

3D RECONSTRUCTION

A QUICK STATUS UPDATE

Tracy Usher
August 28, 2014

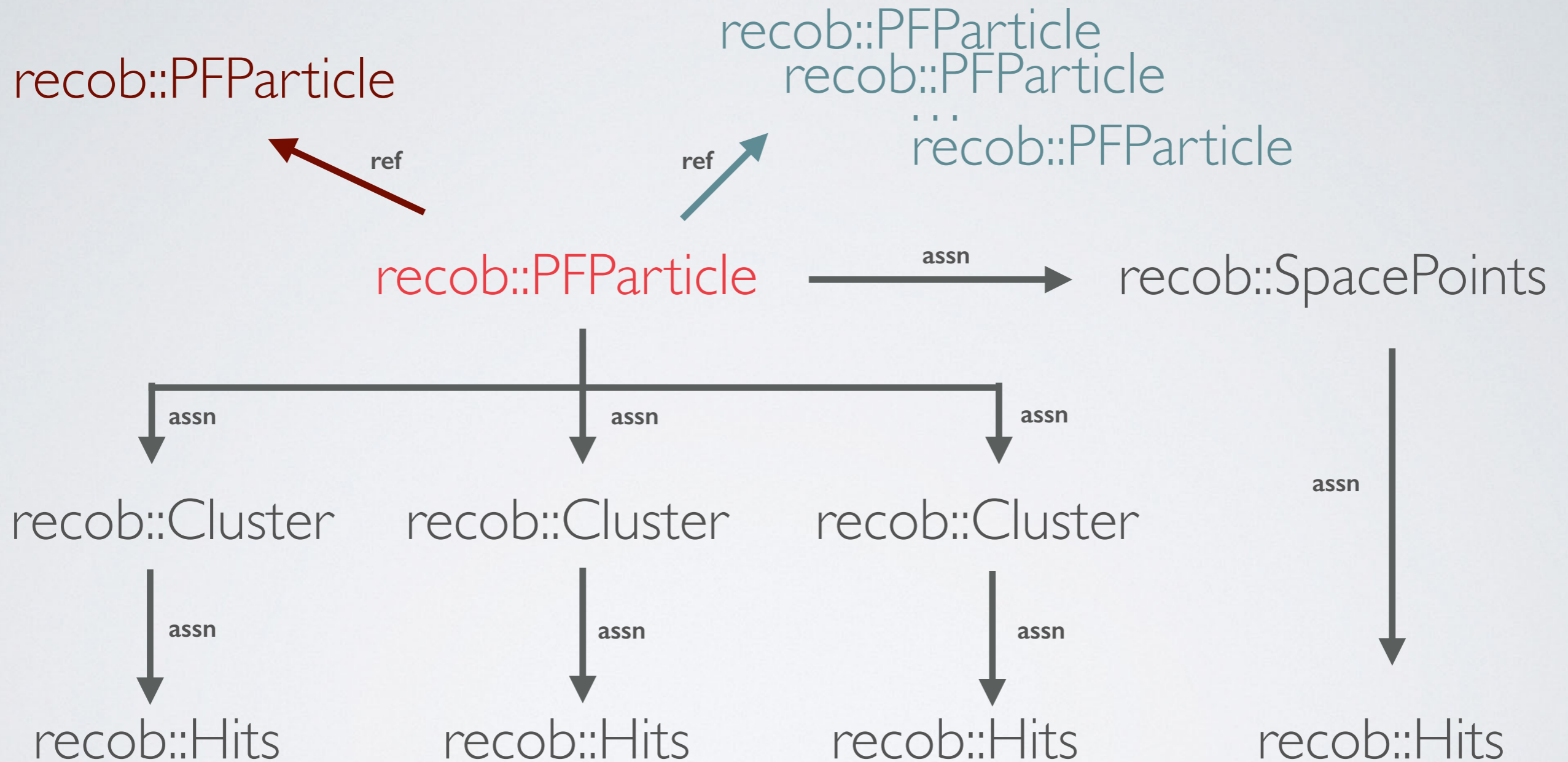
OVERVIEW

- A pedestrian's recap of Pandora in mcc 5
- A reminder of the PFParticle scheme
- Quick set of plots to show Pandora info is getting into art
- Track fits - the next step
- Some basic plots to demonstrate that the track fits are working
- Summary

QUICK PANDORA REMINDER

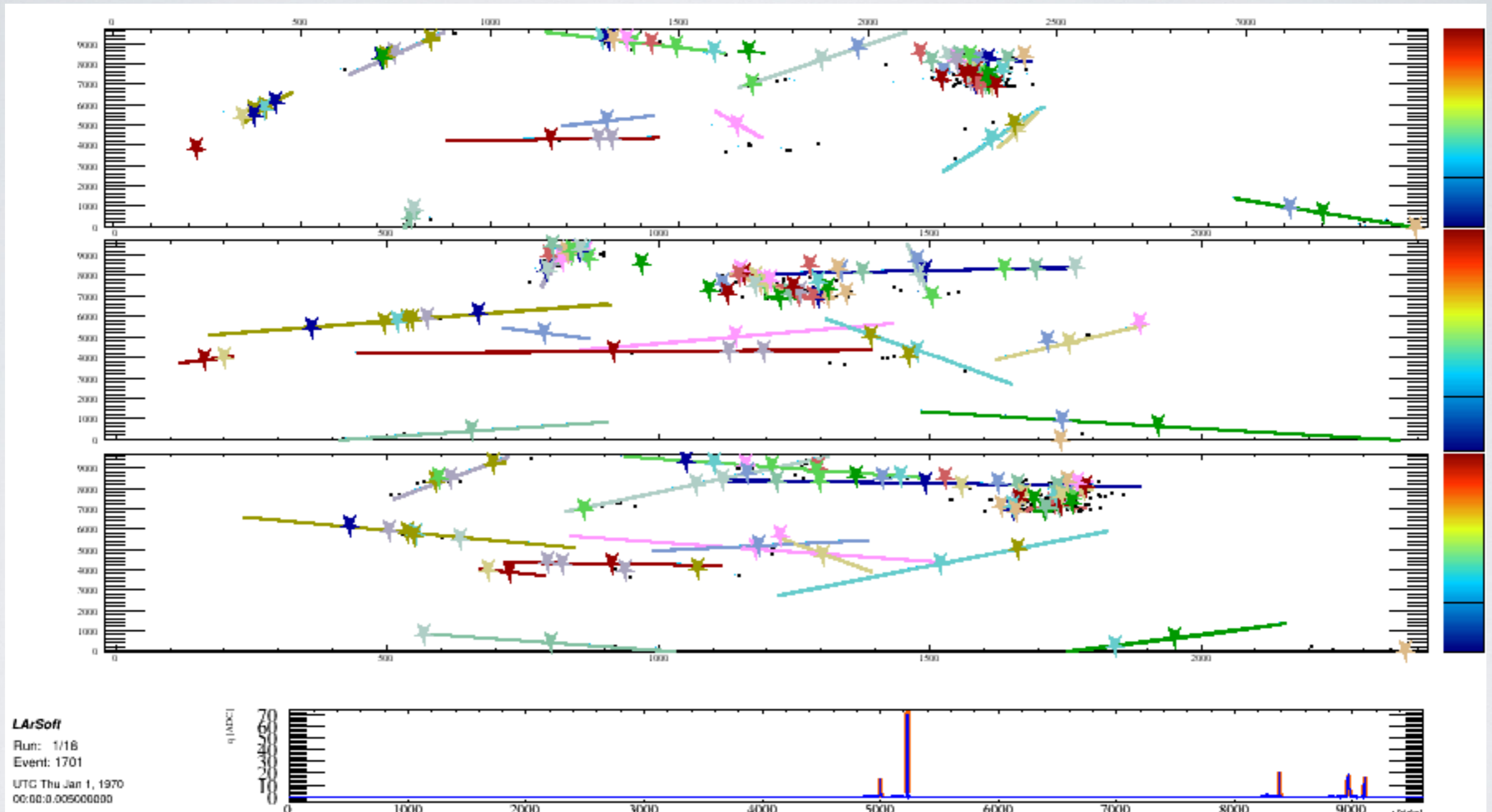
- New with MCC 5 is the 3D Pandora reconstruction
 - Within the Pandora framework:
 - Starts with cluster reconstruction in 2D
 - Mates the 2D clusters to build 3D particles
 - Produces a hierarchal structure of particles as its output
 - See Andy Blake's presentations at these meetings (e.g. docdb 3569)
 - Output of this hierarchal structure in art:
 - 2D hits associated to 2D clusters
 - 3D space points
 - Uses the new PFParticle object to tie it all together
 - Describes the hierarchal structure
 - Associates 2D Clusters to form 3D objects
 - Associates the 3D Space Points due to 2D hits in associated clusters

PFPARTICLE SCHEME



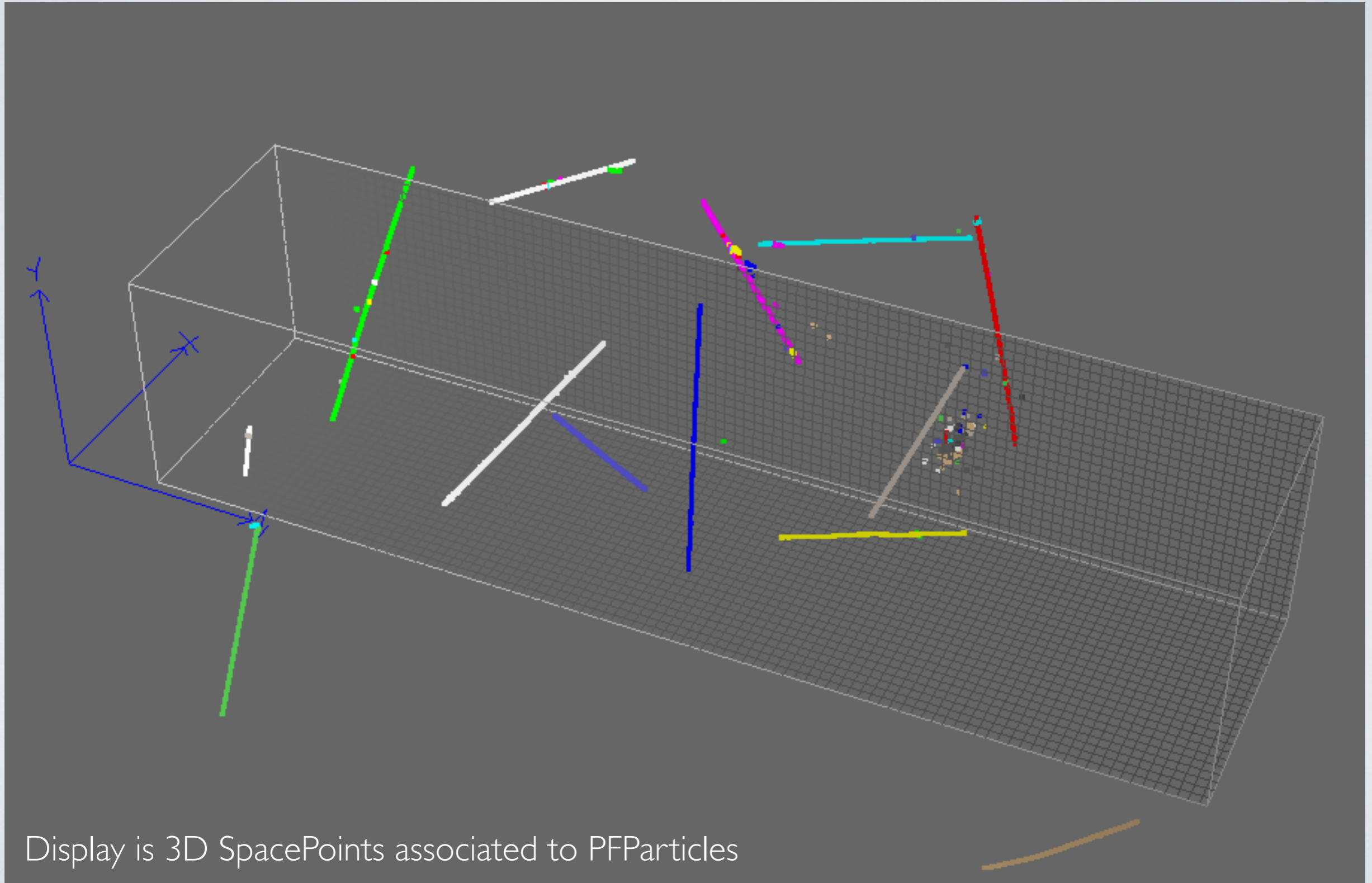
From Andy Blake's presentation - docdb 3598

WHAT IT LOOKS LIKE

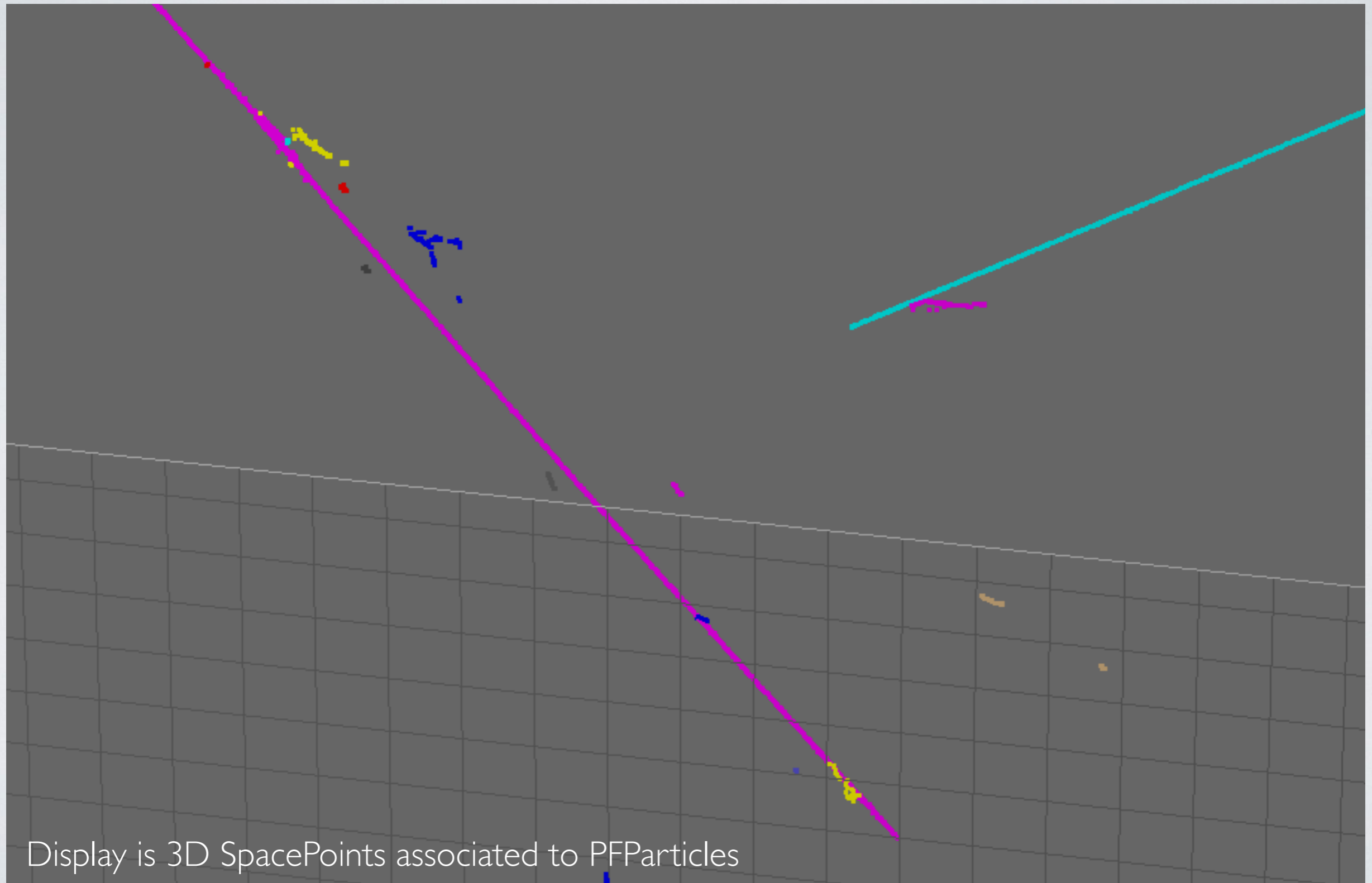


Each star in 2D plots above represent a PFParticle
(in most cases they are delta rays associated to longer tracks)

WHAT IT LOOKS LIKE



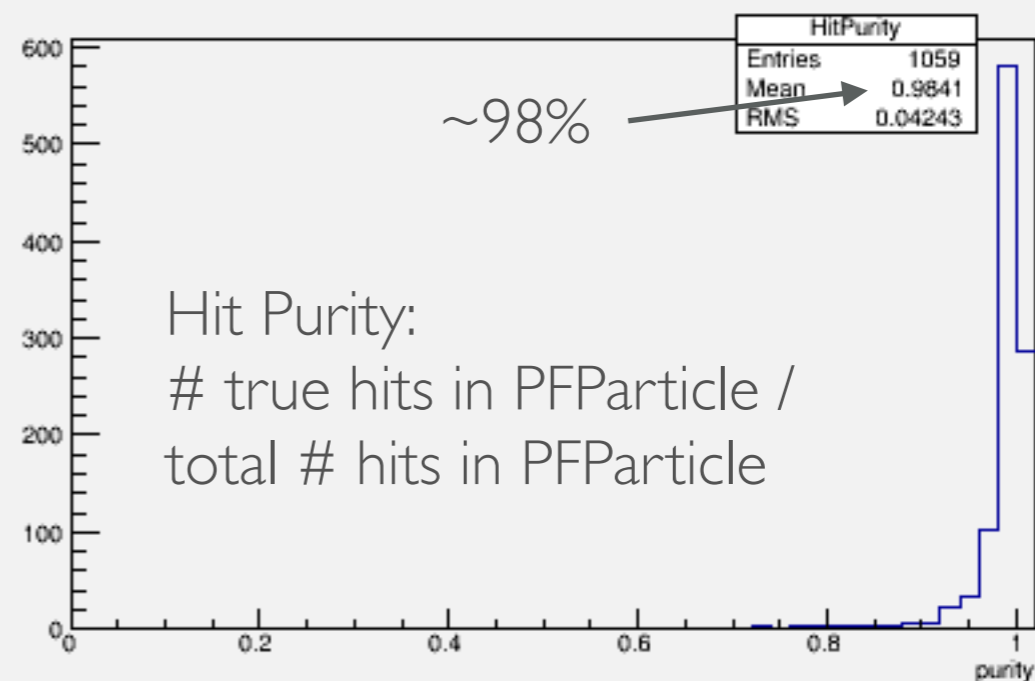
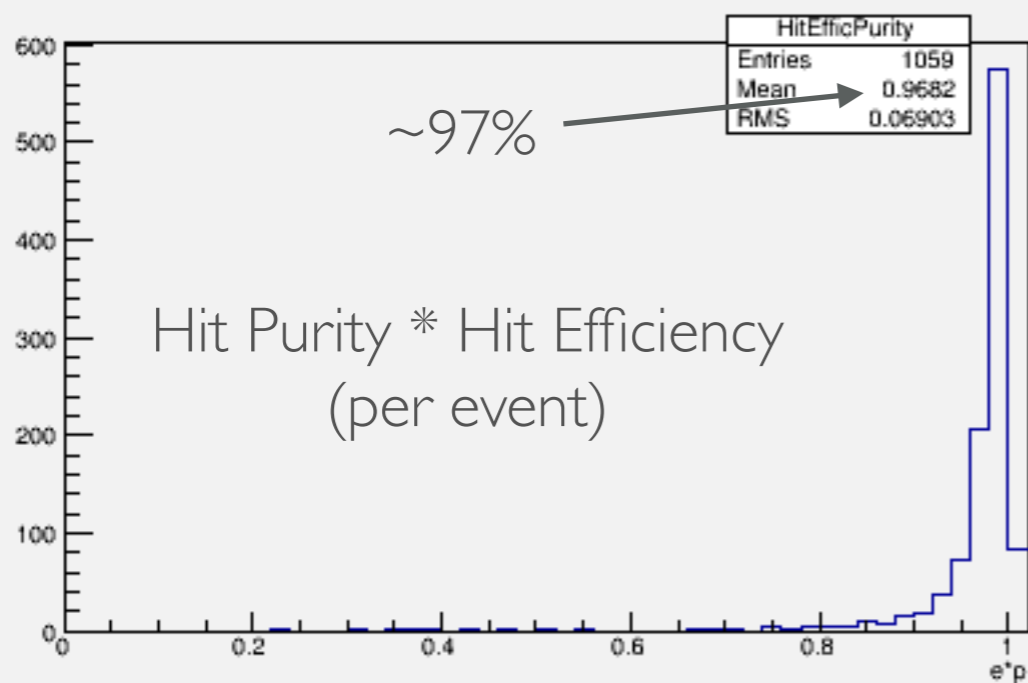
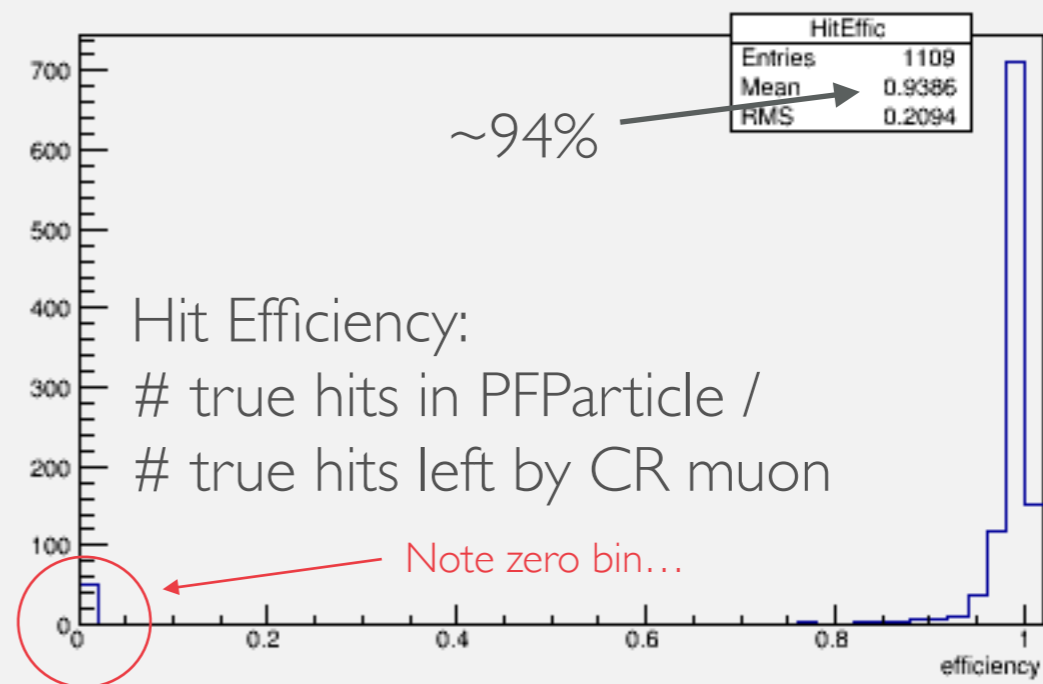
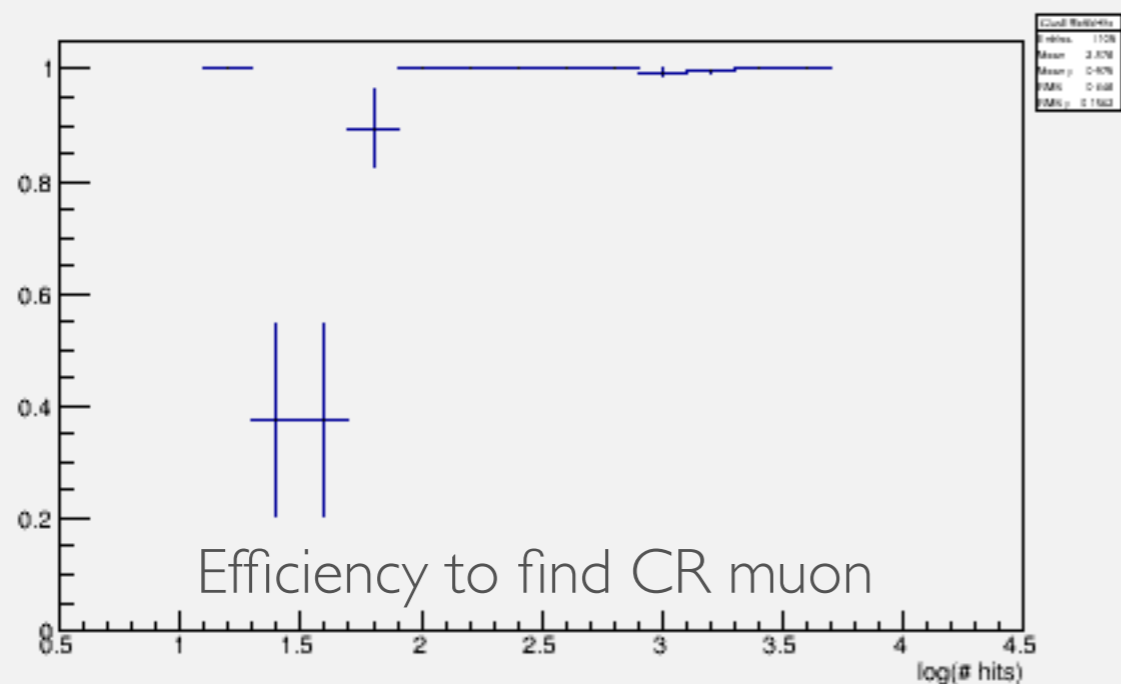
WHAT IT LOOKS LIKE



Display is 3D SpacePoints associated to PFParticles

BASIC PERFORMANCE

LOOKING AT CR MUONS ONLY



The Fine Print: Above plots intended as “proof of principle”, not true measure of current performance
Based on 100 events, the numbers are consistent with previous presentations

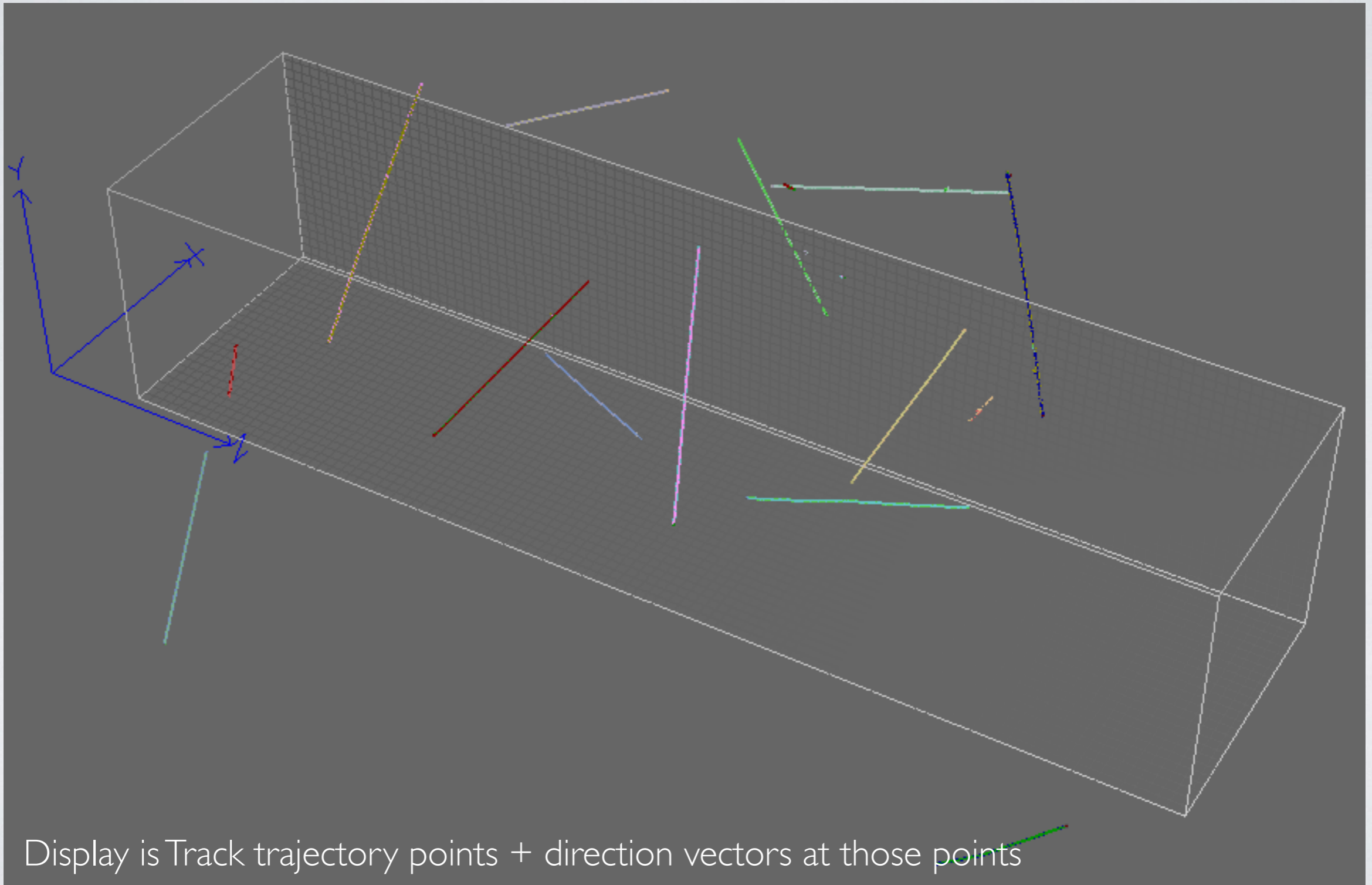
THE NEXT STEP

- Note that Pandora is a pattern recognition stage
 - Outputs are hits grouped into logical objects - e.g. tracks
 - It does aim to pattern recognize the entire event...
 - The hierarchal structure of PFParticles represents the particle decay chain
 - But its output is not the final reconstructed objects
 - tracks, showers, vertices, etc.
 - For MCC 5 there is no further reconstruction on the Pandora output
 - Primarily because no downstream code was ready to process the information
- The next step is to take the PFParticles output by Pandora and try to turn them into fit tracks
 - Immediate use: could then feed to CR finder to look for muons

PFPARTICLE TRACK FITS

- Start with Herb's Track3DKalmanHit_module
 - Fits 2D hits in all 3 views to produce 3D tracks:
 - Collects "all" 2D hits (either truly all or all from results of clustering)
 - Uses the SeedFinder to get candidate track start positions and directions
 - Loops over candidate seeds and tries to build tracks using a kalman filter finder/follower approach
 - Finishes when all seeds are looked at or list of available hits is exhausted
- Note that 2D hits associated to PFParticles already form a candidate track and it should not be necessary to "find" it again
 - Modify Track3DKalmanHit_module to group 2D hits associated to PFParticles in distinct groups
 - Loop over these groups of hits
 - SeedFinder only "sees" the 2D hits from one PFParticle on any given loop
 - Thanks to Herb for making this update available in larsoft v02_05_02

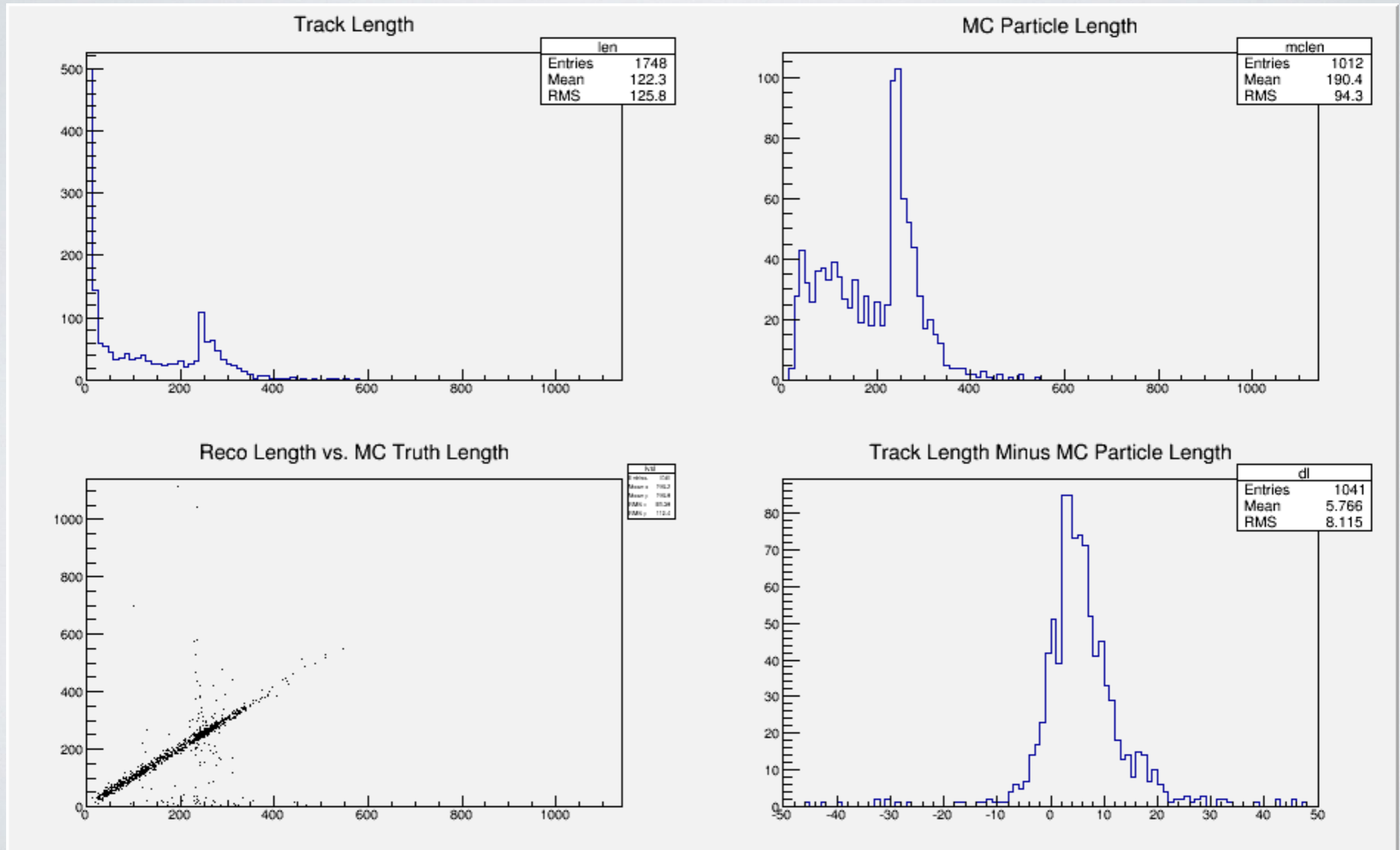
TRACK FITS - EXAMPLE EVENT



TRACK FITS - BASIC PERFORMANCE

OUTPUT OF TRACKANA_MODULE

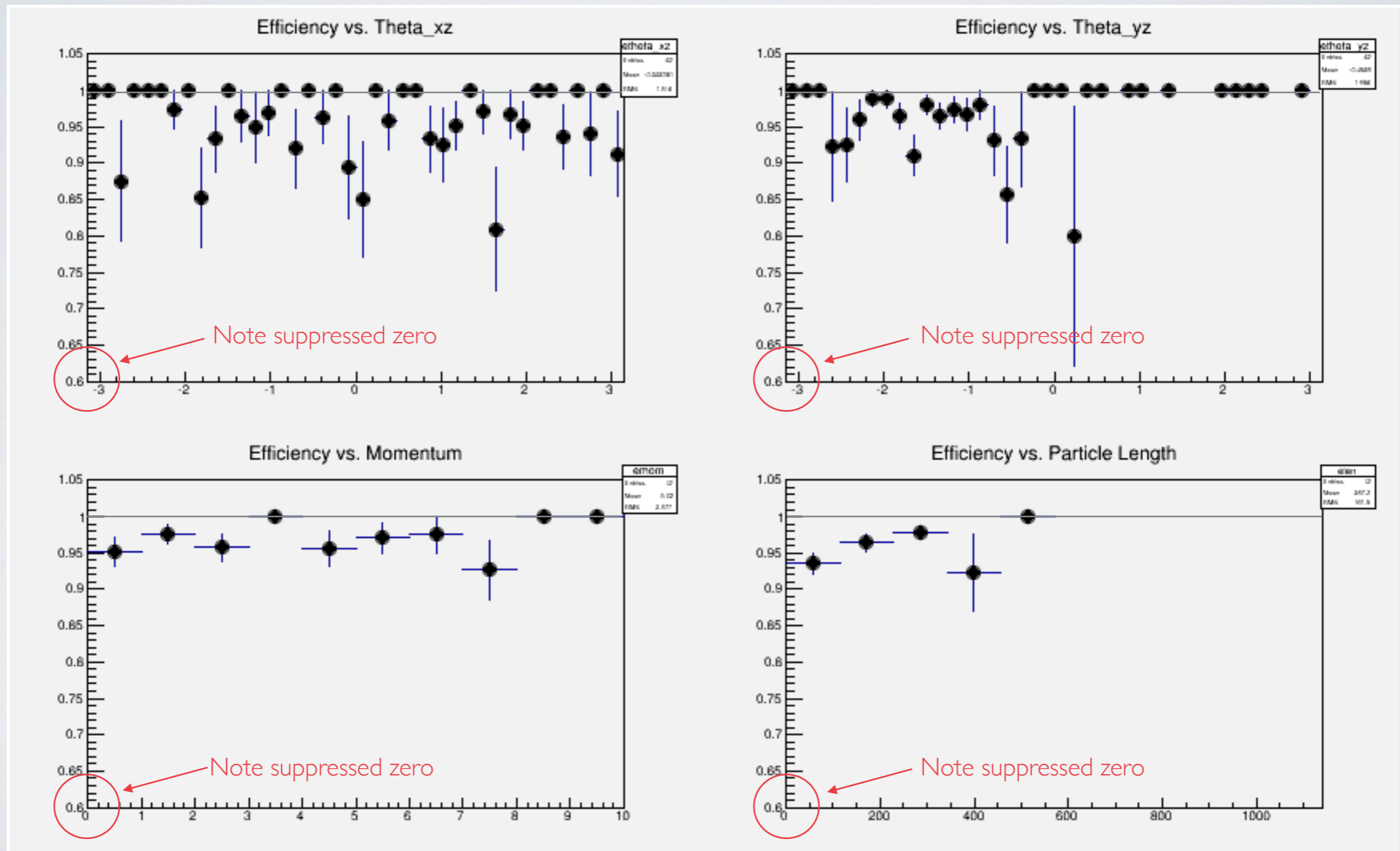
All Fit Tracks in Event



TRACK FITS - BASIC PERFORMANCE

OUTPUT OF TRACKANA_MODULE

All Fit Tracks in Event



PFPARTICLE SUMMARY/OUTLOOK

- MCC 5 makes the full Pandora reconstruction available in the art framework for the first time
 - Output accessed via the PFParticle hierarchal objects
 - Basic first look at performance in the art framework appears to be as advertised in the various Pandora presentations made to the AT group
- Thanks to Herb, now have the ability to produce fit tracks with the Pandora output
 - Though at the expense of running a “private” reconstruction job as it is not part of the MCC 5 reco3D reconstruction
 - And the basic first look of performance here looks promising as well
- Now the real work begins!
 - A good first task might be to feed the output of the track fits into the Cosmic Ray tagger...