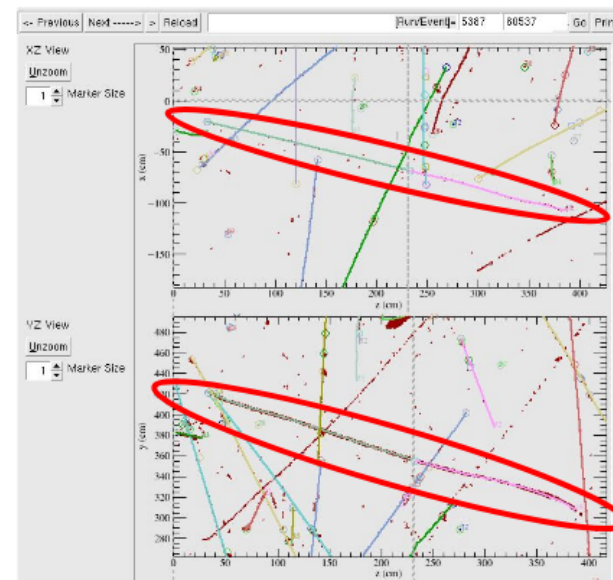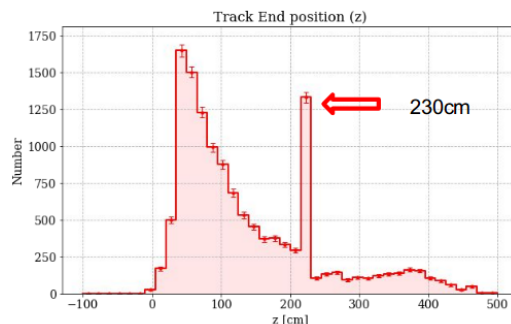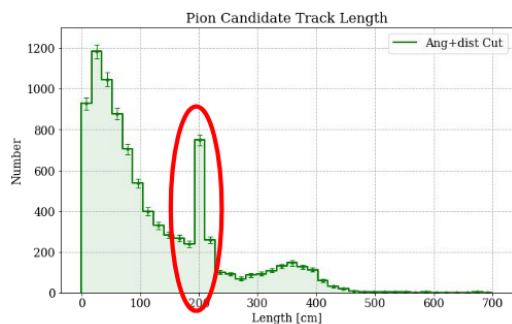# Looking Into Broken Tracks

Jake Calcutt

February 13, 2019

- Owen found a set of beam tracks that were "breaking" at the APA 3/2 transition
  - Run 5387 @ 1GeV
- I wrote a simple algorithm to identify these and to try to stitch together
 - Ran on same run

- Looks for a beam track ending "close" to the APA3/2 transition

    – Fcl parameter controls this

- Loops over the rest of the tracks in the event

    – Tries to find one on the opposite side of the APA transition

    – Within some fcl-configurable tolerance

- If found, saves the stitching candidate's track ID, start position, cosine, and the combined calorimetry

```
root [14] beamana->Scan("event:endZ:beamTrackID:stitchTrackID:stitch_cos_theta", "endZ > 220. && endZ < 240.")
***********************************************************************************
*    Row   * Instance *   Event   EndZ      BeamID StitchID  Cosine  *
***********************************************************************************
*        1 *        0 *    70064 * 228.54624 *        9 *       16 * 0.9950597 *
*       10 *        0 *    71022 * 229.44252 *       12 *          *           *
*       11 *        0 *    71043 * 228.16052 *       10 *       30 * 0.9856082 *
*       23 *        0 *    28003 * 227.19487 *        6 *       17 * 0.9441388 *
*       48 *        0 *   116451 * 229.18696 *       11 *       45 * 0.9491214 *
*       76 *        0 *     7922 * 228.35794 *        7 *       21 * 0.9983798 *
*       90 *        0 *     7110 * 228.68270 *        8 *          *           *
*       98 *        0 *     7348 * 228.70893 *       16 *       17 * 0.9041371 *
*      121 *        0 *    53384 * 220.92182 *       15 *          *           *
*      123 *        0 *    53428 * 228.43898 *       15 *       32 * 0.9794689 *
*      125 *        0 *    53579 * 228.45991 *       12 *       22 * 0.9544512 *
*      139 *        0 *    42189 * 227.93096 *       16 *       25 * 0.9247405 *
*      195 *        0 *    45503 * 228.70059 *        7 *       12 * -0.443149 *
*      205 *        0 *    44524 * 223.87413 *        8 *          *           *
*      210 *        0 *    45059 * 226.85305 *       14 *          *           *
*      211 *        0 *    45101 * 229.58577 *       11 *       33 * 0.9996384 *
*      227 *        0 *    23304 * 227.20059 *       13 *          *           *
*      231 *        0 *    23794 * 223.19537 *       16 *       73 * -0.245564 *
*      252 *        0 *     8996 * 230.67530 *       19 *          *           *
*      255 *        0 *     9073 * 228.80604 *        7 *       29 * 0.9862245 *
*      258 *        0 *     9315 * 228.59693 *       12 *       13 * 0.9845603 *
*      260 *        0 *     9482 * 228.99264 *       10 *        9 * 0.9609715 *
*      267 *        0 *   108794 * 228.95478 *       11 *       30 *      -nan *
*      299 *        0 *    18884 * 229.11219 *       13 *          *           *
*      300 *        0 *    19075 * 233.72424 *       55 *          *           *
Type <CR> to continue or q to quit ==>
```
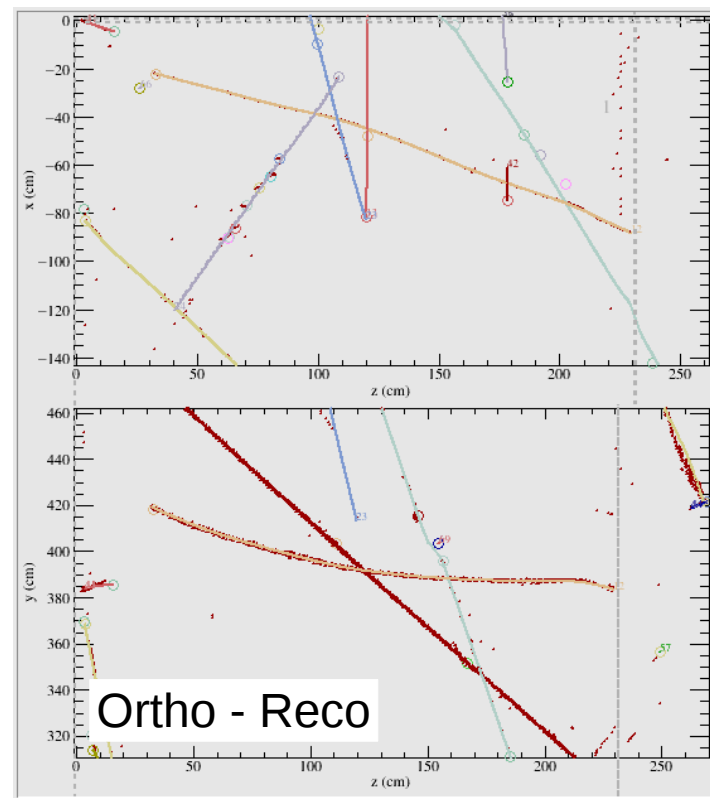
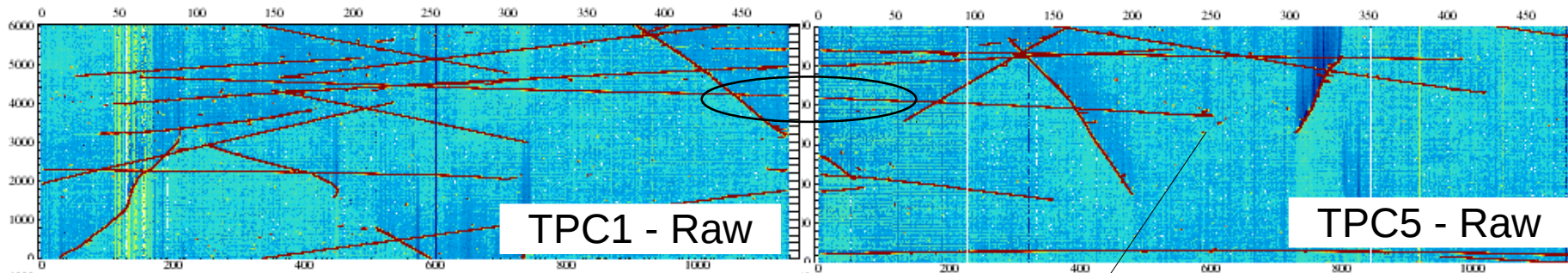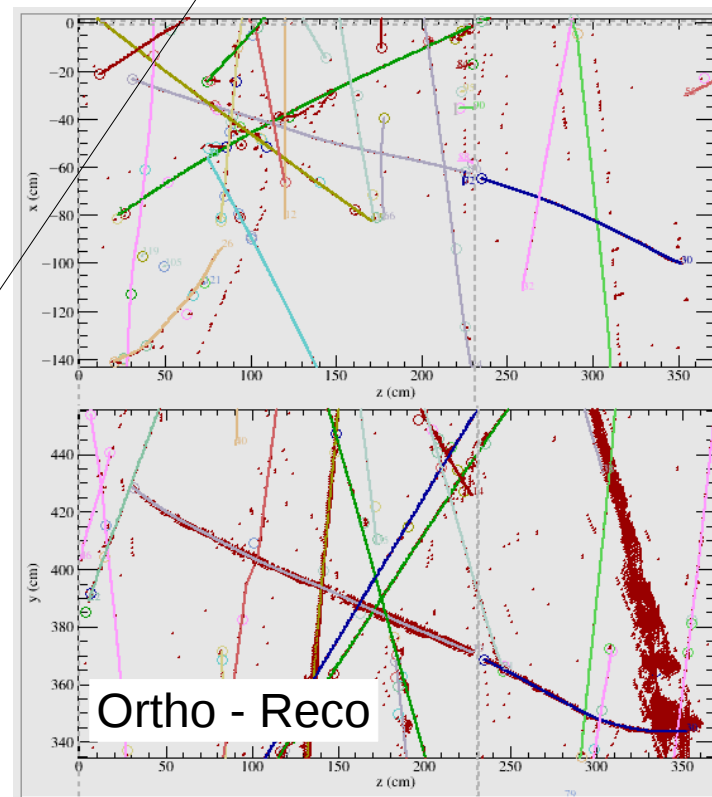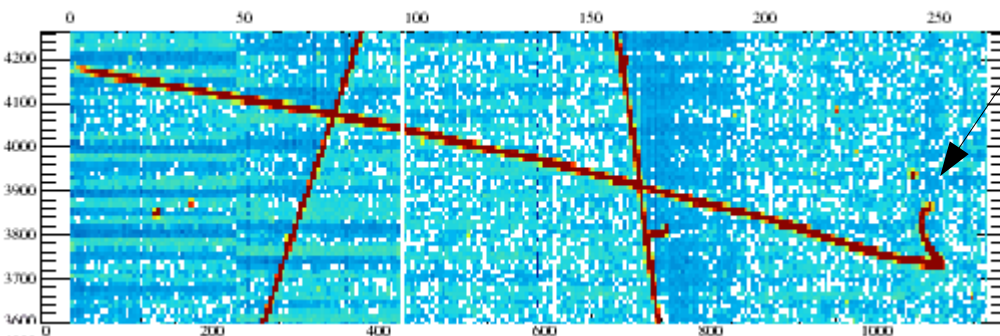- Can use this to identify potentially broken tracks and stitching candidates

TPC1 - Raw

TPC5 - Raw

Ortho - Reco

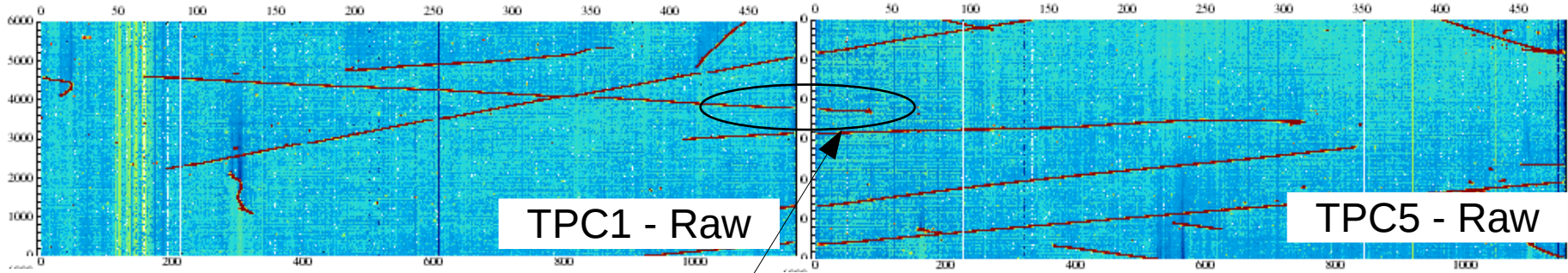TPC1 - Raw

TPC5 - Raw
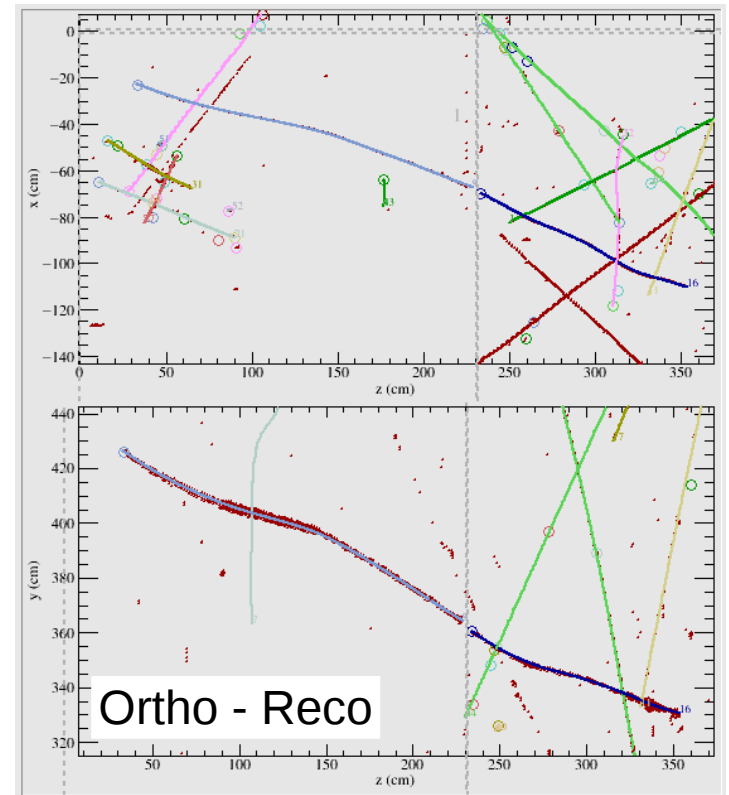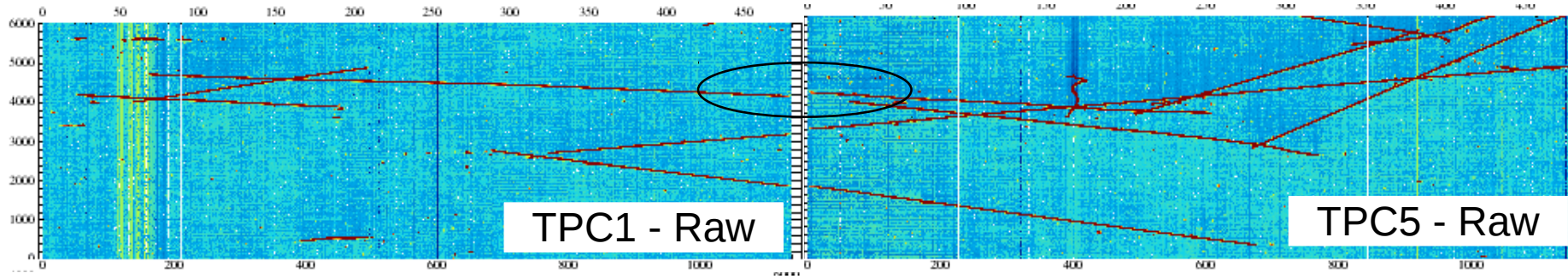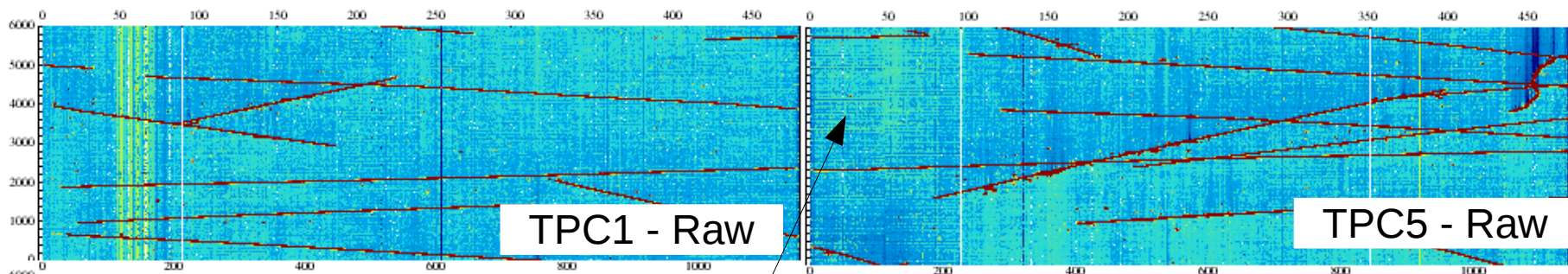
71022 * 229.44252 *   12 *   *   *

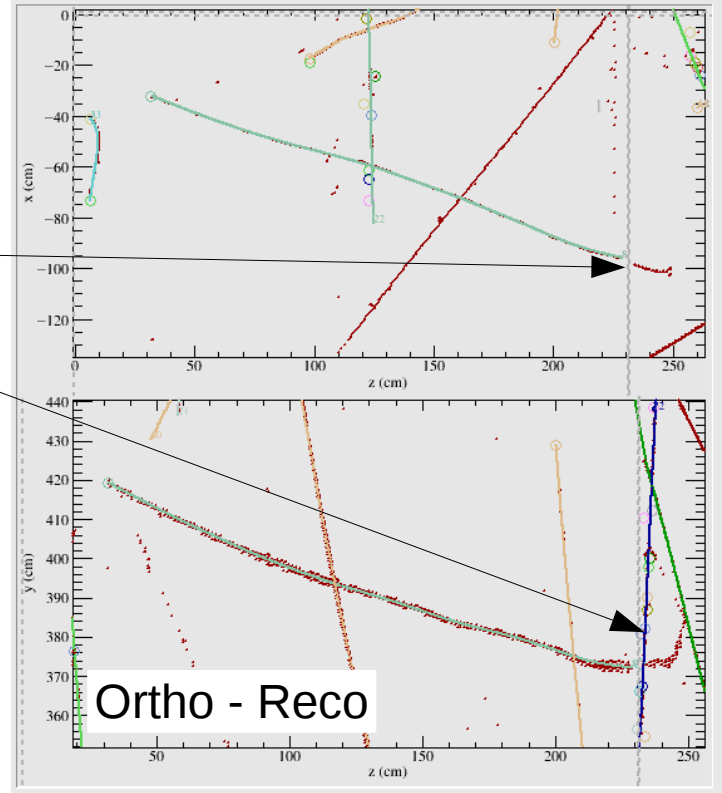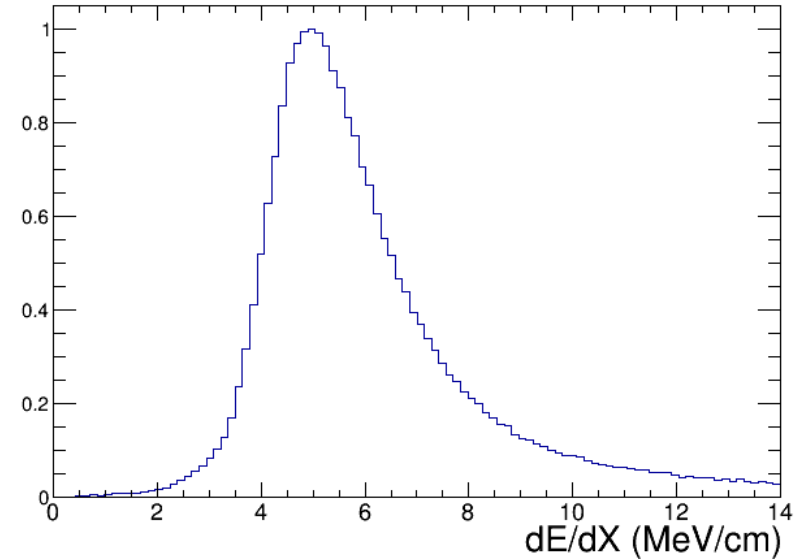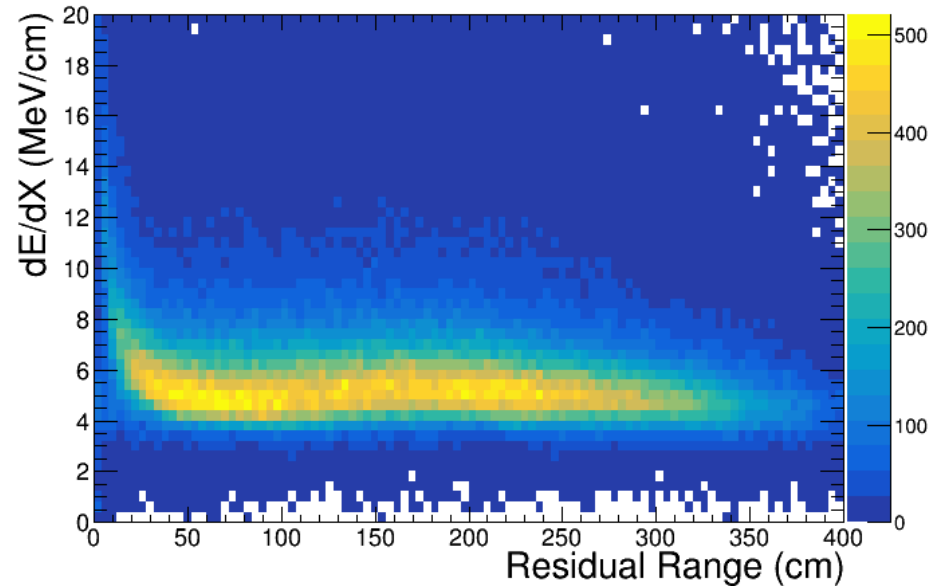No candidate found in reco, and no raw data in APA2

Ortho - Reco

TPC1 - Raw

TPC5 - Raw

Can see a Michel electron at the end of this track

Ortho - Reco

Jake Calcutt

TPC1 - Raw

TPC5 - Raw

No track reconstructed, but hits were received

Ortho - Reco

- Stitched Calorimetry:

  – Adding residual range of stitching candidate to the broken track

  – Looks to be all one species (probably muons)

  – But uncalibrated → doesn't line up to what you expect (see Heng-Ye's recent talks)

    • Heng-Ye gave me code to calibrate

- Have code to identify potential broken tracks

- Saves info to help Pandora experts diagnose the problem

- Currently part of another module, but I will put this into its own analyzer

- To do: calibrate dE/dX of the stitched tracks

TPC1 - Raw

TPC5 - Raw

Ortho - Reco