2019 Track-Finding Efficiency: WABs
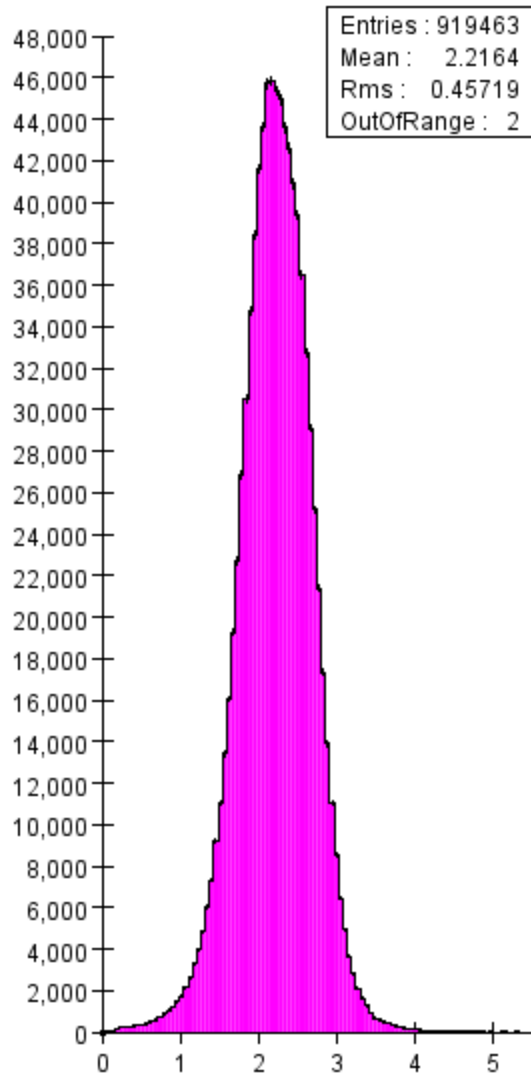
Norman Graf (SLAC)

Data Reconstruction Meeting

May 11, 2021

Track-Finding Efficiency with Data
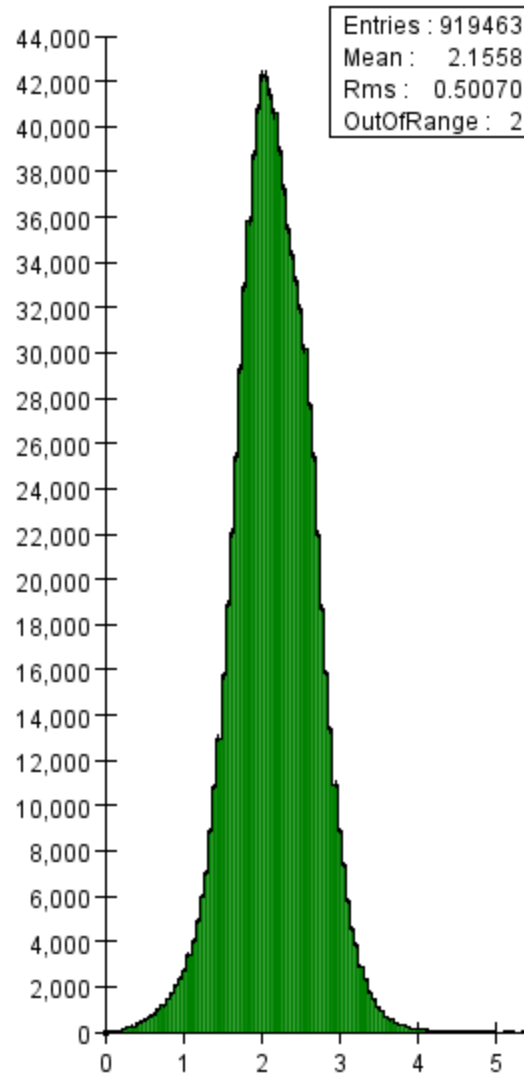
- **Data Samples**
  - Data run 105
- **Reconstruction Version**
  - hps-java 5.1 snapshot
- **Detector**
  - HPS_PhysicsRun2019-v2-FEE-Pass0
- **Skim events containing two and only two clusters in the fiducial region of the calorimeter**
- **Clusters in diagonally opposite quadrants**
- **Cluster times within 2ns**
- **Cluster Esum > 3.5GeV**
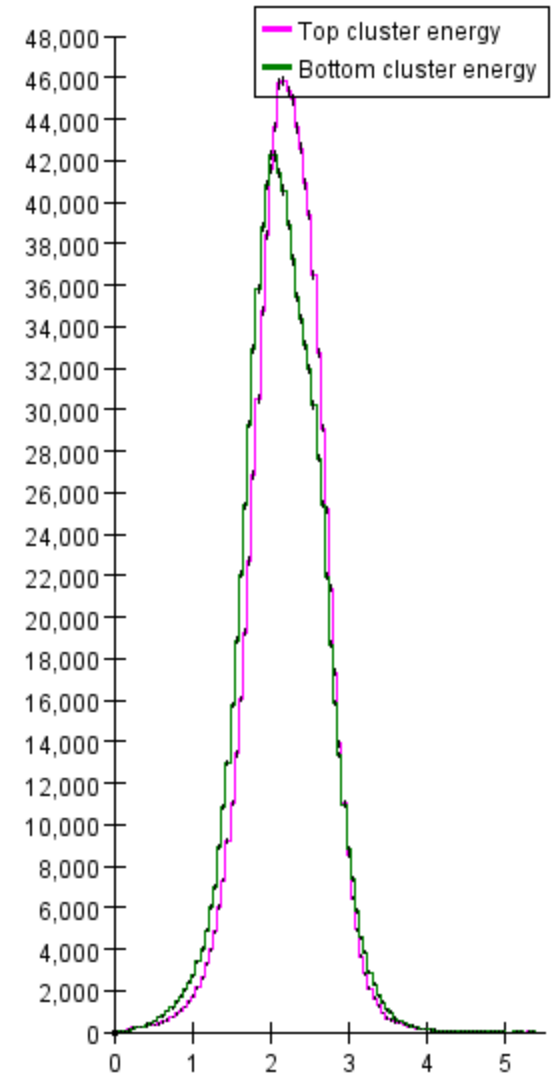- **Provides 918954 WAB candidates**

Cluster Energies

Top cluster energy

Entries : 919463
Mean : 2.2164
Rms : 0.45719
OutOfRange : 2

Bottom cluster energy

Entries : 919463
Mean : 2.1558
Rms : 0.50070
OutOfRange : 2

aida8172138980026543742.aida

Top cluster energy
Bottom cluster energy

Event Characteristics

Cluster esum

Entries :	918954
Mean :	4.3713
Rms :	0.28960
OutOfRange : 511	

Cluster x vs y

Entries : 1837942	
XMean :	-11.134
XRms :	136.11
YMean :	0.34225
YRms :	54.955
OutOfRange : 988	

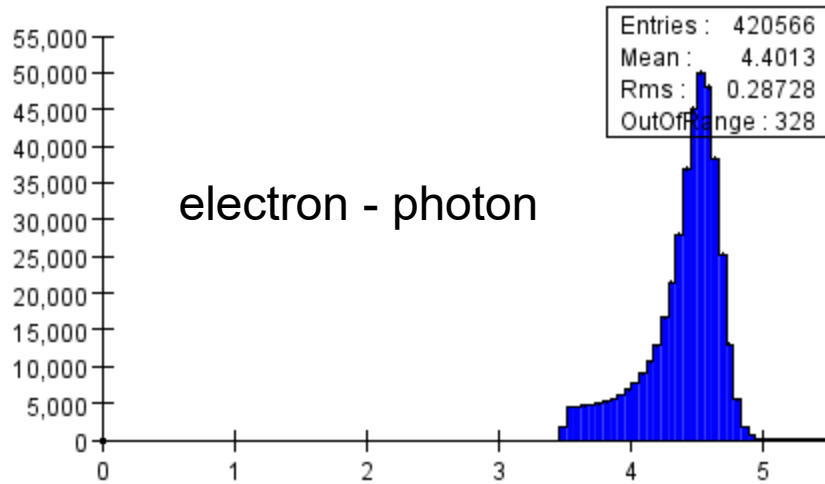Note missing crystals in bottom
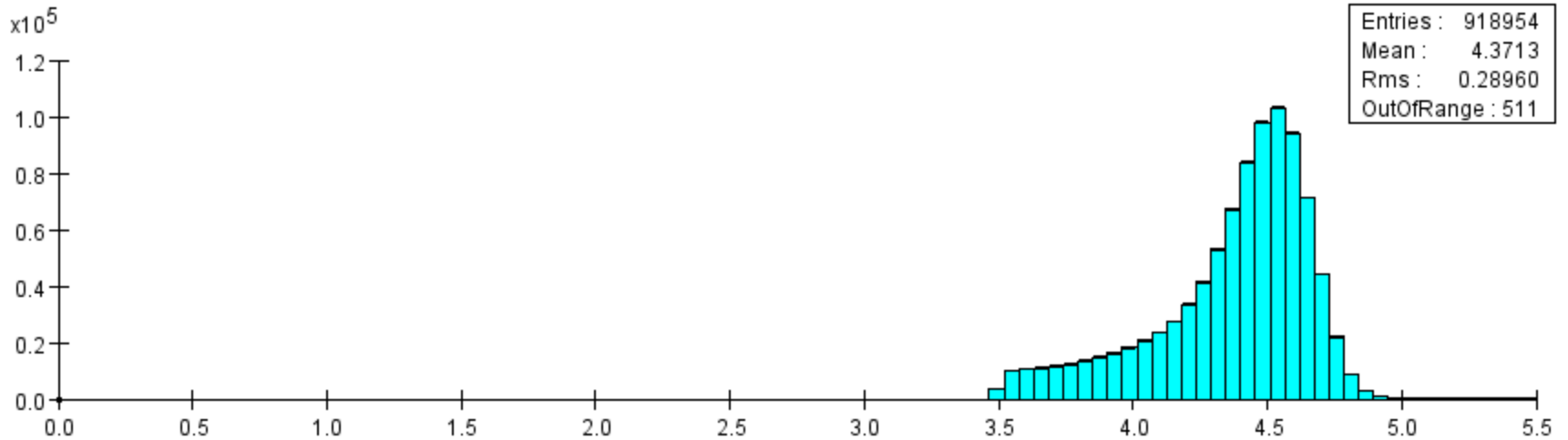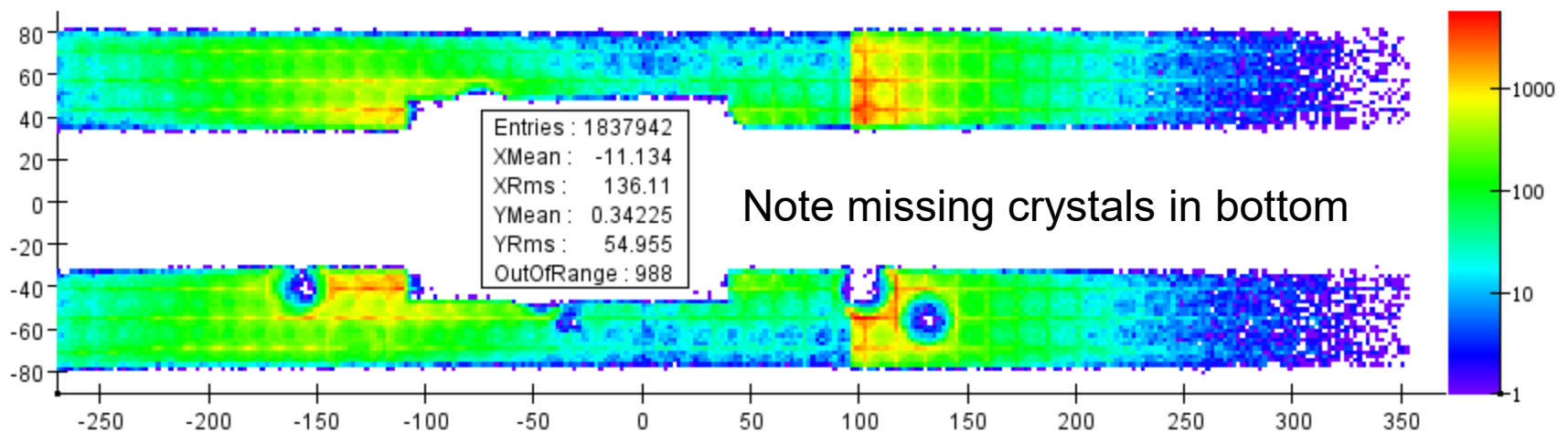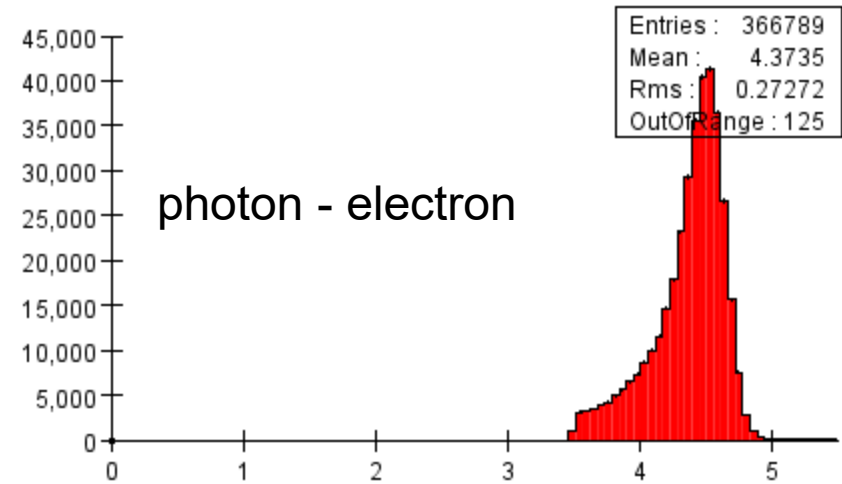
Event Classification

- Hypothesis is that these events are wide-angle bremsstrahlung (WAB) candidates where we have detected both the inelastically-scattered electron and the radiated photon.

- Esum should equal beam energy

- One, or the other, of the clusters should have an associated track, the other should not.

- Discard events with a reconstructed positron, as these may be real trident events.

- Events reconstructed with two photons is a measure of the track inefficiency.
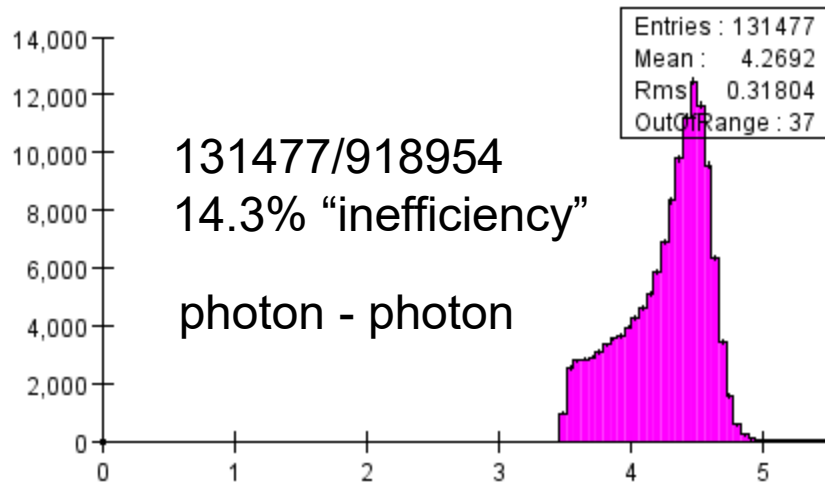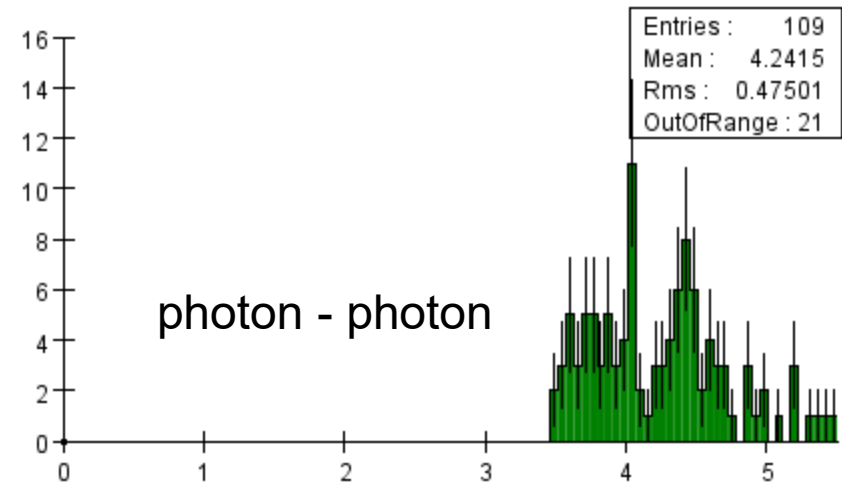
Event Cluster Types GBL

Cluster esum GBL eg

electron - photon

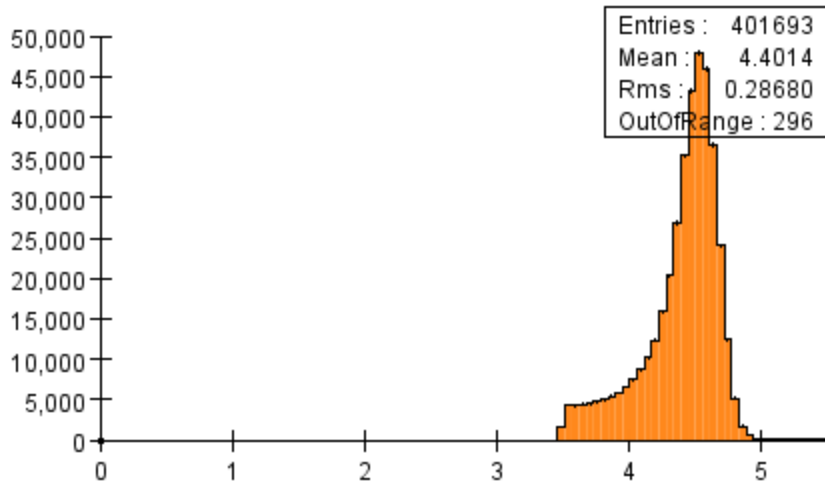| Entries :	420566
Mean :	4.4013
Rms :	0.28728
OutOfRange :	328

Cluster esum GBL ge

photon - electron

Entries :	366789
Mean :	4.3735
Rms :	0.27272
OutOfRange :	125

Cluster esum GBL gg

131477/918954
14.3% "inefficiency"

photon - photon

Entries :	131477
Mean :	4.2692
Rms :	0.31804
OutOfRange :	37

Cluster esum GBL ee

photon - photon

Entries :	109
Mean :	4.2415
Rms :	0.47501
OutOfRange :	21

Event Cluster Types KF

148286/918954
16.1% "inefficiency"
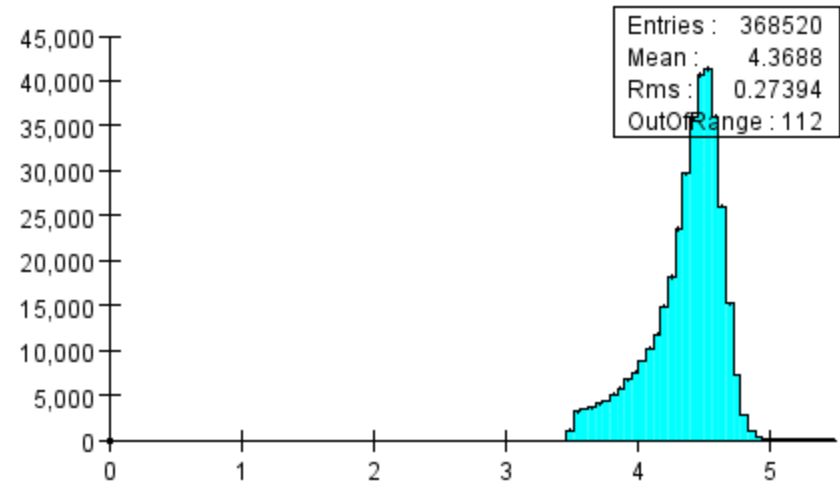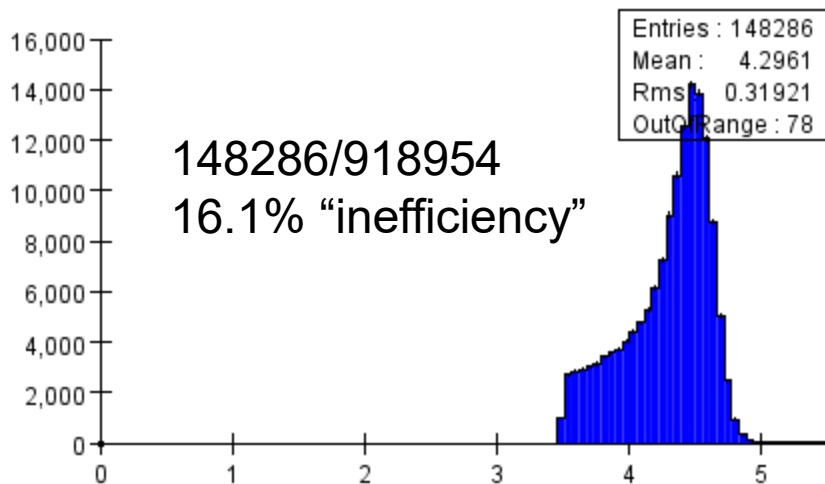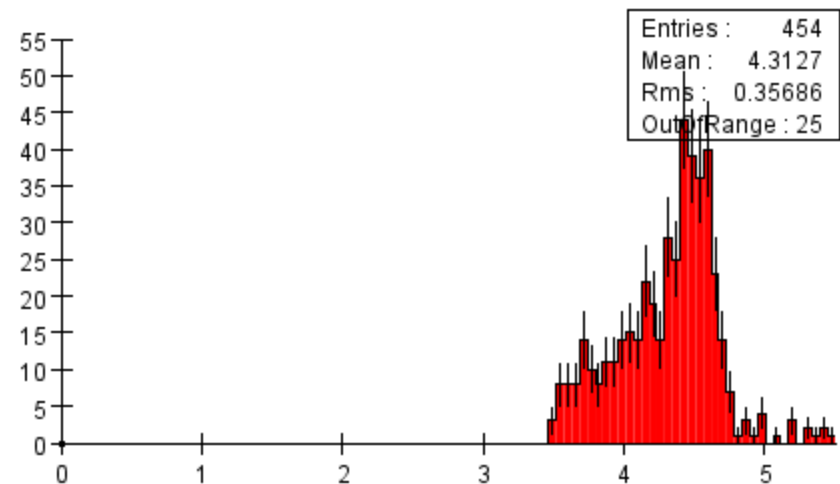
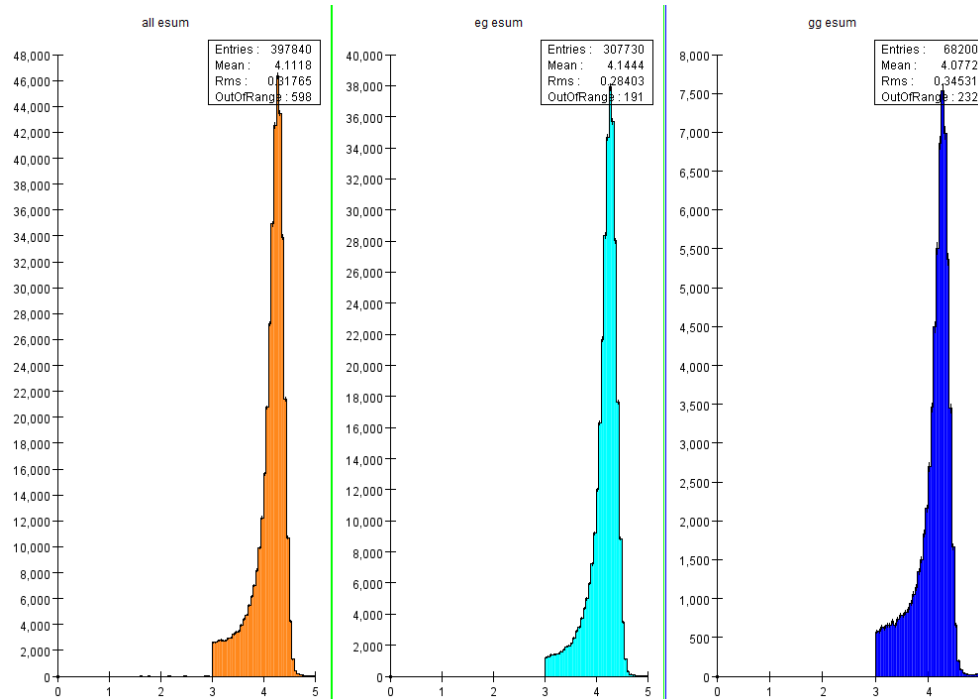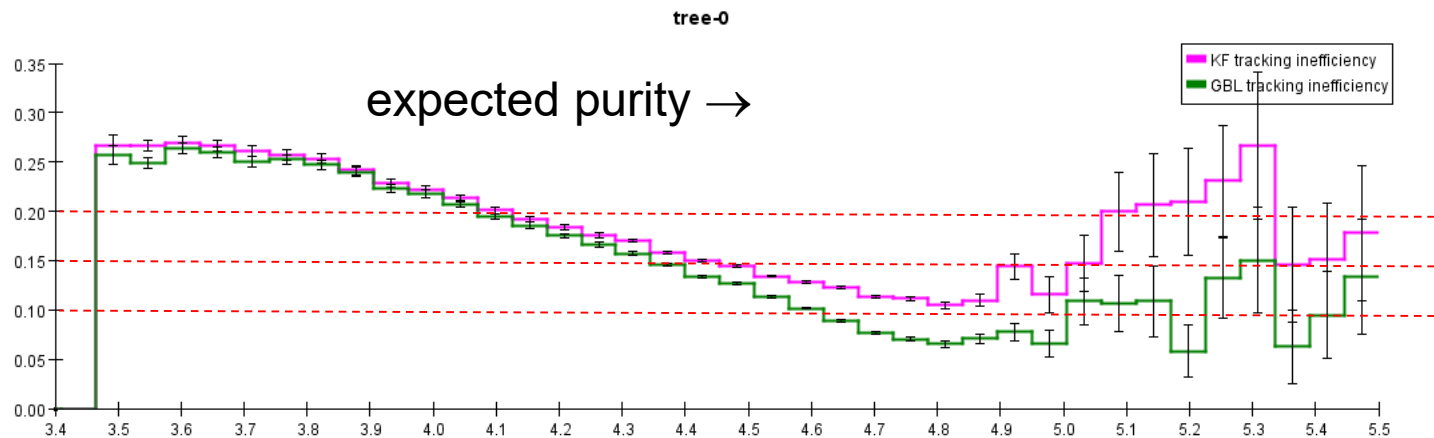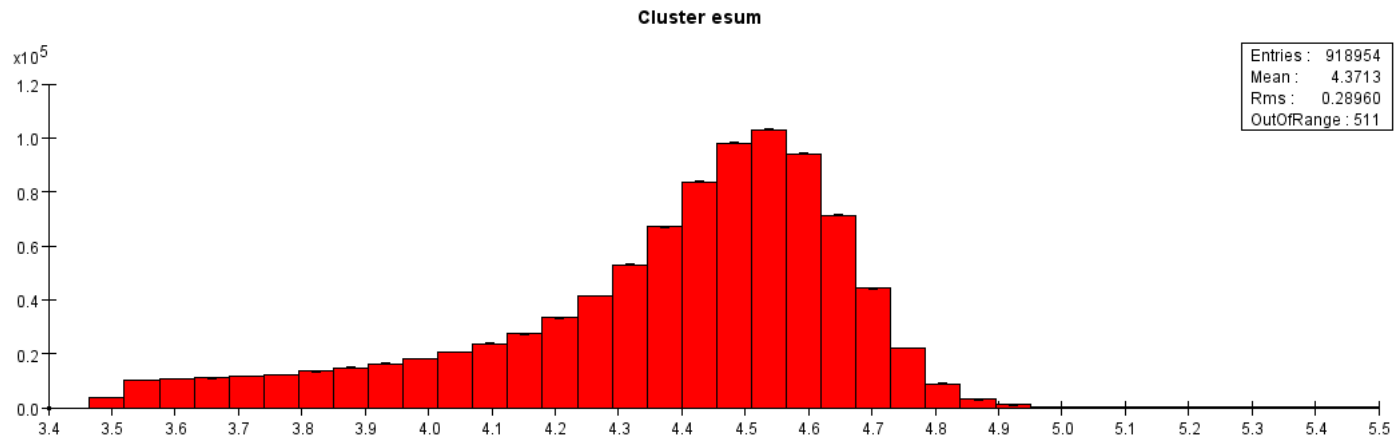# "Inefficiency"

- Measured "inefficiency" is affected by the purity of the parent sample.

- Note that the gg Esum distribution has more of a "porch" at low Esum than the eg (or ge) sample

"Inefficiency" vs Esum

- Expect purity of the parent sample to increase as Esum nears beam energy.

Cluster esum

Entries : 918954
Mean : 4.3713
Rms : 0.28960
OutOfRange : 511

tree-0

expected purity →

KF tracking inefficiency
GBL tracking inefficiency

Track-Finding Efficiency Using Data

- Preliminary study of the track-finding efficiency using WABS indicates an inefficiency of finding tracks in the momentum range between 1 and 3.5GeV of between ~10-15%

- Seed Tracker appears to have a slightly higher efficiency of finding tracks.
  - This study conducted before the latest round of KF strategies and code improvements.

- Will be repeated with the latest snapshot.

- Will study the track-finding efficiency in greater detail
  - top/bottom
  - slot/hole
  - as function of cluster energy (track momentum)

- Compare with FEE tracking efficiencies reported at last meeting.