Calorimeter Studies with 3 & 7 GeV Track Trigger

Matt Baumgart, Mel Shochet

University of Chicago

Goal: extend test of calorimeter simulation to tracks of momentum 3-12 GeV/c.

Data: isolated single-track trigger with 3 & 7 GeV/c thresholds

- strict good track criteria
  - > 35 axial hits, >23 stereo hits
  - > 2 good axial superlayers, >1 good stereo superlayers
  - $|d| < 1$ cm, $|z_0| < 60$ cm
  - $P_T > 3$ or 7 GeV/c
- 5x5 tower track isolation around the seed track
- data: offline 4.5.2; simulation: offline 4.6.1

Concern: As track P_T increases, jets become dominant.

$\Rightarrow$ large correlated background

Track isolation removes events with extra charged hadrons.

What about π^0's? CES Isolation

In the 3x3 tower region around the seed track, allow no more than one CES wire cluster and one CES strip cluster with $E_T > 0.5$ GeV. The cluster must be within $\Delta x < 5$ cm and $\Delta z < 4$ cm of the seed track.

Background and Signal:

cdf1344: CEM:

B	B	B
S	S	S
B	S	B

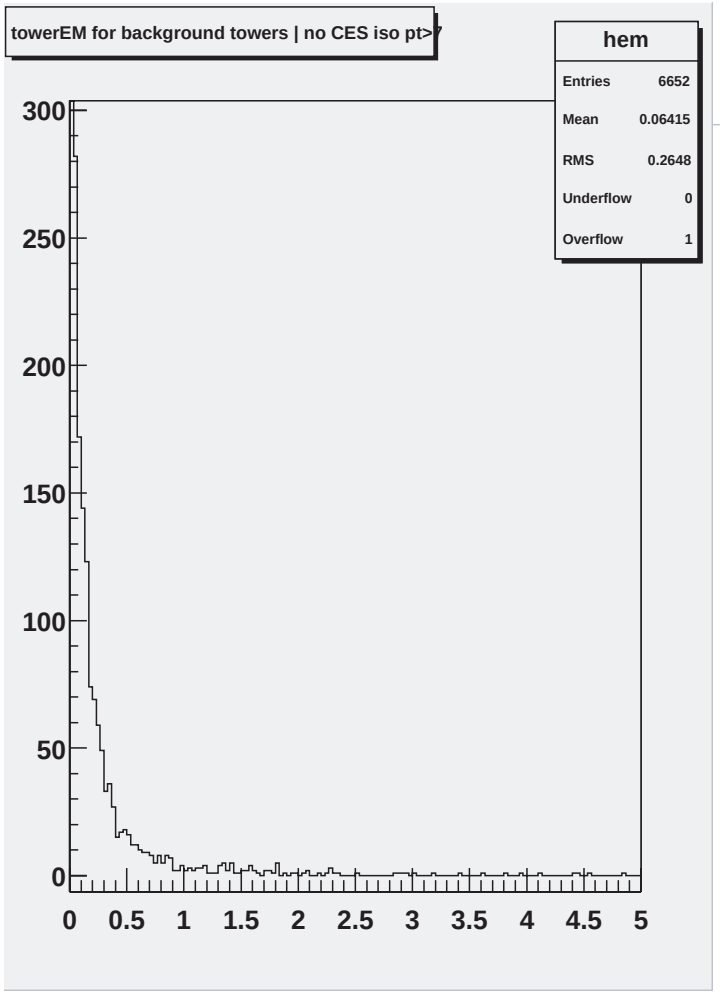
3x3 CHA

non-1344:

B	S	B
	S	
B		B

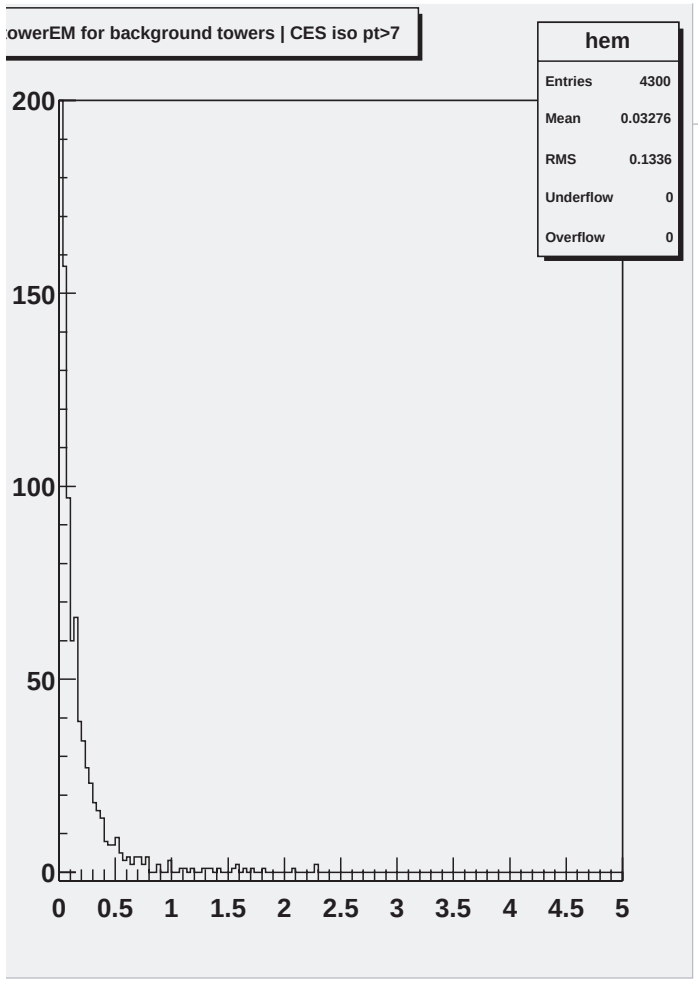
Differences in data/simulation comparison tells us something about lateral sharing.

7 GeV Trigger: energy in each of 7 adjacent CEM towers



No CES iso- mean: 64 MeV

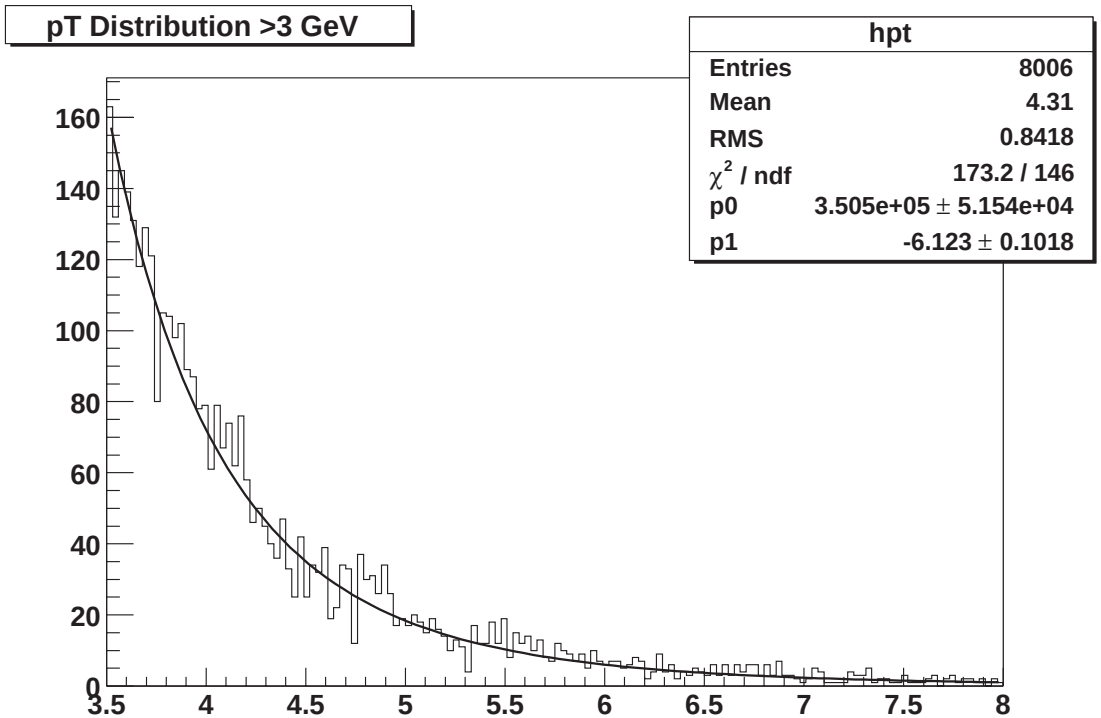
rms: 265 MeV



CES iso- mean: 33 MeV

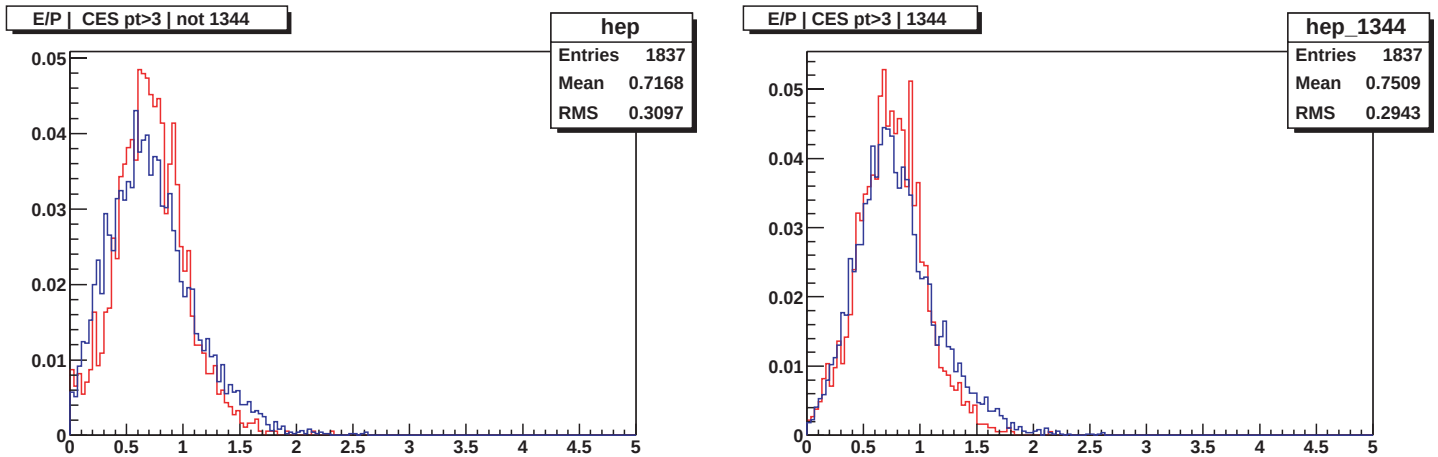
rms: 131 MeV

For simulation input, fit data P_T spectra to a power law.

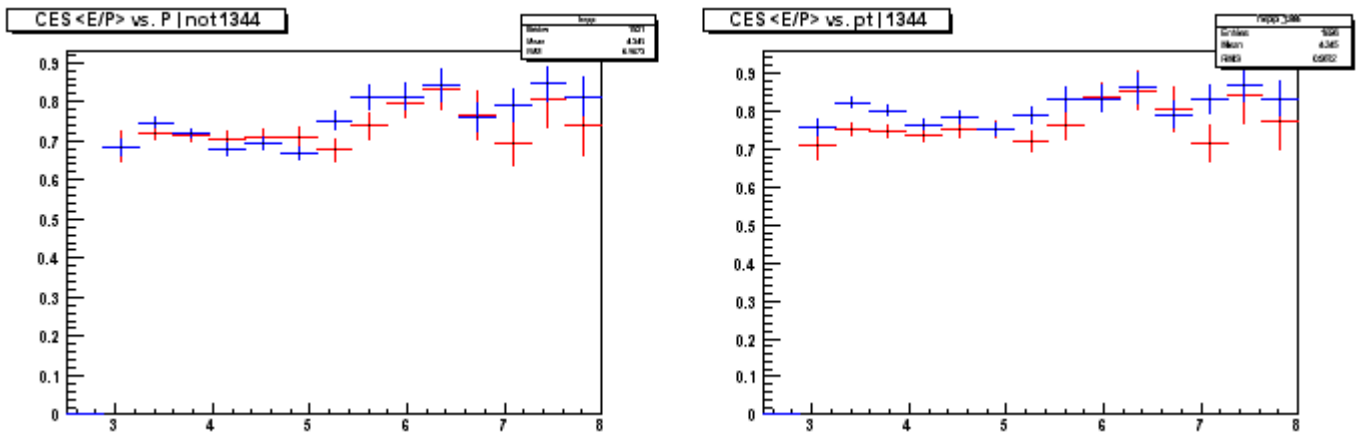


Data – Simulation Comparison

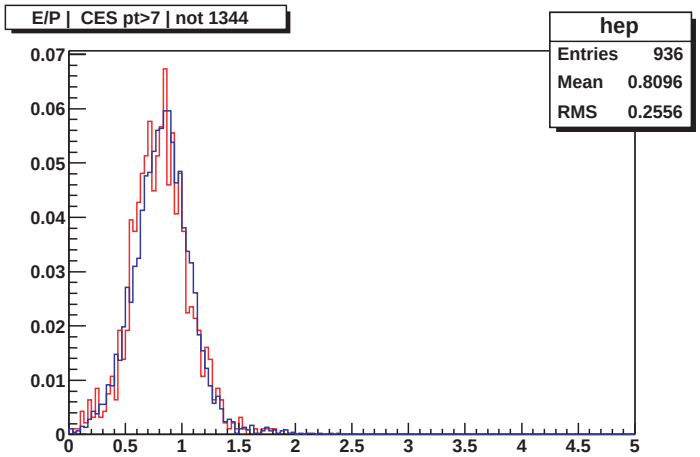
P_T>3, not 1344 **E/P** PT>3, 1344



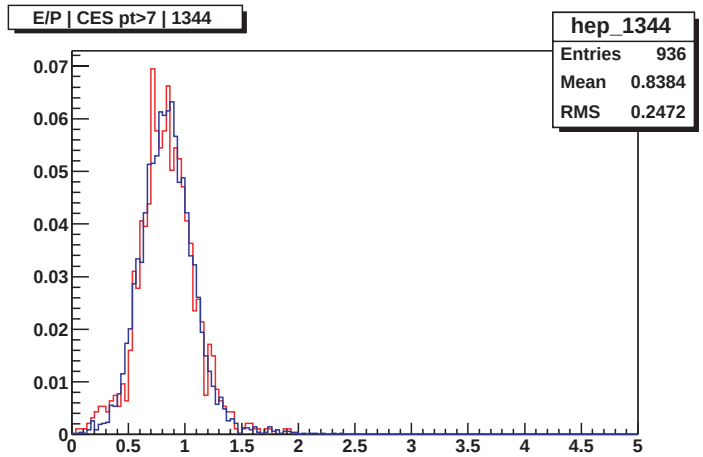
broader in central tower; high-side tail overall; look at <E/P> vs P

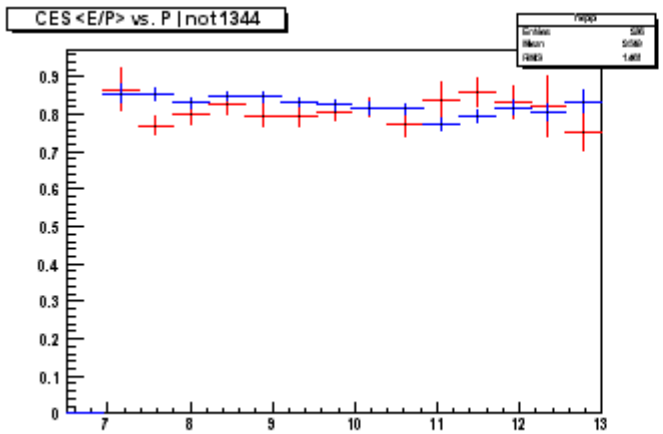


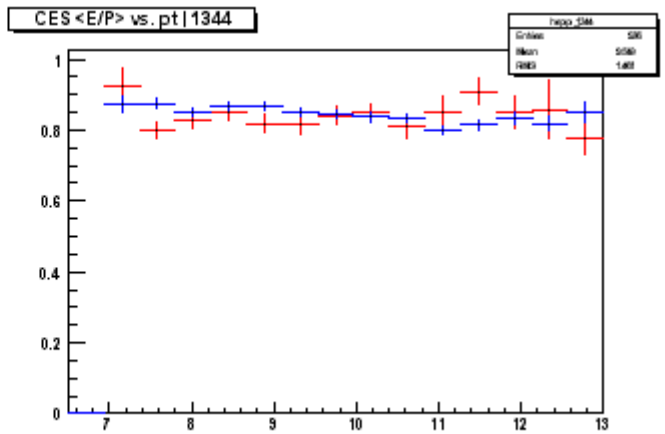
PT>7, not 1344



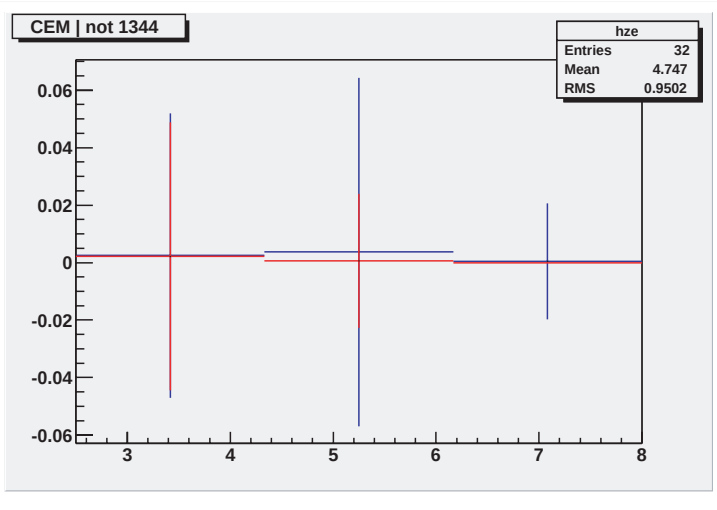
PT>7, 1344

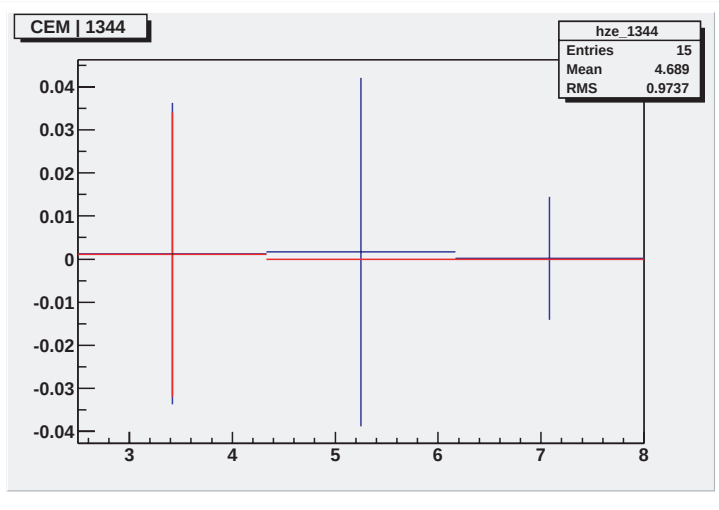


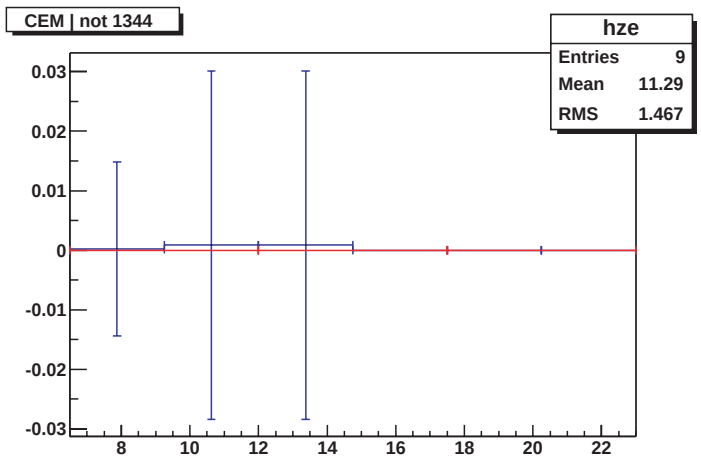


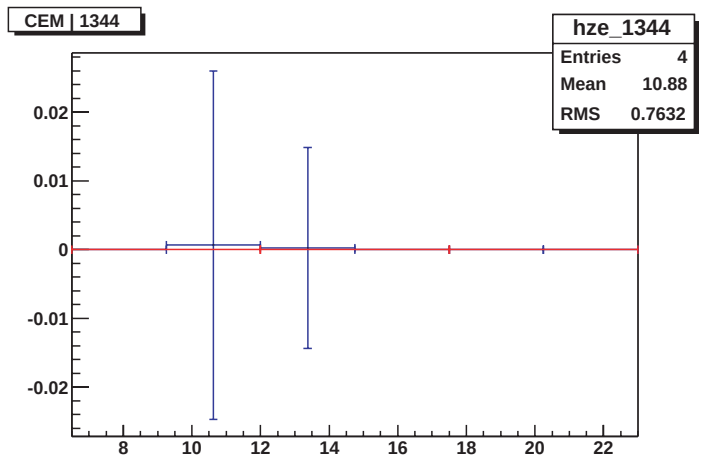


Fraction of CEM Zeros is small (as expected) and in good agreement



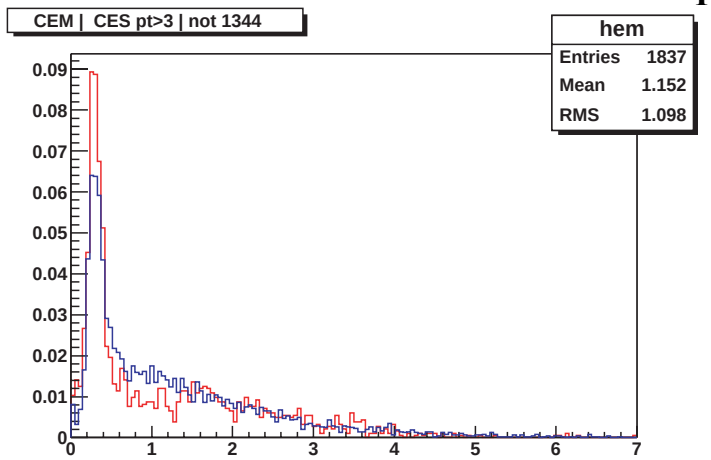


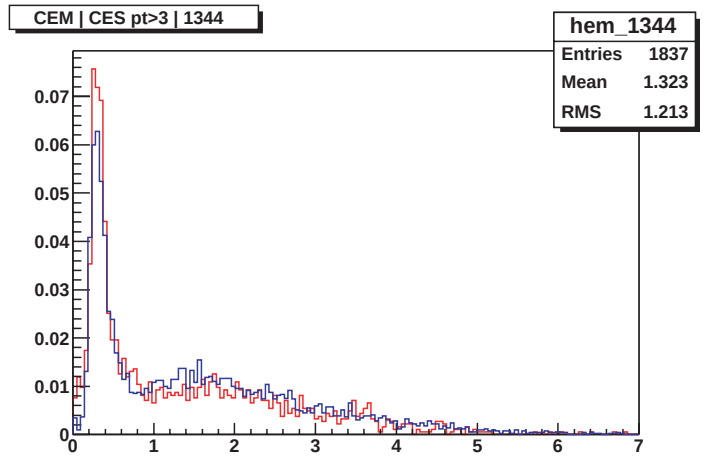




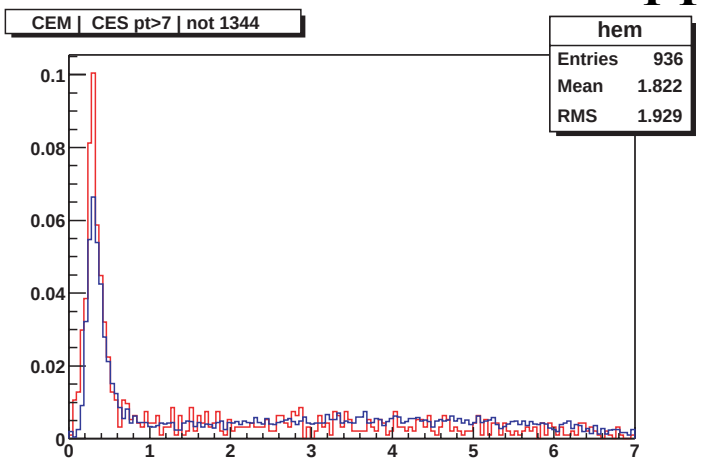
CEM Energy: 4-tower sum OK; lateral size may be larger in data

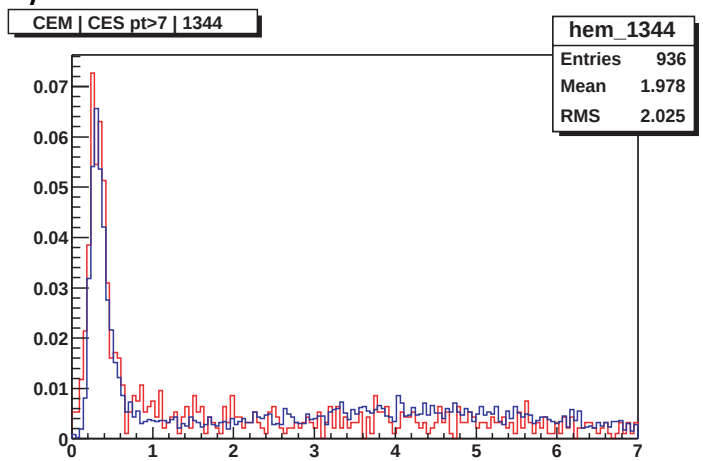
$P_T > 3$





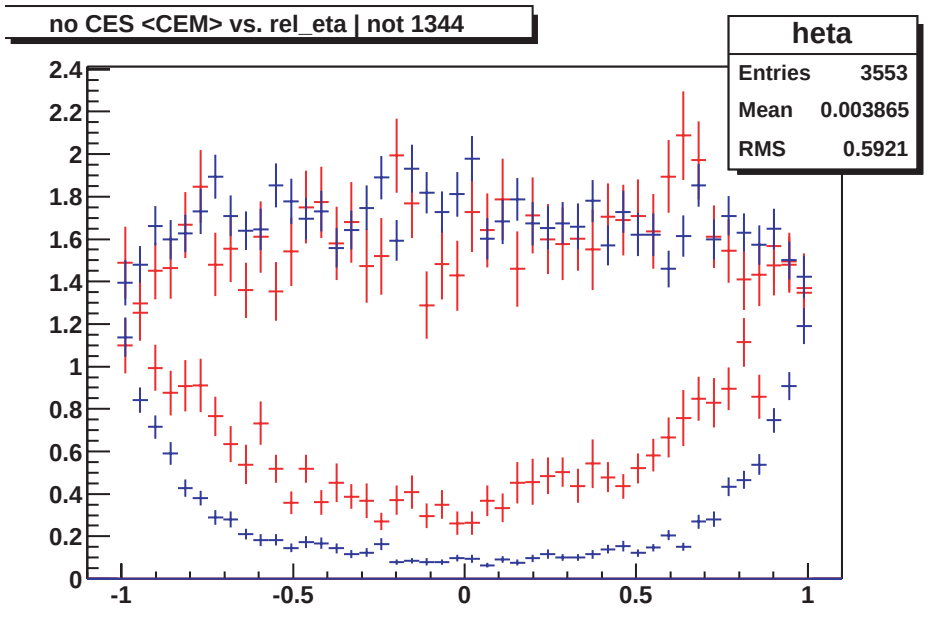
PT > 7



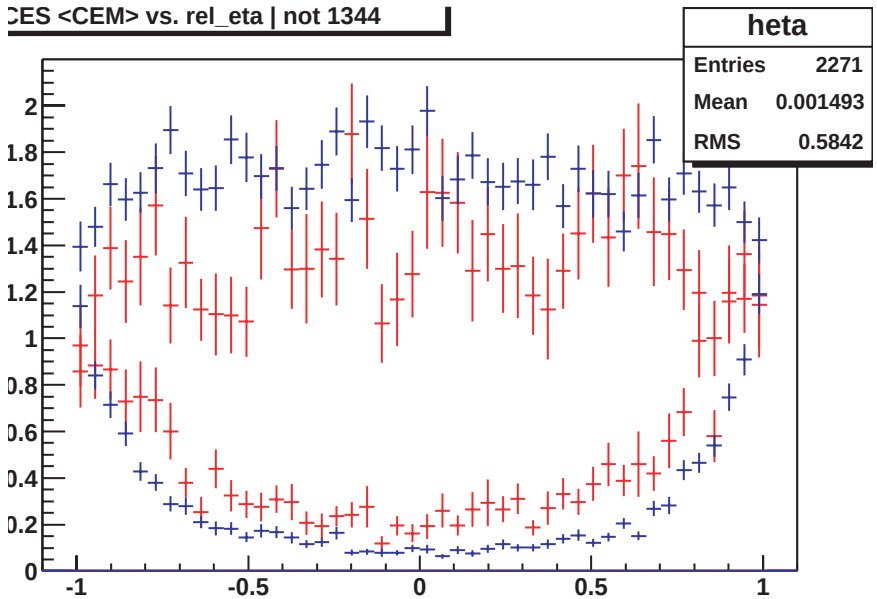


Effect of CES isolation clearly seen in P_T>7 CEM distributions

no CES isolation



CES isolation

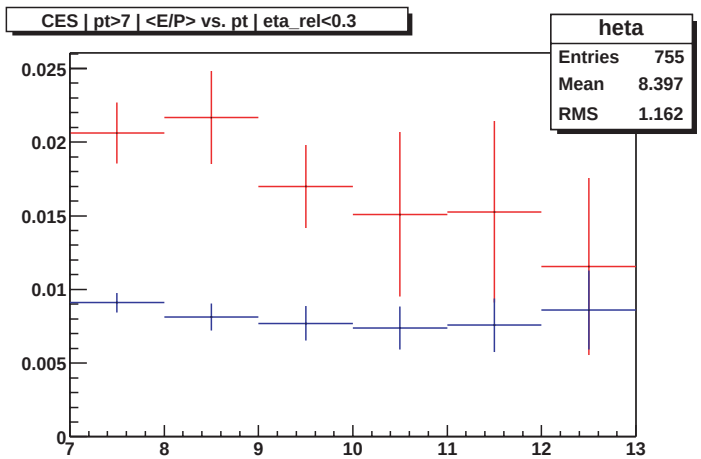


If the lateral leakage were larger in data, expect to scale with P_T.

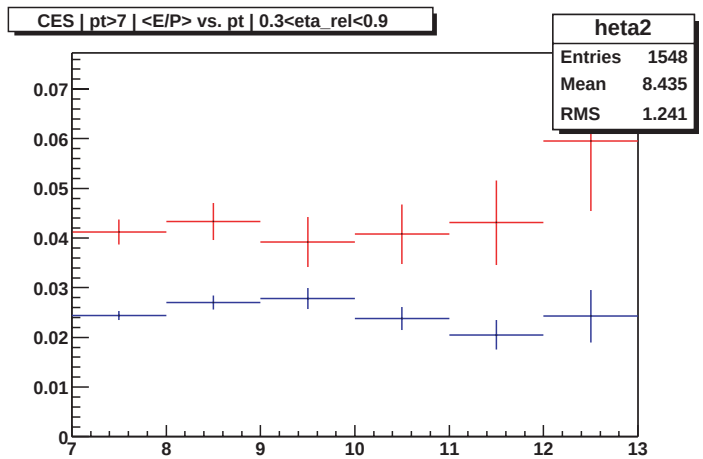
(But maybe also if it is correlated background!)

Plot CEM/P for the nearest eta tower as a function of P.

Track in center of tower

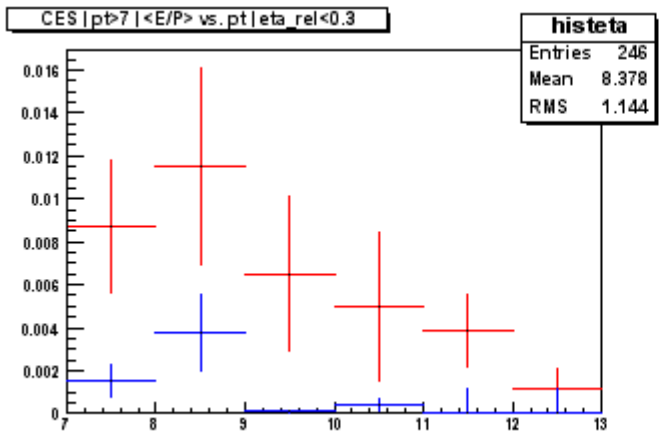


Track closer to tower edge

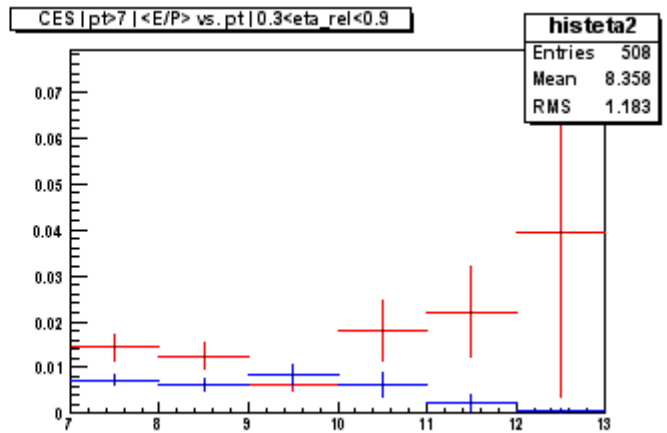


To check that this is due to leakage rather than correlated background, look at those tracks that are minimum ionizing in the CEM (< 600 MeV).

Track in center of tower



Track closer to tower edge



The fraction of energy in the adjacent EM tower is down by a factor of 4 compared to the previous plot.

Summary (so far)

- **CES isolation helps to reduce the background level at high P_T.**
- **Overall agreement between data and simulation is good.**
- **Simulation E/P is a bit broader than the data at intermediate P_T.**
- **The lateral spreading in the data is larger than in the simulation.**