

Showers Updates for DUNE MC Production

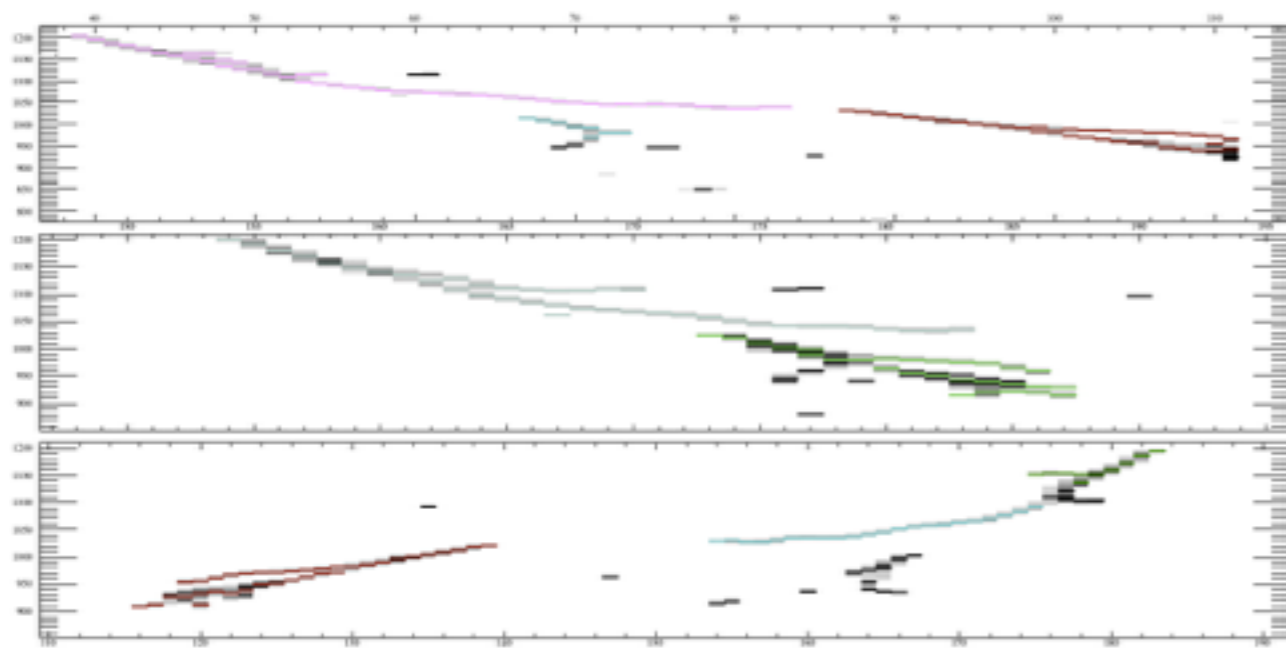
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17/11/2015

EMShower Updates

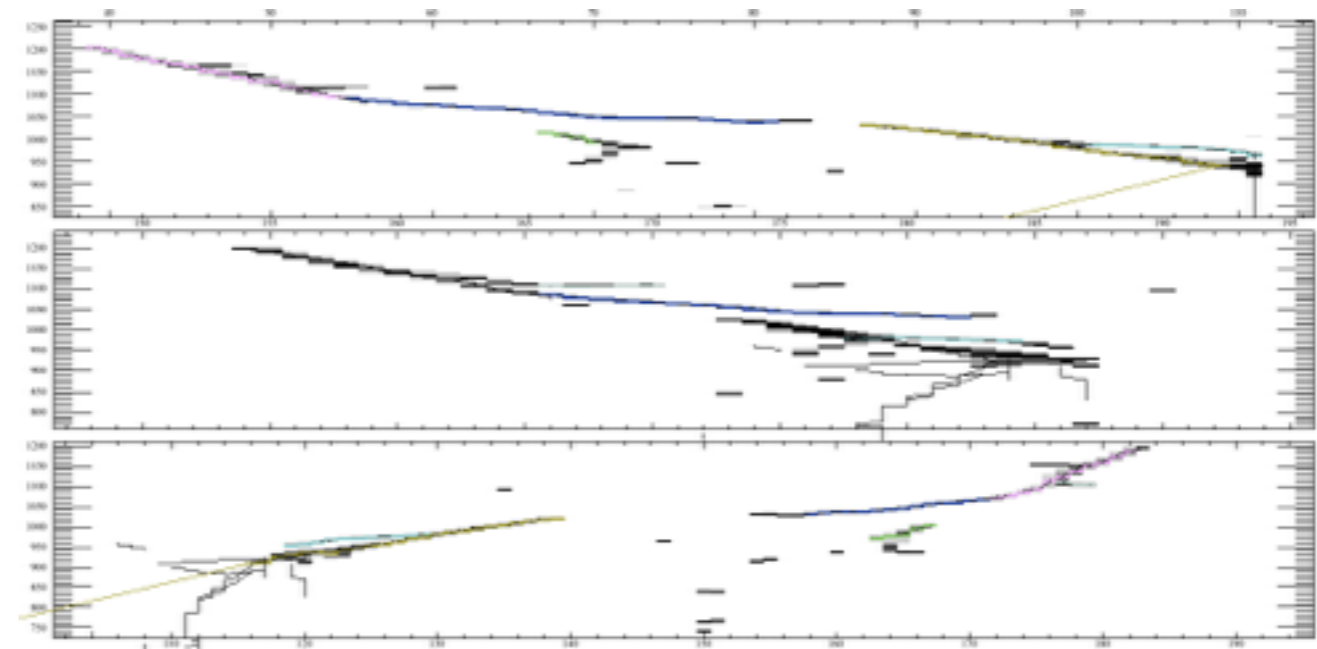
- Introduced EMShower in this meeting on 6th October:
<https://indico.fnal.gov/getFile.py/access?contribId=8&resId=0&materialId=slides&confId=10545>
- Haven't really improved the method but have been working on improving the reconstructed quantities of the showers;
 - Start point, direction, dE/dx , energy etc.
- Looking good; still need a lot of work.
- Will spend the rest of the time before the next MCC improving these shower properties further.

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 form showers:



BlurredCluster

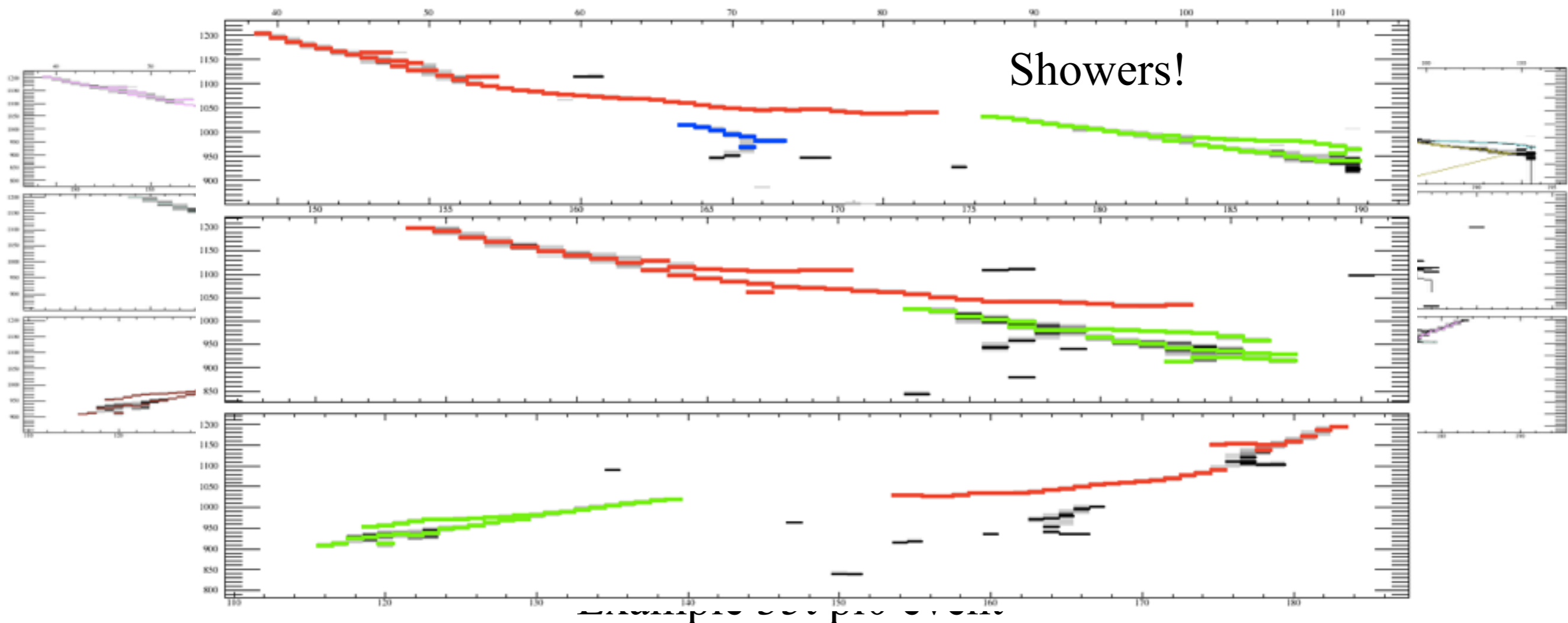


PMTrack

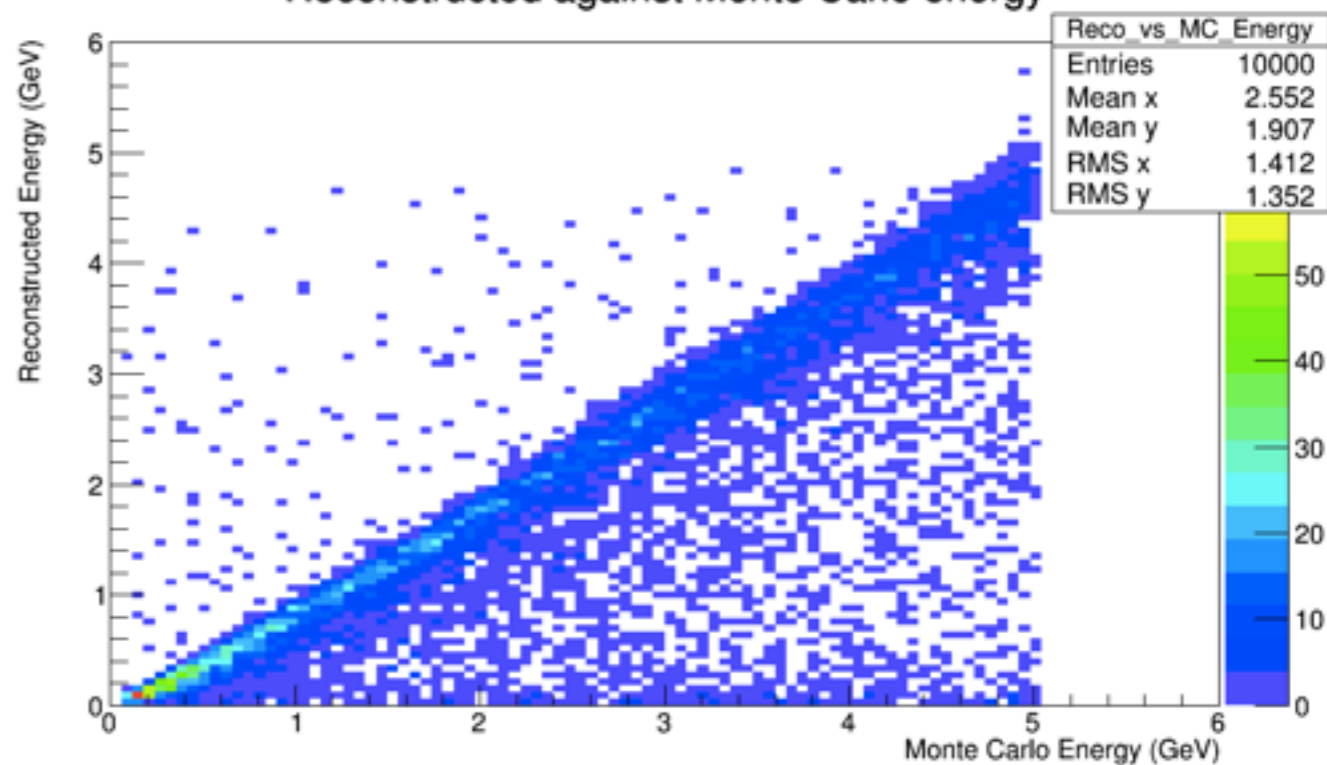
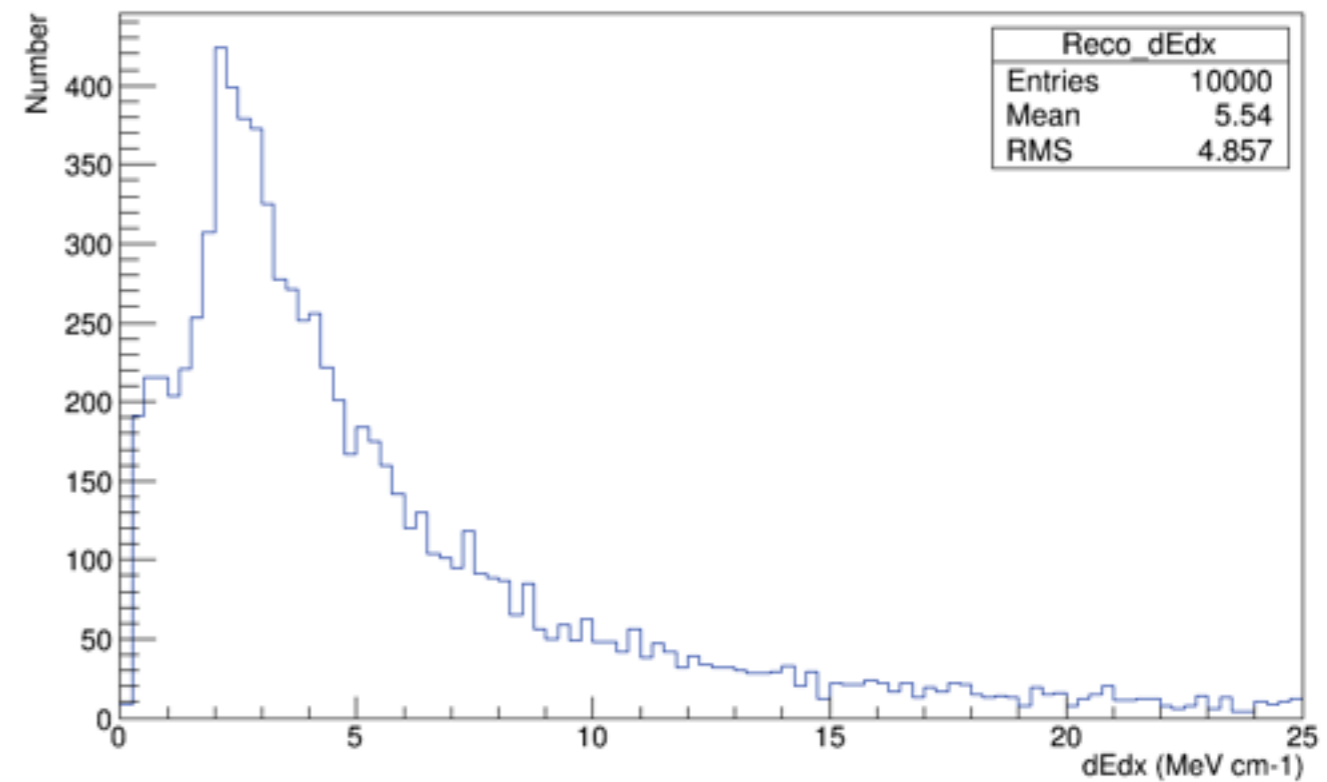
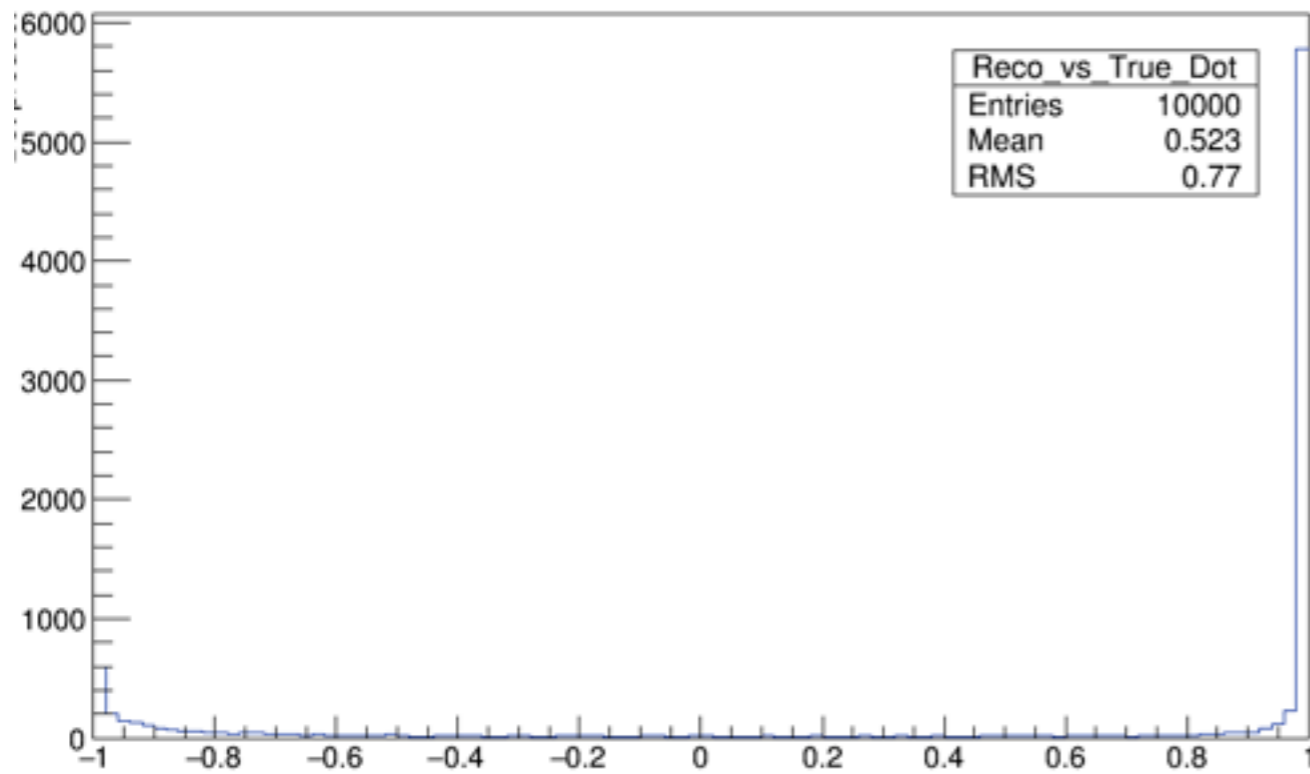
Example 35t pi0 event

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 form showers:



Shower Properties



- FD electron pg.
- Top left: trueDirection.(reconDirection)
- Top right: dE/dx
- Bottom right: recon v true energy

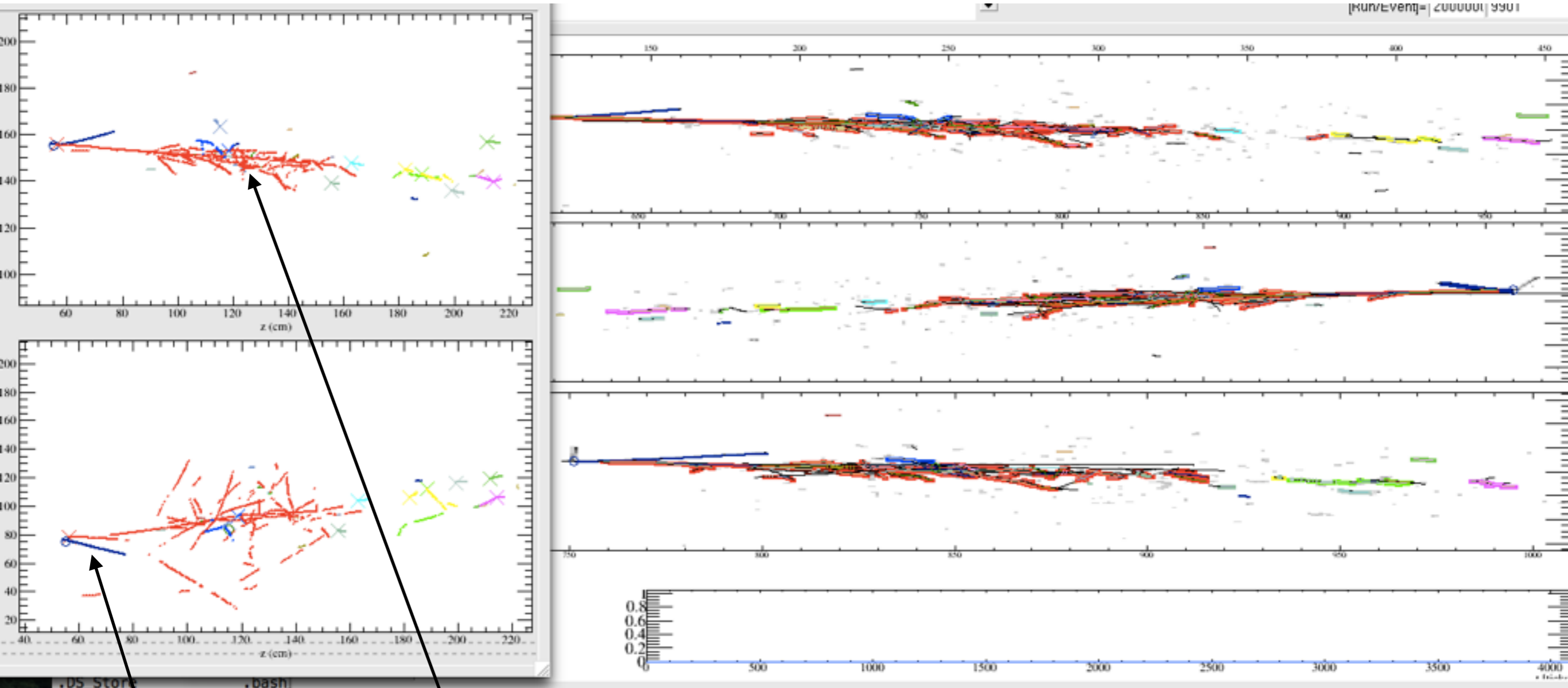
Other Improvements

- Made the shower energy determination a separate algorithm (so Dorota can use it):
 - `RecoAlg/ShowerEnergyAlg.(cxx/h)`
- This uses a linear function to convert the total charge from all the hits in a given plane to energy.
 - Different for each plane.
 - Using MC particle gun (photons), determined this function for dune35t and dune10kt.
 - Implemented in `RecoAlg/showeralgorithms.fcl`
- Also added an algorithm for track/shower separation:
 - `RecoAlg/TrackShowerSeparationAlg.(cxx/h)`
- All in develop.

Track Shower Separation

- Still in very early development.
- Basic aim for this week (for the MCC) is to be able to separation the hadronic tracks and lepton showers in DUNE FD nueCC events.
- Current algorithm:
 - Considers the interaction vertex (if it exists) and removes track-like objects which originate close-by.
 - Attempts to identify hadronic tracks upstream of any showers if no interaction vertex is found.
- Will be improved further this week, and beyond!

Track Shower Separation



Track

Shower

Summary

- Improved shower properties, and continuing to improve.
- Added alg for finding shower energy and have conversion for DUNE 35t and FD.
- Initial track/shower separation alg.