The University Of Sheffield.

New Showering Module: EMShower

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Thanks to Tingjun Yang
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Background

- Have been working on reconstructing pi0s for the DUNE 35t experiment;
  - Developed new clustering algorithm (BlurredCluster)
    - Now using these 2D clusters to make 3D shower objects.
- Original idea for this showering method was to perform all necessary reconstruction in 2D (form complete, but 2D showers), and then simply match between the views to make 3D objects.

Shower Module

- Consists of an art producer:
  `larreco/ShowerFinder/EMShower_module.cc`

- with an associated algorithm class:
  `larreco/RecoAlg/EMShowerAlg(.h/.cxx)`

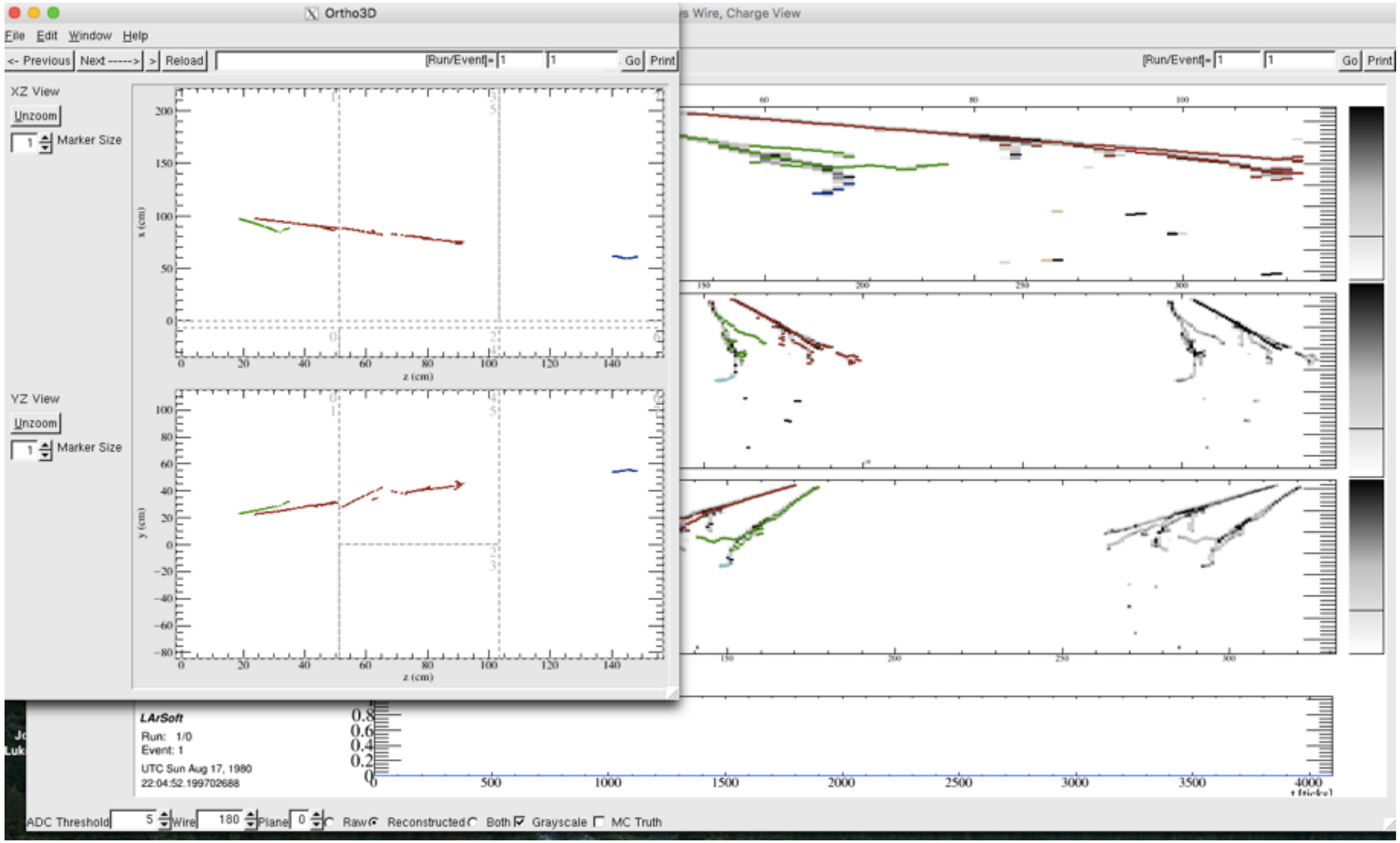
- Currently on feature branch
  `feature/wallbank_EMShowerToMerge`
  (N.B. NOT `feature/wallbank_EMShower`! This is old.)

- See also
  https://cdcvs.fnal.gov/redmine/projects/larreco/repository?utf8=✓&rev=feature%2Fwallbank_EMShowerToMerge

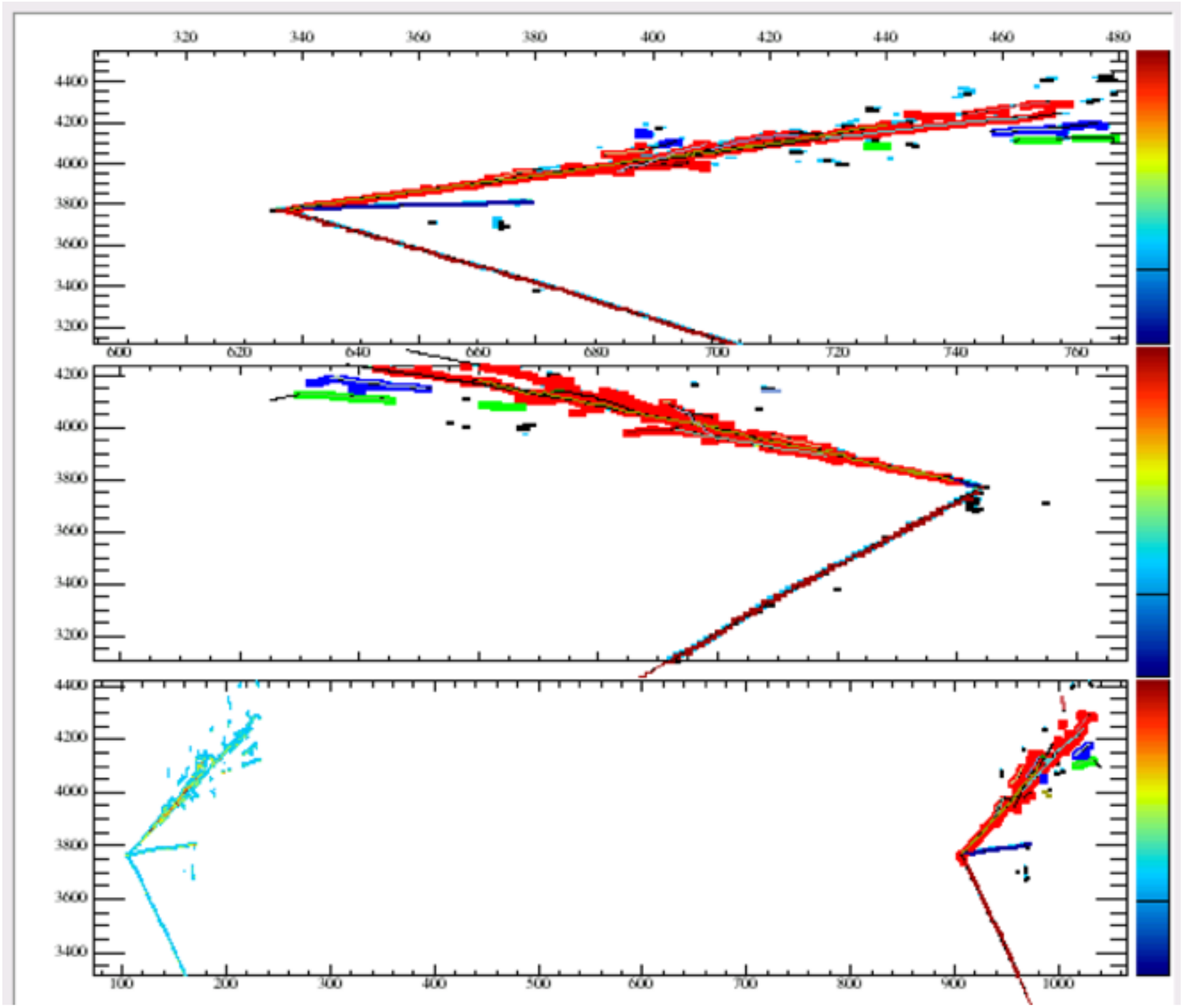
EMShower Algorithm

- The method takes as input from the event clusters and tracks which have already been found.
- It uses associations to match the 3D tracks and the 2D clusters in order to bring the clusters together to form shower objects:
  - Takes the tracks and finds the associated hits
  - Finds the clusters associated with these hits
  - Forms showers from these hits
    - Keeps associations with the tracks and space points

Performance: Example Event



Performance: Shower & Hadron track



Tingjun Yang

Shower Properties

- Just finished identifying the vertex and the initial track-like segment of the shower (useful for dE/dx and direction calculations).
- Methods also in EMShowerAlg.
- Vertex is found by:
  - identifying two ‘ends’ of the shower and attempting to reconstruct a track from each end to the centre of the shower,
  - using this track and the charge deposits to decide which ‘end’ is the true vertex.
- The track found will be used to determine further properties.

Conclusion

- The method seems to have promise (see previous slides) and has encouraged me to continue development.
  - Is not completed yet but hopefully will be in a few days.
- Since other reconstructions (e.g. Tingjun's far detector study, slide 6) are starting to use this, it would be much easier to put it in develop.
- No breaking changes etc.
- Can this be included in the next release?!