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# *Update on E/p from Minimum Bias*

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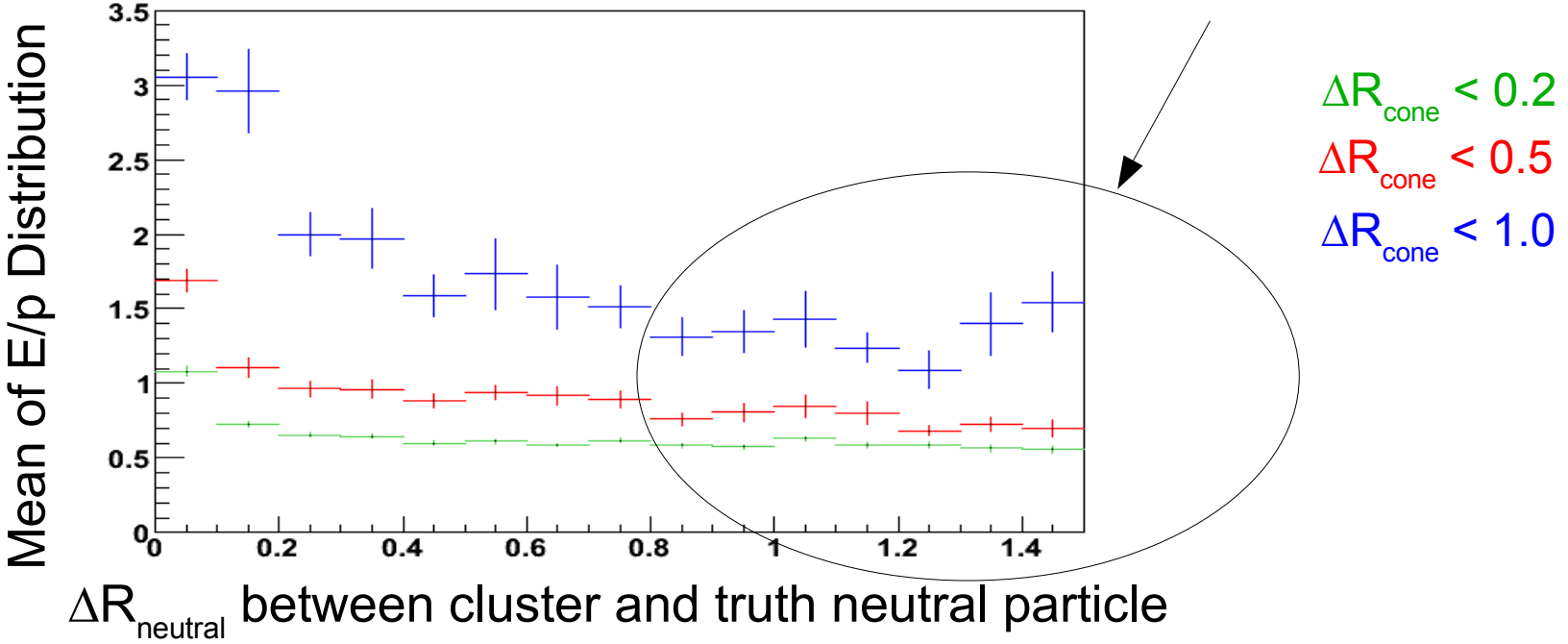
# *Recall from last time...*

- The basic idea of the calibration
  - Motivation behind work is to check the hadronic energy scale in situ by looking at the ration of momentum from the inner detector (should be close to actual) to the calorimeter energy.
  - Current work on single pions from taus does not cover the low E range (below 20GeV). We need to see if minimum bias events can do this.
- Current work
  - E taken as the sum of CaloTopoCluster energies in some $\Delta$R cone.
  - Uncalibrated clusters still being used.
  - Comparing E/p for 3GeV single pion sample of 41k events (csc11.007401.singlepart_singlepi2.recon.AOD.v11004103) with 3GeV charged hadrons in minimum bias sample of 41k events (csc11.005001.pythia_minbias.recotrig.AOD.v11000505).
  - 3GeV used because this is the lowest momentum single pions CSC AOD data currently avaliable and also because cluster reconstruction is more difficult for lower energy. Plan to study down to 1GeV soon!

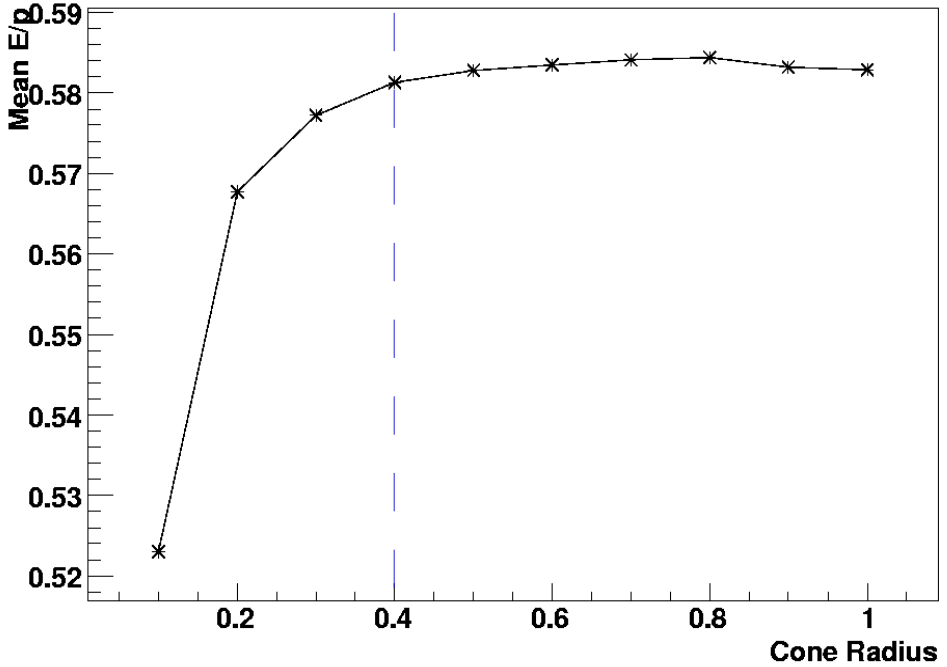
# Recall from last time...

- Basic requirements of track selection:
  - Track with one CaloTopoCluster within $\Delta R_{match} < 0.05$.
  - 2.5GeV < Track P < 3.5 GeV. (For comparison with 3GeV sample)
  - Isolation between tracks $\Delta R_{track\ isolation} > 0.8$.
- For large cone sizes E/p is still large after accounting for neutral contaminants! Due to extra charged particles not leaving tracks in ID?



# Selecting single hadrons

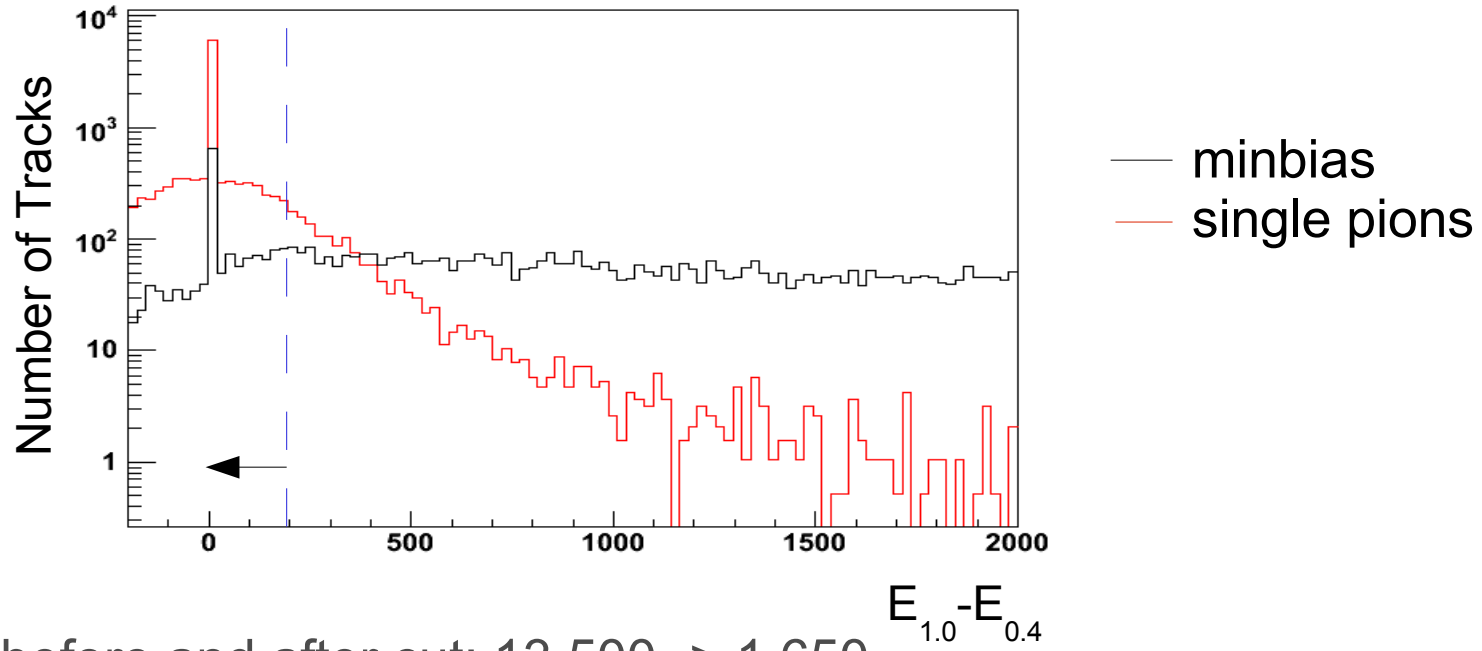
- So problem is complicated because clusters may be contamined by the same type of particle (predominantly charged pions).
- Also can not be limited with smaller cone size as this biases the E/p low.
- $\Delta R_{cone}$ = 0.4 was chosen to study as it should contain over 99% of the pion energy on average.




E/p vs. $\Delta R_{cone}$ for 3GeV Single Pion sample

# Selecting single hadron

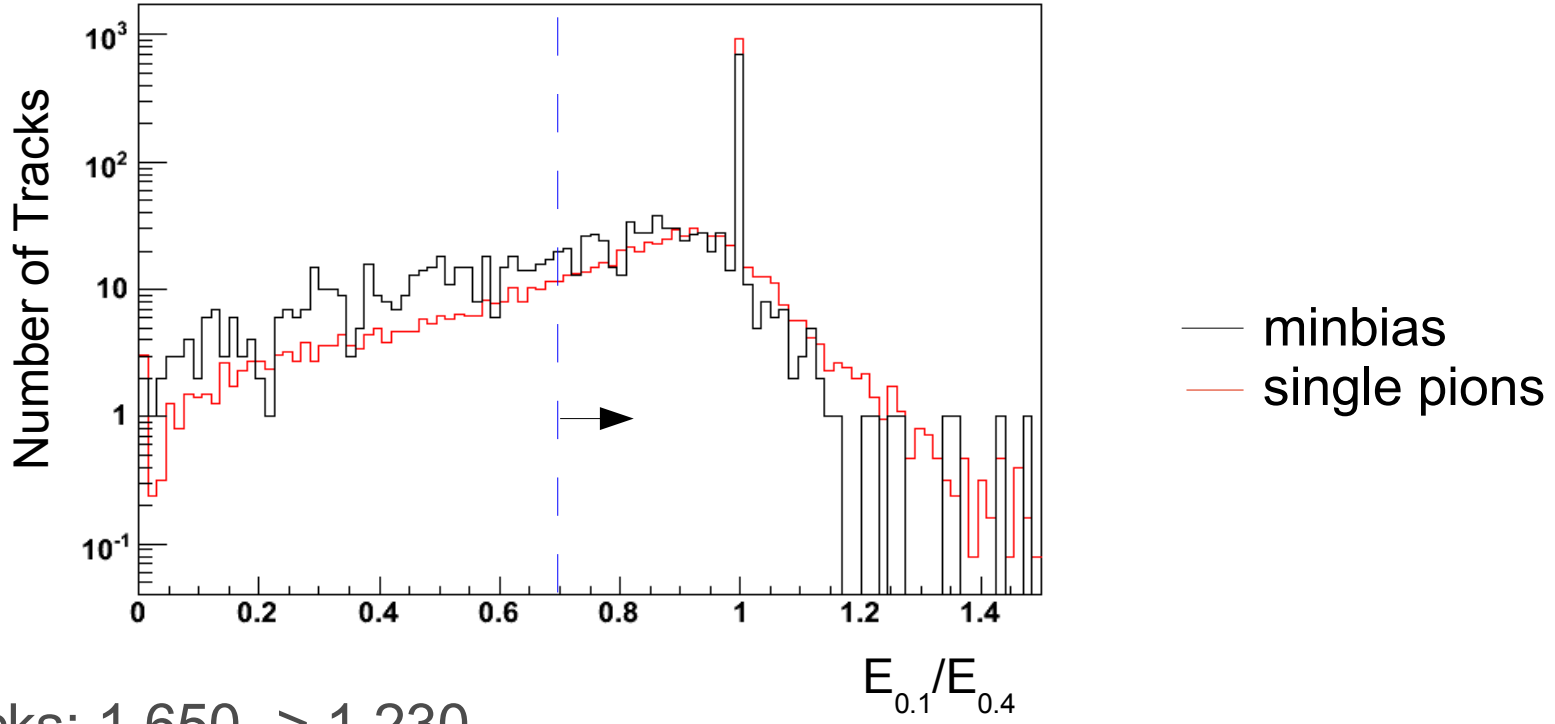
- Some basic selection cuts help to remove contaminants from both charged and neutral sources:
- Isolation of clusters:
  - Energy in $\Delta R_{cone} = 1.0$ – Energy in $\Delta R_{cone} = 0.4$ < 200 MeV.




- Tracks before and after cut: 13,500 -> 1,650
- E/p mean: 0.869 -> 0.688 ◄—— For 41k events
- E/p RMS: 0.546 -> 0.384

# Selection of single hadrons

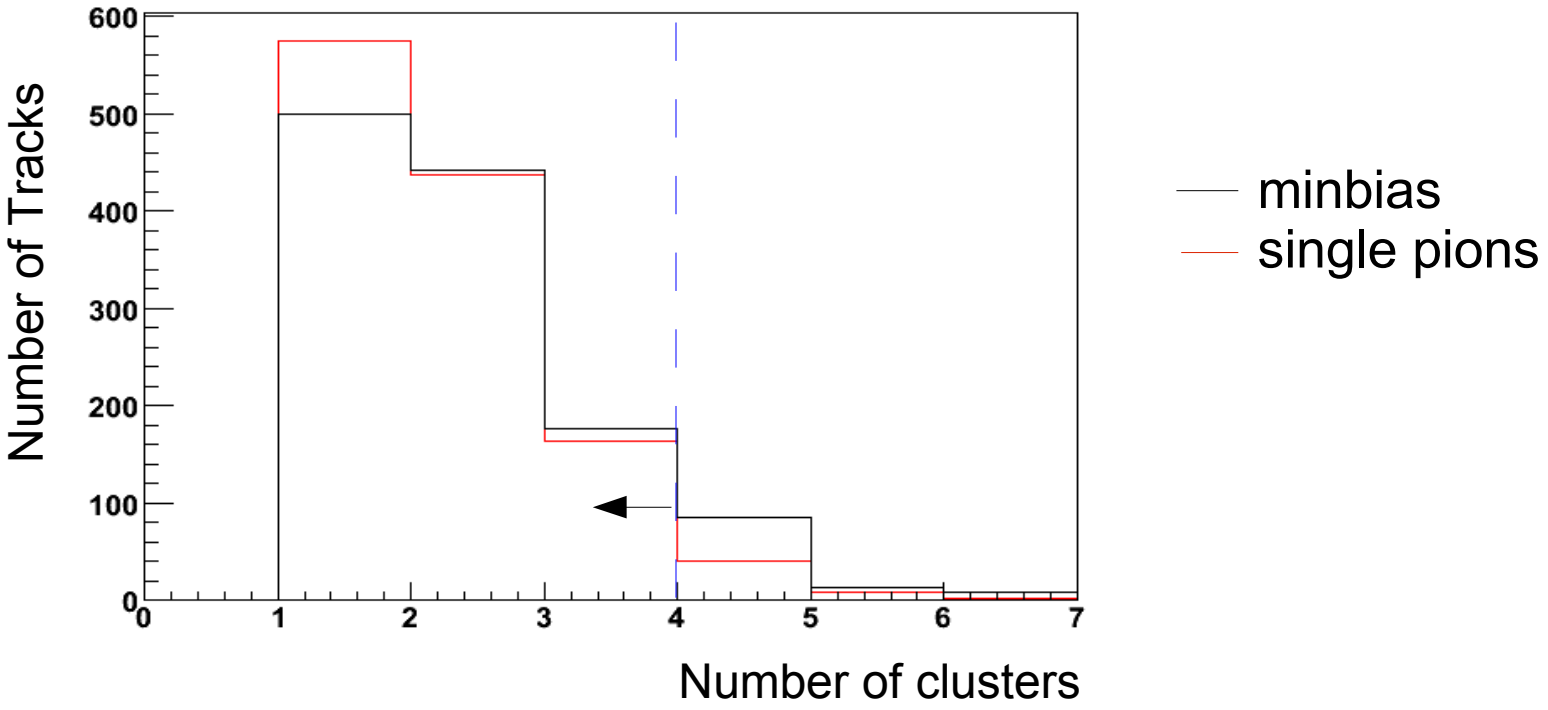
- Core Fraction:
  - Energy in $\Delta R_{cone}=0.1$/Energy in $\Delta R_{cone}=0.4$ > 0.7




- Tracks: 1,650 -> 1,230
- E/p mean: 0.688 -> 0.624
- E/p RMS: 0.384 -> 0.305

# Selection of single hadrons

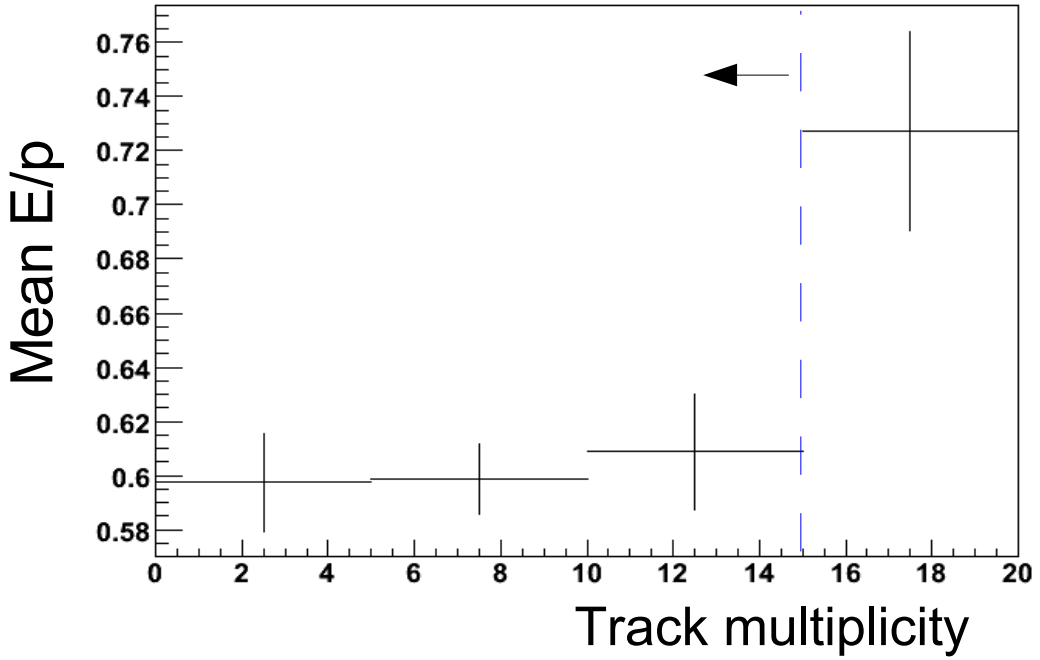
- Number of clusters in cone < 4




- Tracks: 1,230 -> 1,120
- E/p mean: 0.624 -> 0.612
- E/p RMS: 0.305 -> 0.300

# Selection of single hadrons

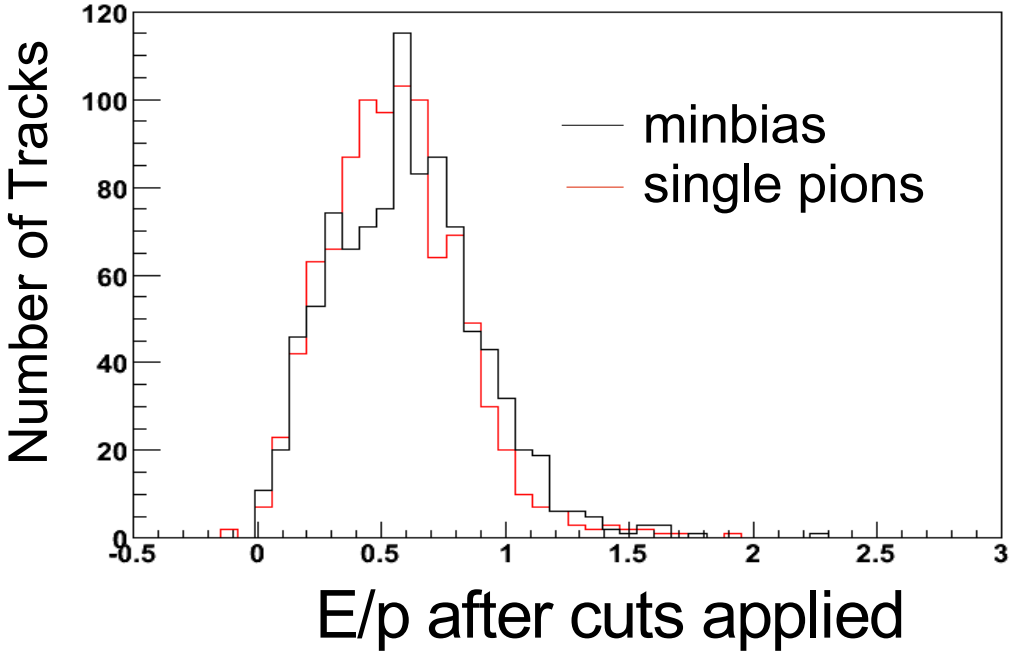
- Choose quiter event
  - Number of tracks in event < 15




- Tracks: 1,120 -> 963
- E/p mean: 0.612 -> 0.600
- E/p RMS: 0.300 -> 0.296

# Results so far

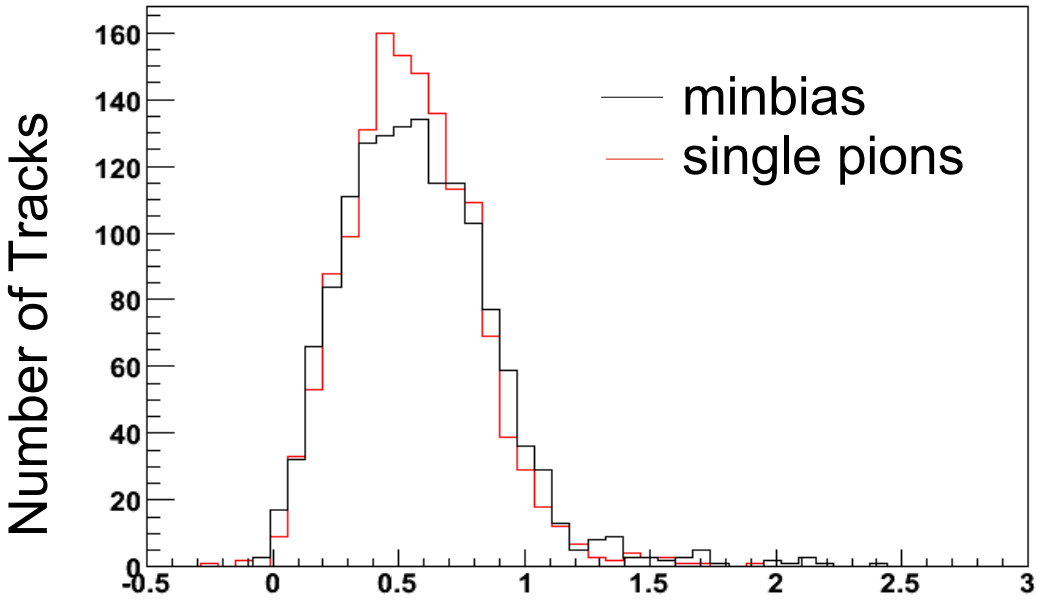
- E/p for minimum bias vs. single pions after cuts. E/p differs by 0.05 (or 8%).
- Due to low statistics it was not possible to compared for eta ranges, so instead the single pion sample was weighted to have the same eta distribution as the minimum bias sample after cuts.




| Sample | E/p mean | E/p RMS |
|---|---|---|
| - minbias (14TeV) | 0.600 | 0.296 |
| - single pion (cuts) | 0.559 | 0.259 |
| - single pion (before cuts) | 0.551 | 0.274 |
| Error: | ±0.010 | |

# First look at 900GeV

- Results better as events less busy. 0.025 (or 4%) different.
- 1.5 times more tracks remain after selection than for the 14TeV case.




| Sample | E/p mean | E/p RMS |
|---|---|---|
| - minbias (900GeV) | 0.586 | 0.311 |
| - single pion (cuts) | 0.561 | 0.262 |
| - single pion (before cuts) | 0.563 | 0.283 |
| Error: | ±0.008 | |

# *Work continuing...*

- More cuts are required. eg. plan to look at strips. Or more vicious cuts, but it is difficult to determine the effect with such low statistics. Also need to remove effects of non-pion hadrons which bias the E/p higher by approx. 0.01.
- Pile-up studies needs. Problem may be easy to remove as contamination from this source is uncorreleted with the track direction and should therefore be subtractable with large statistics.
- Trigger effects. About to begin.
- Calibrated Clusters.
- Jet Energy. Could select tracks bases on topocluster properies but get the energy from the reconstructed jet object.
- High P tracks. Tail reachs to the O(10GeV) range so definitley worth studying the overlap region between single pions from minimum bias and taus