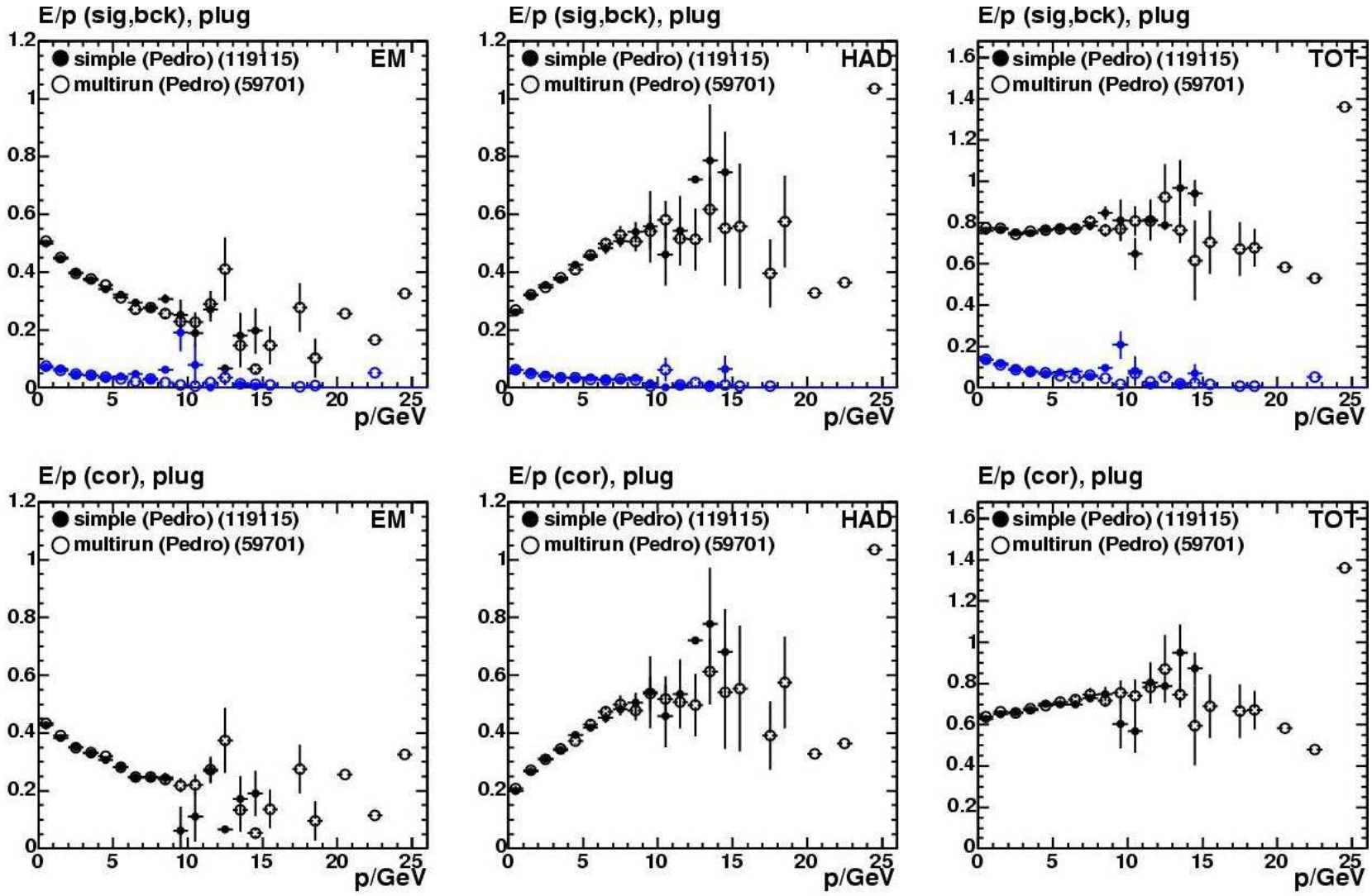
Simple mean, no lepton veto.

Plug Response Simulation



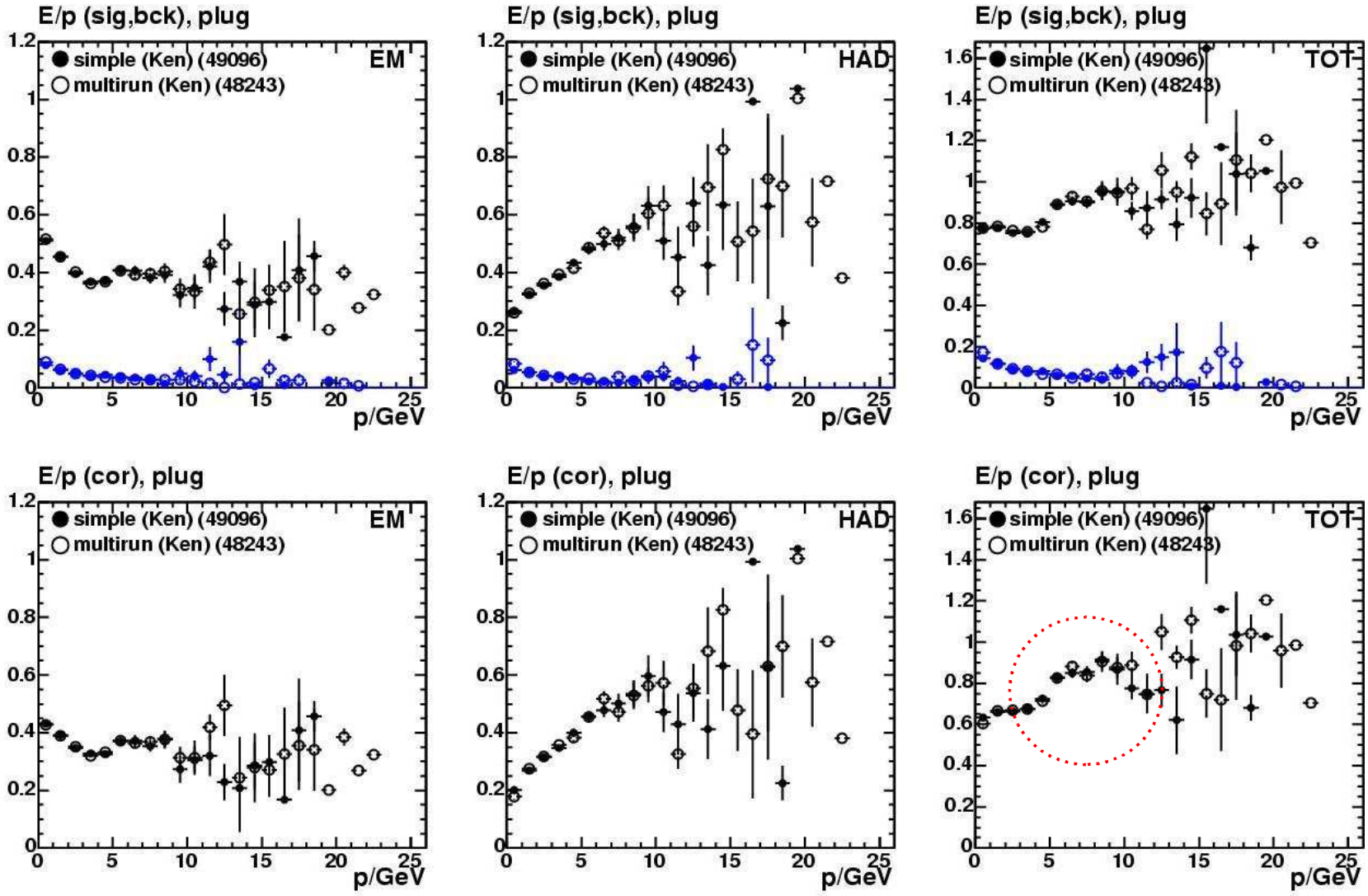
- Did generate Pythia MB but wasn't able to reproduce “bump” in pydj000 at p>5 GeV/c.
- Ken and I did various cross checks
  - dependence on background contamination
  - dependence on multiple run scheme (mcProduction vs. my own tools)
  - impact on calibration passes 13A (pydj000) vs. 17(my runs)
- Finally Ken pointed me to a suspicious log entry that suggested that I did not use the Gen-5 default hadronic shower profile parameters:
  - Profiles for p>5GeV/c are indeed much broader than in pydj000
  - Additional loss of shower energy outside 2x2(EM) and 3x3(HAD) signal regions
  - Explains lower E/p response in my samples (+better consistency with data).

Dependence on Multirun Scheme (1)



- Applying my analysis tools to Stntuples generated in my simulation + production framework
- Negligible impact of run dependend scheme on absolute response

Dependence on Multirun Scheme (2)



- Same exercise but using Ken's regenerated Stntuples

Conclusions

- Introducing lepton veto + using Gaussian means for TOT response instead of simple means improves MC/data comparisons
- MC/data discrepancy at p=12-20GeV/c claimed in JER NIM draft is probably underestimated by a factor of 2
  - Point-to-point differences between measured and simulated E/p are statistically consistent with previous measurement
  - But average uncertainty claimed in the NIM draft (3%) might be to tight because it lacks a statistical component plus is based on a tower group which is non-representative for absolute corrections uncertainties.
- Probably found reason for inconsistency between archived and newly generated Pythia MB sample.
  - After clarification I intend to start with plug simulation tuning soon.