PFA update

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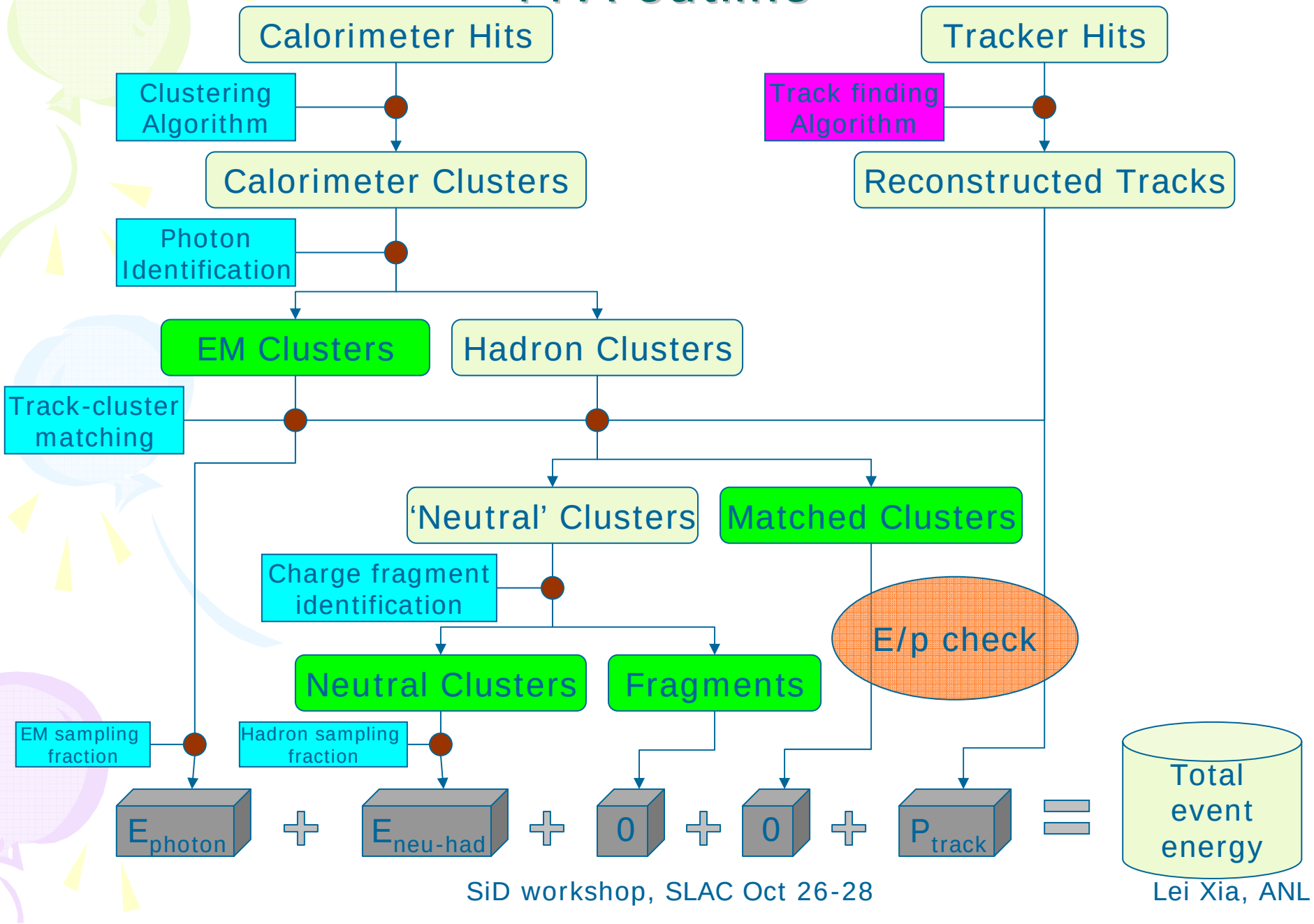
- RMS90 calculation
- PFA at Z-pole
- First look at 200 GeV (qqbar uds events)
- First look at 500 GeV (qqbar uds events)

SiD workshop, SLAC Oct 26-28

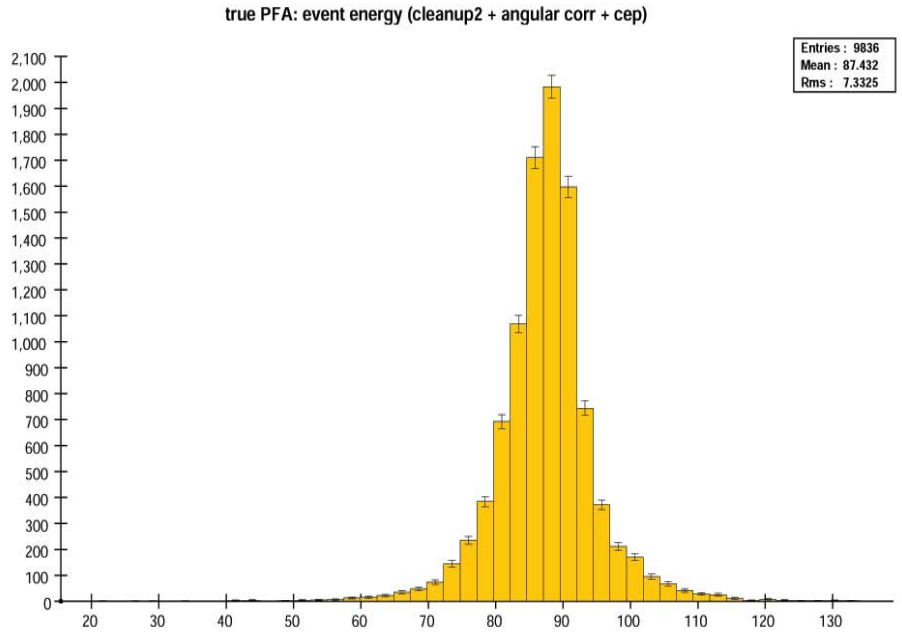
RMS90 calculation

- My calculation is available at the following locations:
  - CVS: org.lcsim/contrib/XiaLei/rms90_order.java
  - http://www.hep.anl.gov/lxia/rms90_order.java
- Everyone is welcome to use/test it – please let me know if you meet any problem
  - Just need to change one line in the program
    - `ICloud1D InputCloud = (ICloud1D) aidaMasterTree.find("/aida-tree/1dCloud");`
- RMS90 definition
  - Any 90% of the events that gives the smallest rms
  - Slightly different from Mark Thomson's (rms of the smallest region that contain 90% of all events)

PFA outline

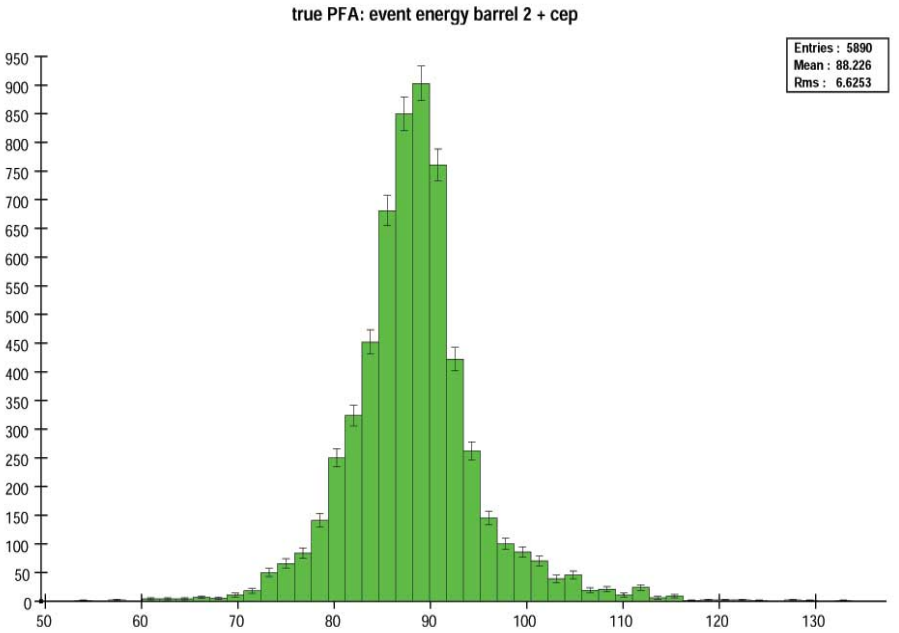

Calorimeter Hits
Tracker Hits
Clustering Algorithm
Track finding Algorithm
Calorimeter Clusters
Reconstructed Tracks
Photon Identification
EM Clusters
Hadron Clusters
Track-cluster matching
'Neutral' Clusters
Matched Clusters
Charge fragment identification
E/p check
Neutral Clusters
Fragments
EM sampling fraction
Hadron sampling fraction
E photon
E neu-had
0
0
P track
Total event energy

PFA at Z-pole: sidaug05_np



No cut

Mean 87.4 GeV
RMS 7.33 GeV
RMS90 4.56 GeV
[49%/sqrt(E)]

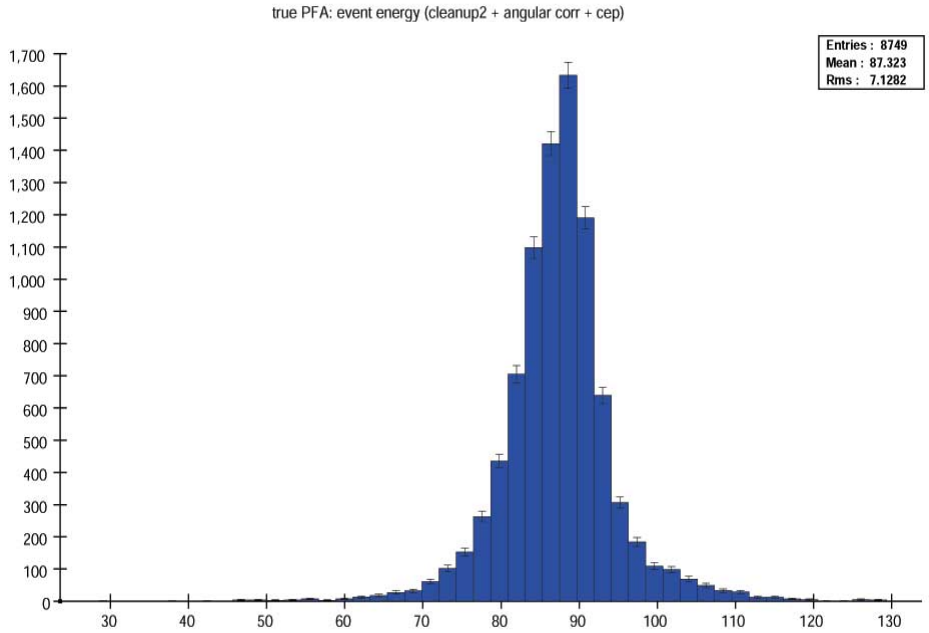


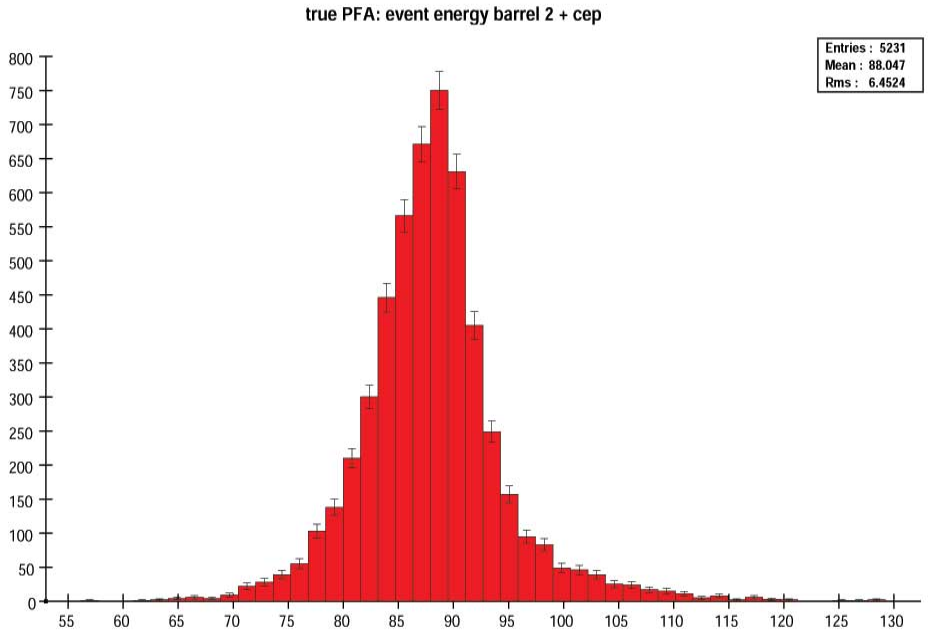
Barrel event (cos(theta[Q]) < sqrt(2)/2)

Mean 88.2 GeV
RMS 6.63 GeV
RMS90 4.28 GeV
[46%/sqrt(E)]

Detector model: SiDaug05_np (none projective cells)
PFA: no change from Vancouver, except adding E/P check
parameters for clustering, etc. are not tuned yet...

PFA at Z-pole: sidaug05





No cut

Mean 87.3 GeV
RMS 7.13 GeV
RMS90 4.44 GeV
[48%/sqrt(E)]

Barrel event (cos(theta[Q]) < sqrt(2)/2)

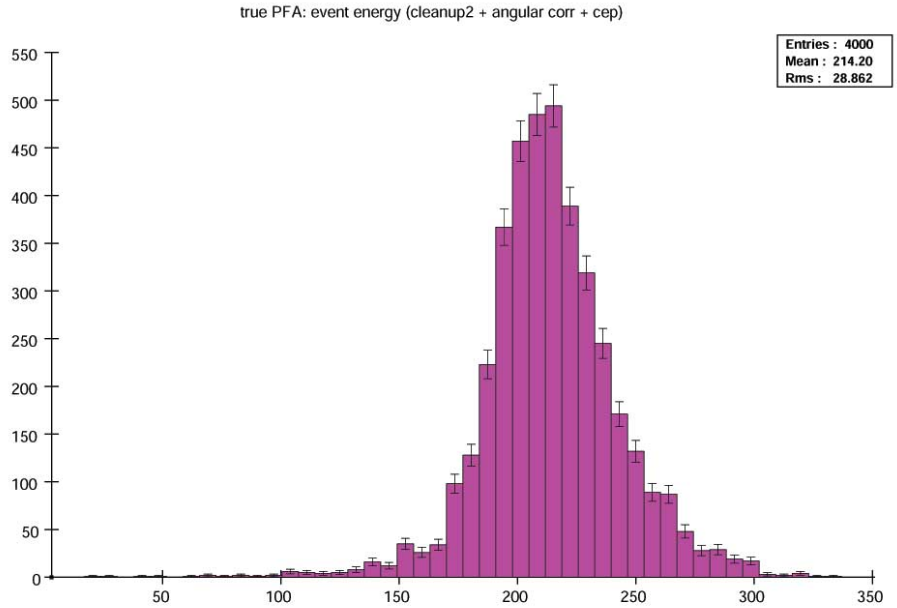
Mean 88.0 GeV
RMS 6.45 GeV
RMS90 4.18 GeV
[45%/sqrt(E)]

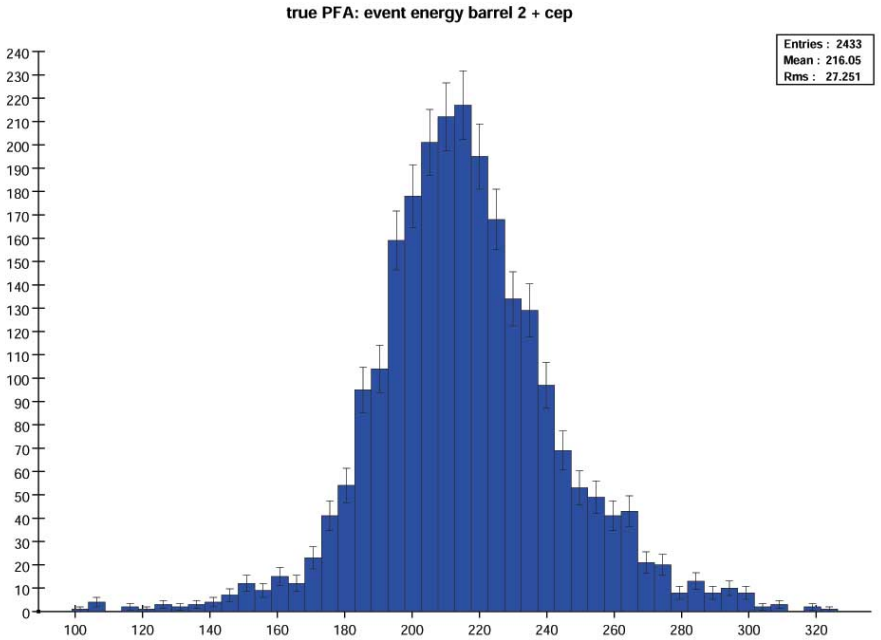
Detector model: SiDaug05 (projective cells)
This is just a sanity check, since higher energy samples are only available for projective detectors

PFA at higher CM energies

- Data sample: qqbar (uds events)
  - At 200, 500 GeV
  - With SiDaug05
- PFA: no change
- Some changes in the program, just to run new data file
  - Explicitly used beam energy at one place
  - Need to handle some new 'RuntimeException's, that didn't occur with Z-pole events
- Just a first look…
  - Was able to run only a small data sample (clustering takes very long time ~$(N[hits])^2$)
  - Results should not be treated as a measure of PFA or SiD performance (PFA not tuned, event at Z-pole)

First look at 200 GeV





No cut

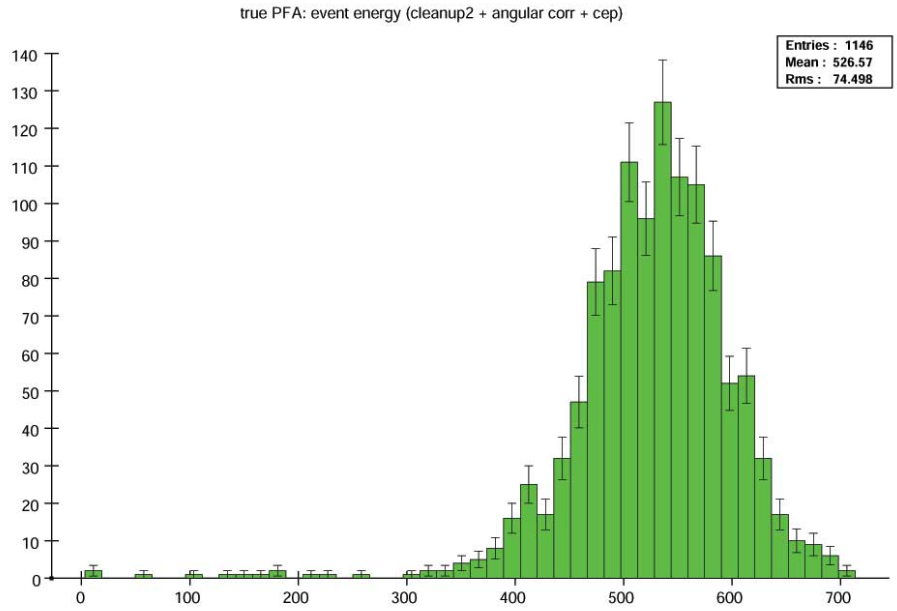
Mean 214.2 GeV
RMS 28.9 GeV
RMS90 19.6 GeV
[134%/sqrt(E)]

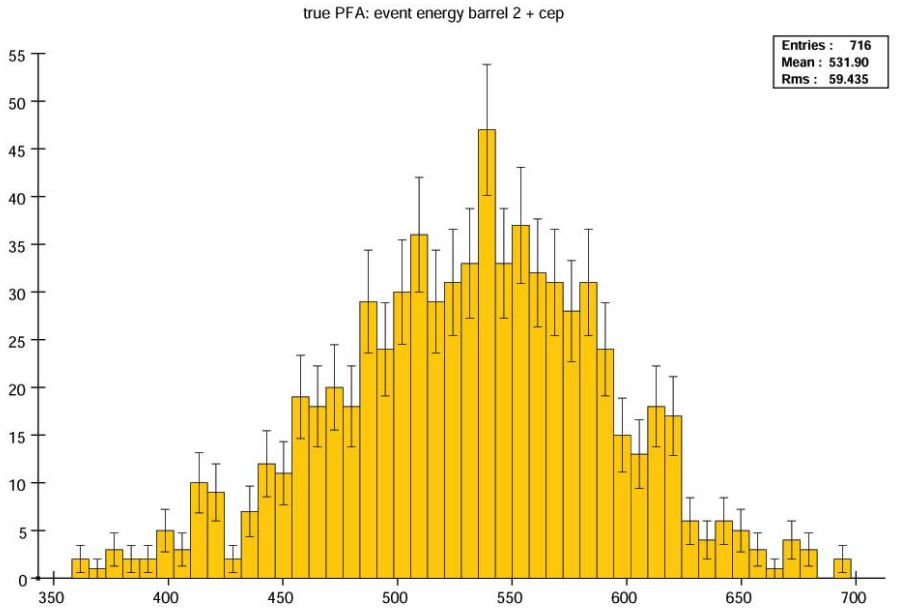
Barrel event (cos(theta[Q]) < sqrt(2)/2)

Mean 216.1 GeV
RMS 27.3 GeV
RMS90 19.4 GeV
[132%/sqrt(E)]

Something in my PFA stopped working at this energy!

First look at 500 GeV





No cut

Mean 526.6 GeV
RMS 74.5 GeV
RMS90 49.2 GeV
[214%/sqrt(E)]

Barrel event (cos(theta) < sqrt(2)/2)

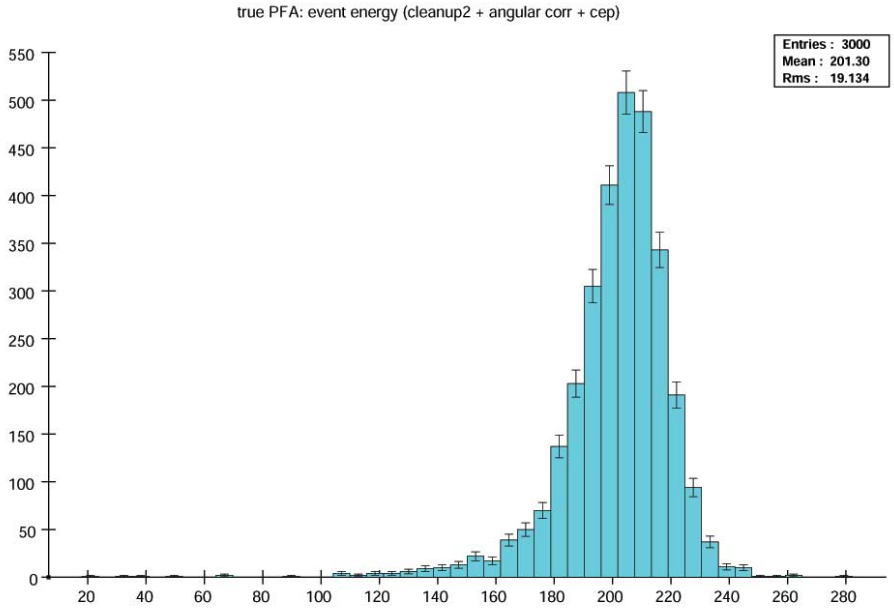
Mean 531.9 GeV
RMS 59.4 GeV
RMS90 46.4 GeV
[201%/sqrt(E)]

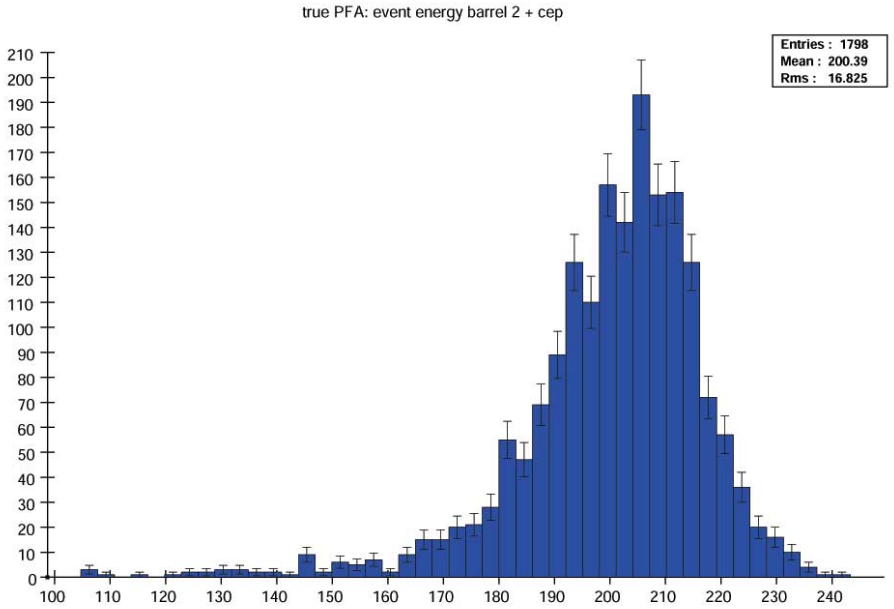
This is significantly worse than just summing up calorimeter energy

What's wrong?

- Noticed the track-cluster association was quite loose
  - OK for Z-pole events (clusters are relatively far apart)
  - Should use a tighter criteria for higher energies

200 GeV with tight track-cluster association





No cut

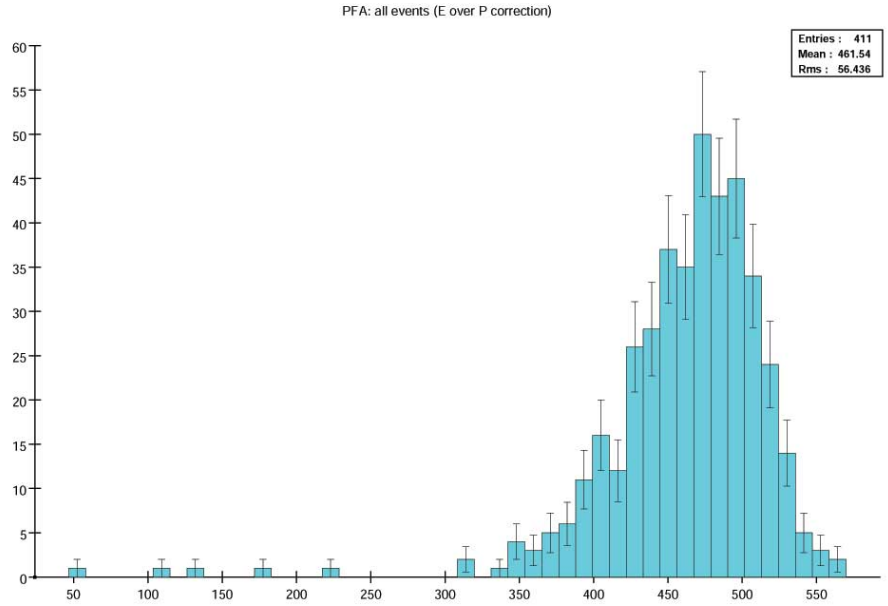
Mean 201.3 GeV
RMS 19.1 GeV
RMS90 11.6 GeV
[82%/sqrt(E)]

Barrel event (cos(theta[Q]) < sqrt(2)/2)

Mean 200.4 GeV
RMS 16.8 GeV
RMS90 10.9 GeV
[77%/sqrt(E)]

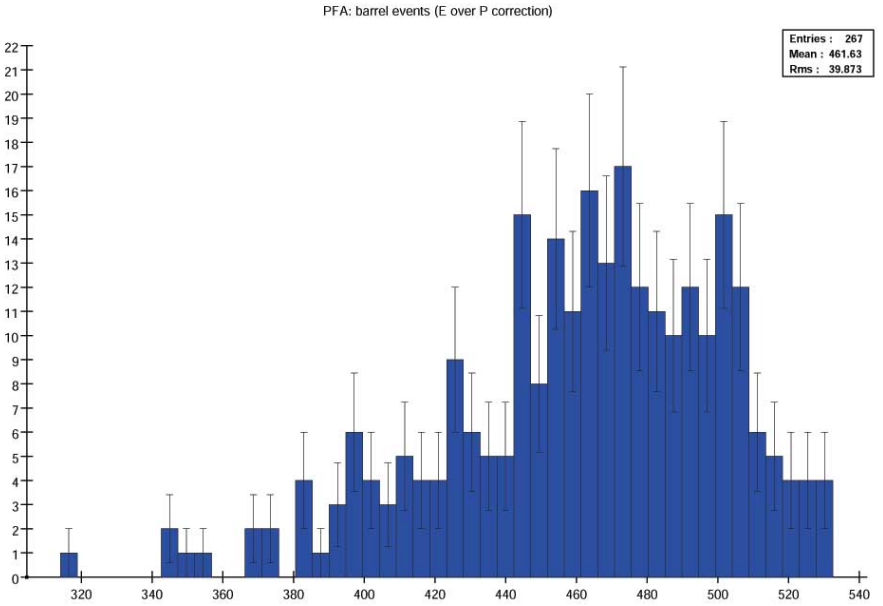
PFA need to be tuned/modified for higher energy
Much better performance should be possible

500 GeV with tight track-cluster association



No cut

Mean 461 GeV
RMS 56.4 GeV
RMS90 33.4 GeV
[156%/sqrt(E)]



Barrel event (cos(theta[Q]) < sqrt(2)/2)

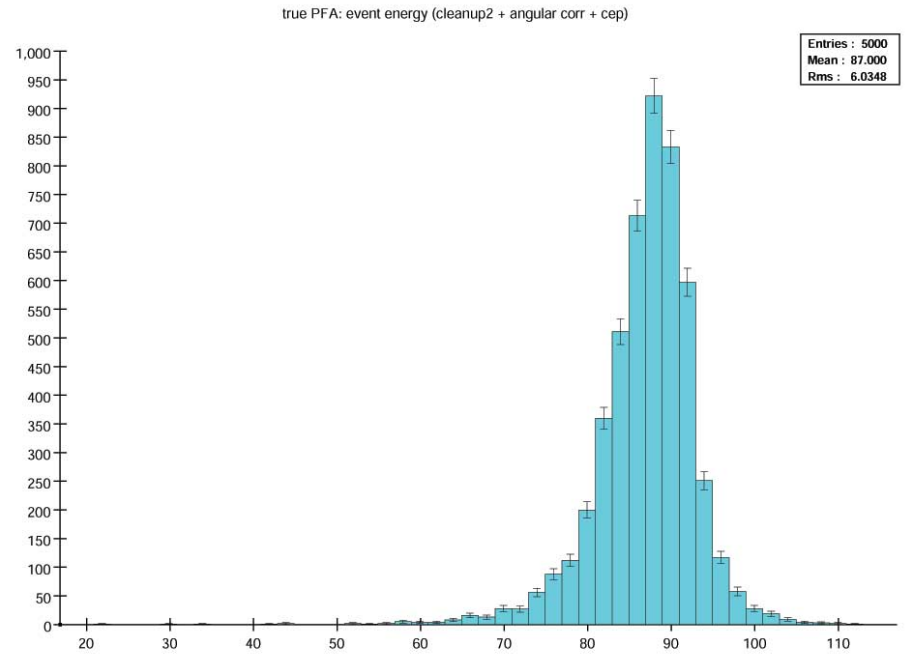
Mean 462 GeV
RMS 39.9 GeV
RMS90 30.1 GeV
[140%/sqrt(E)]

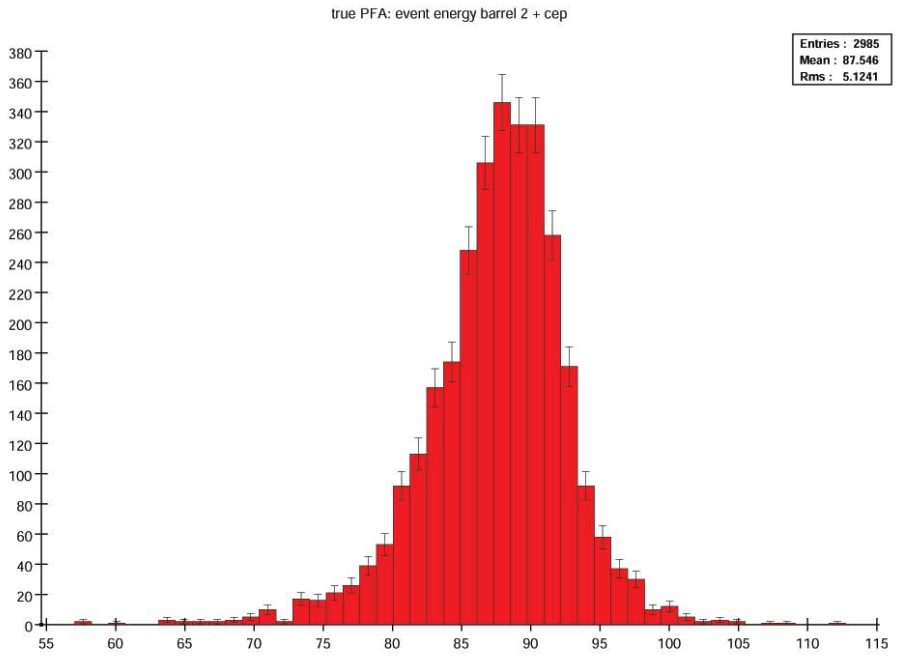
PFA need to be tuned/modified for higher energy
Much better performance should be possible

Back to Z-pole

- Do we really need loose track-cluster association at Z-pole?
- Try the tight criteria for Z-pole events as well

Back to Z-pole: sidaug05_np





No cut

Mean 87.0 GeV
RMS 6.03 GeV
RMS90 3.81 GeV
[41%/sqrt(E)]

Barrel event (cos(theta[Q]) < sqrt(2)/2)

Mean 87.5 GeV
RMS 5.12 GeV
RMS90 3.54 GeV
[38%/sqrt(E)]

Got it last night – so, very preliminary!

Summary

- PFA performance at Z-pole significantly improved from VLCW'06
  - New result need to be confirmed
  - Plenty of room for further improvement
- PFA constructed at Z-pole doesn't (automatically) work at higher energy
  - Tuning/modification is necessary
  - PFA performance should be significantly improved
- My PFA code
  - Will put some latest version into CVS
  - Code has been messed up by small modifications over time
  - A major re-write is expected – this time will try to follow PFA template whenever possible