

Muon Alignment Update

Tom Junk

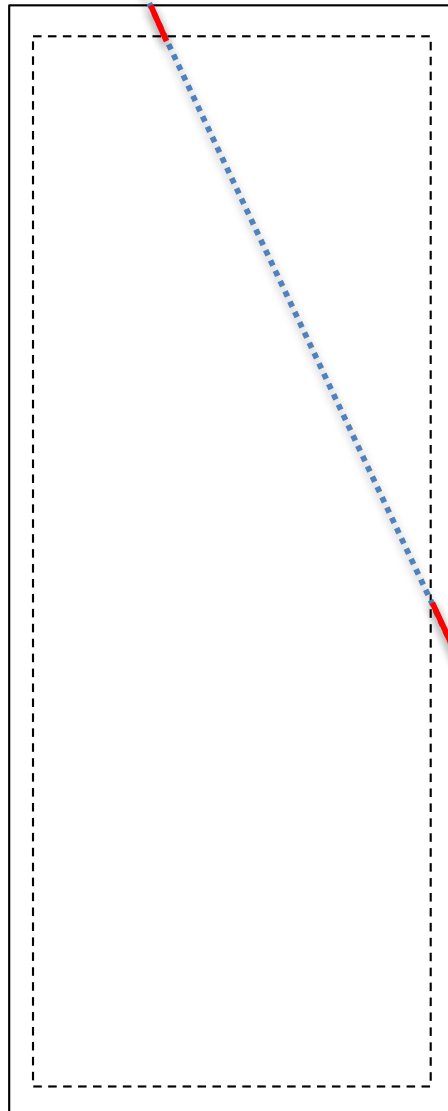
Calibration TF Meeting

December 5, 2017

Status

- I started looking at the MUSUN sample -- part of MCC 9.1
 - Fully simulated and reconstructed
 - DUNE single-phase FD module
 - Indexed here: <http://dune-data.fnal.gov/mc/mcc9/index.html>
- Starting approach
 - Parameterize APA alignment parameters in terms of x , y , and z offsets, and roll, pitch, and yaw angles
 - Drift is always along the nominal x axis, even if the APA is rotated (pitch and yaw are assumed not to affect the drift direction)
 - Rotations are around the APA center point. Roll: around x , Pitch: around z , Yaw: around y
 - look at PMTRACK's space points in Gallery
 - Identify strings of space points on either side of horizontal or vertical gaps
 - Fit a 3D line to space points and require chisquared/DOF not to exceed a cut.
 - match up strings on either side of a gap
 - fit a 3D line to the pairs and add chisquareds together.
 - Explore the chisquared sum as a function of the APA alignment parameters. See which coordinate combinations are well constrained and which aren't

Search Region for Stubs



Seek stubs close to edges of the APA. y and z region sizes are independently adjustable.

Arbitrarily set these to 10 cm. Similar to 35-ton analysis.

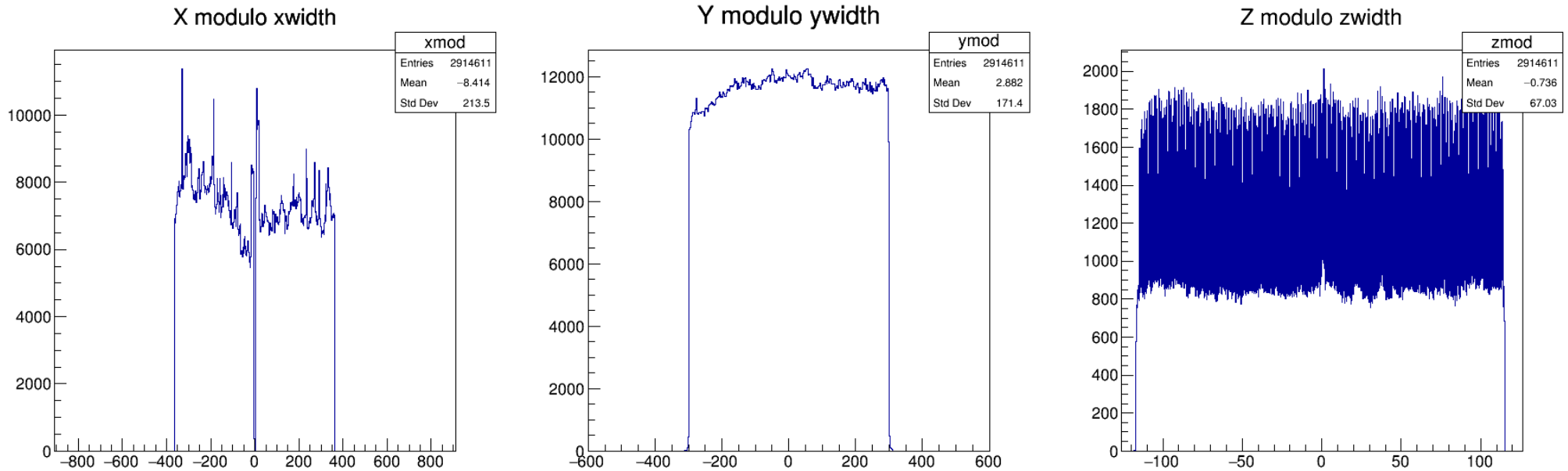
Another adjustable parameter: how far away spacepoints can be before starting a new cluster: 2 cm (perhaps smaller).

Gallery and geometry

- An issue – Gallery doesn't have access to the geometry service.
- It can be linked in, using the non-*art* service provider, but it has to be initialized with the right gdml and other fcl parameters, and I was in a hurry.
- Nominal geometry is very regular – just need nominal APA dimensions, locations, and spacing.
- Check these with histograms of x , y , and z modulo APA sizes.
- Should see gaps in distributions of space points when the APA sizes are right.
- Can probably just dump the wire positions but this is useful since the space points are output from reco algorithms.

Spacepoint Modulo Plots

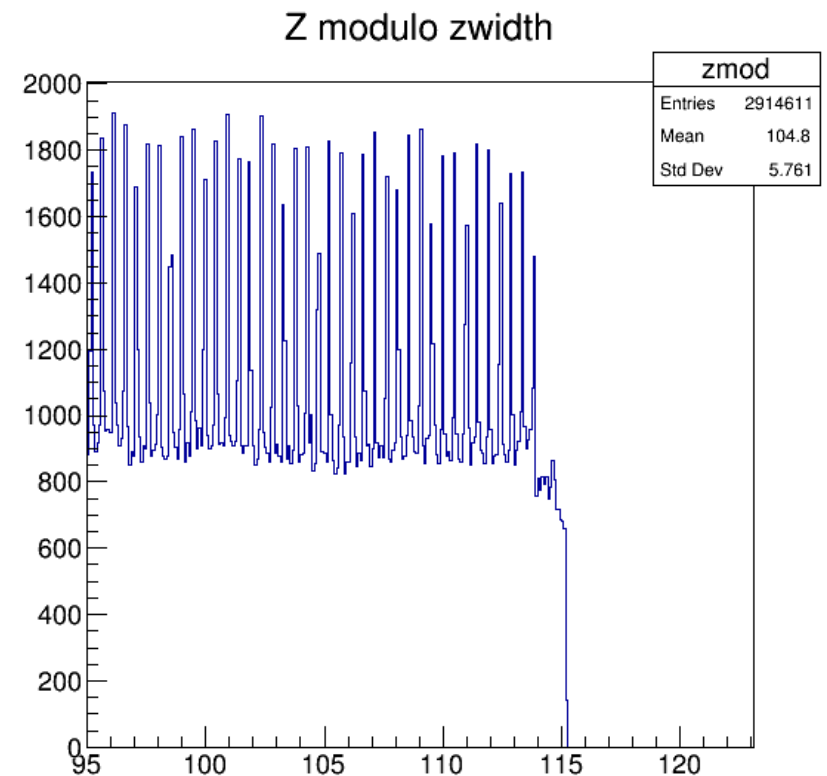
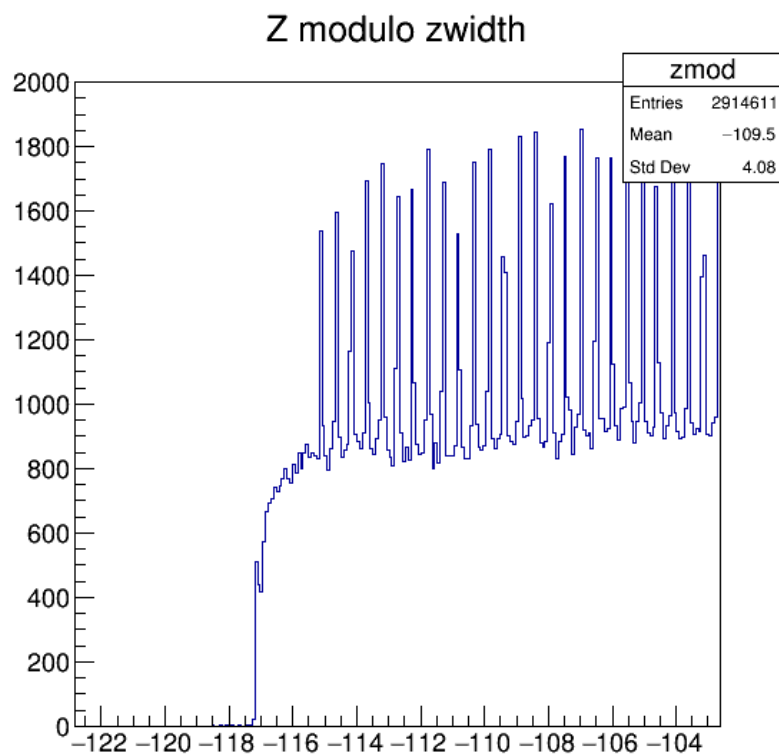
357 total events, so there's some scatter expected.



From DocDB 158: Nominal Z width: 231.59. Empirical from space points: 232.39
X width: 363.7 cm, Y width: 600 cm

Zooming in Z

A close look at the z modulo 232.39 cm. (minus half for the offset to the middle of the APA), zoomed in on both sides.

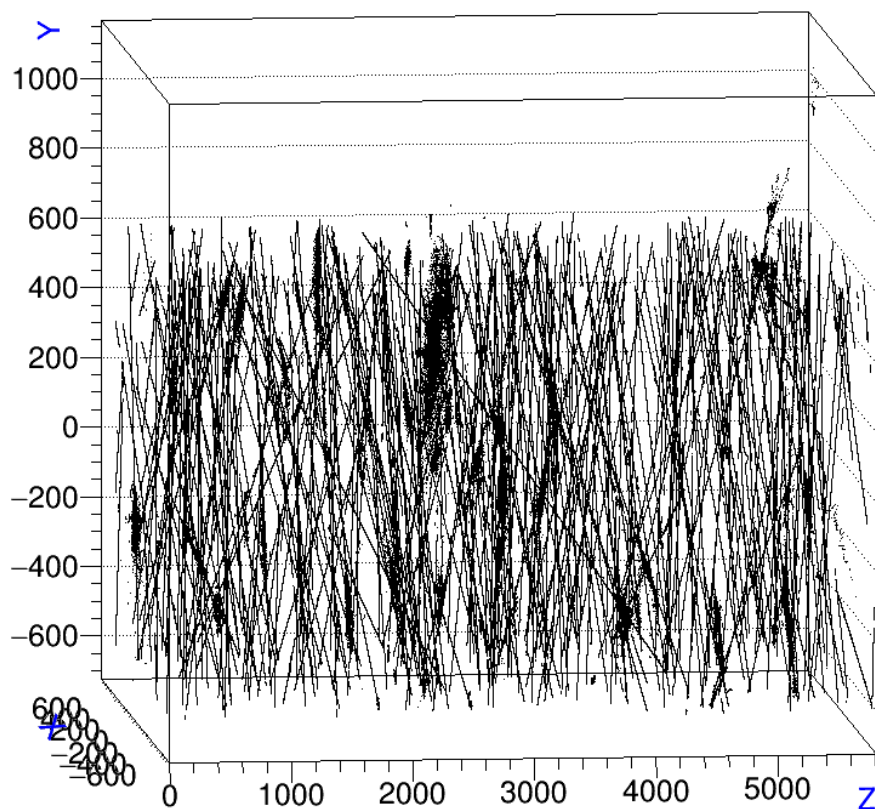


Interesting structure: perhaps some spacepoints have no corresponding collection hits, or some may share collection hits.

Some Event Displays

- Using PMTRACK spacepoints.
- In 1000 MC events, have 357 with any space points at all.

pandora SpacePoint Display



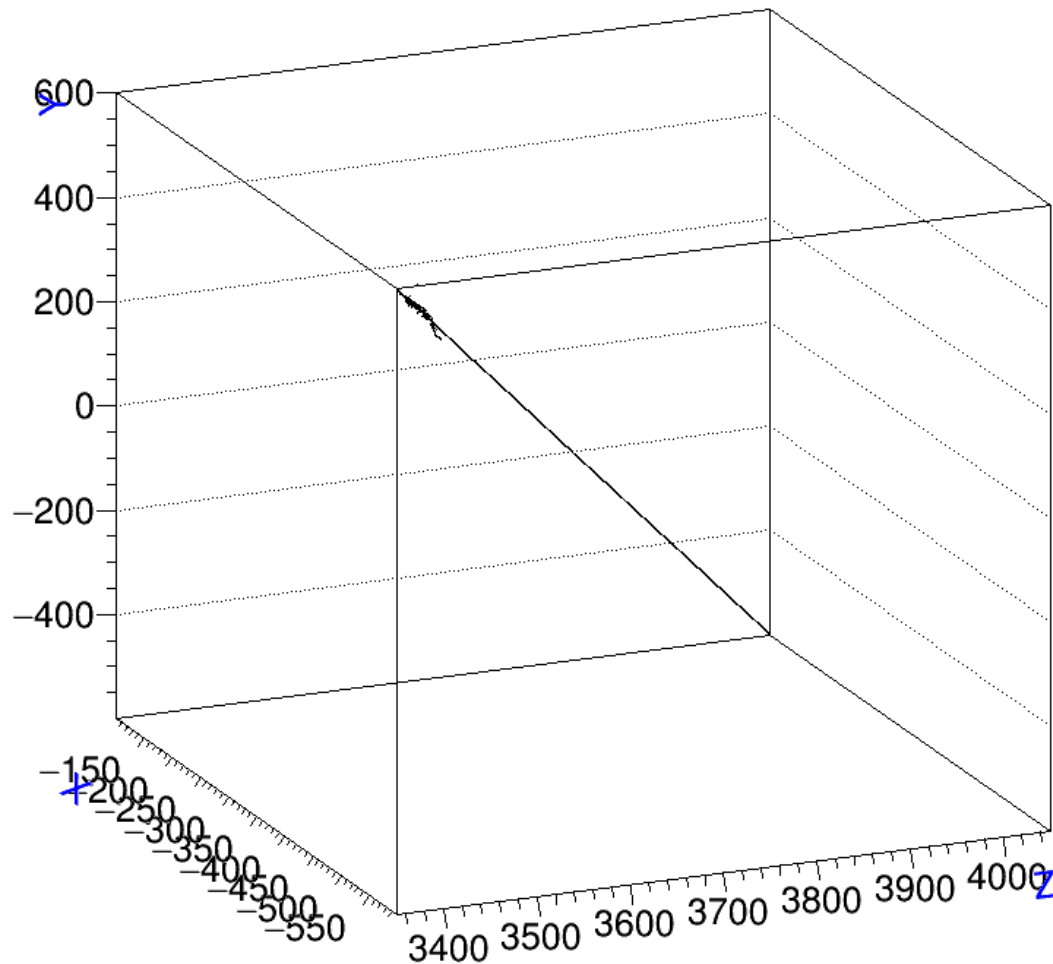
Pandora shows the showers better, so used in these event displays.

pmtrack is more optimized for finding straight tracks even in messy environments

axes are in cm

Some Cosmic-Ray Events

pandora SpacePoint Display



It would be great if they were all like this one.

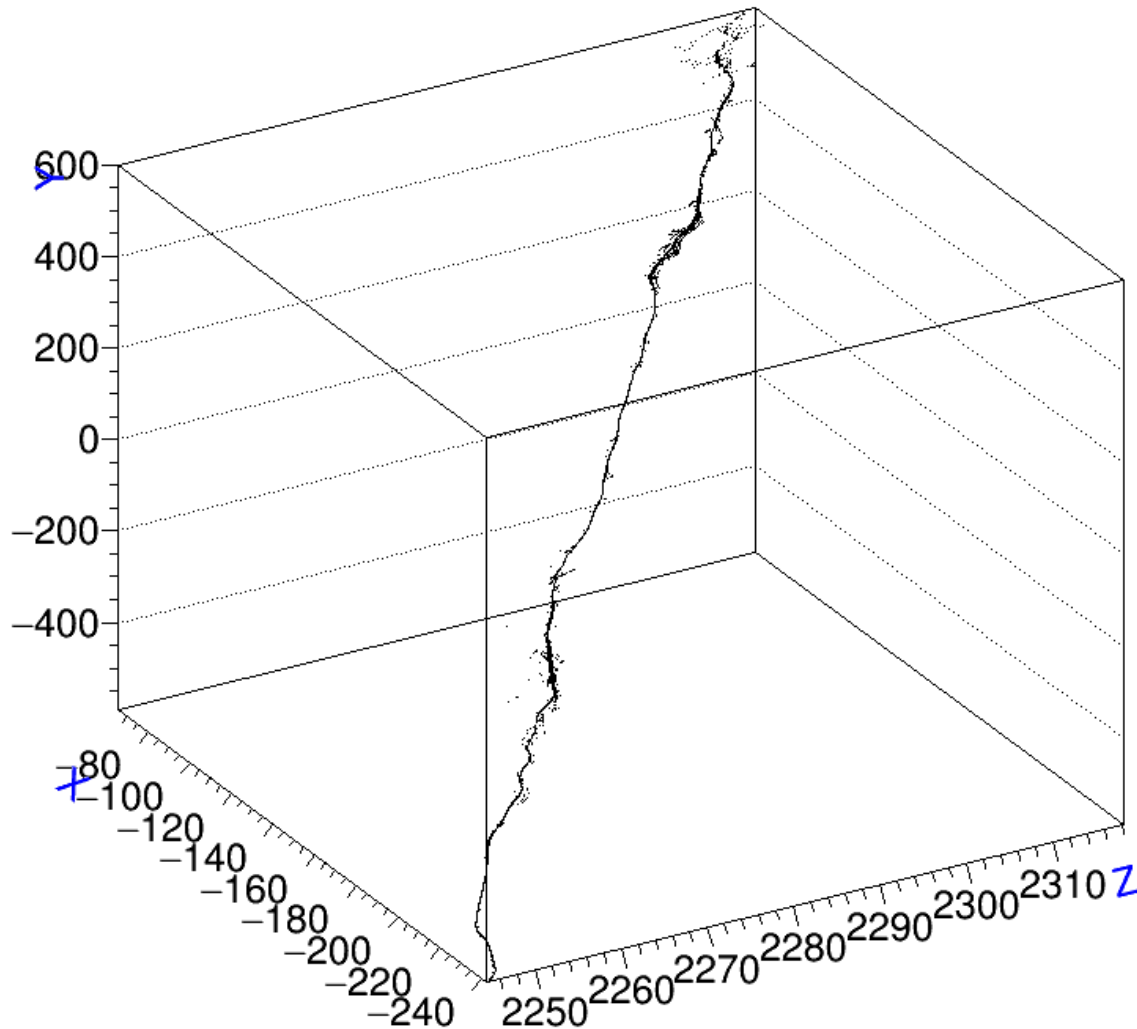
A little bit of interaction near the top.

Gaps are so small they don't show up in this display.

Axes are in cm

Reasons for the Cuts: Scattering

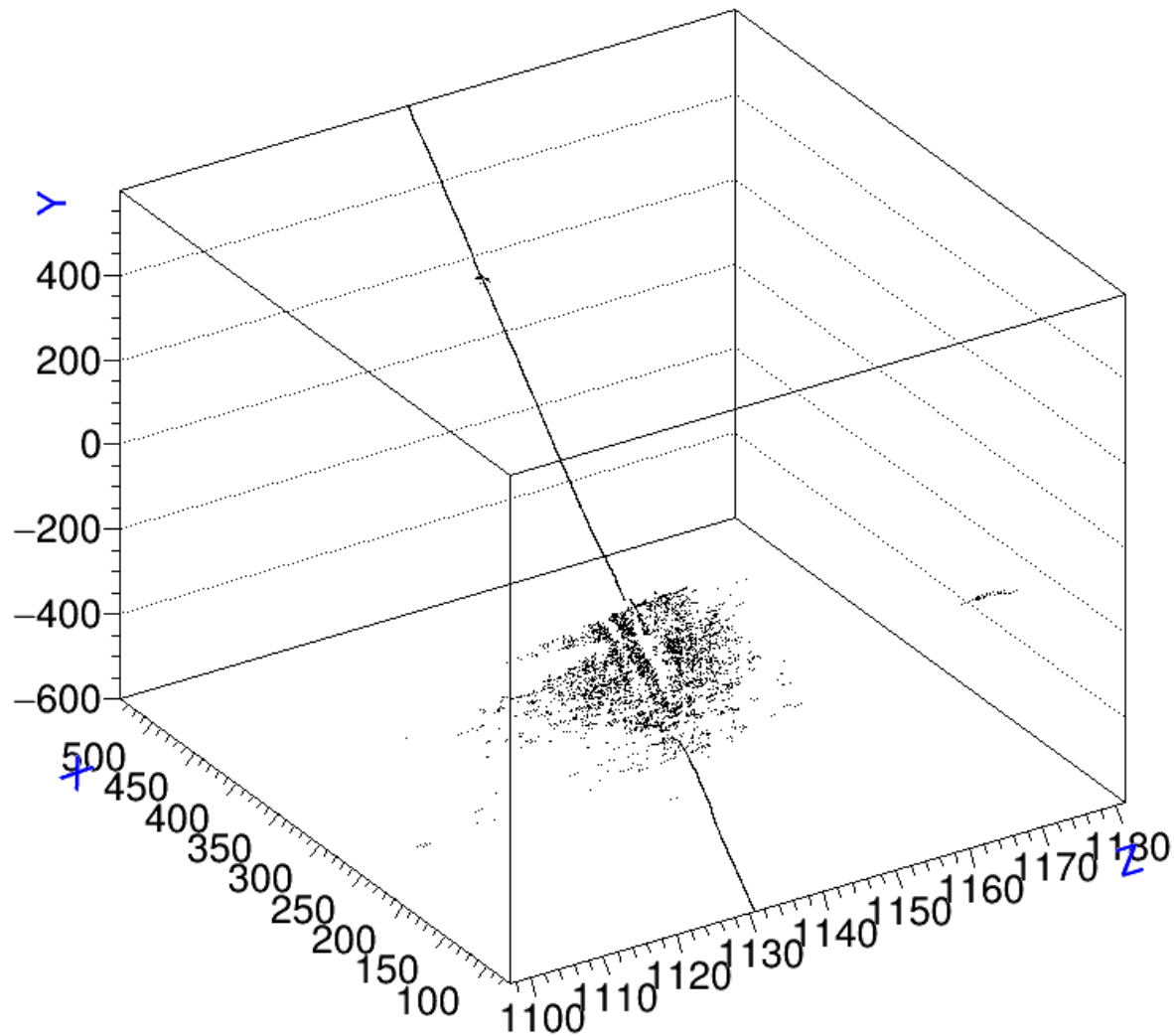
pandora SpacePoint Display



axes are in cm

Reasons for the Cuts: Showering

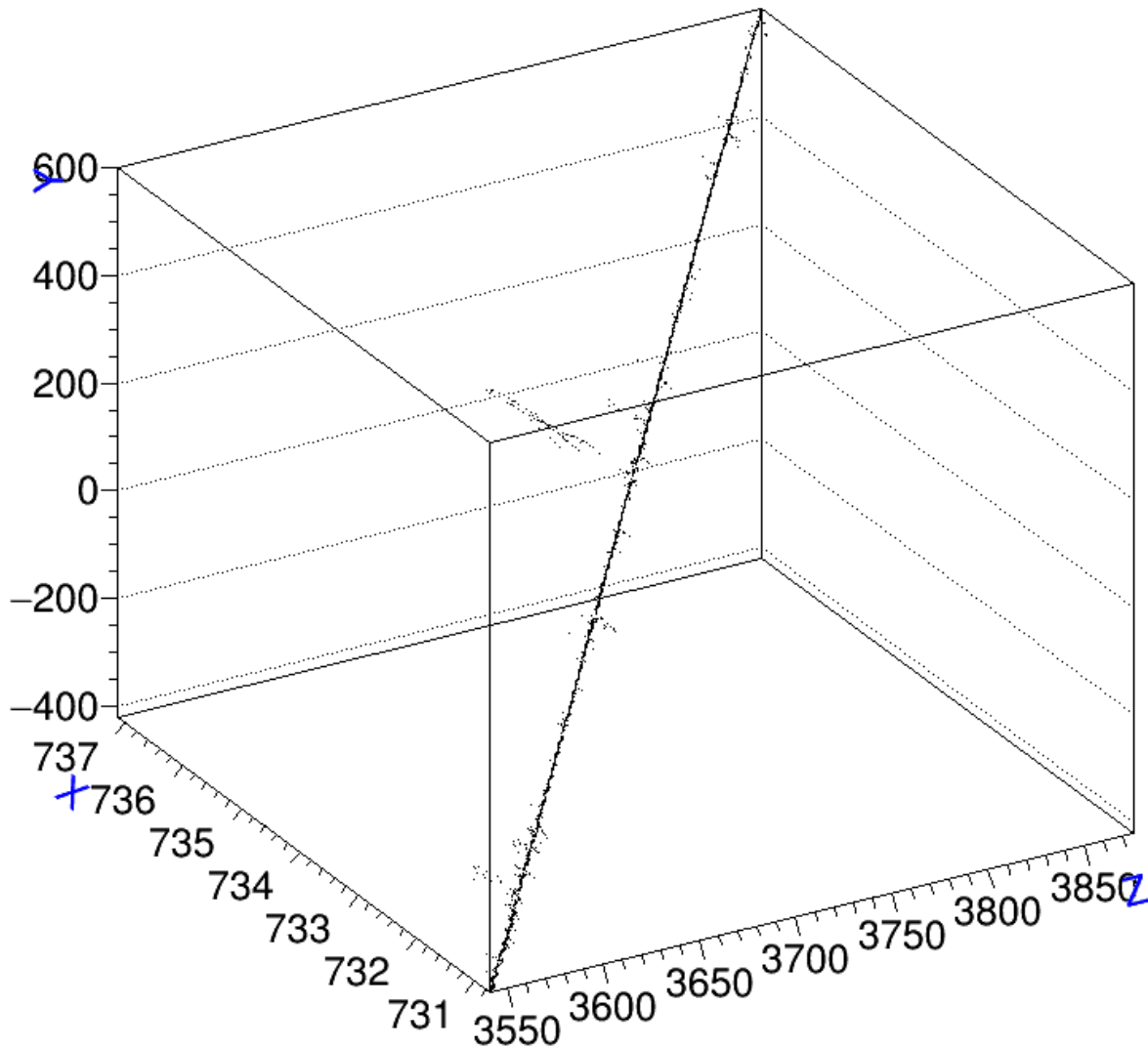
pandora SpacePoint Display



axes are in cm

Reasons for the Cuts

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Just a little bit
wiggly!

This track is more
isochronous than
others: 6 cm in x over
10 m in y