



The
University
Of
Sheffield.

EM Shower Reconstruction

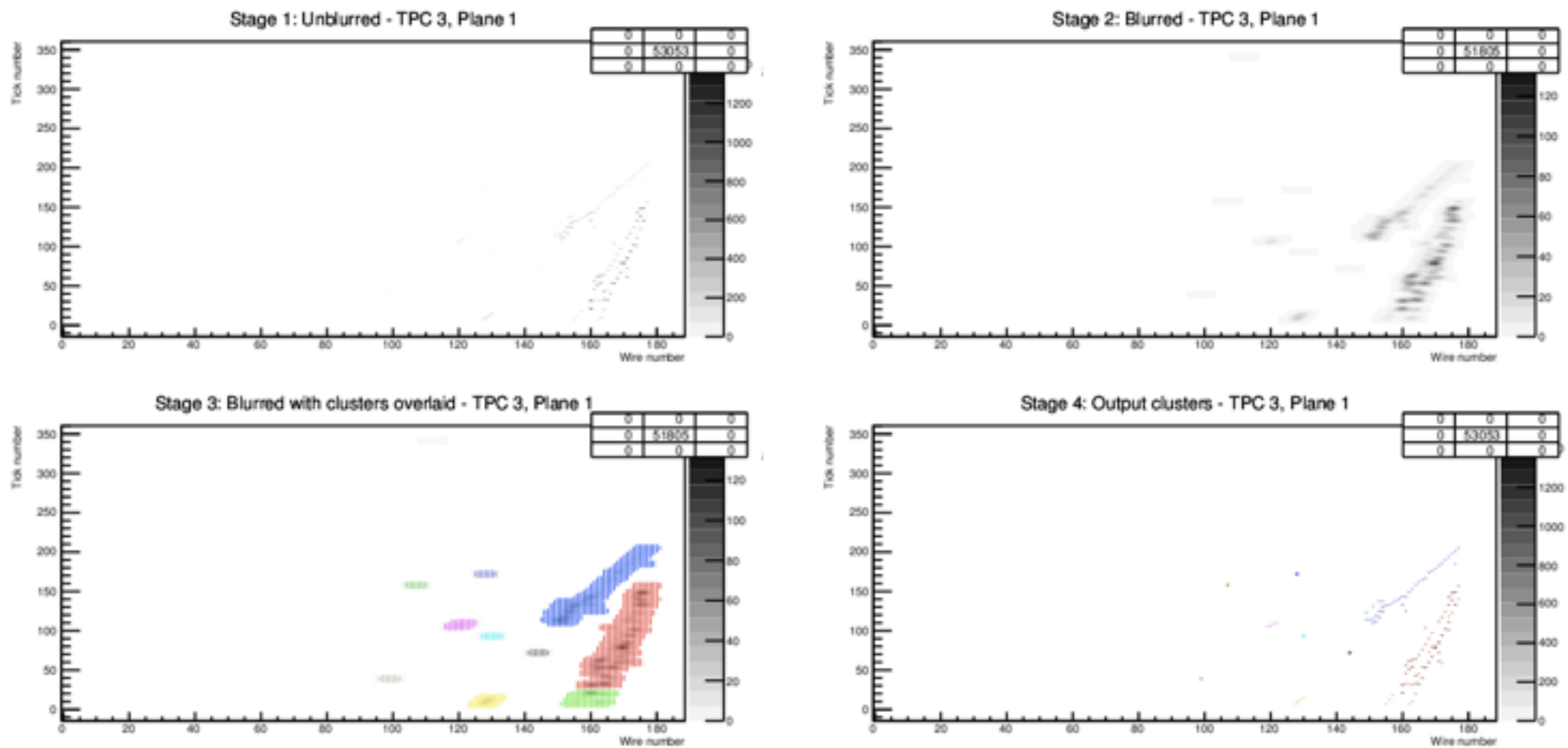
Mike Wallbank
University of Sheffield
12/10/2015

Introduction

- Have been working on EM cluster reconstruction for the last few months;
- Developed BlurredCluster 2D reconstruction method within LArSoft.
- With promising development of this, I am extending to 3D to assist with 3D shower reconstruction.
- Motivation is π^0 reconstruction in 35t but has application in far detector EM showers also.

Blurred Clustering

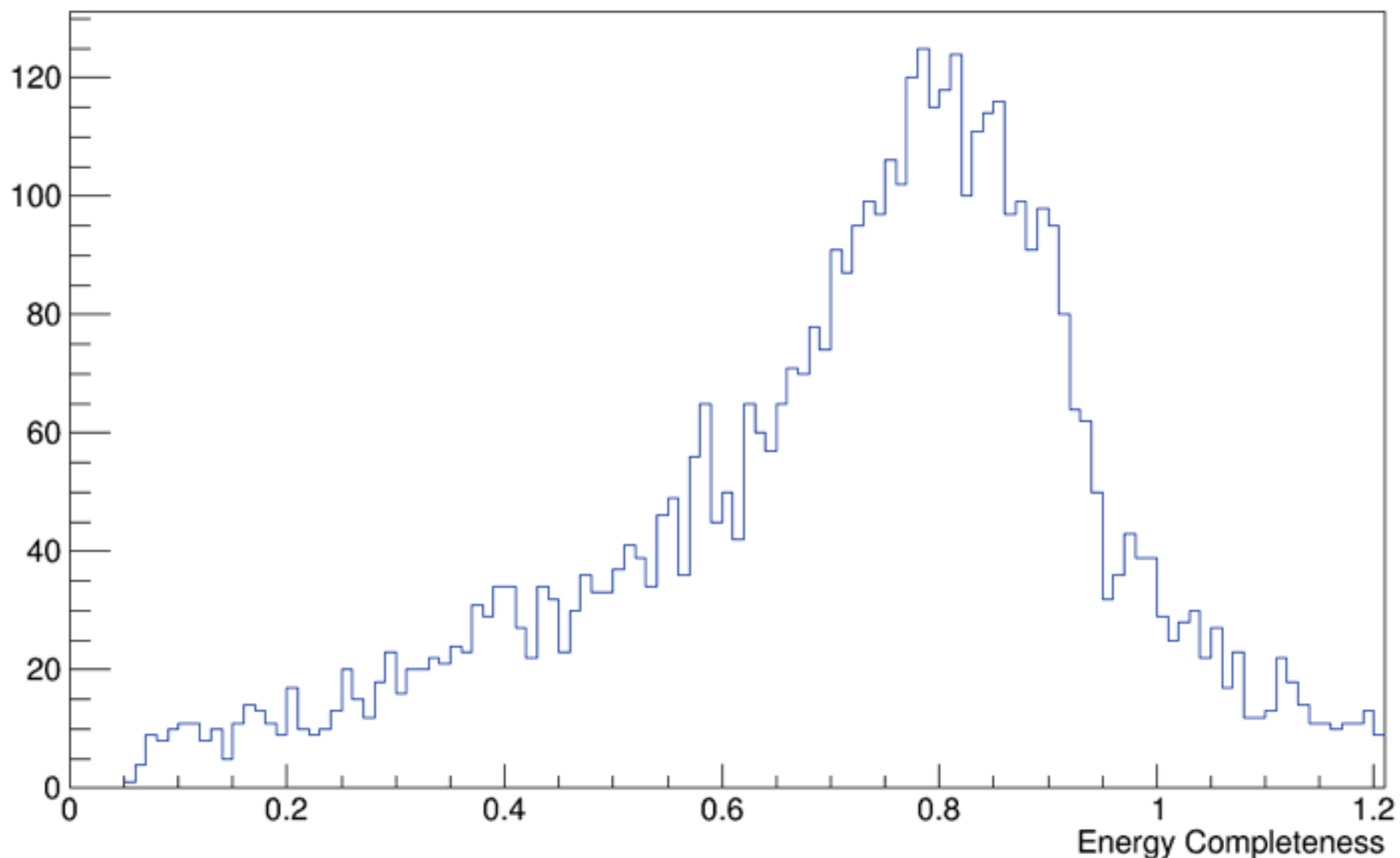
- Cluster technique which uses a 2D Gaussian function to ‘blur’ a hit map and allow formation of more complete clusters.



- After convolving the hits with the Gaussian, clustering proceeds in a nearest neighbour-style.

BlurredCluster Performance

- Given many updates on this in previous meetings.
- Summary plot: Energy Completeness (how much energy deposited by a particular particle is reconstructed in the largest cluster associated with this particle).

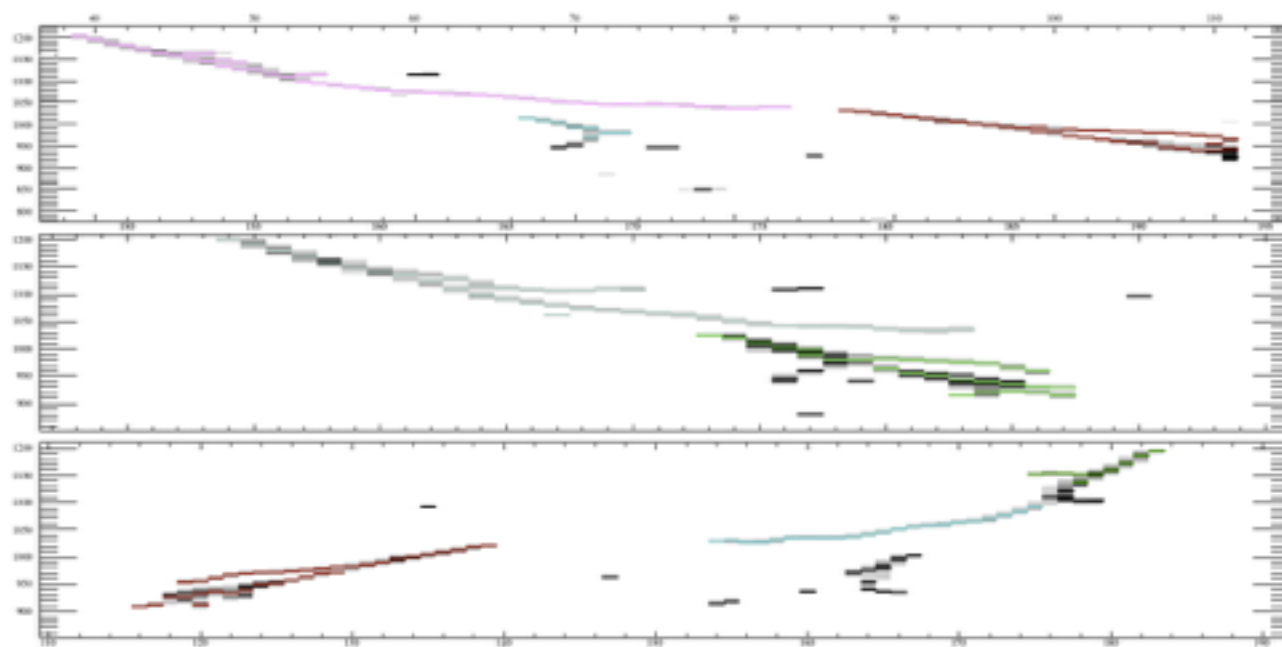


EM Showers

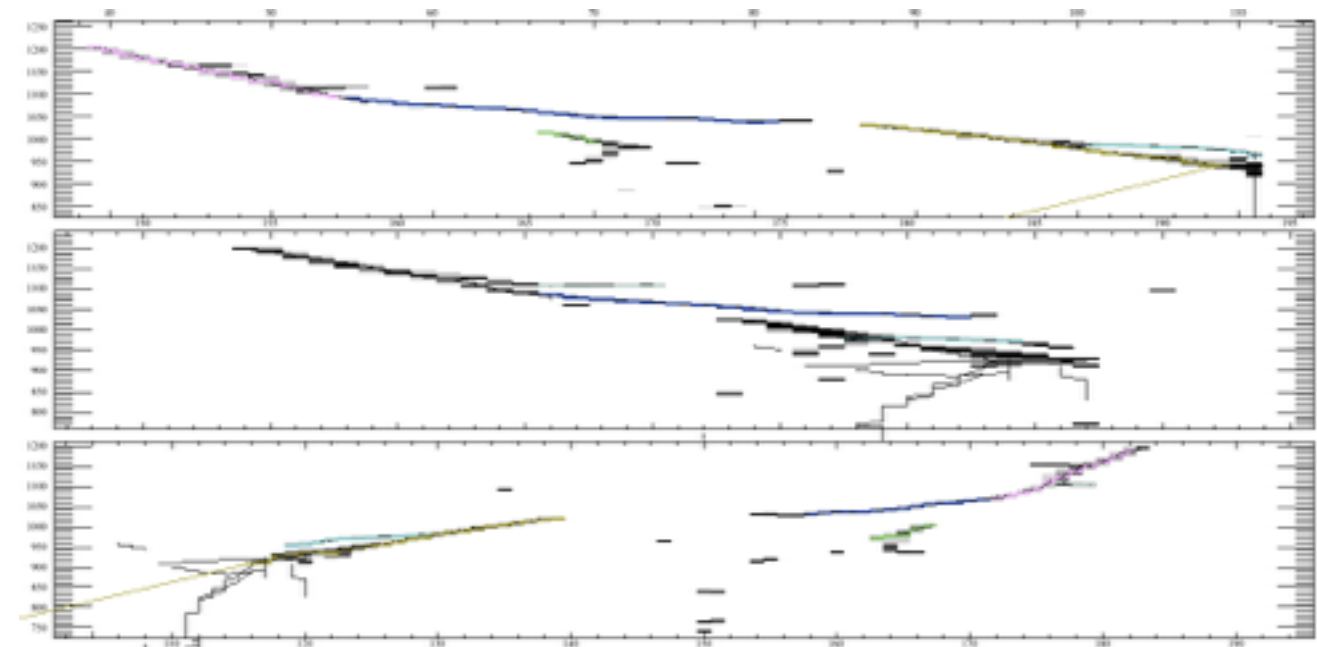
- Original idea: take these well-formed 2D clusters and simply match between the views to form 3D shower objects.
 - i.e. No more reconstruction in 3D, do everything in 2D.
- Also added option to BlurredCluster to cluster only hits not tagged (by PMTrack) as track-like [help with hadron track/EM shower in, e.g. nueCC event].
- Still very early in the development but initial results and progress looks promising.

Algorithm Details

- 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 form showers:



BlurredCluster

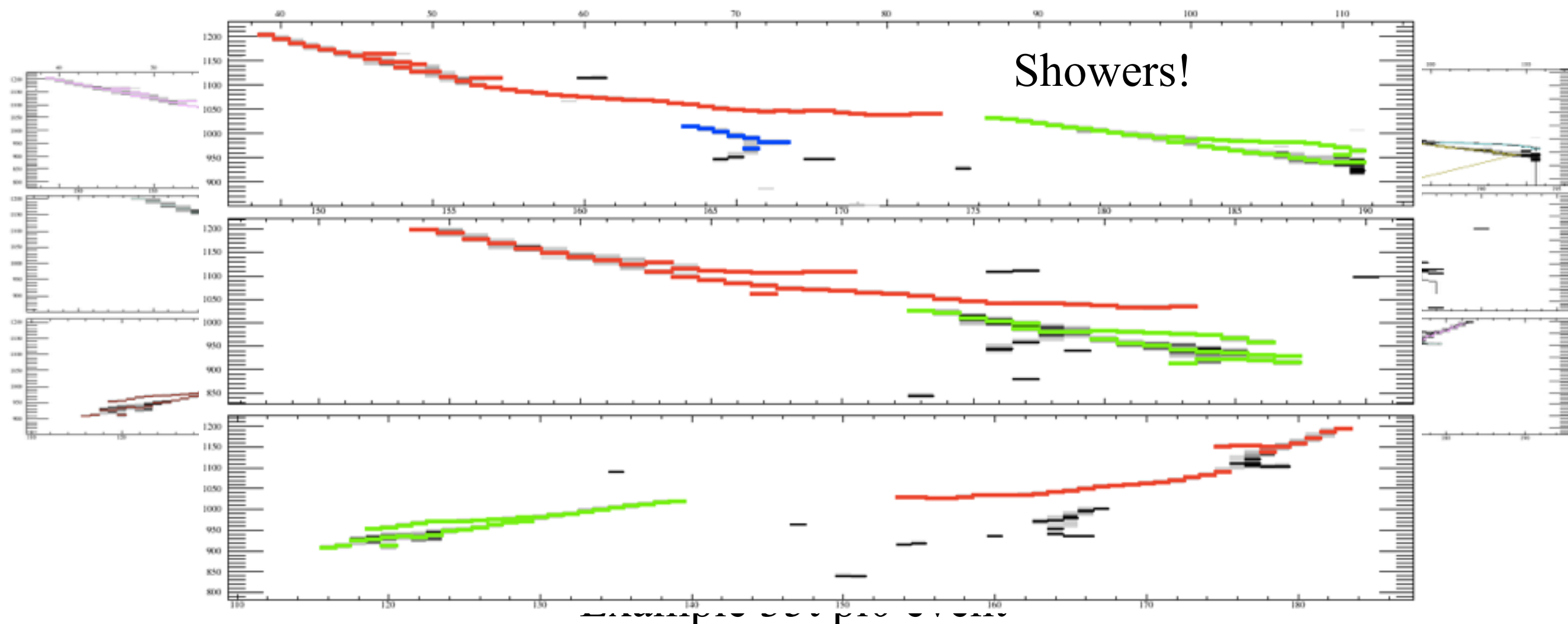


PMTrack

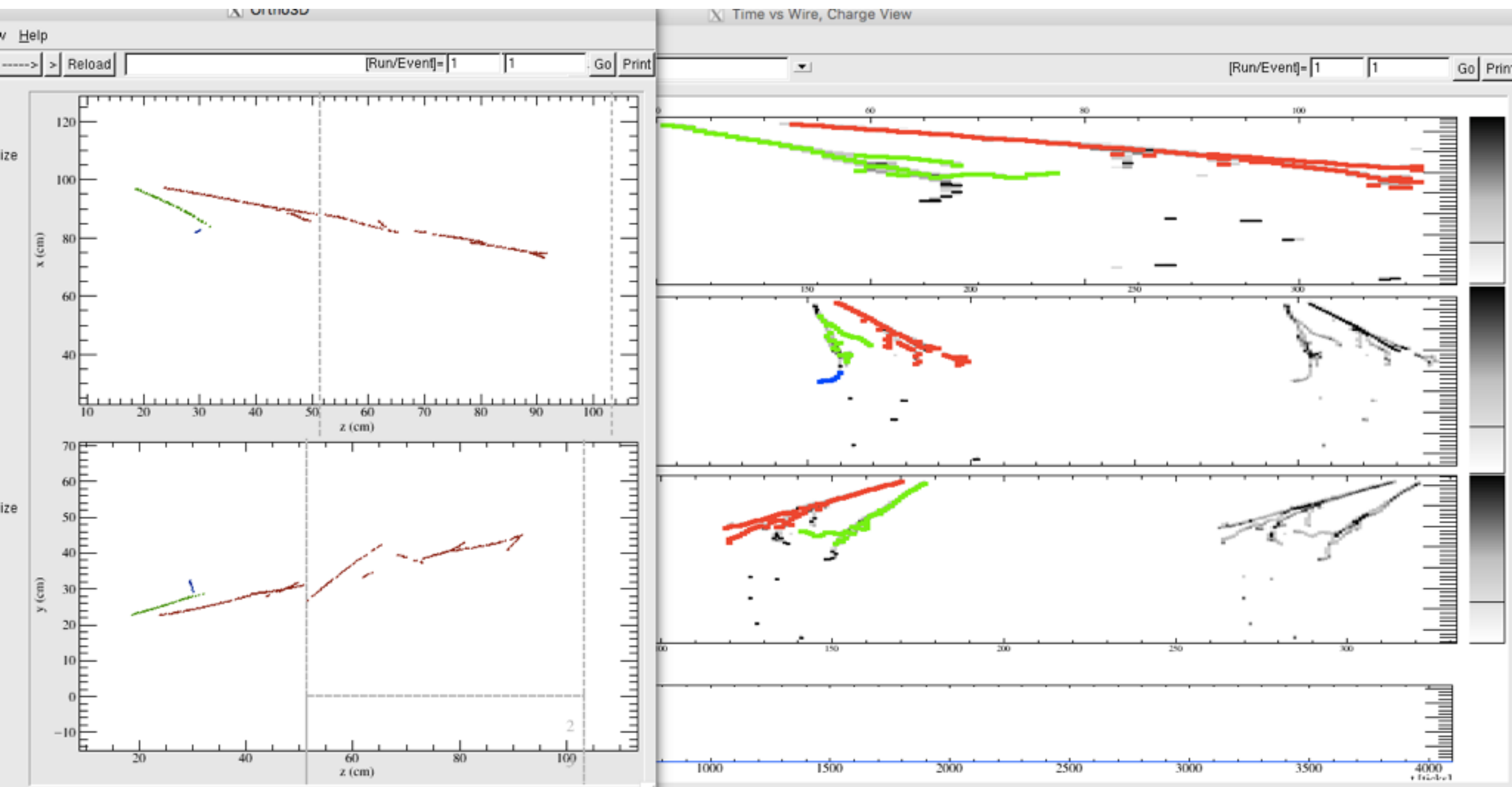
Example 35t π^0 event

Algorithm Details

- 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 form showers:

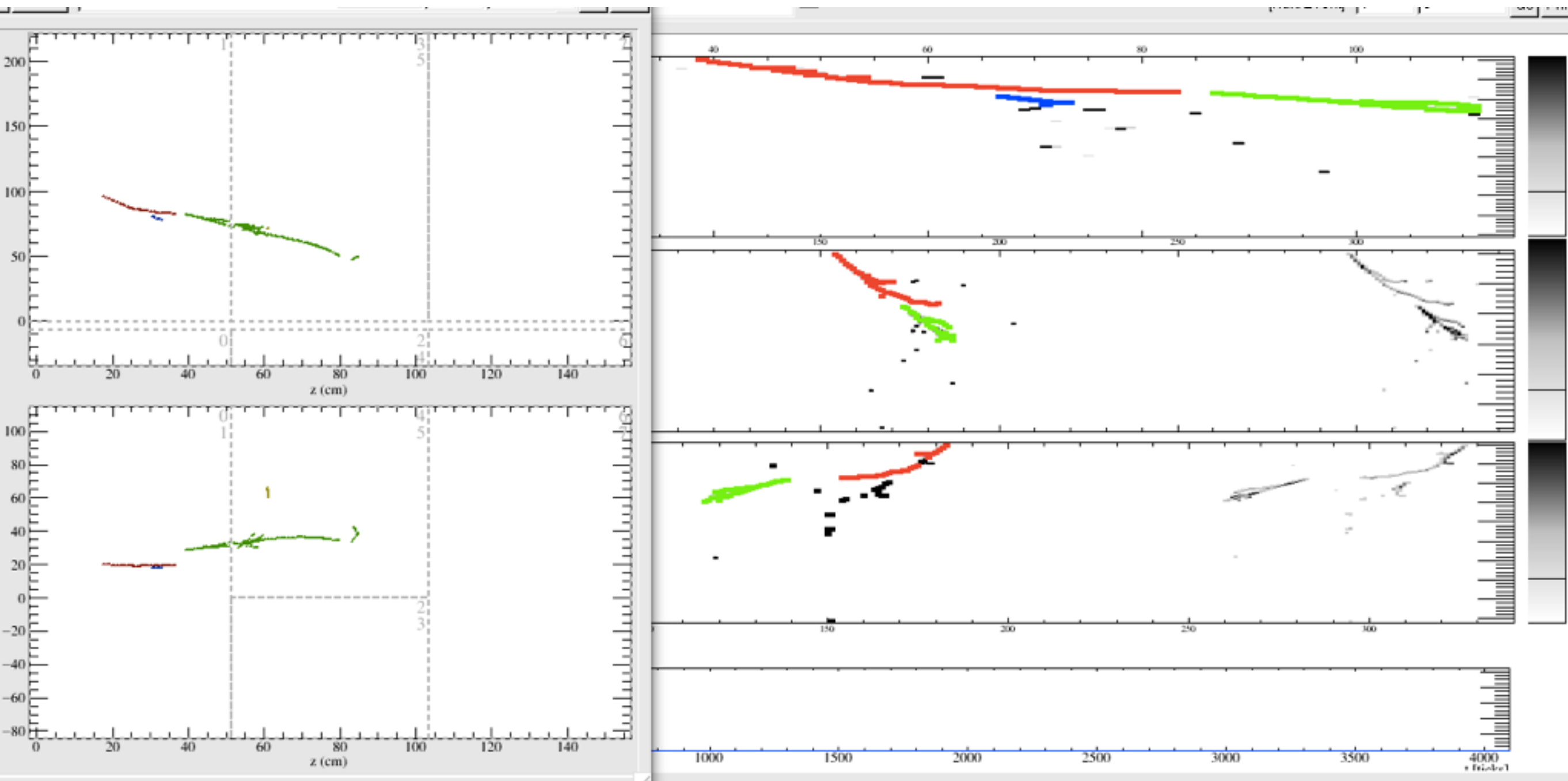


Example Events



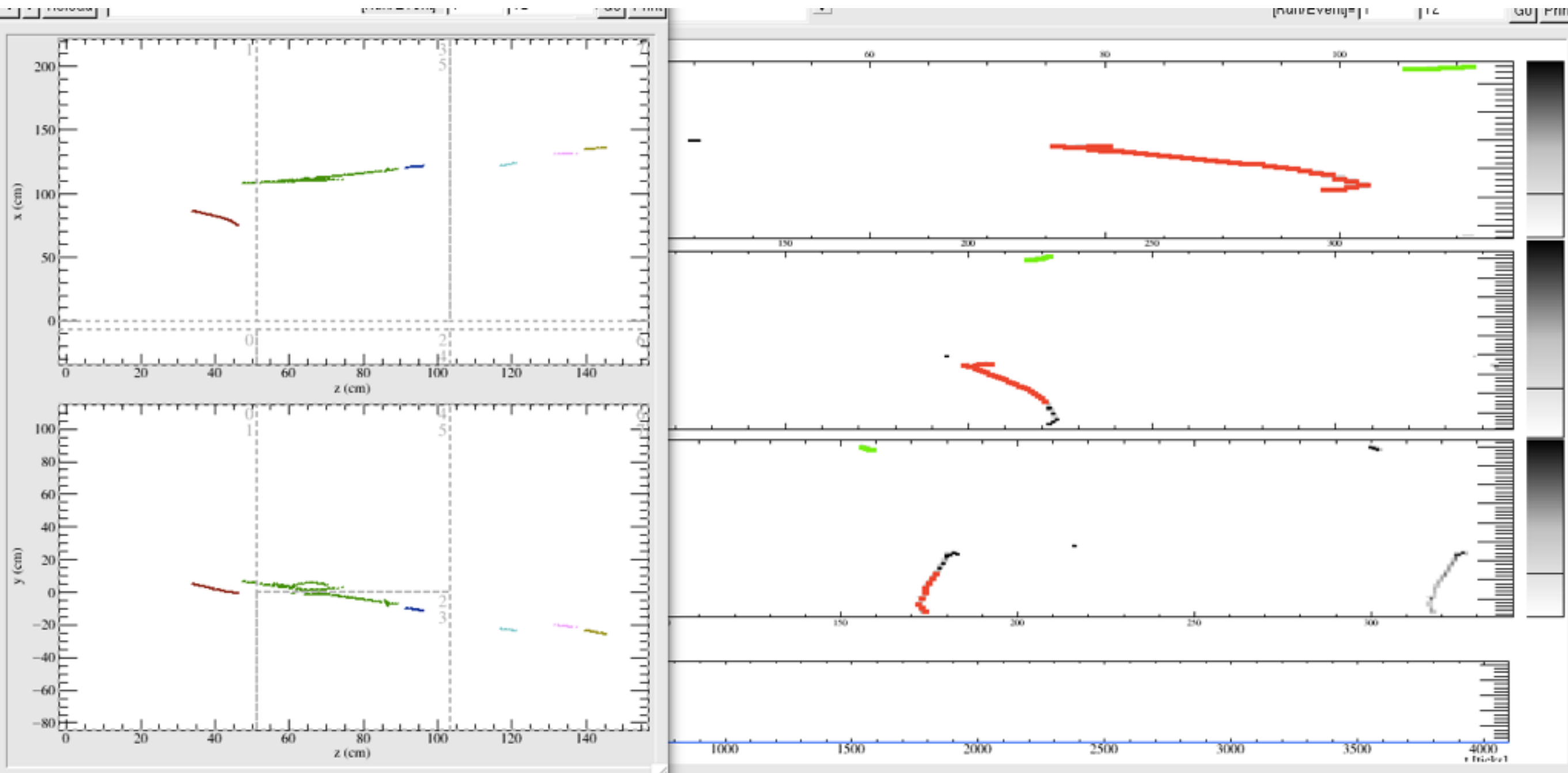
35t π^0

Example Events



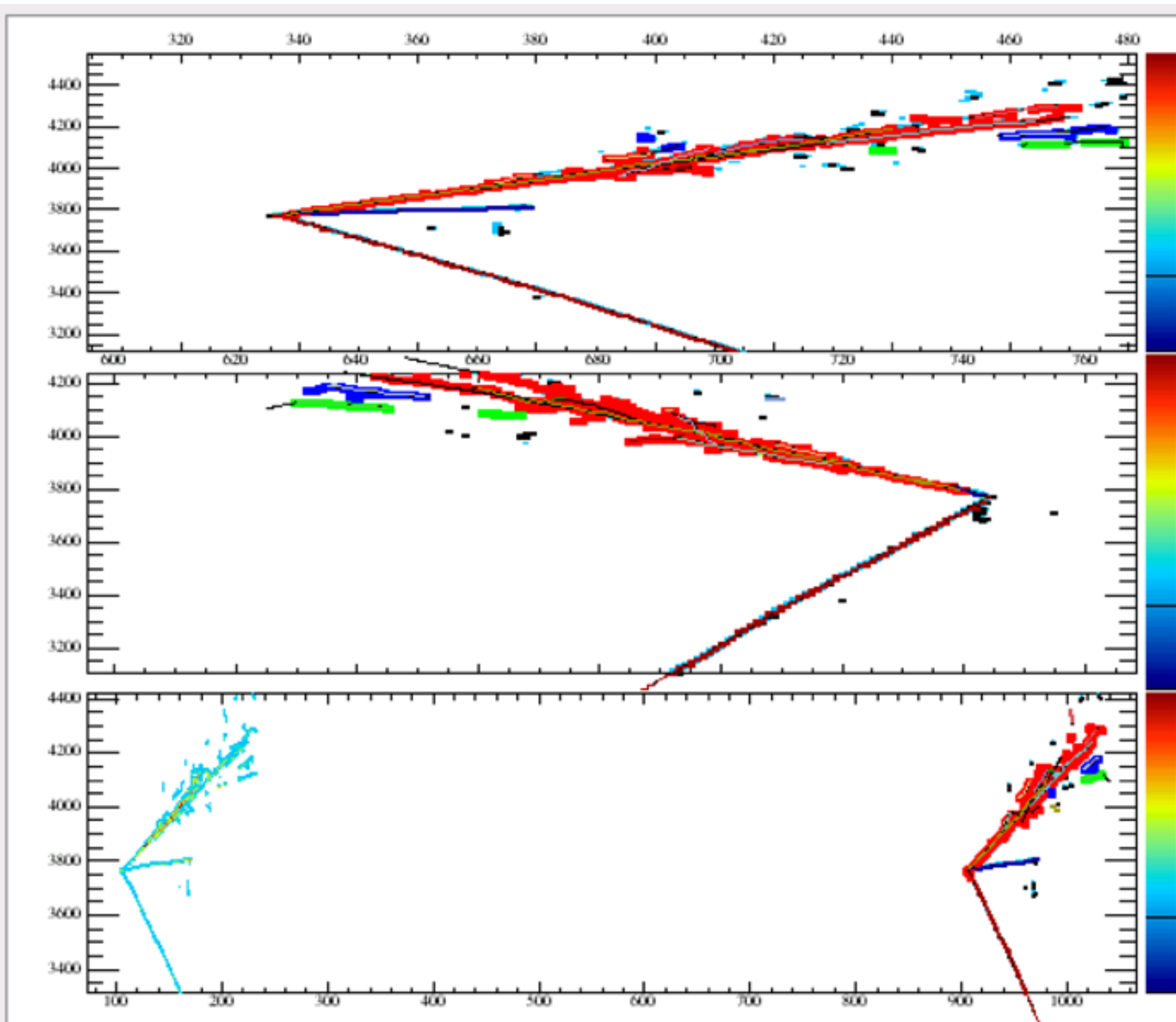
35t π^0

Example Events



35t π^0

Example Events



FD nueCC

Tingjun Yang

Shower Properties

- In the last few days, started writing algorithms to find the shower vertex (conversion point), initial direction and dE/dx etc.
- Will update more on this and show some validation plots in the next meeting.

Summary

- New EM shower module in LArSoft.
 - Now in develop; EMShower_module.cc
 - Configure using @local::dune35t_emshower or @local::dune10kt_emshower
- Showing good promise for both 35t and FD reconstruction.
- Initial development will (hopefully) finish this week! Then validation plots can be made.