# EMShower Update: pi0 Reconstruction

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Shower Reminder

- Uses 2D clustering BlurredCluster for the initial reconstruction.

  - Well developed method so most of the reconstruction is done in 2D.

  - This method has been improved slightly since my last update at the FD reco meeting; probably won't be changed much from now onwards.

- Simply match between the views to form 3D shower objects.

Shower Algorithm

- The shower reconstruction runs on the output of clustering and tracking on the events.

- Each cluster is associated with a track and, by using the 3D nature of tracks, means that clusters across multiple views can be matched to forms showers:
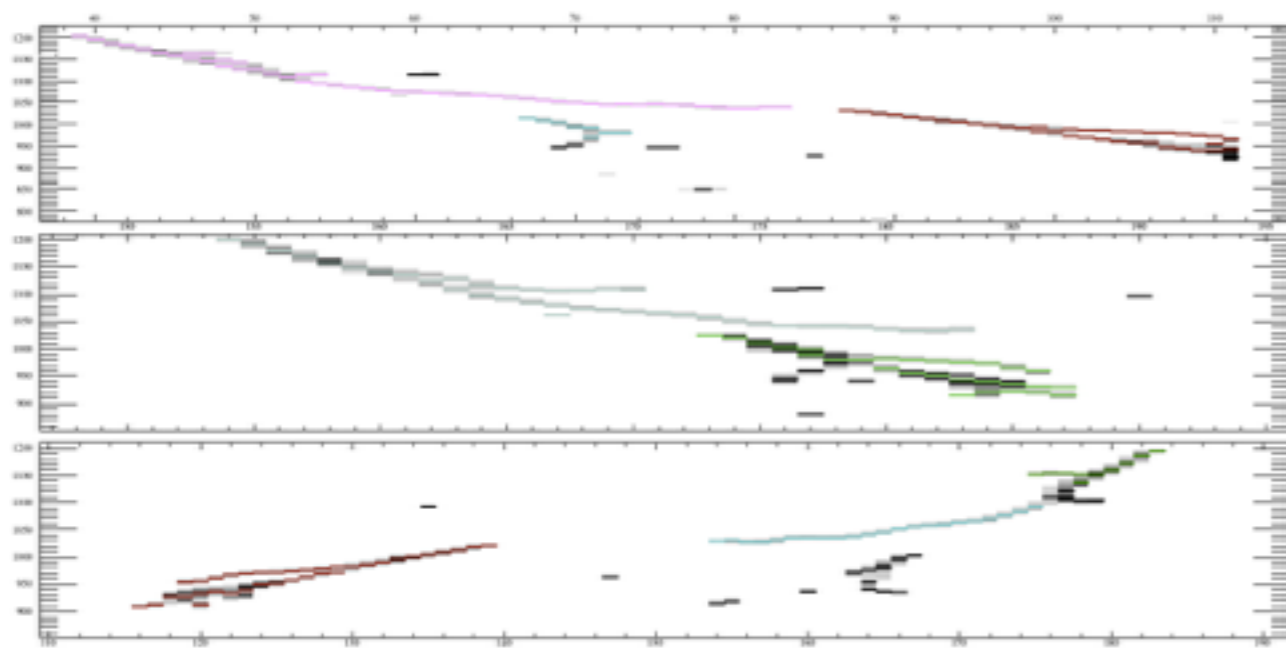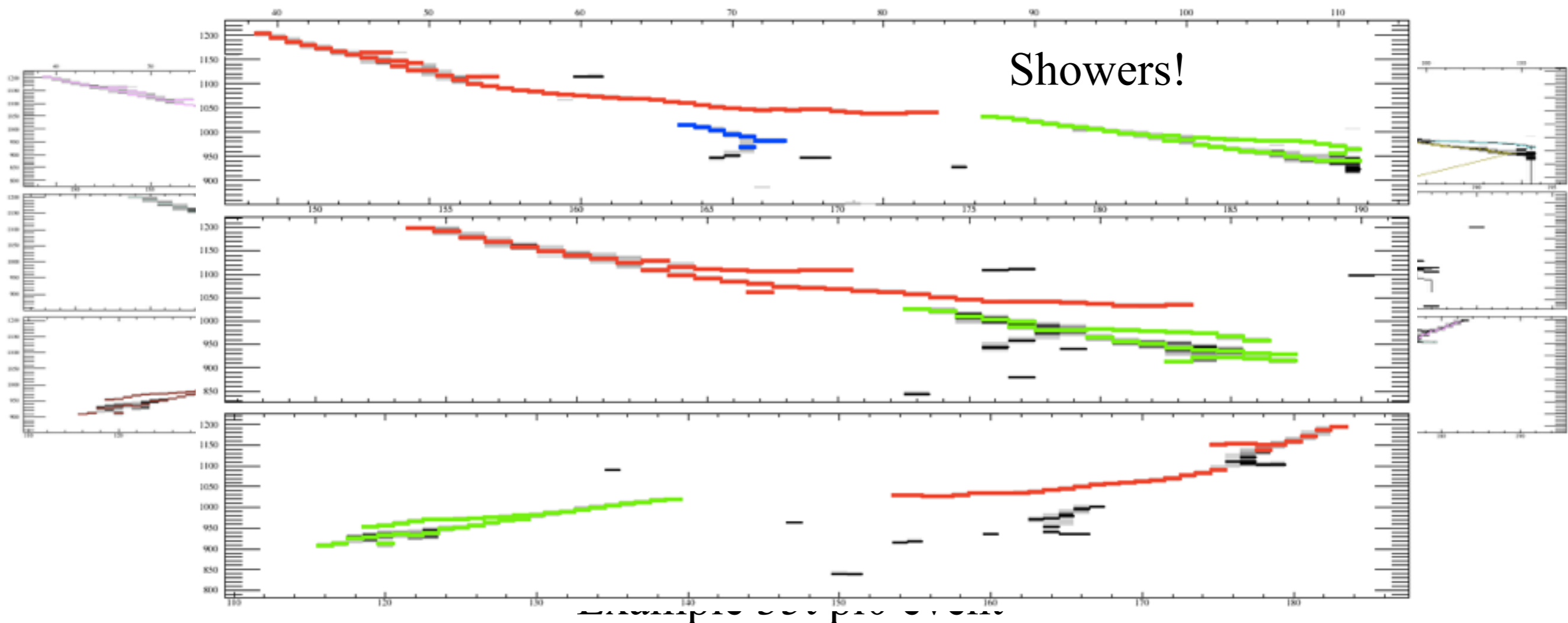

BlurredCluster
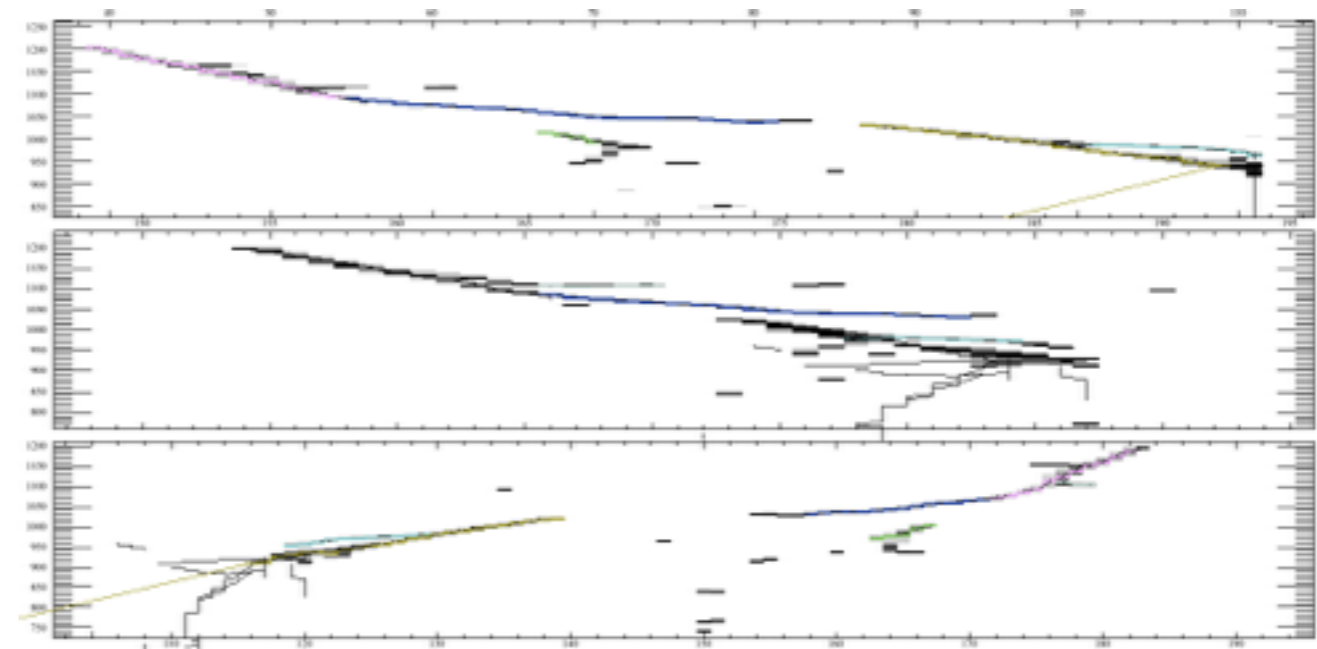
PMTrack

Example 35t pi0 event

Shower Algorithm

- The shower reconstruction runs on the output of clustering and tracking on the events.

- Each cluster is associated with a track and, by using the 3D nature of tracks, means that clusters across multiple views can be matched to forms showers:


Showers!

Example 500 p.e. event

Shower Properties

- Been working on reconstructing the properties of these showers over the last couple of weeks.

- Properties: energy, shower start, dEdx, direction etc.

- Particular aim of this reconstruction is to reconstruct pi0s in the 35t. Of interest here are the direction and the energy:

  - Energy is ok, recon is slightly lower than true (small problem with fragmented showers)

 - Direction not bad, needs improvements.

Shower Properties
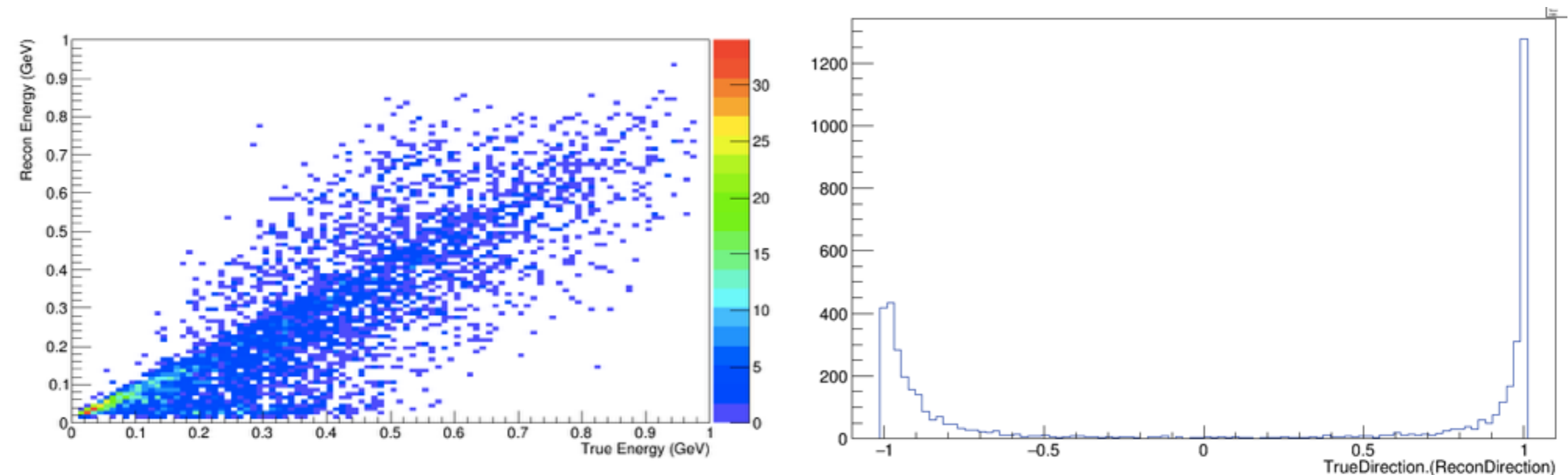
- Energy: in general ok. Need to improve slightly.

- Probably smalls issues with containment/fragmentation.

- Direction: normally ok but often oriented incorrectly.

- I fixed this last week but all my jobs failed so I couldn't update the plot! :(

- Karl?...

Reconstructing pi0s

- Had a quick look at how we're doing with pi0 reconstruction using this showering technique.

- Have reconstructed a mass peak using pi0 particle gun (in 35t, can extend to FD at some point).

- For the following, I used truth info to select the largest shower for each photon in each event…

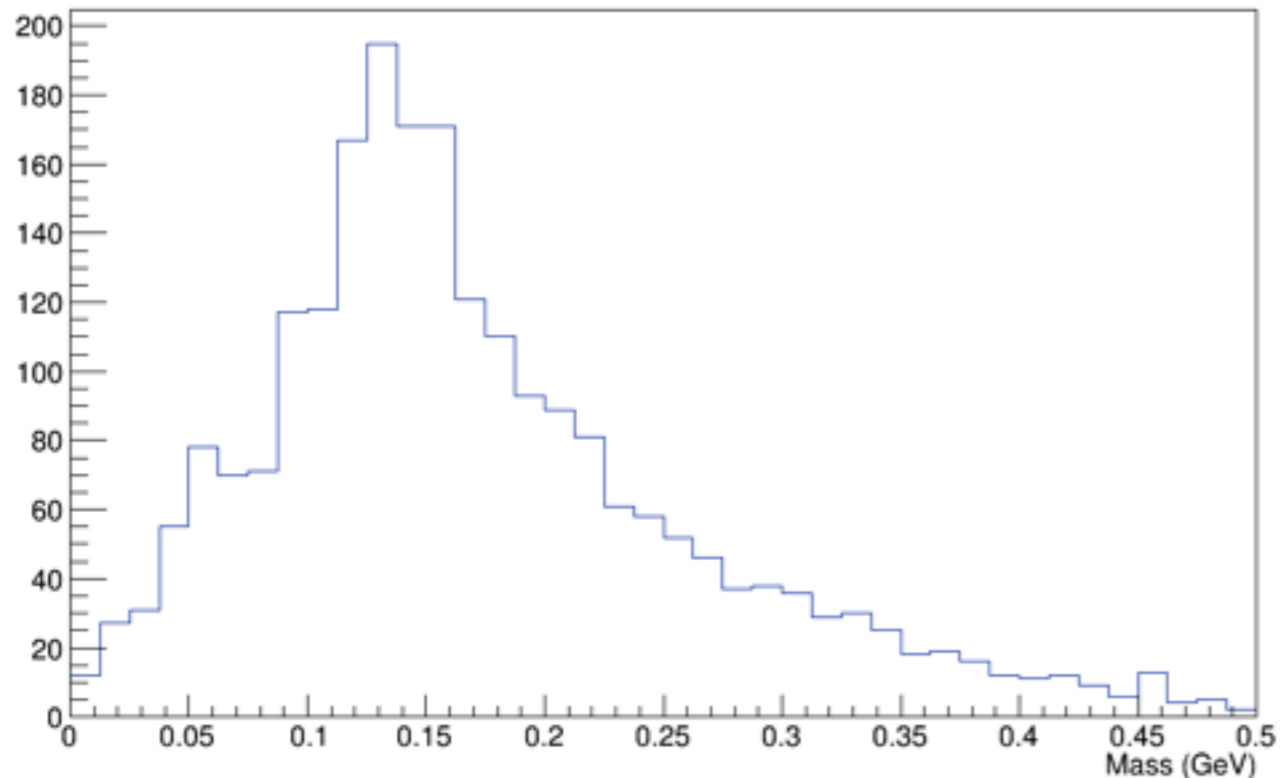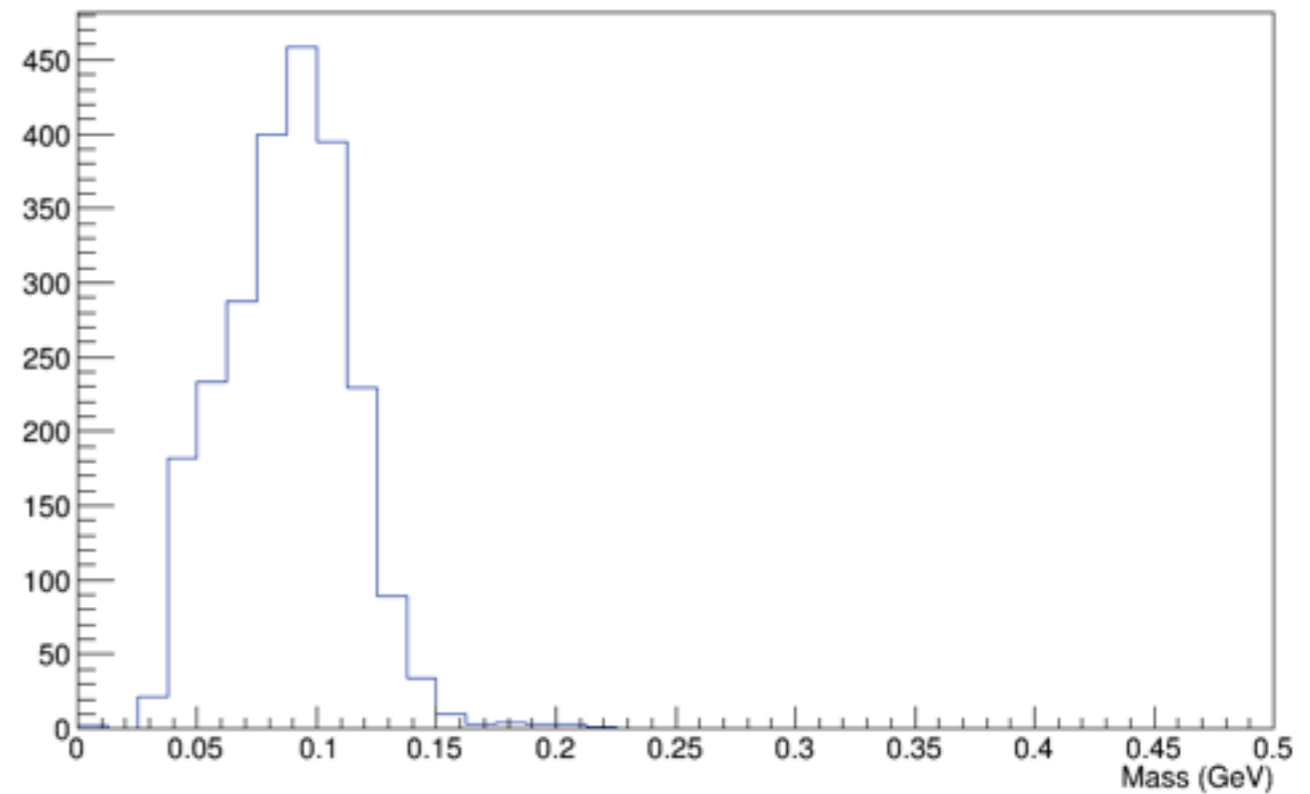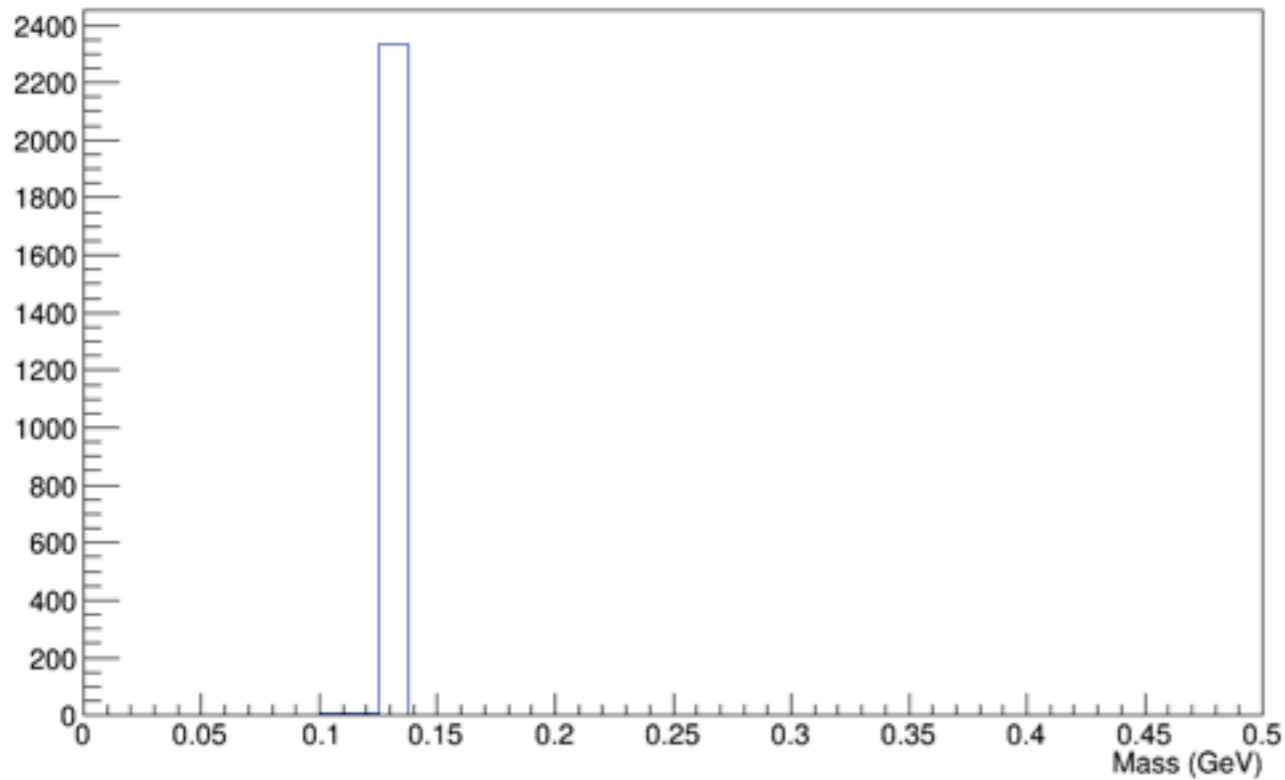 - Want to test recon, not event selection!

Mass Peak
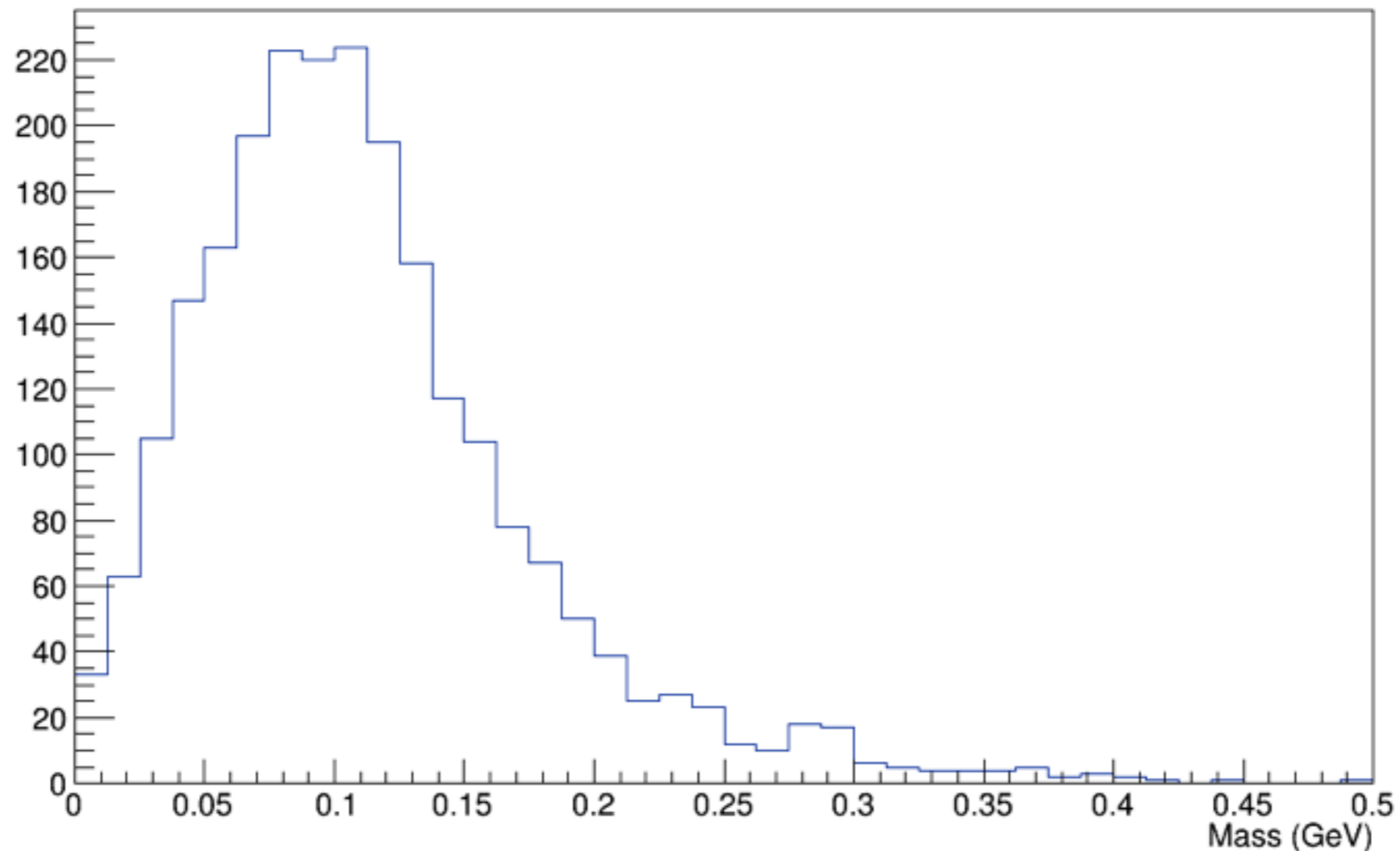
- Ok for first attempt!

- Peaks too low (energy issue) and is quite wide (direction problem).

Mass Peak ft. True Quantities

- Top left: true direction, true energy.

- Top right: true direction, recon energy.

- Bottom right: recon direction, true energy.

Notes

- Can see that the direction affects the mass peak the most.

- Need to run this again after fixing the orientation of the showers late last week (thought it would be done for this meeting but alas…)!

- Energy also slightly low; will try turning on cluster merging to see if this fixes fragmentation issues.

- This used an energy calibration calculated for 35t — need to redo this for FD.

- Haven't shown any nue events but track/shower separation needs to be worked on.

Next!

- Work on improving the direction determination and improving the shower completeness.

- Find correct energy calibration for FD.

- Improve track/shower discrimination to help nue events.

- Need to work on showers which pass through the APAs.

- Going to try and get most of this sorted this week, in time for next MCC.