2D Clustering Efficiency/Purity for Shower Events

Osc Meeting 5/12/14

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MC Samples

- Single e- or single Pi0 events with energies between 100MeV and 1.9GeV
- Clustering algorithm: FuzzyCluster
- Comparison with MC uses “MCShower” objects created by Kazu
  - Single e- events generally have one “MCShower” in them
  - Pi0 events generally have two
- Analysis done in LArLight, code easily ported to LArSoft

Figures of Merit

- (0): “Efficiency”
- (1): “Purity”
- (2): “Other Purity”

Figure of Merit (0)

- "Efficiency": (# of MCShowers / # of clusters) **per event**, per plane
- This is generally a small number for raw FuzzyCluster output.

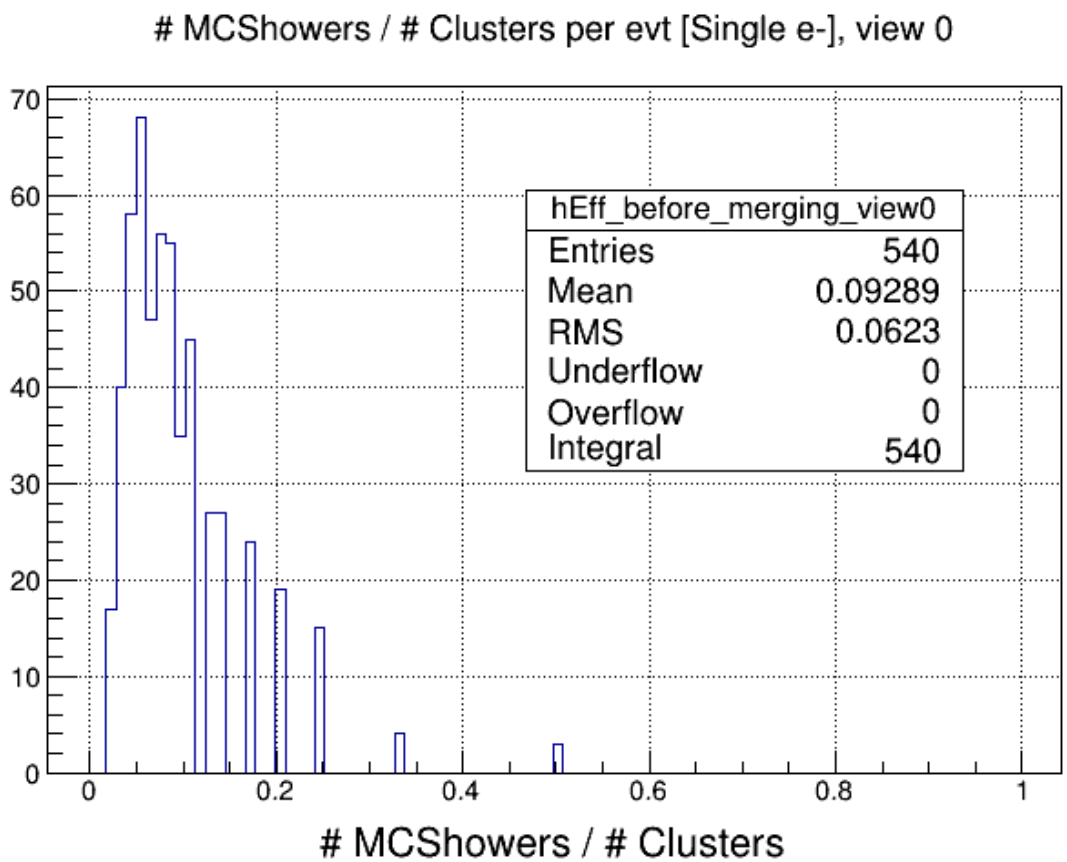


Figure of Merit (0)

- Here's what it looks like for Pi0 events:

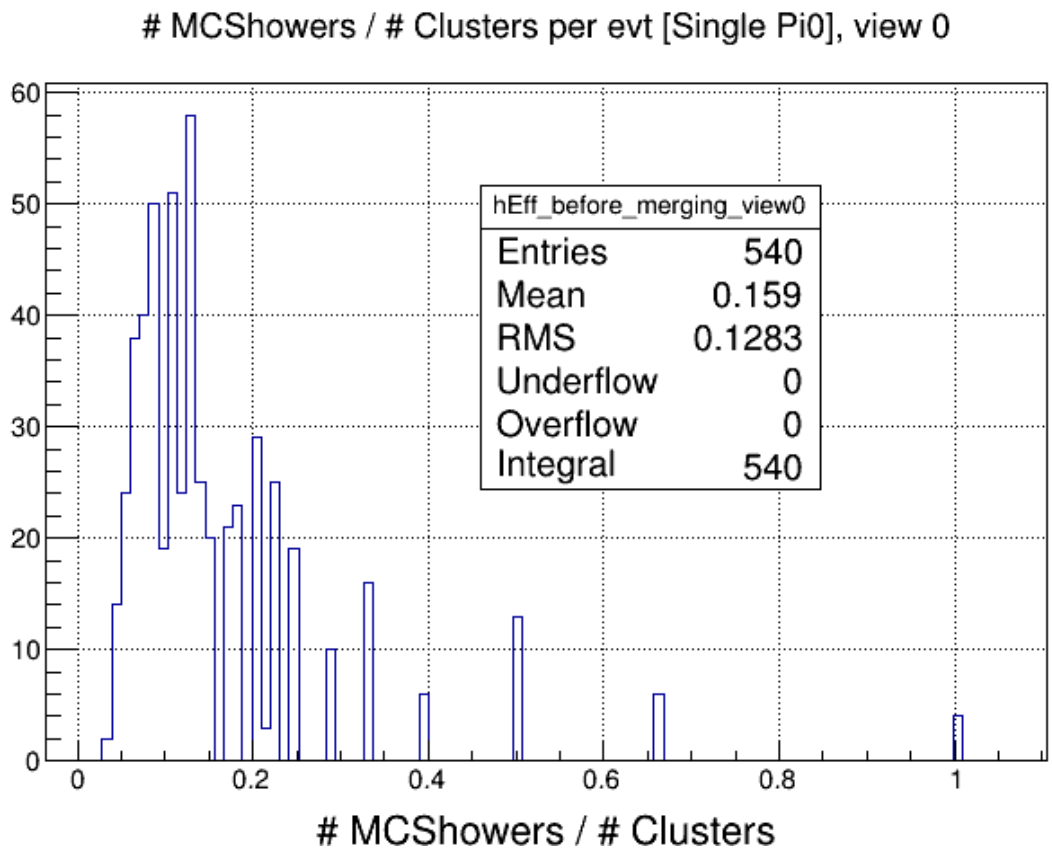


Figure of Merit (1)

- "Purity": For a given cluster, the highest fraction of its charge belonging to a single MCShower.

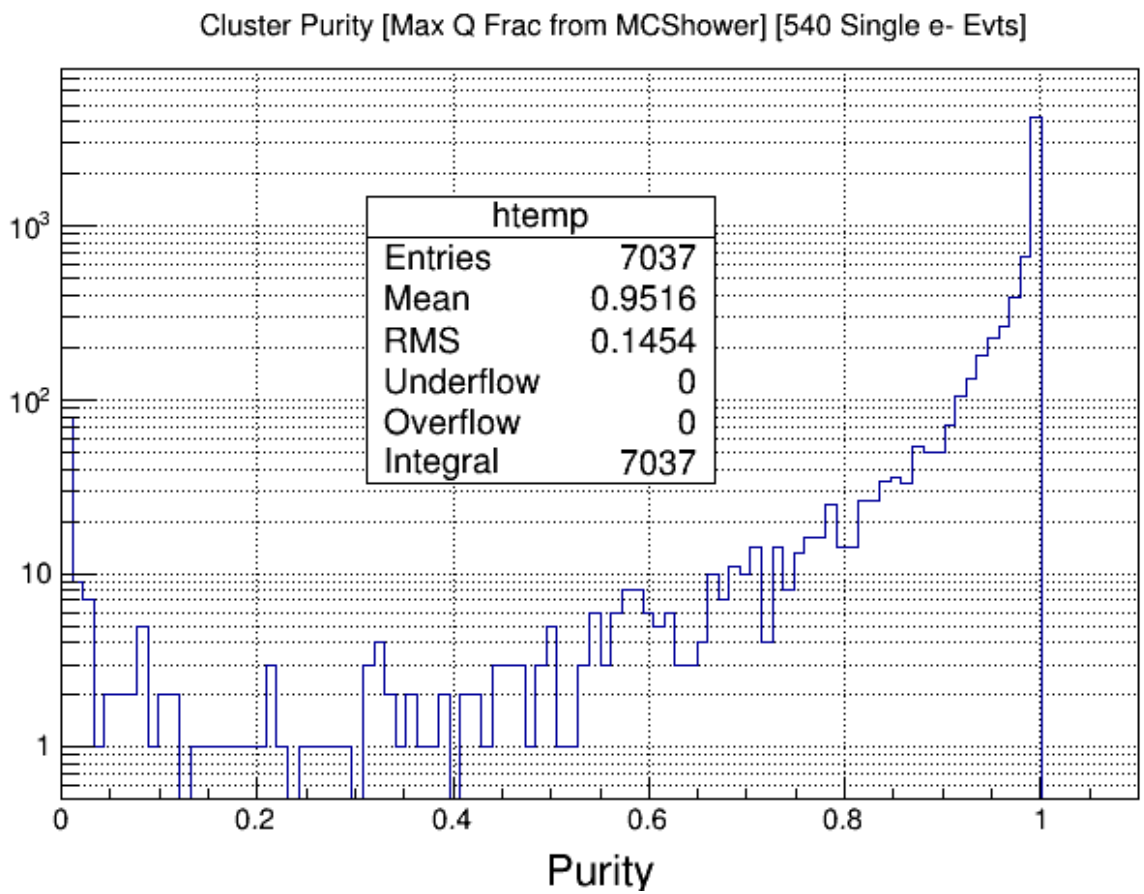


Figure of Merit (1)

- Here's what it looks like for Pi0 events:

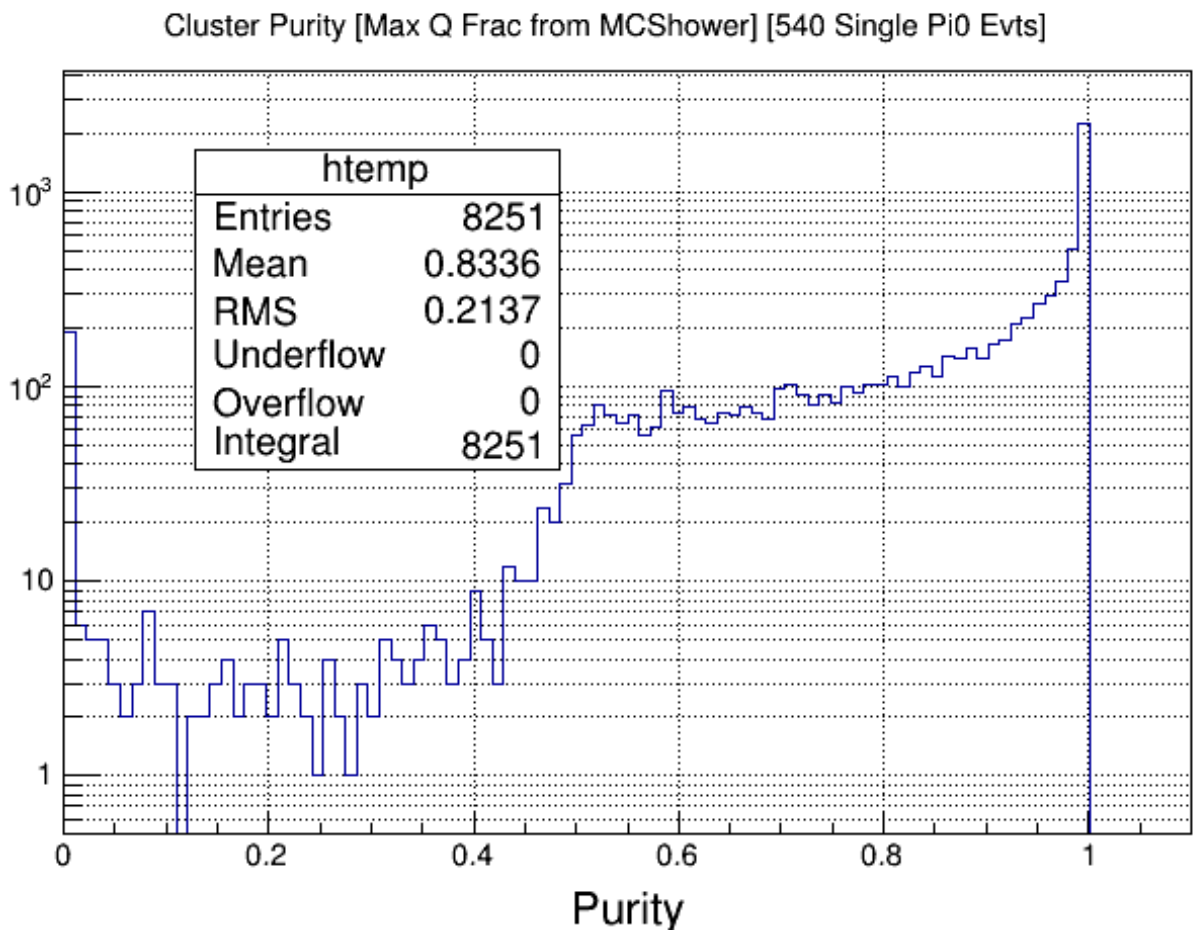


Figure of Merit (1)

- You can also plot Purity vs. Cluster Charge

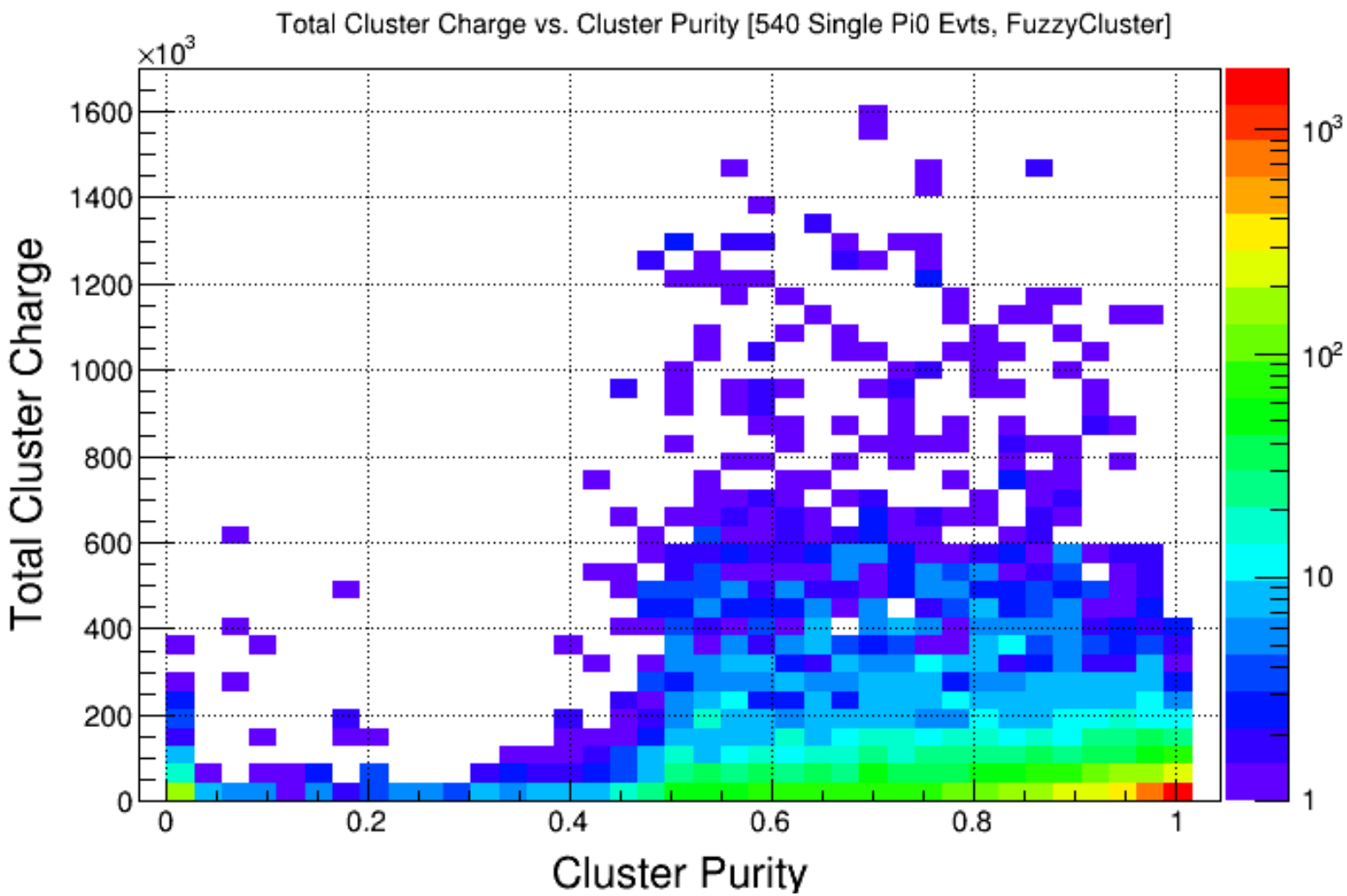


Figure of Merit (2)

- “Other Purity” For a given cluster, it’s highest amount of charge belonging to one MCShower divided by the total charge of that MCShower
- Can be greater than 1 because we are comparing charge from *reconstructed* hits to MC charge.

Figure of Merit (2)

- For single electron showers:

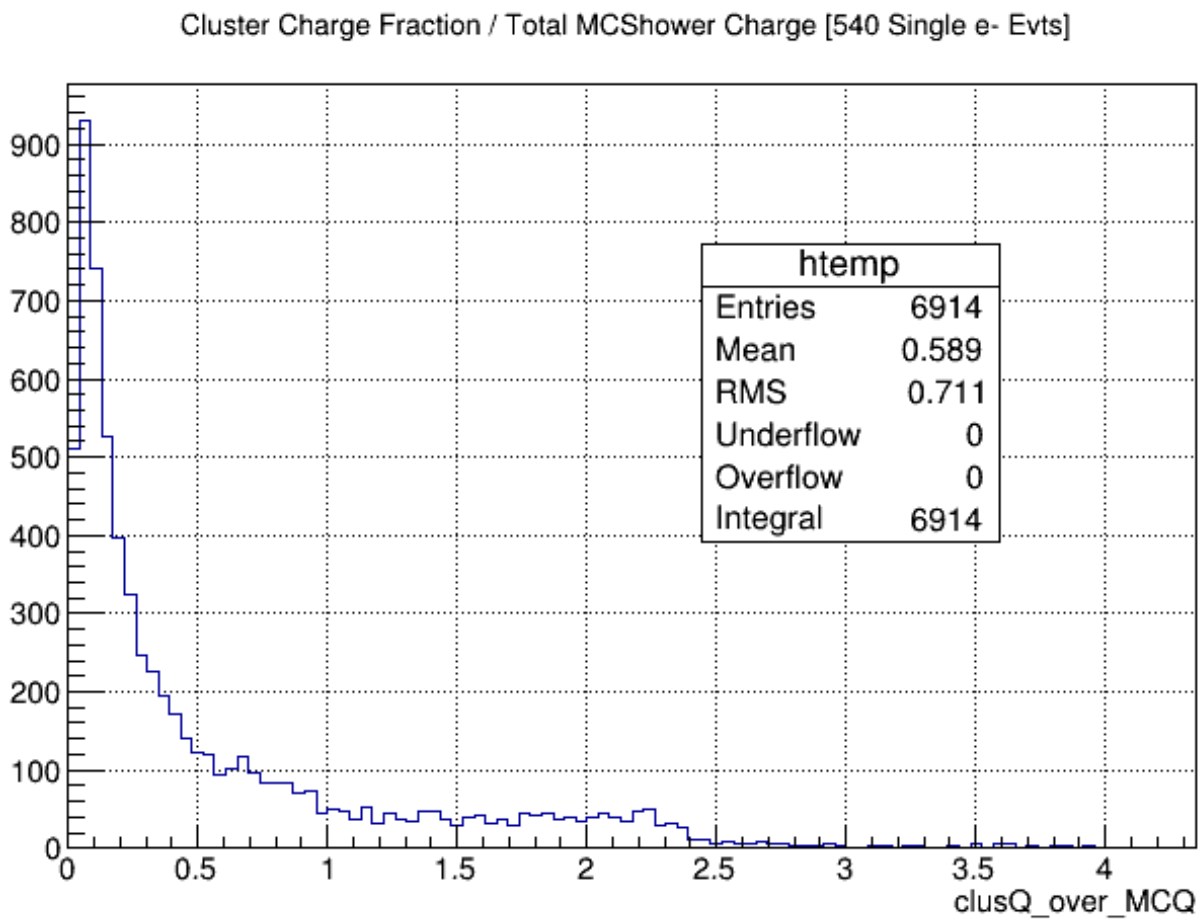
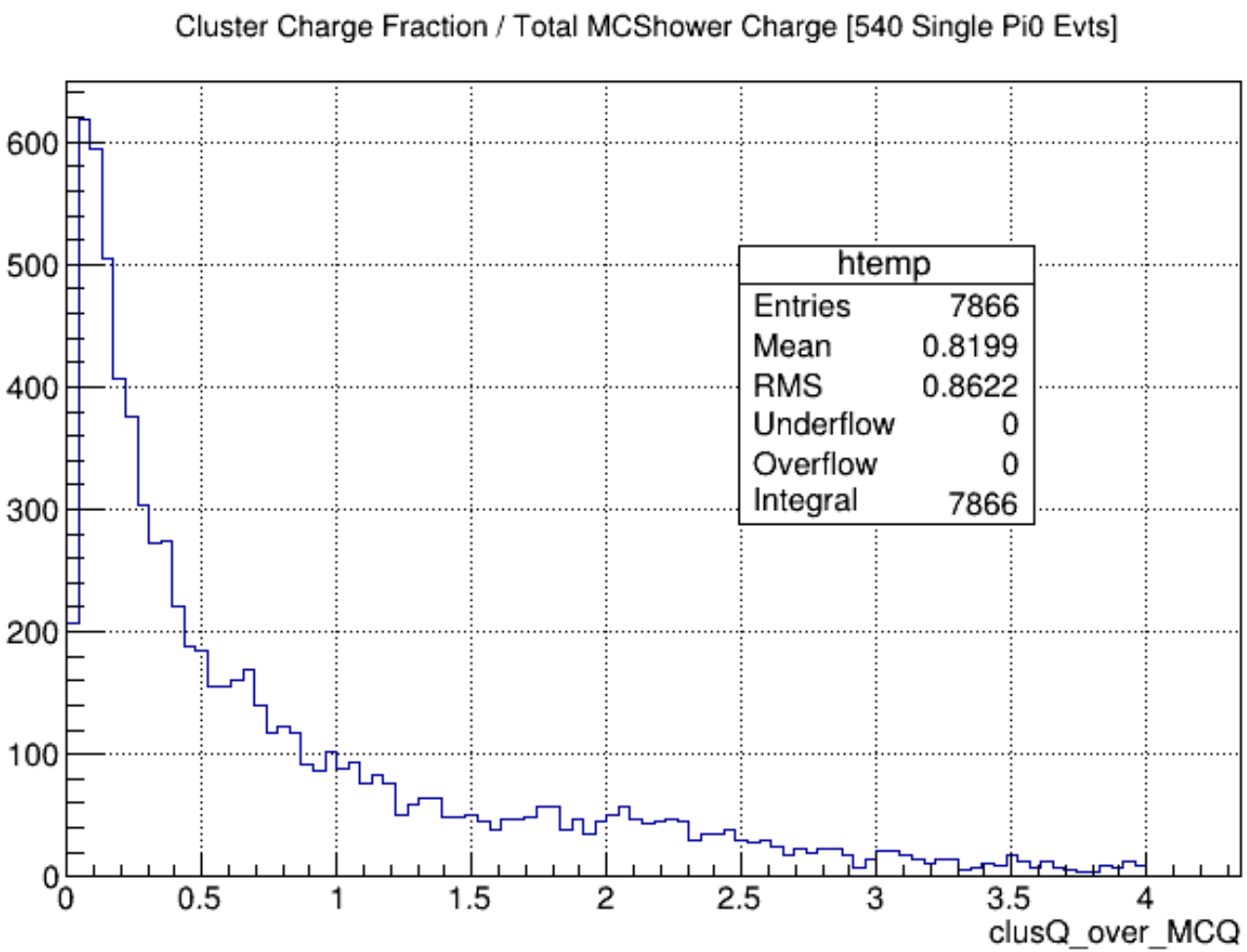


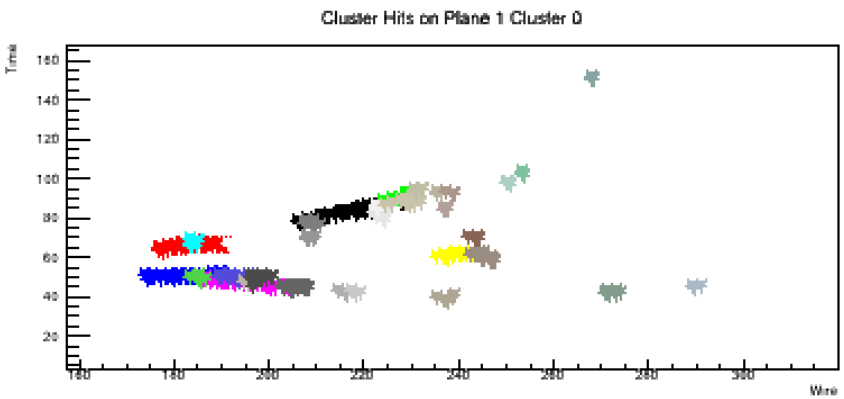
Figure of Merit (2)

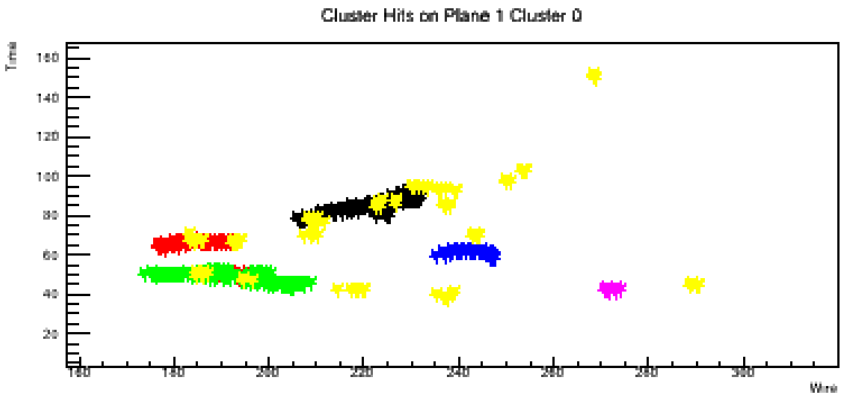
- For single pi0 events:



Cluster Merging

- Uses various algorithms in a framework built by Kazu, including
  - && conditions between algorithms
  - || conditions between algorithms
  - “Prohibit” algorithms to prevent merging
- Hopefully the right merging can greatly increase efficiency without hurting purity.





Single Pi0 Event

Left: Raw FuzzyClusters
(each color is a different cluster)

Right: After some preliminary merging.

Cluster Merging Algorithms

- Angle Compatibility (comparing 2D angles of reconstructed axes of two clusters)
- Polygon Algorithms (draw a polygon containing the cluster, check for overlaps with other clusters, etc)
- Shortest Distance Compatibility (shortest distance between line segments representing axes of clusters)
- Track Separation (a “prohibit” algorithm looking to prevent merging of two track-like clusters that could be the start of Pi0 showers)
- And more…