Reconstruction Issues Exploration for HD Production

Ryan Cross

Where we are...

I gave a previous talk that showed the current look of some reconstruction metrics for Pandora with the new production validation files, comparing them to a non-refactored version of `dunetpc`.

There was an unexplained difference with the tracks, which I needed to look into. Showers were being affected by a different bug, so the issues there were less easy to spot.
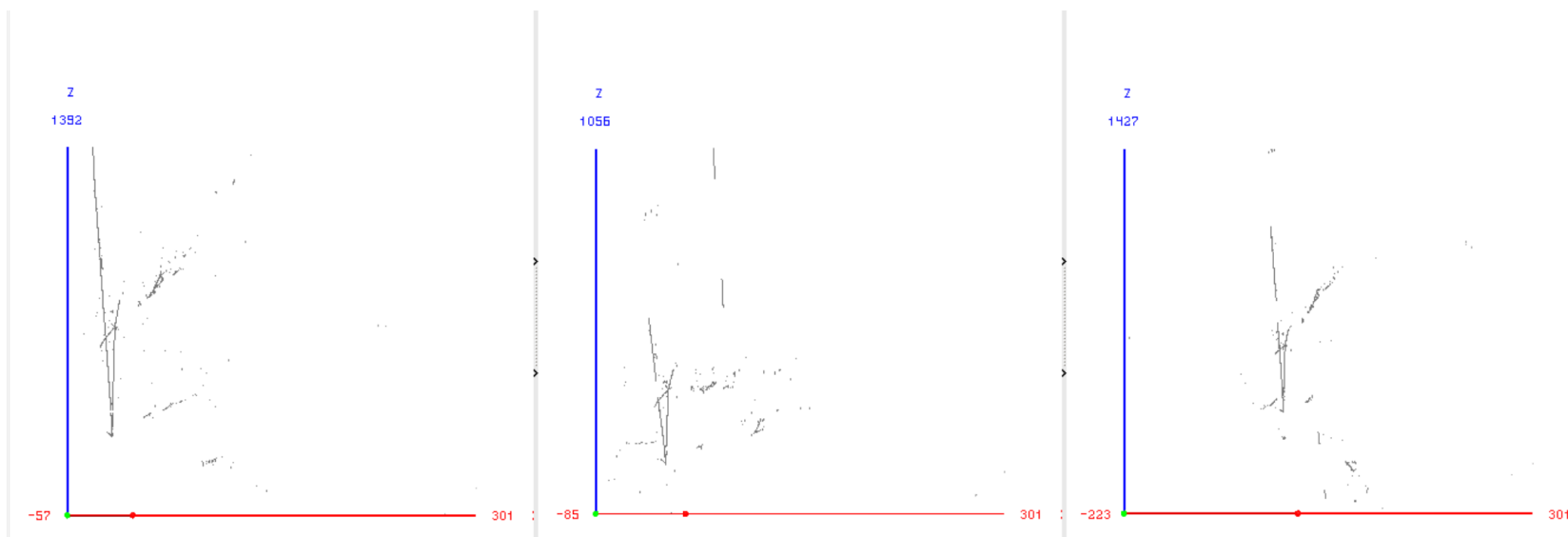
I've now been able to look into these issues, so can walk you through that exploration and the steps we've taken to figure the issues out.
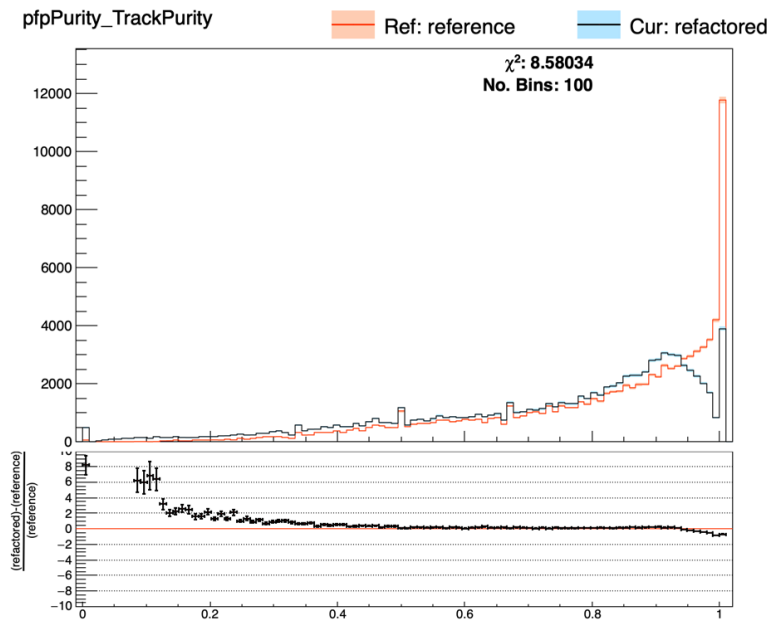

Previous slides are here.

Hand Scanning

First things first, I figured looking over some Pandora event displays to see if there was any obvious issues was the easiest first step.


W, U, V Views

3D Event Display

From this point on, I started to check various other parts of the reconstruction on Dom's advice, and testing out different reconstruction configurations, to start to track down the issue specifically. Any insights around this are useful!

First, checking if the 3D spacepoints from `spsolve` look sensible for the event.
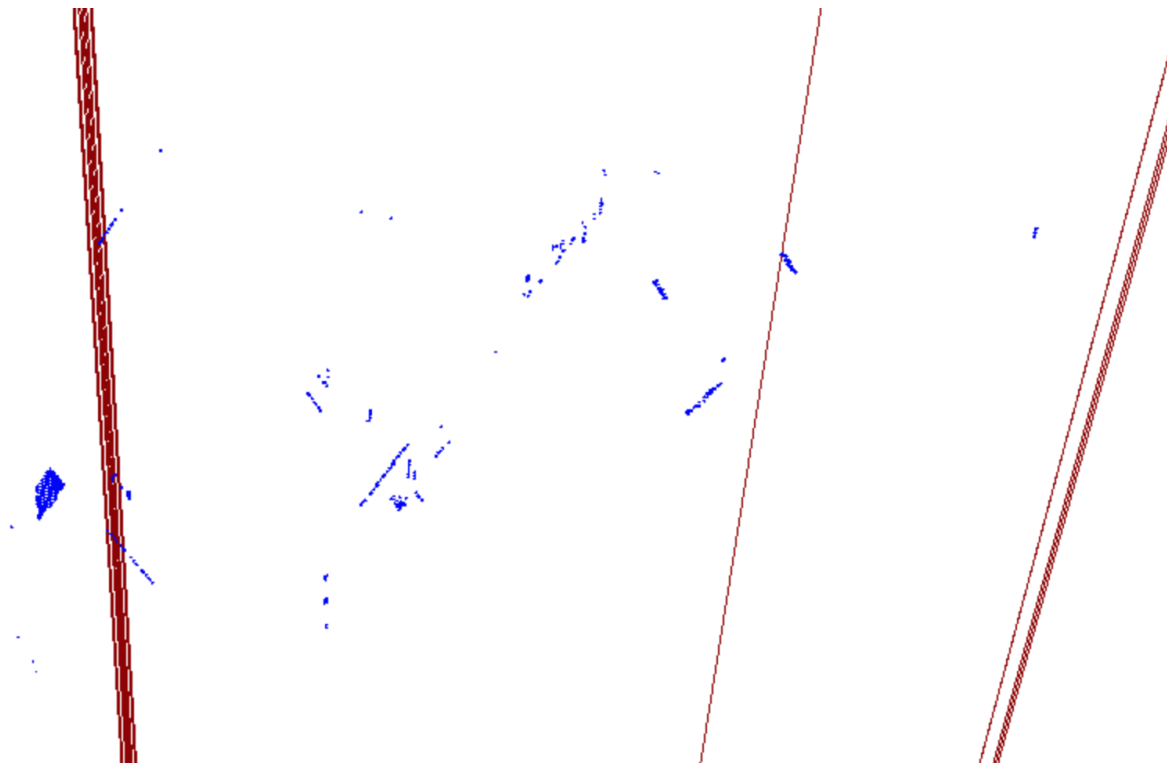
2D Offset

The 2D hits can also be checked, and Chris noted that there is an odd offset in some of the hits (notice that the hits in the bottom of this V/U view are offset uniformly, whereas the top hits cover the MC lines perfectly).
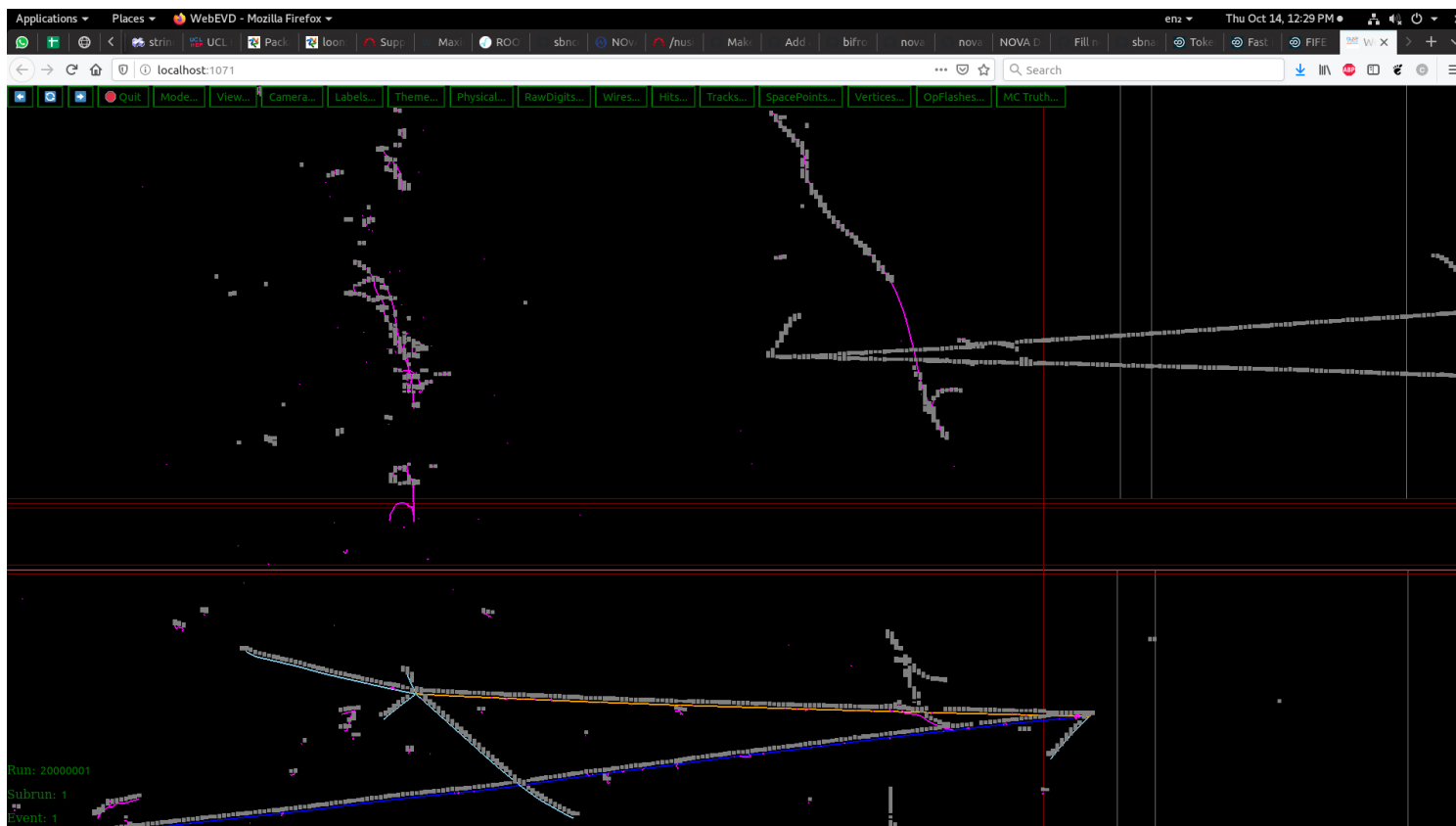
1D Simulation

After a quick sanity check of how `gaushit` looked, Dom suggested to look how the files looked if re-done with the 1D detsim fcl (since moving to the 2D sim is a big part of the upgrade for these new files). So the following plots are the same events but done with the `1dsimulation` and `1dsignalprocessing` FCLs.
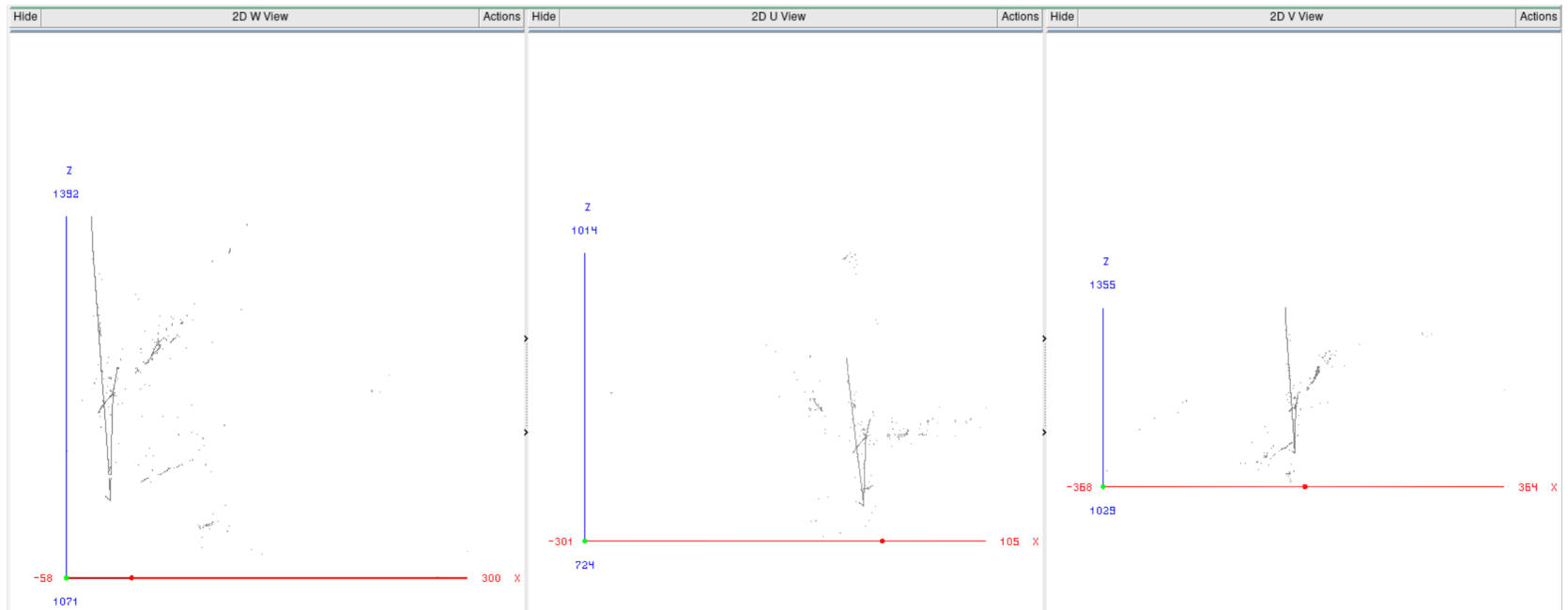
1D Simulation

Similarly, the `spsolve` output with the 1D path. This looks much better than the 2D version, where you can actually see where individual particles are etc.
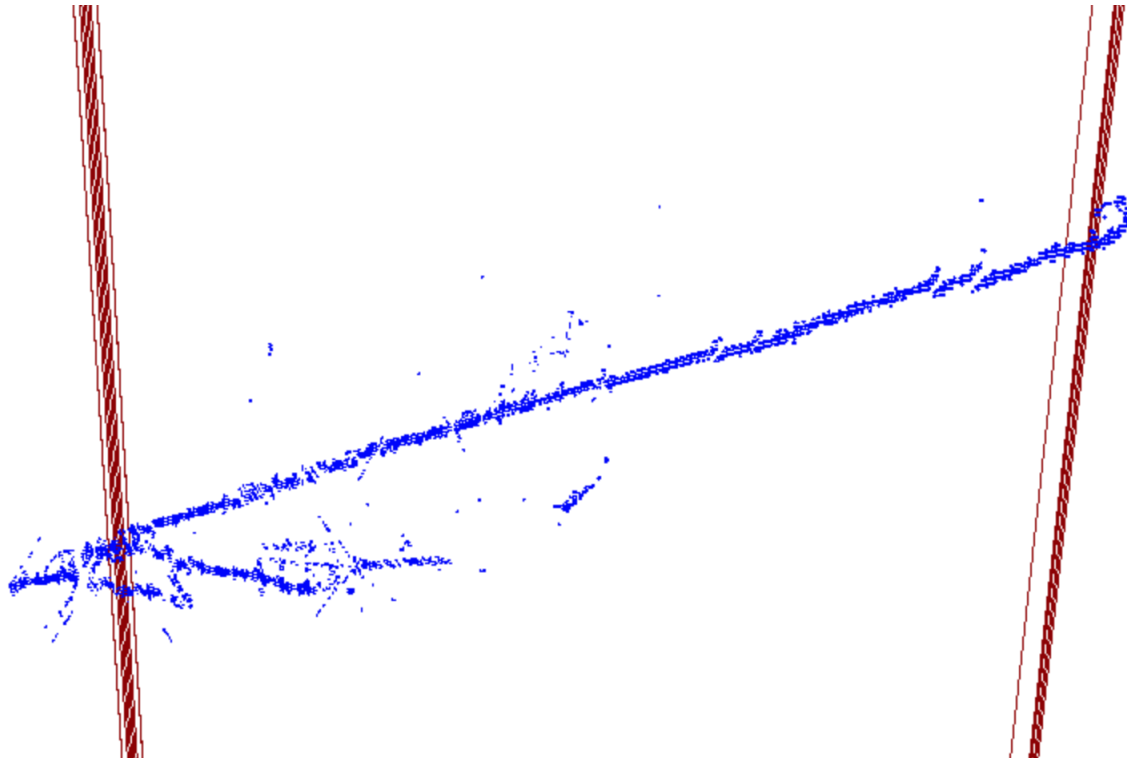
Timing Checking

After a further sanity check with `gaushit` in the 1D reco case (which was mostly unchanged), Dom suggested to check altering with the timing threshold in `spsolve`, bumping it up by a factor of 10 or so, to see if some form of timing offset was causing issues.
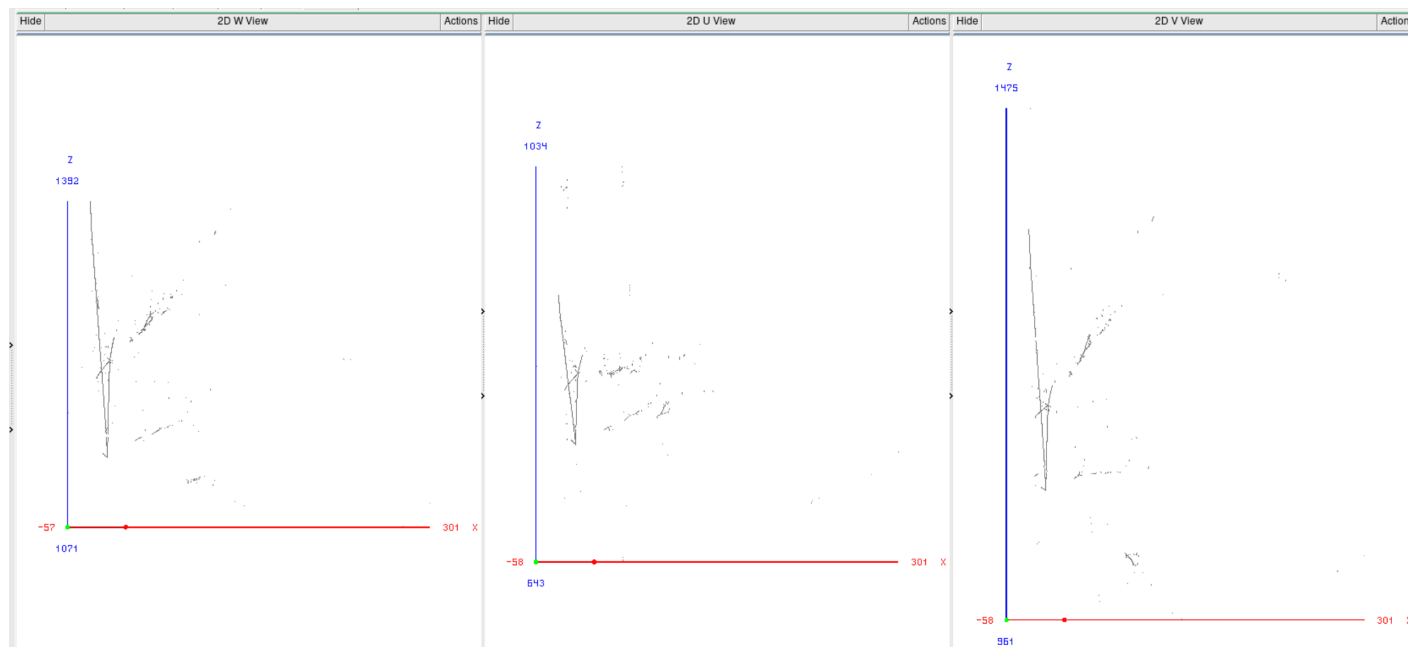
`WireIntersectThresholdDriftDir` to `3.0` not `0.3`.

Timing Checking

Similarly, checking the 3D spacepoints showed they are closer (though not perfect, which is fairly expected when you increase a threshold by 10x...).
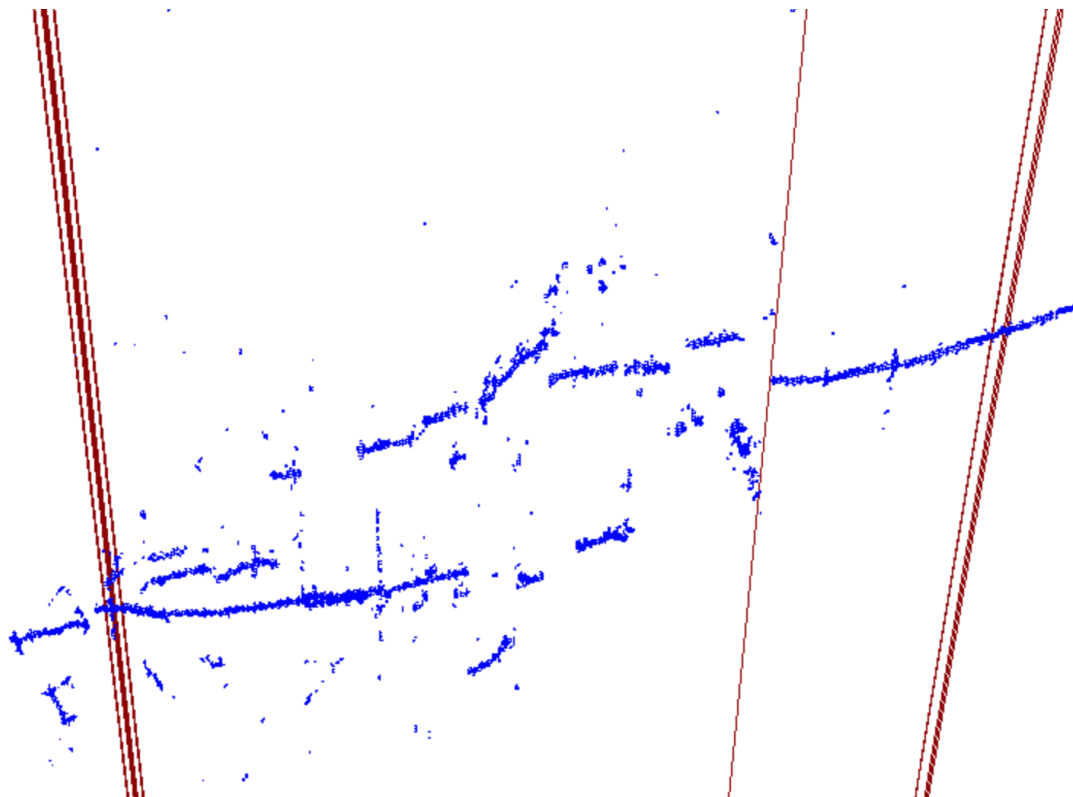
Where we are...

At this point, it seemed like there was some form of issue arising from an interaction between `wirecell` and `spsolve`.

There is a slack channel (`#lartpc_view_timing_offset`) with some discussion around this from the relevant parties.

There has been a few more points of testing:

- Check if the timing assumption (`wirecell` sets the timing of the deconvolved waveforms to be the same between the three planes, to reflect that we're looking at the same charge), causes any issues for `spsolve` by forcing the timing to be based on the collection plane: That didn't seem to change much of anything.

- Few more combinations of running:

  - 1D Sim -> 2D Reco
  - 2D Sim -> 1D Reco

Final Notes

Any other inputs would be appreciated! Once we get a sensible looking output, I can re-run the Pandora metric plots to compare the results again.

In the mentioned slack channel (`#lartpc_view_timing_offset`), there should also be some study of the deconvolved waveforms in an event by Haiwang, which all looks sensible.

That, plus the fact that `wirecell` and `spsolve` play nicely at PD SP is also an interesting point to consider...

Getting to the bottom of this means we can be closer to kicking a production of, but this is blocking currently.

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