

# Comparing CRT and Pandora Tagged Tracks in ICARUS

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## Motivation

The goal of this project is to analyze the effectiveness of a comparison of the most probable values (MPV) between the CRT and TPC (reconstructed with Pandora software) tagged tracks of the detector for future calibrations, using Run 2 data. The combination of CRT and Pandora tagging allows for more tracks to be measured, as well as a wider range of angles.

## Background

ICARUS is a LArTPC used to image tracks of charged particles through the measurement of their ionization electrons. It consists of two cryostats, both split into two TPCs by a central cathode plane with dual anode planes on either side. Ionization electrons drift away from the cathode to wire planes on the side of the detector, consisting of a front induction plane, middle induction plane, and collection plane. Induced currents on the wire planes are used to record precise data on the characteristics of the charged particles and tracks. Additionally, Cosmic Ray Taggers (CRT) surround the exterior of the detector.

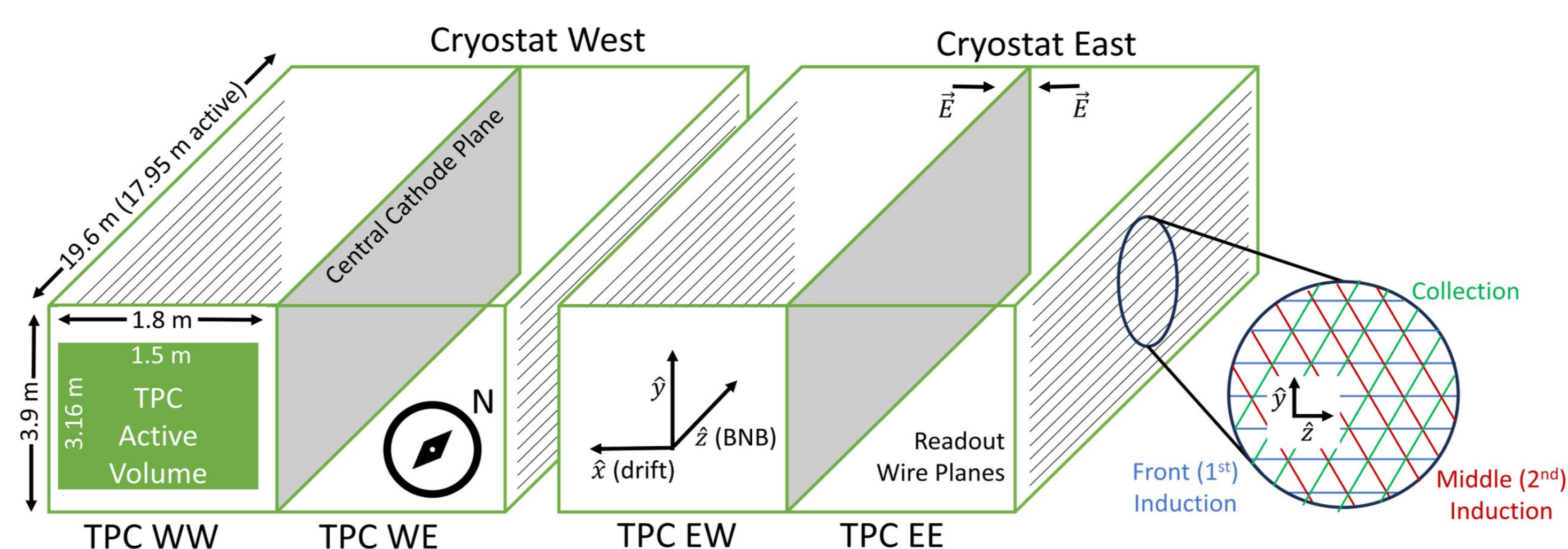


Figure 1. A diagram of the ICARUS TPC system, including internal components, directional aspects, and wire plane structure.

## Methods

Analyzing several distributions of data is necessary to produce an accurate Y-Z MPV map.

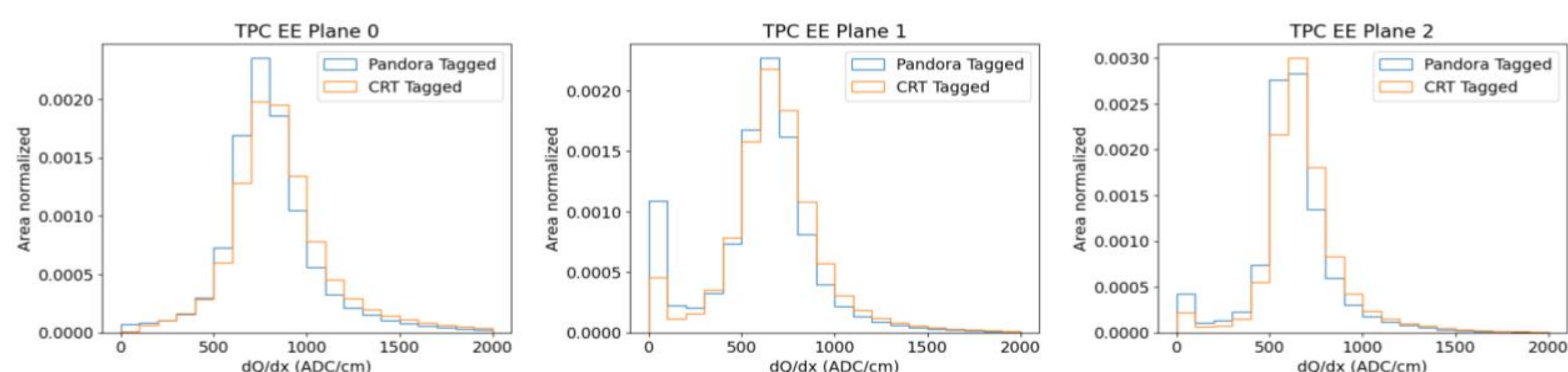


Figure 2. Distributions of  $dQ/dx$  for both Pandora and CRT in the three planes of TPC EE

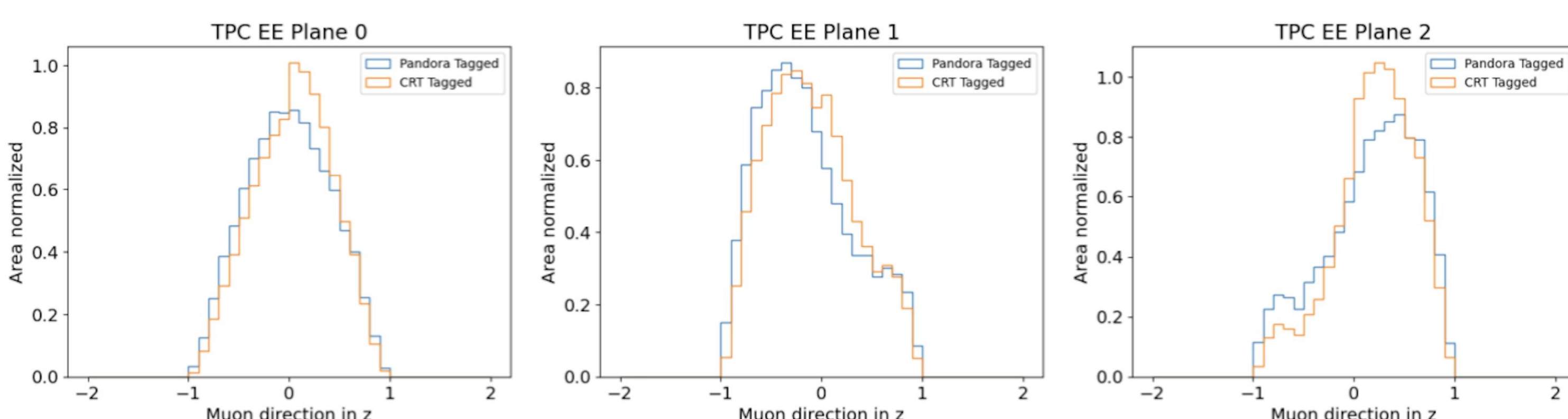


Figure 3. Distributions of  $z$  direction for both Pandora and CRT in the three planes of TPC EE

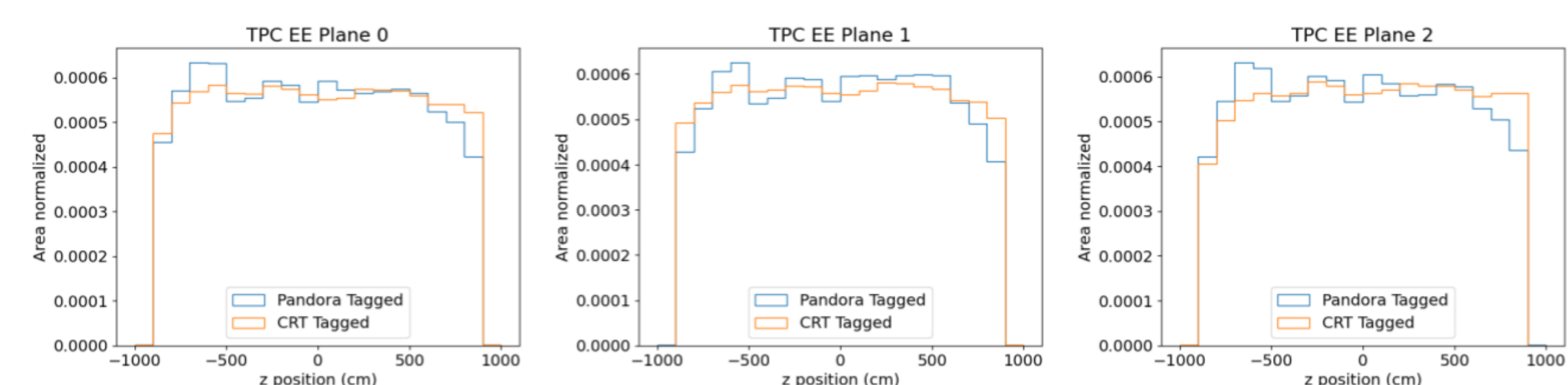


Figure 4. Distributions of  $z$  axis position for both Pandora and CRT in the three planes of TPC EE

## Results

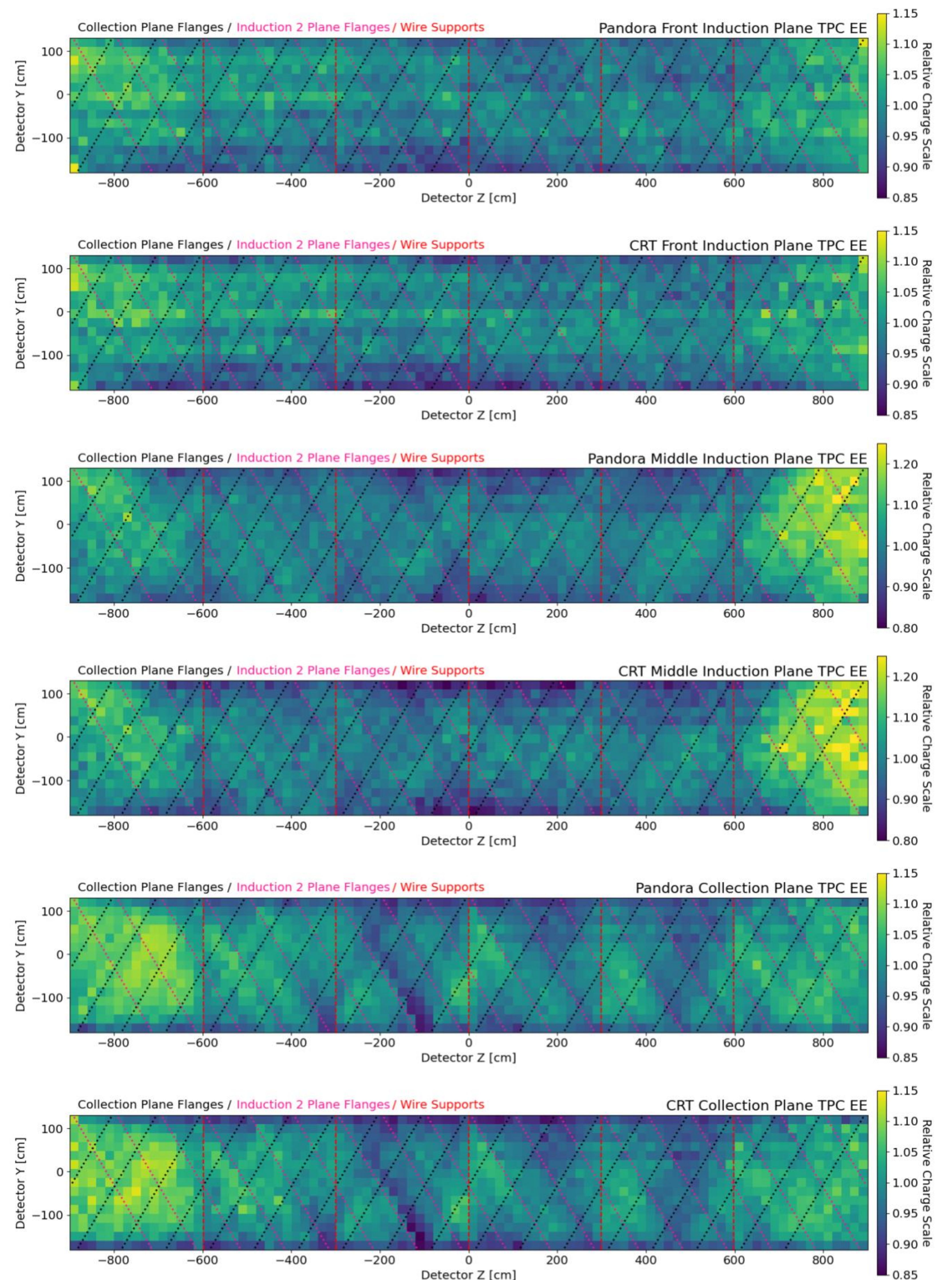
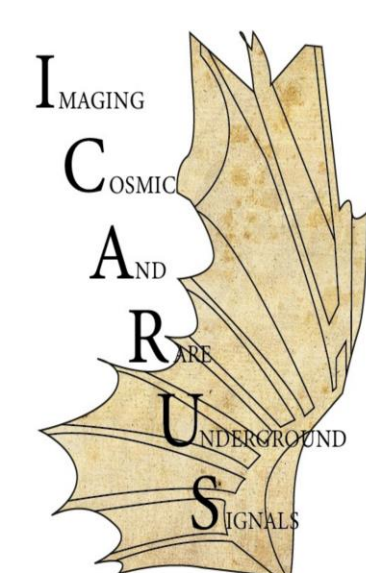


Figure 5. Maps of the Run 2  $dQ/dx$  MPV (most probable value) across the planes of TPC EE, showing a strong correlation of relative charge scale between CRT and Pandora tagged tracks. Also pictured are mechanical aspects of the detector, like mechanical supports and wire flange barriers

## Conclusion

CRT and Pandora tagged tracks appear to have a consistent correlation across all planes and TPCs, confirming their comparison as a valuable tool in future ICARUS calibrations. Regions of charge non-uniformity and physical detector features are clearly and reliably identified. Combining the external tagging of CRT and internal tracking of the Pandora creates a more complete version of particle interactions, with more tracks and a broader range of angles covered.



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