

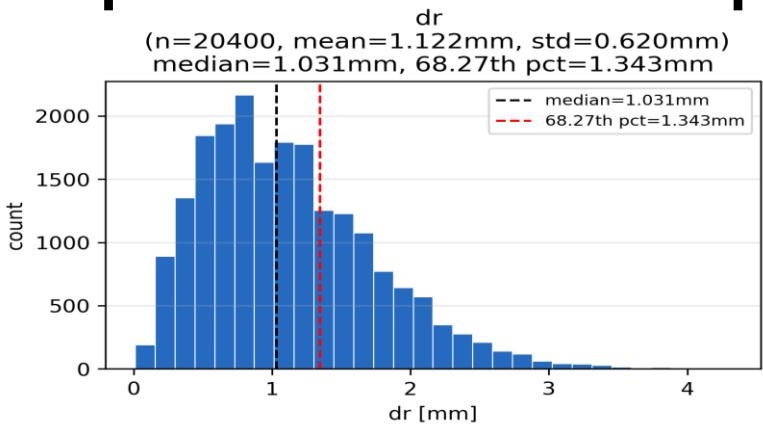


Wire-Cell ProtoDUNE Local Meeting

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Chung-Ang University
Aug12, 2026 (Wed)

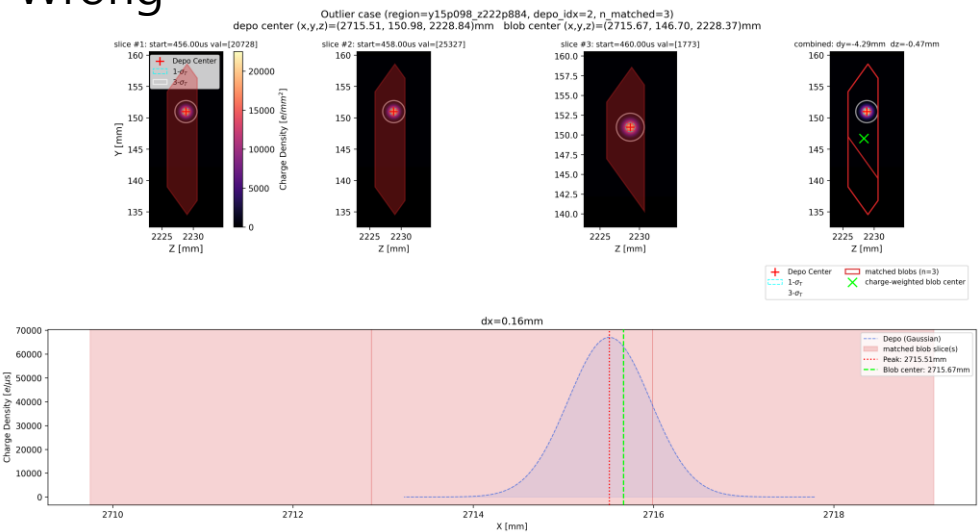
Wire-Cell 3D Imaging

Depo-Blob Center Comparison

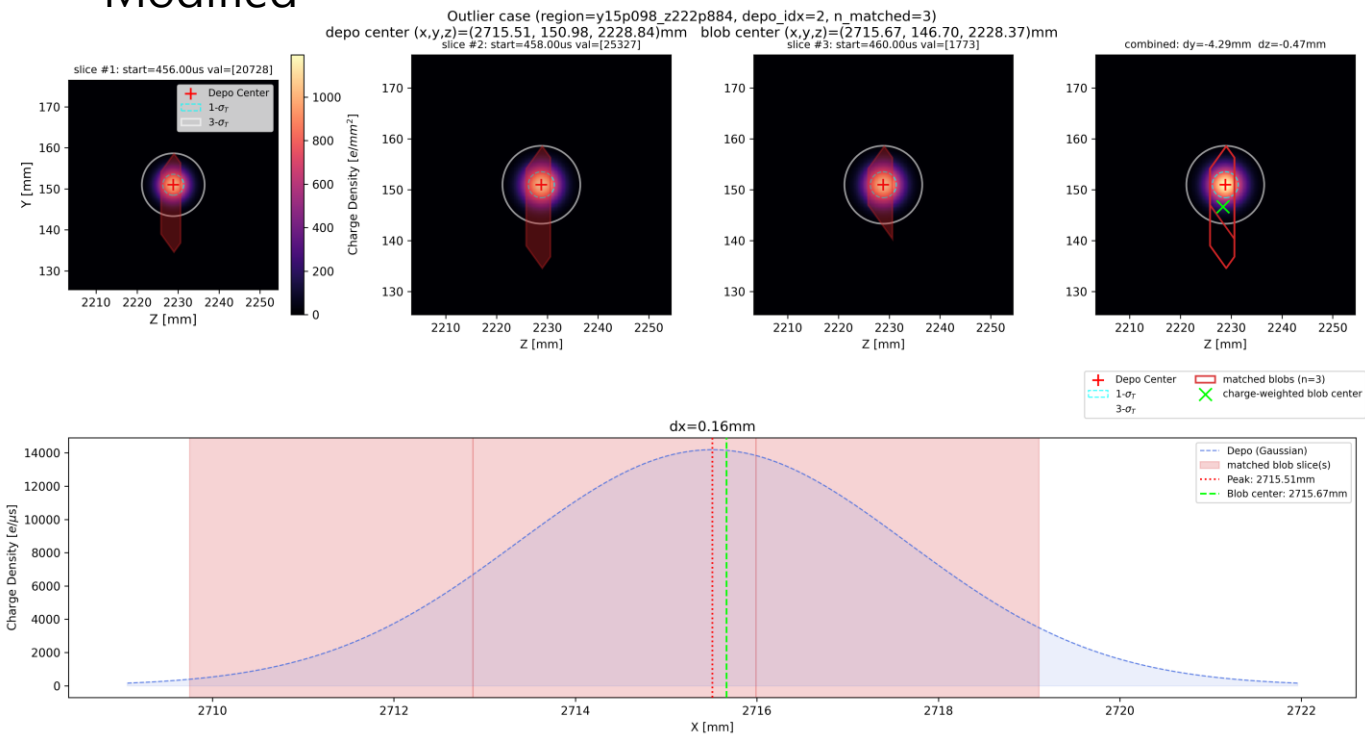


- Depo smearing was previously omitted, but this has been corrected.
- Worst 50 outliers among ~20000 point depos

Wrong

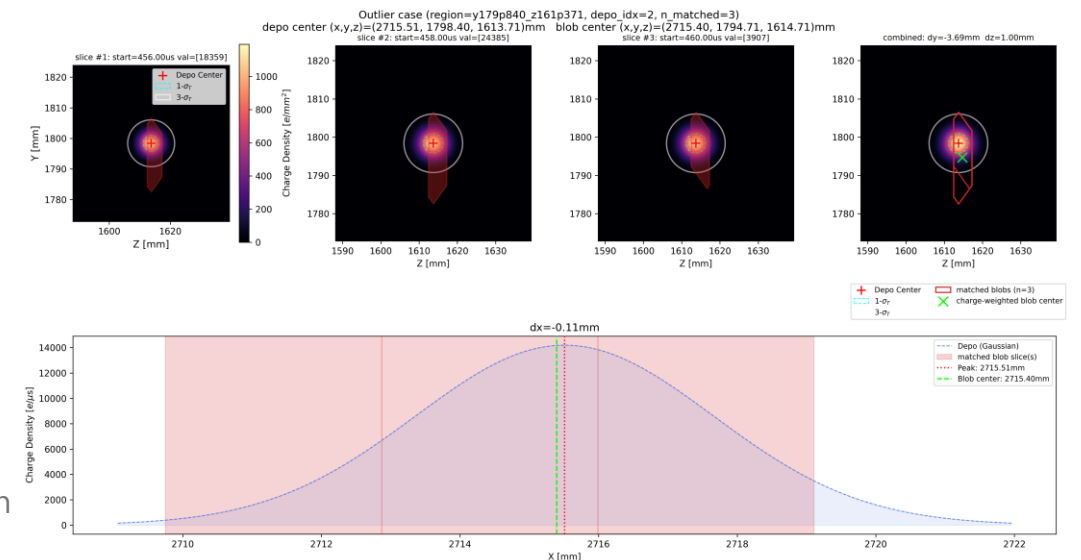
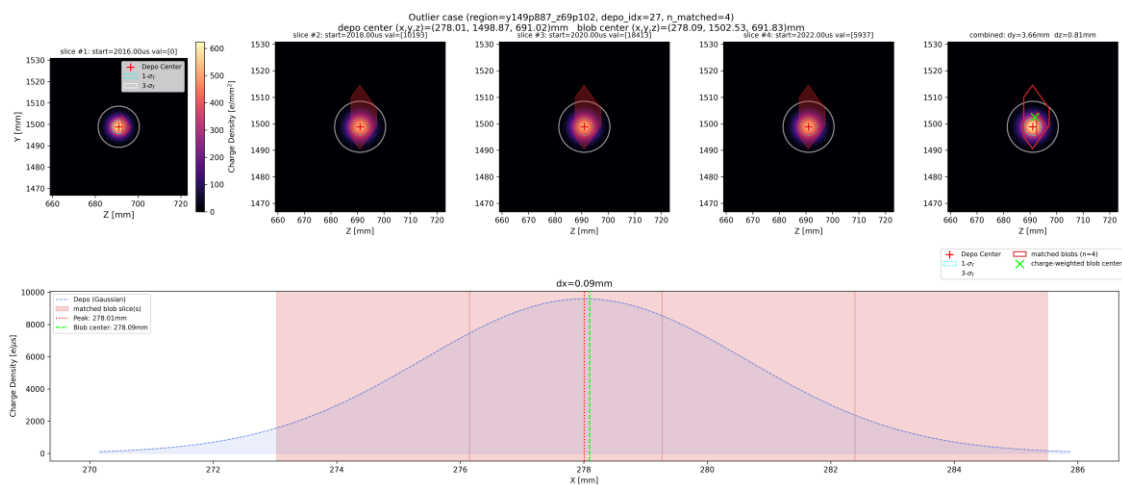
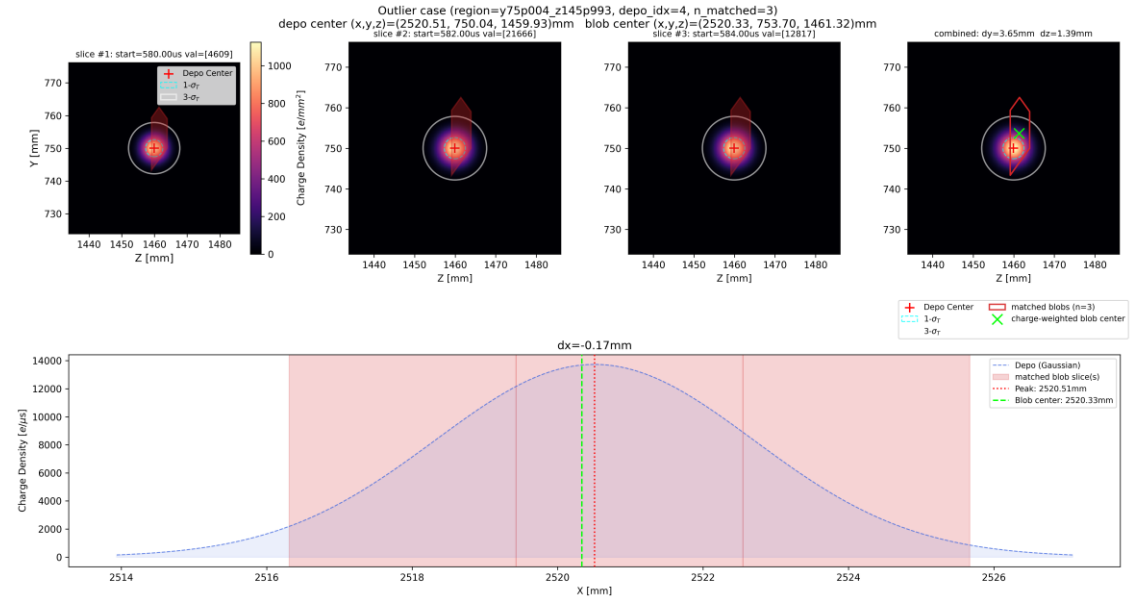
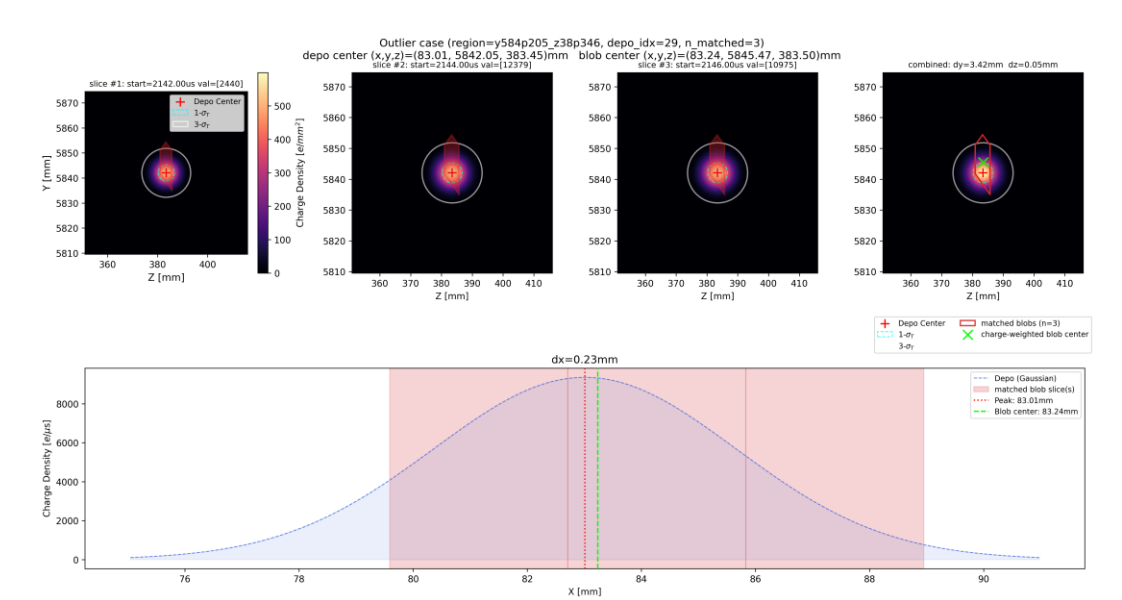


Modified



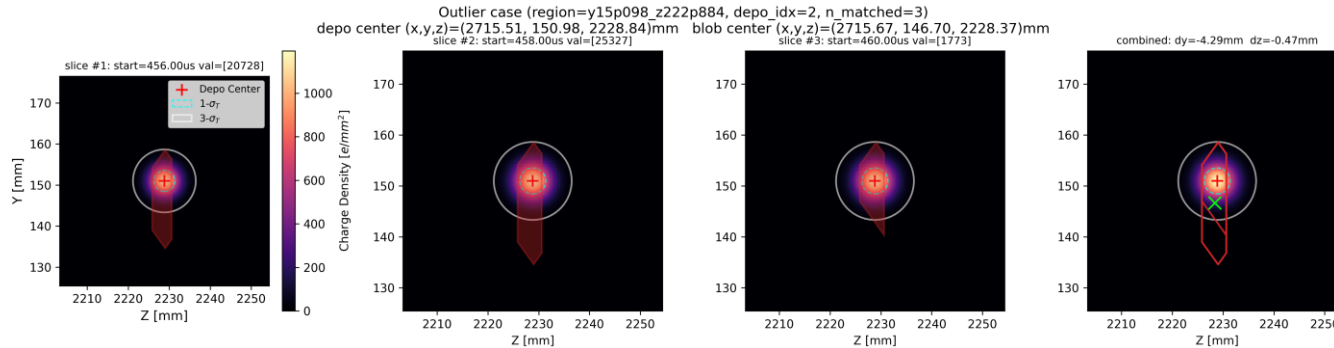
Wire-Cell 3D Imaging

Depo-Blob Center Comparison

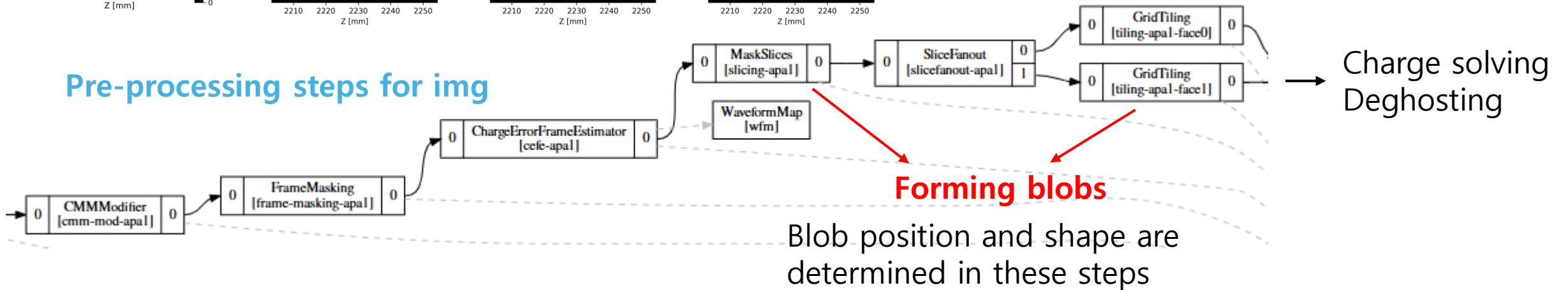


Wire-Cell 3D Imaging Debugging

- Origin of excessed region of blobs



Pre-processing steps for img

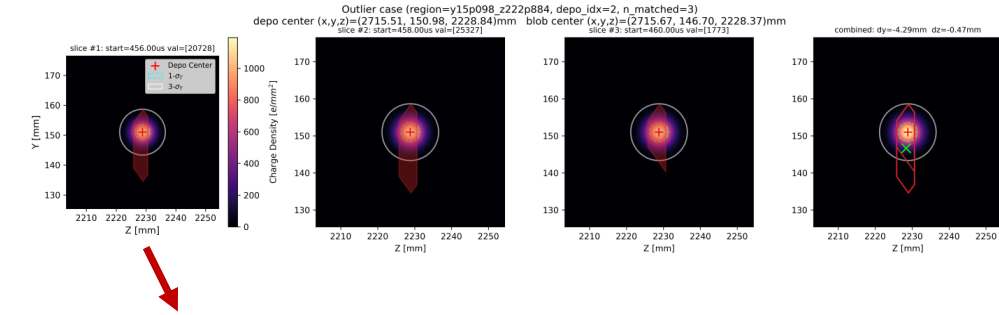


- In the Maskslices, wires to be used for grid tiling are selected from the input frame data by channel and time tick through thresholding.

```

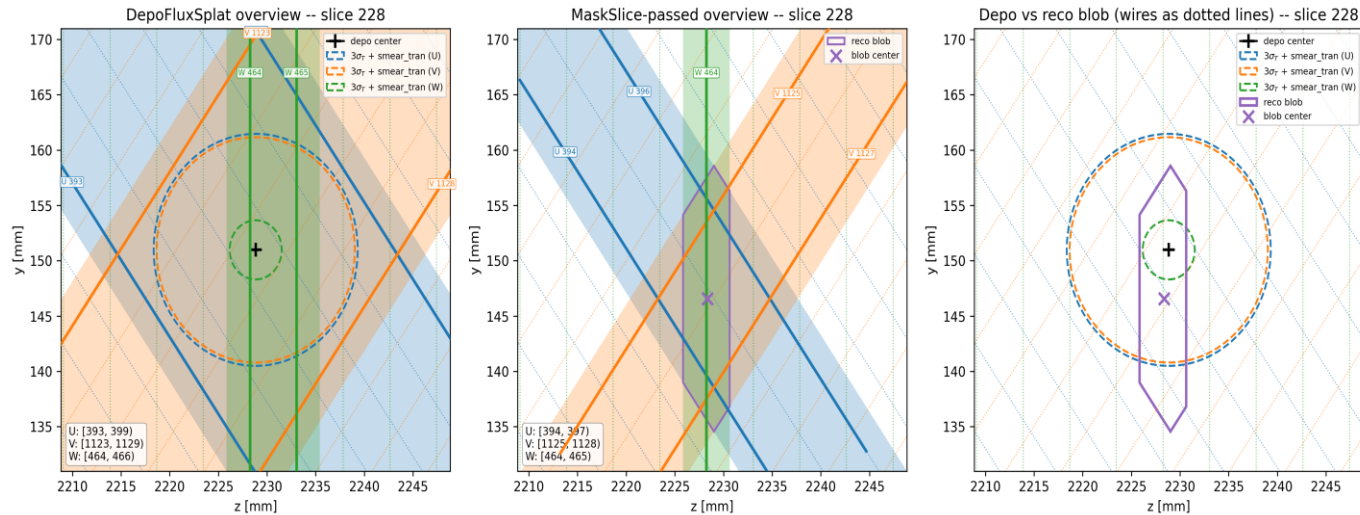
bool Img::MaskSliceBase::thresholding(const WireCell::ITrace::ChargeSequence& wiener_charge,
                                     const WireCell::ITrace::ChargeSequence& gauss_charge, const size_t qind,
                                     const double threshold, const int tick_span, const bool verbose,
                                     int* stage)
    
```

Wire-Cell 3D Imaging Debugging



**Point depo
(Depofluxsplat)**

blob after MaskSlice



Since smearing is relatively small in the W plane, fewer wires are detected, resulting in blobs being mainly formed along the y axis.

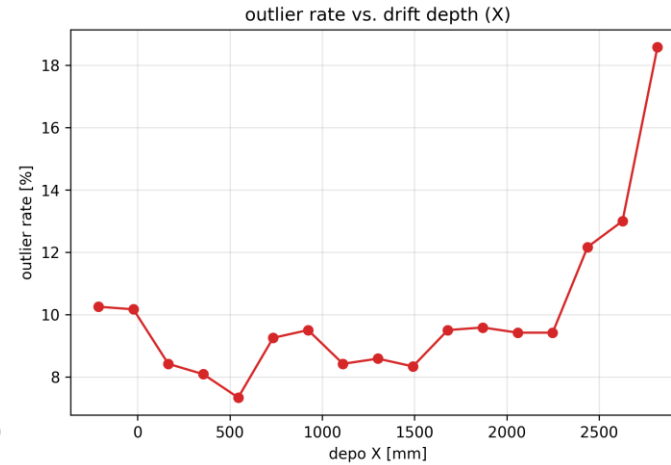
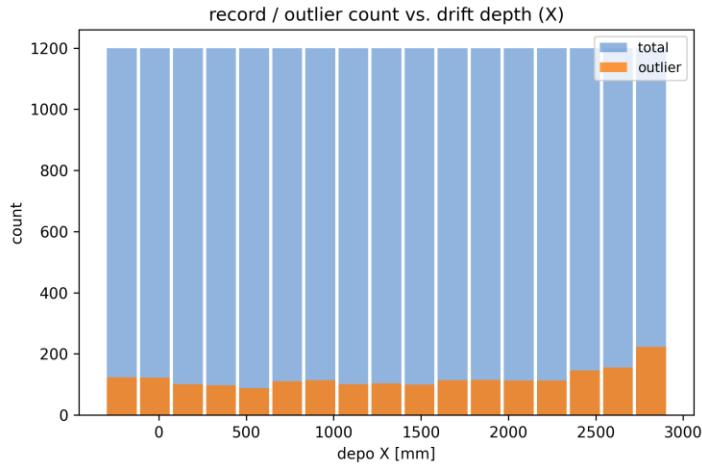
- The end portions of wire strips in Depofluxsplat are removed by thresholding in MaskSlices.
- Wire strips are formed narrower in the img pipeline.

U: [393, 399) -> [394, 397)
 V: [1123, 1129) -> [1125, 1128)
 W: [464, 466) -> [464, 466)

- Blobs are generally formed smaller than depo
- This excess region is a natural consequence of wire geometry combined with the img algorithm,
- It could be evaluated using a metric for blob size.

Wire-Cell 3D Imaging

Why outlier rate rises near the anode?



$$\sigma_L = \sqrt{L^2 + (s^{long} \cdot n_{tick} \cdot v_{drift})^2}$$

$$\sigma_T = \sqrt{T^2 + (s^{tran} \cdot p)^2}$$

- Smearing (s^{tran}, s^{long}): fixed
- Drift diffusion (L, T): depend on drift distance

- MaskSlice's trims theoretical (DepoFluxSplat) width of wire strips down to ~2–3 wires per plane.

Near anode

- Diffusion is negligible and blob size is small.
- One wire's pitch (~4.7 mm) is a large fraction of the total blob size
→ The reco blob's center shifts easily depending on which wires pass or fail the threshold.

Near cathode

- Diffusion dominates and is larger.
- This same one-wire step is only a small part of the whole size → the center stays stable.

Smaller blobs are more sensitive to wire size and threshold → higher outlier rate.

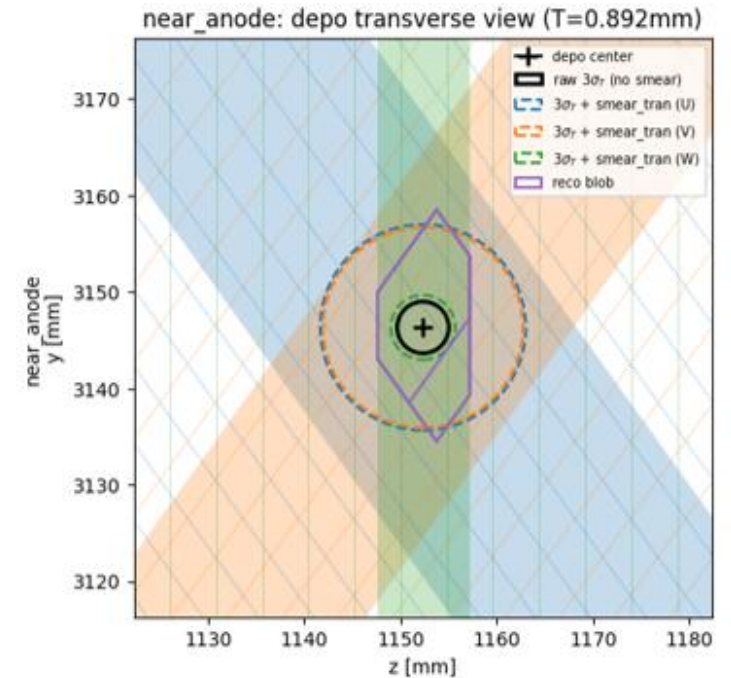
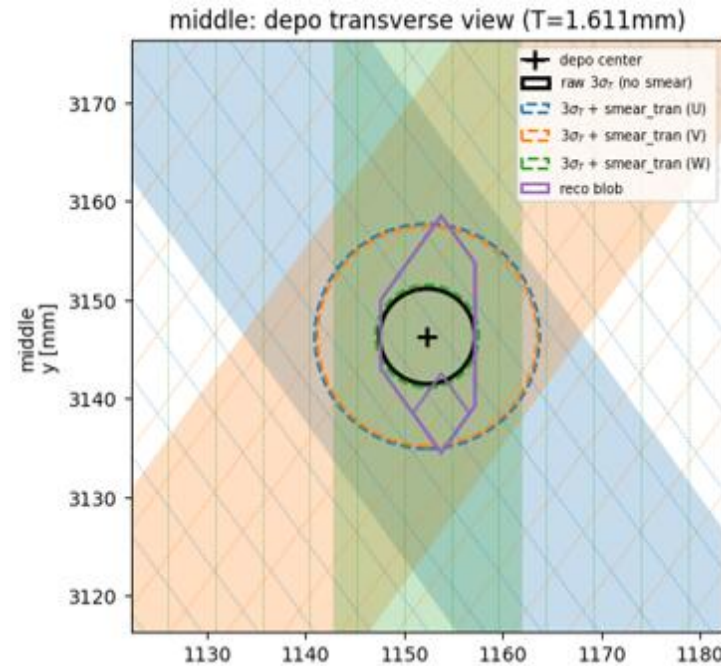
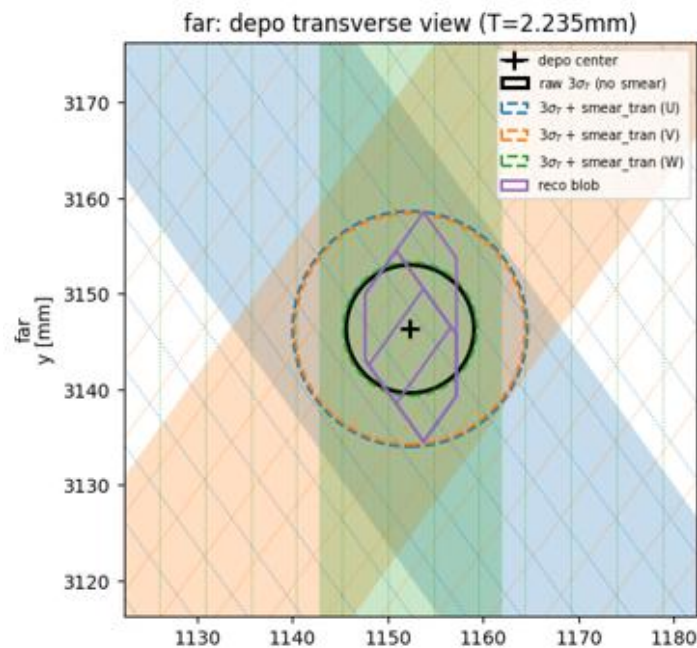
Backup

Wire-Cell 3D Imaging

Truth Smearing Checking

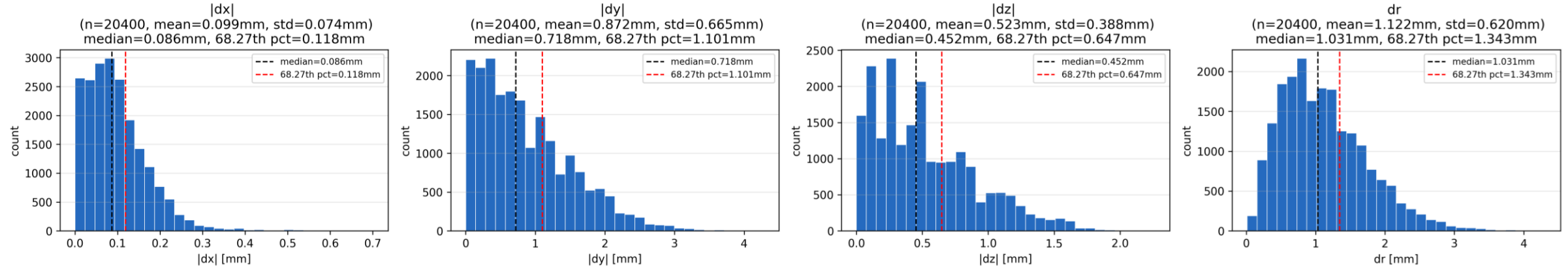
- Checked how depos are diffused and smeared at various x-coordinates
 - Same (y,z)
 - far(x=10cm), middle(x=170cm), near(x=290cm)
- Depo size does not change dramatically with x-position due to smearing

position	raw_3T	3sig_U	3sig_V	3sig_W
far	6.705	12.318	12.061	7.000
middle	4.833	11.408	11.130	5.235
near_anode	2.676	10.674	10.377	3.347



Wire-Cell 3D Imaging

Depo-Blob Center Comparison



	Median	68.27% Percentile
x [mm]	0.086	0.118
y [mm]	0.718	1.101
z [mm]	0.452	0.647
r [mm]	1.031	1.343

- Measurements along the y-axis were relatively larger than the other axes, by about 1 to 3 cm.
- In dr, a peak was observed around 1 cm.
- The worst 10% within the dr distribution was classified as outliers. (2040 sample)
- The 50 worst samples were visually inspected.

Outlier cases:

- 1) The blob sufficiently includes the depo, but there is a large center mismatch.
- 2) The blob fails to sufficiently cover the depo, and there is a large center mismatch.
- 3) The blob contains depo, but the blob size is large.