Update on single hardon E/p performance using minimum bias events: in the lead up to my spanish holiday on the beach

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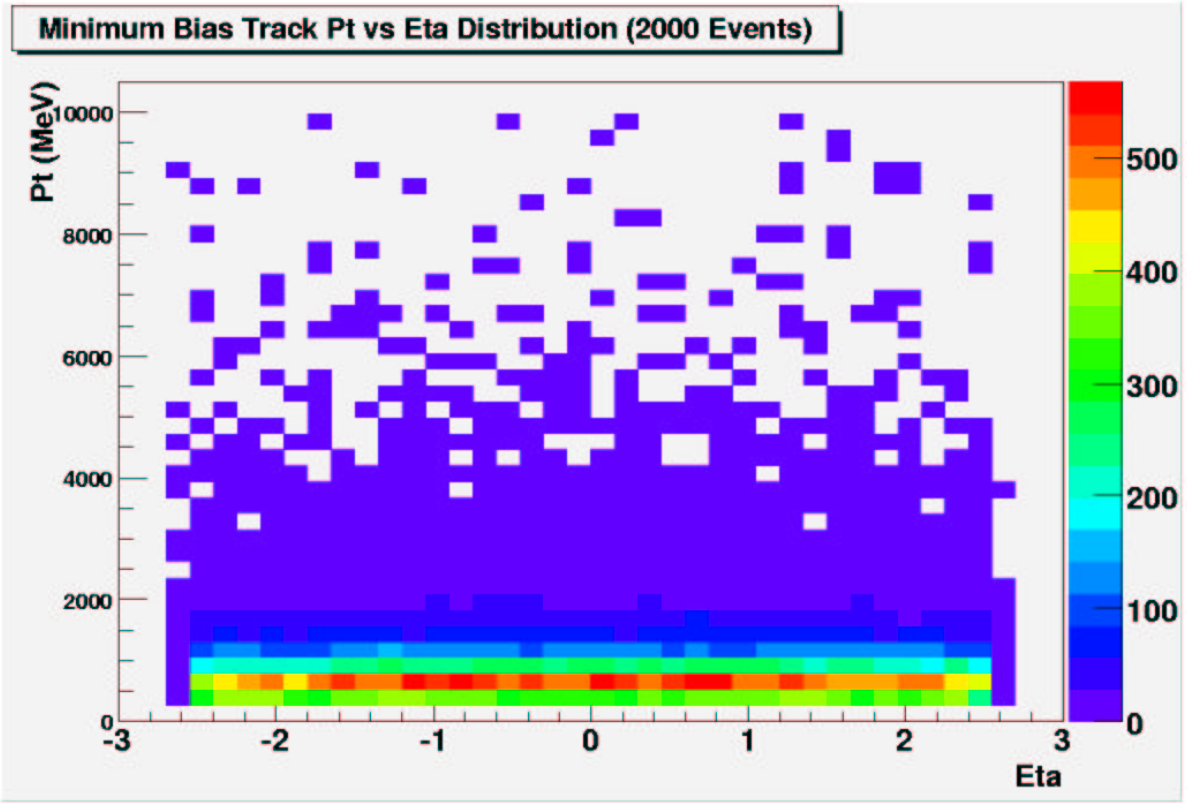
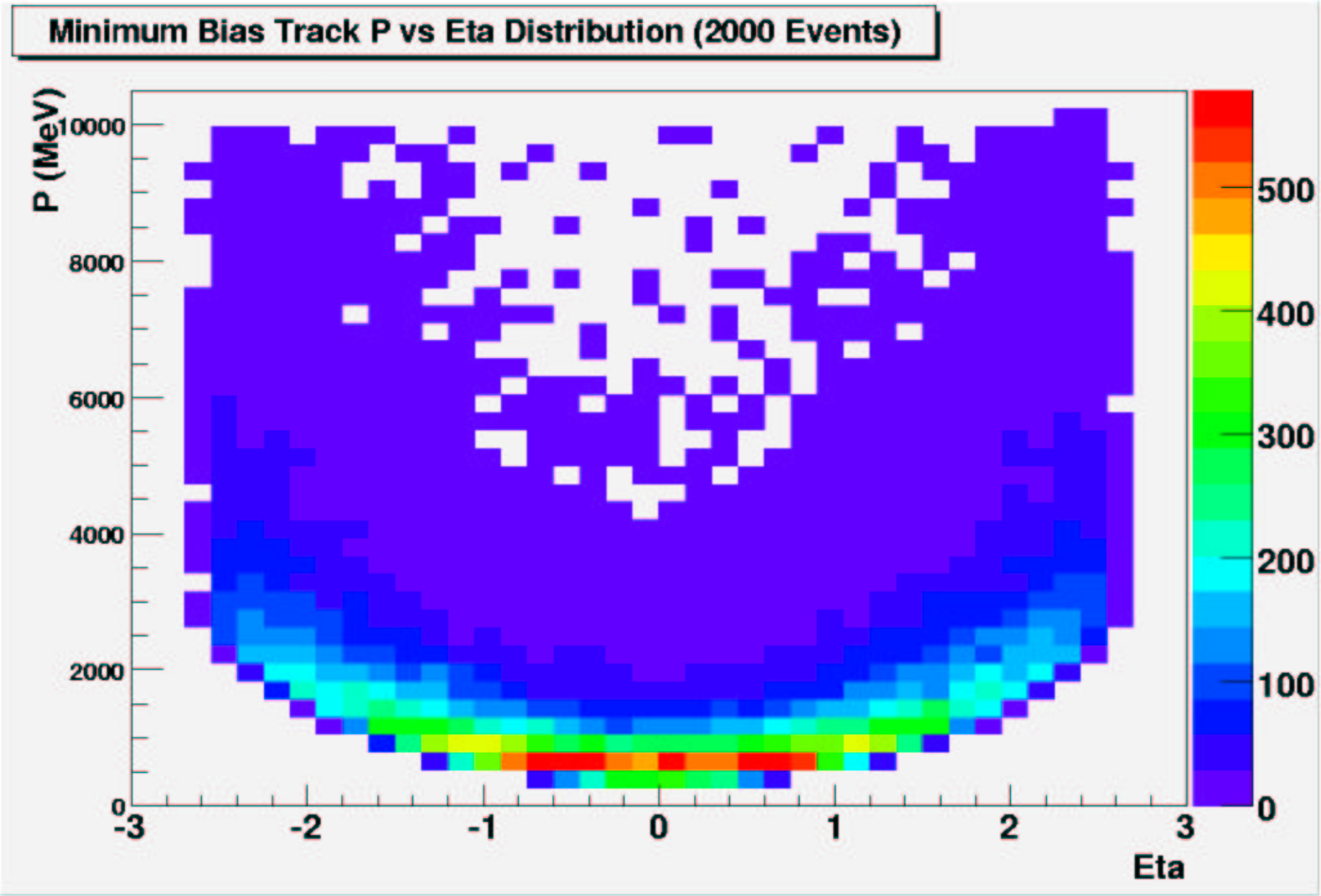
From last time: (but new plots)

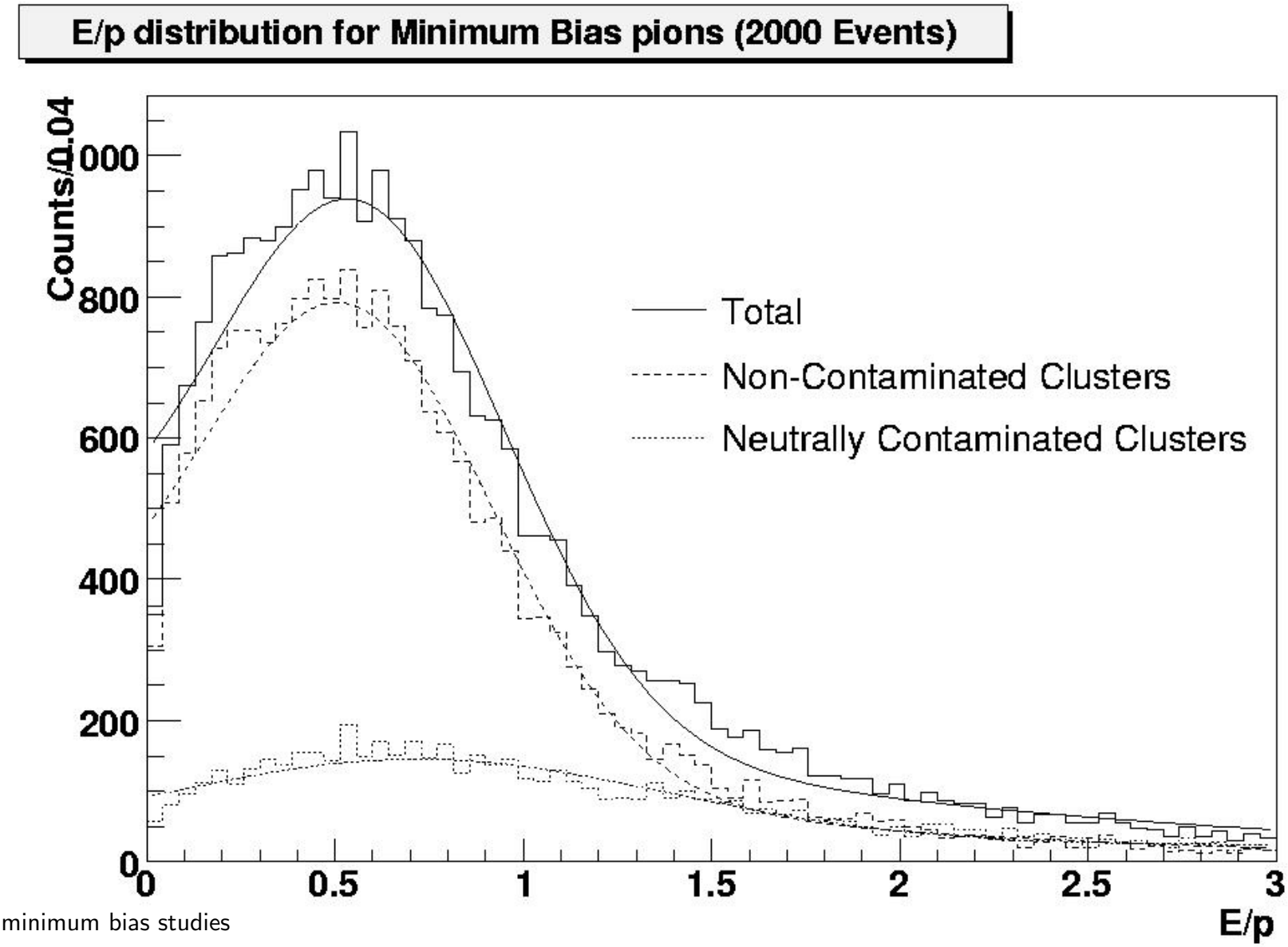
- Pt distribution uniform across η.




Minimum Bias Track P vs Eta Distribution (2000 Events)
P (MeV)
10000
8000
6000
4000
2000
0
-3
-2
-1
0
1
2
3
Eta
500
400
300
200
100
0

Something new: Track To CaloTopoCluster Matching

- I now get a resonable match between tracks and the calorimeter clusters.
- Using $\Delta R = \sqrt{\Delta\eta^2 + \Delta\phi^2}$. Where the seed position is that of the track when extrapolated to 2nd Layer of EM Calo.
- I took the calorimeter energy as the sum of CaloTopClusters within:
  - $\Delta R < 0.2$
  - $\Delta R < 0.05$
- Truth data taken using cones seeded with track coordinates also.
- If a cone contains a neutral particle I've label it as neutrally contaminated. Such particle include γ, π^0, K^0, n.
- For cone of $\Delta R < 0.2$ a comparison of contaminated and non-contaminated clusters was done by fitting E/p to a gaussian + decaying exp.
- Just Pions for the moment.



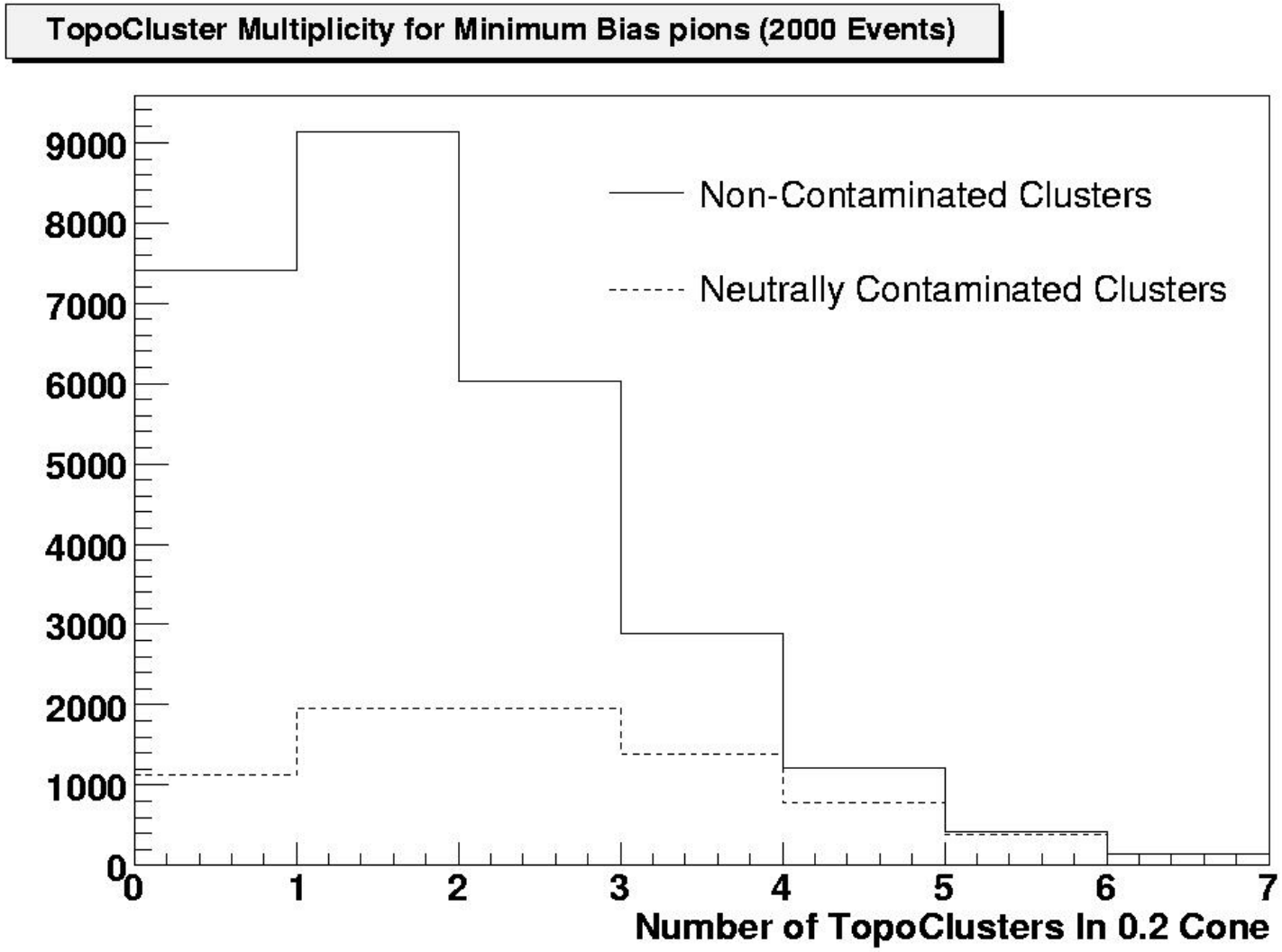
Comparison of E/p for clusters with and without neutral particle contamination

Tail on the right possibly due to over counting clusters. Implies cone too large?

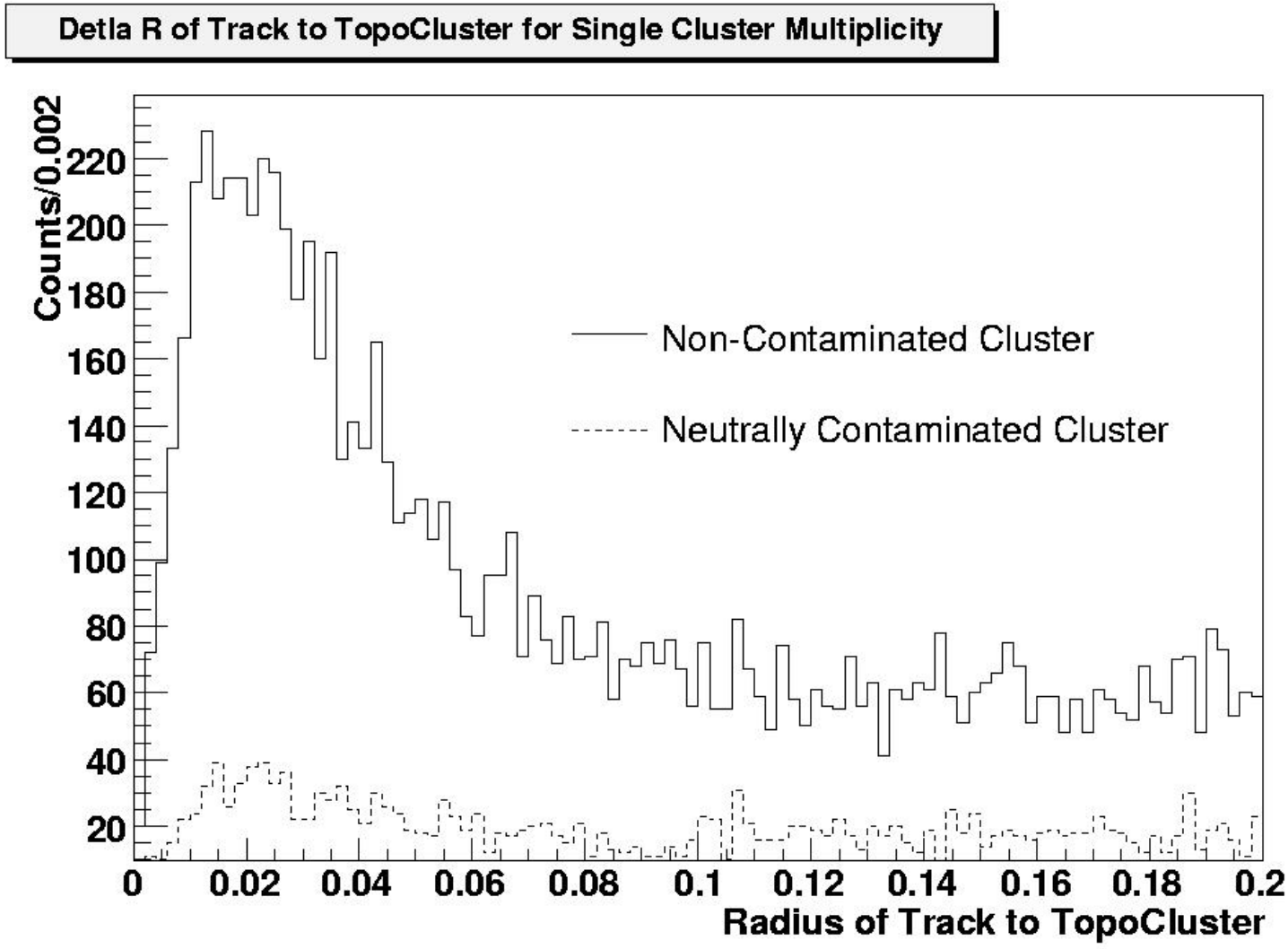
Results from the gaussian component of the fits:

- Total -
  - mean: 0.568 ± 0.008
  - σ: 0.389 ± 0.074
- Non-contaminated -
  - mean: 0.532 ± 0.008
  - σ: 0.389 ± 0.009
- Contaminated -
  - mean: 0.721 ± 0.024
  - σ: 0.666 ± 0.036

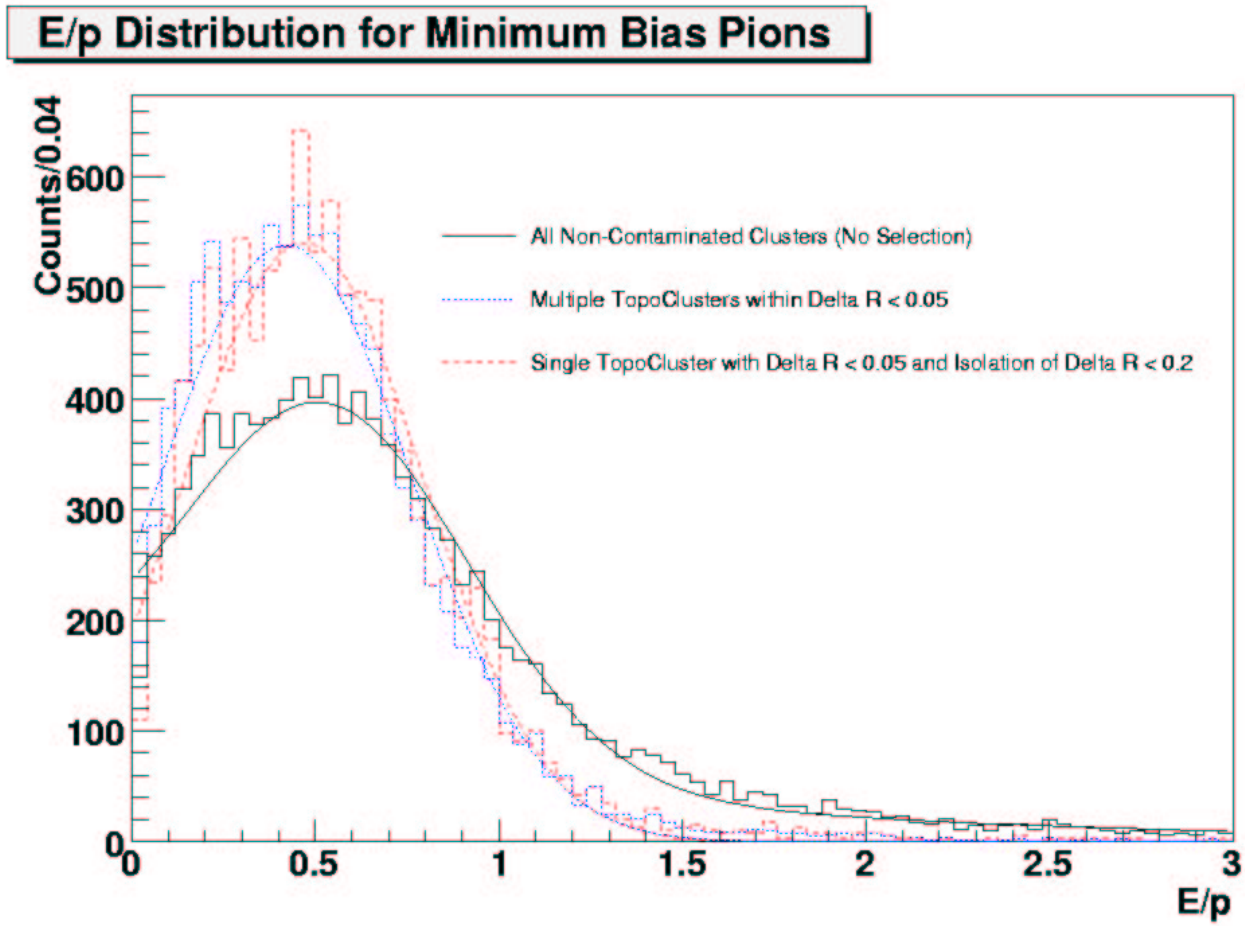
- So for neutral particles we see a slight change in the expected mean (and therefore energy scale meaurement) as well as the resolution.
- For cone size of 0.05 there were too few truth particles in the cone to notice a shift in mean. So could be a viable method to measure the energy scale?
- Could also use cone of 0.2 and select based on multiplicity of TopoClusters and ΔR between track and closest cluster:



Multiplicity of CaloTopoClusters in cone of 0.2 around pion track seed



ΔR between pion track and closest CaloTopoCluster



E/p distribution for various CaloTopoCluster selection schemes. Normalised to the same height.

Plotting E/p for these CaloTopoClusters selection schemes shows a decrease in mean and resolution from the plain 0.2 cone.

Fitting to only a gaussian this time gives:

- Cone 0.2 with selection -
  - mean: 0.469 ± 0.007
  - σ: 0.325 ± 0.006
- Cone 0.05 -
  - mean: 0.420 ± 0.005
  - σ: 0.345 ± 0.005

Note: This plot is just for uncontaminated clusters. I tried to examine the bias due to contamination, but it was negligable when compared with:

- statistical uncertainty (I may try with more data)
- sensitivity of calorimeter energy to reconstruction scheme.

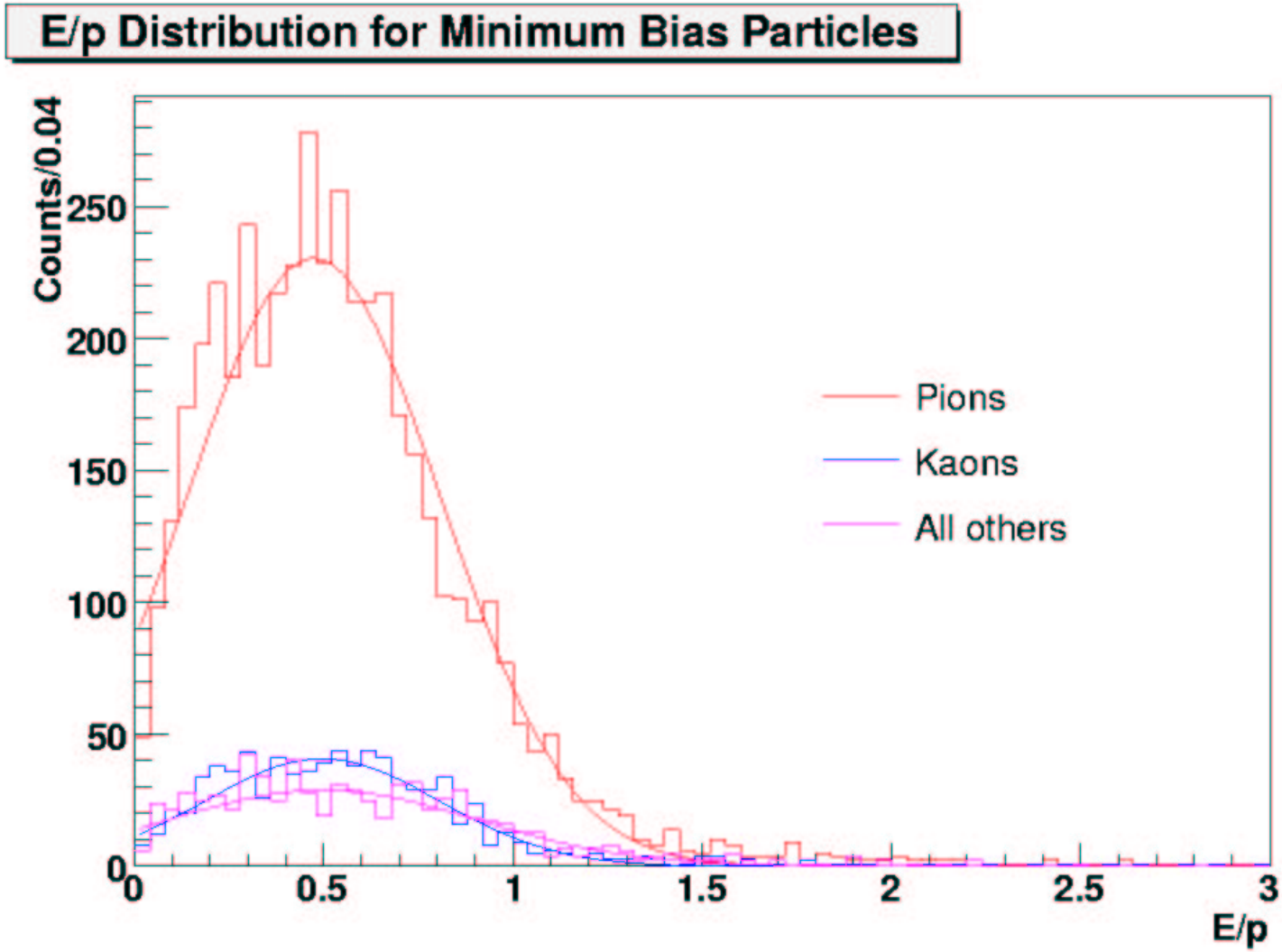
However I should still examine shower shape variables for further seperation of neutrals.

E/p for different type of particles

So far just looked at pions. However min. bais contains other types of charged hadrons (from last time):

- $\approx 2.5\%$ - leptons
- $\approx 75\%$ - $\pi^{\pm}$
- $\approx 14\%$ - $K^{\pm}$
- remaining - heavy hadrons (> 1 GeV)

Plotting E/P for these doesn't reveal anything special. Heavier hadrons appear to be consistent with Pions from gaussian fits, but the statistic are limited.



E/p after selection for all charged particles in minimum bias sample (2000 Events)

Conclusions so far and what next

Conclusions:

- There is a very large number of single charged hadrons in the minimum bias sample (csc11) I looked.Good.
- effect from neutral contamination small.Good.
- I'm still a bit confused about how we can use this to determine the absolute energy scale when I'm not sure about how such particles are reconstructed within a Jet. Bad.

Next:

- Need to compare to energy from calibrated CaloTopoClusters.
- Repeat what I've done so far using jet reconstruction energies from the calorimeter. Probably for the 0.4.Cone Algorithm.
- Look at non-linearity effect. How does E/p compare for different particle energies up to 15 GeV?
- Then do all the stuff I listed in my last talk: pile-up, MC generator comparison, 900GeV study.