Raw and deconvoluted signal shapes

DUNE 35-ton
Simulation and Reconstruction

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November 4, 2015

Introduction

I have been looking at LAr TPC signal spectra

Inspired by talk by Michelle at Oct. 13 FD physics meeting

- https://indico.fnal.gov/conferenceDisplay.py?confId=10567

See my talk at the last 35 ton sim/reco meetings

- https://indico.fnal.gov/conferenceDisplay.py?confId=10604
- https://indico.fnal.gov/conferenceDisplay.py?confId=10692

Many issues raised

- List of issues and resolutions on following page

Issues

Issues:

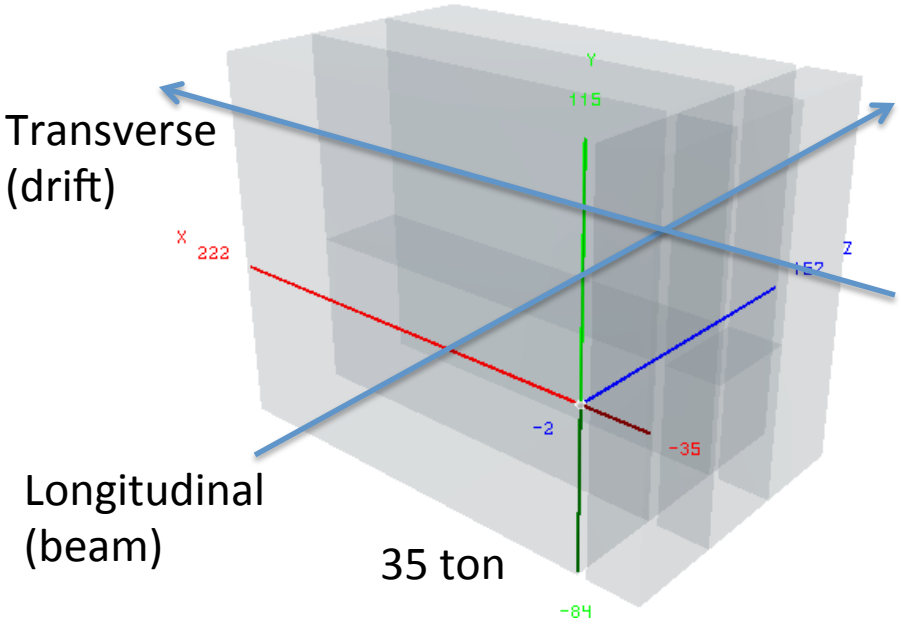
Issue	Resolution
Deconvoluted signal size much smaller than raw	Deconvolution includes ADC-toofC calibration (factor not checked)
Raw signal disappearing for long drift	J. Insler fixed bug in offline ZS
Deconvoluted signal also disappearing	Same as previous
Deconvoluted has negative tails	High frequency filter?
Deconvoluted much narrower than sim for very short drifts	Same as previous?

Following pages have plots showing the last couple issues

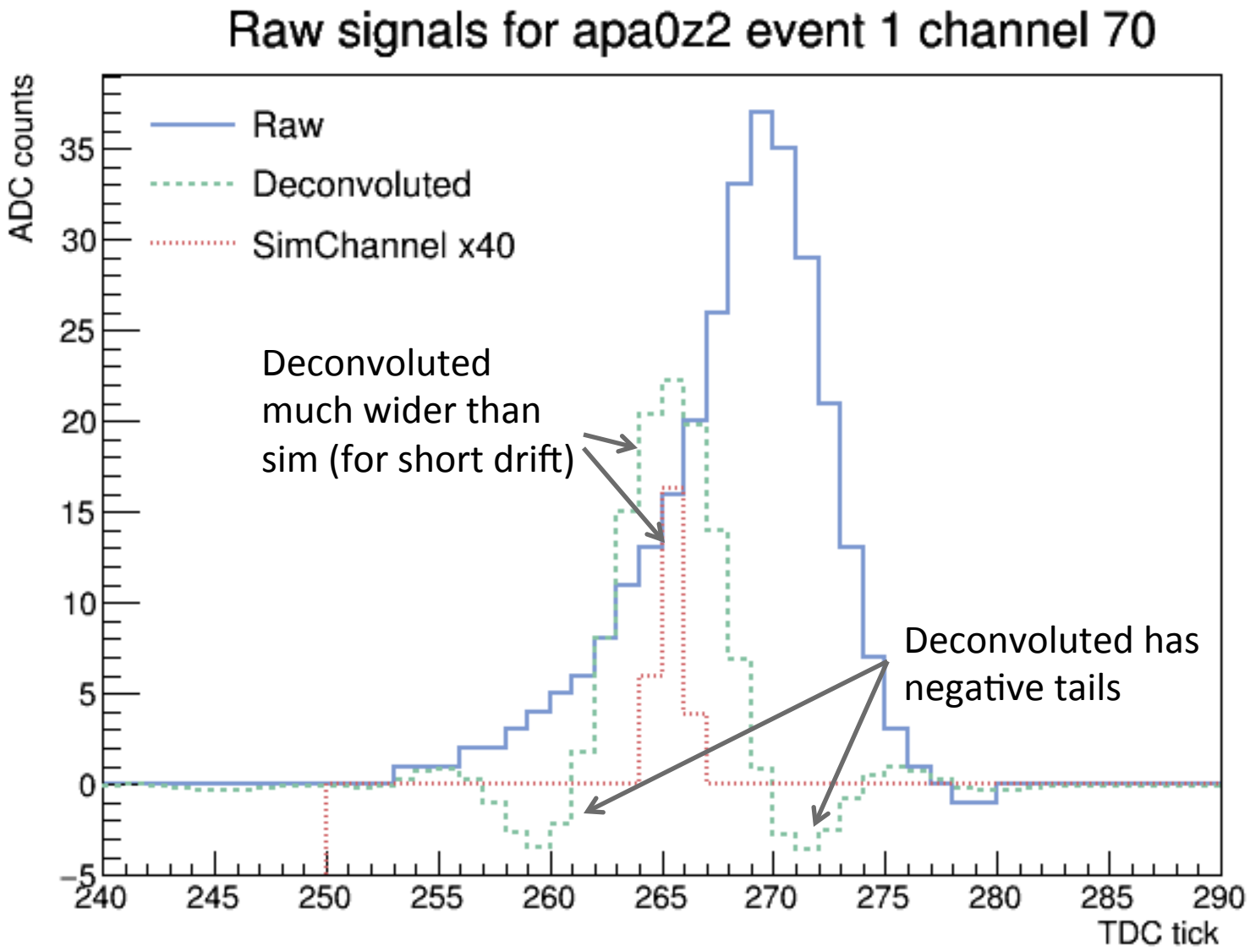
Procedure

Simulation studies

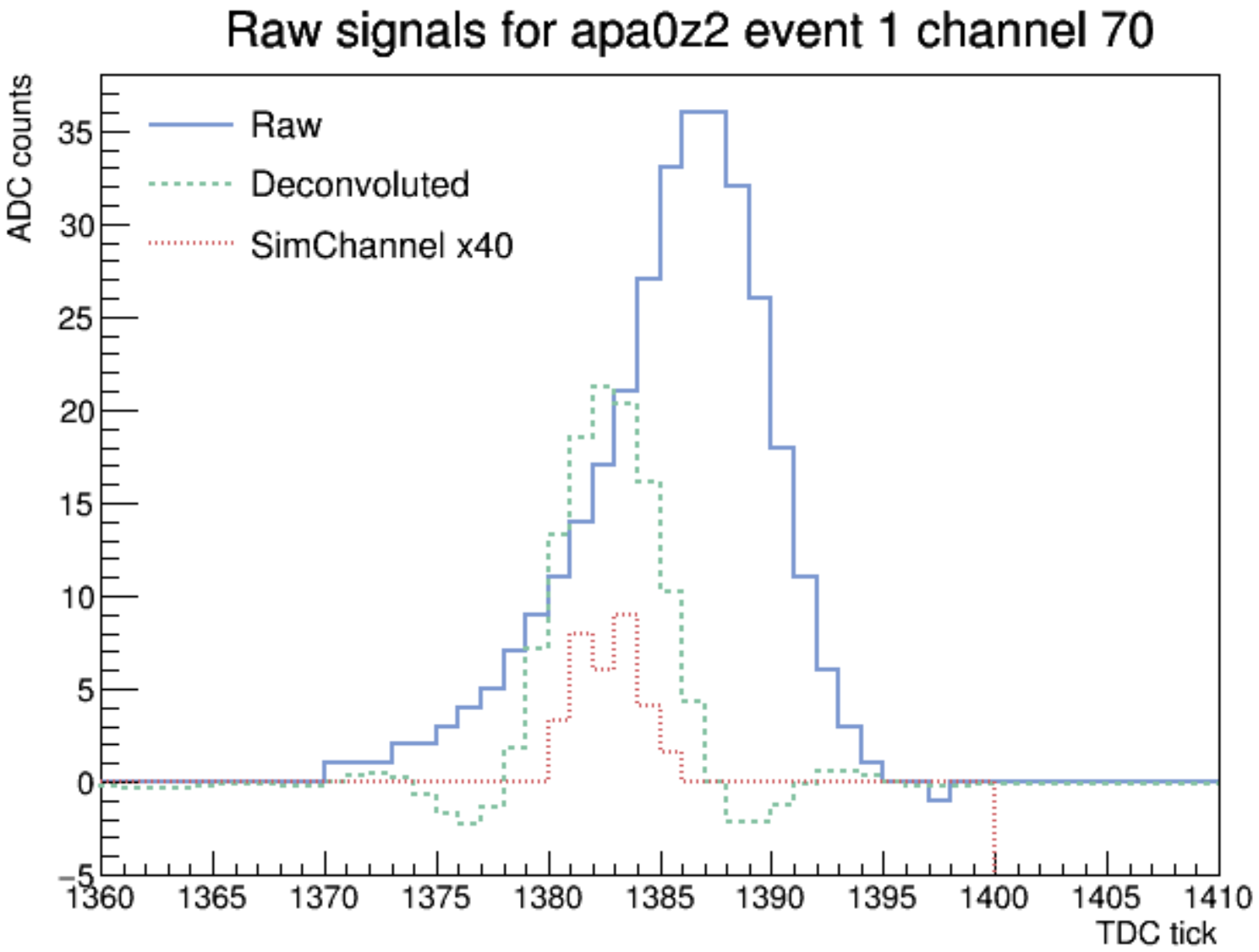
- Throw horizontal single muons at 35t or FD workspace detector
- Transverse muons (along *x*)
  - Perpendicular to wire plane
  - To study signal shape as a function of channel
- Longitudinal muons (along *z*)
  - Parallel to wire plane
  - To study signal shape as a function of TDC tick
- Select ticks or channels by hand where signal is
  - in expected direction
    - not scattered
  - and narrow
    - no delta rays



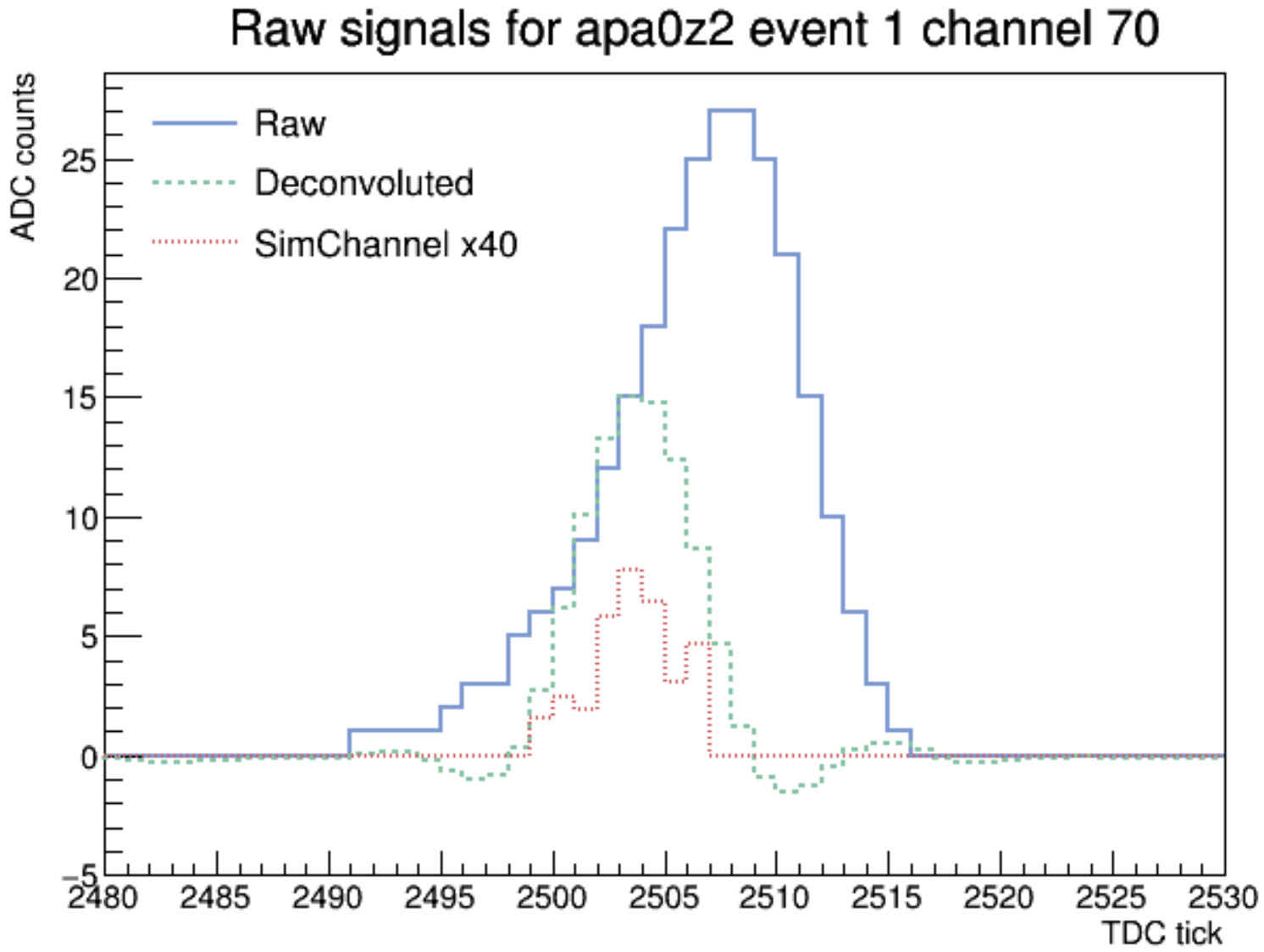
TDC signal shapes for 35 ton: short drift



TDC signal shapes for 35 ton: mid drift



TDC signal shapes for 35 ton: long drift



Comments/conclusions

Remaining issue is deconvolution distorts signal shape

- Adds negative tails
  - Raising concerns about energy resolution due to non-linear response with changing signal width
- Much broader than original simulated signal
  - Loss in spatial resolution and distinction
  - But only for very short drift

I would like to investigate further

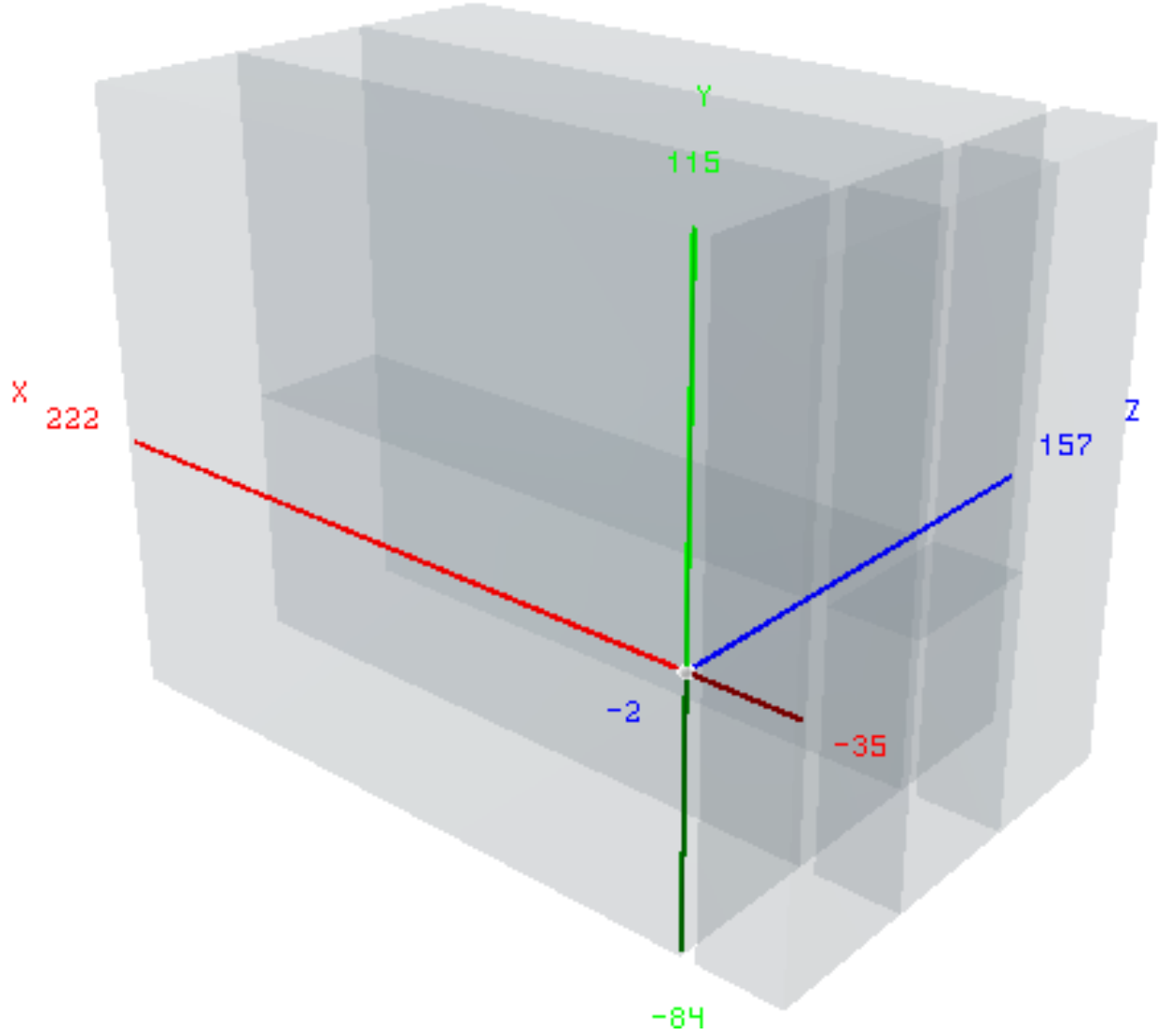
- But districted now by other issues (see other talks)

Extras

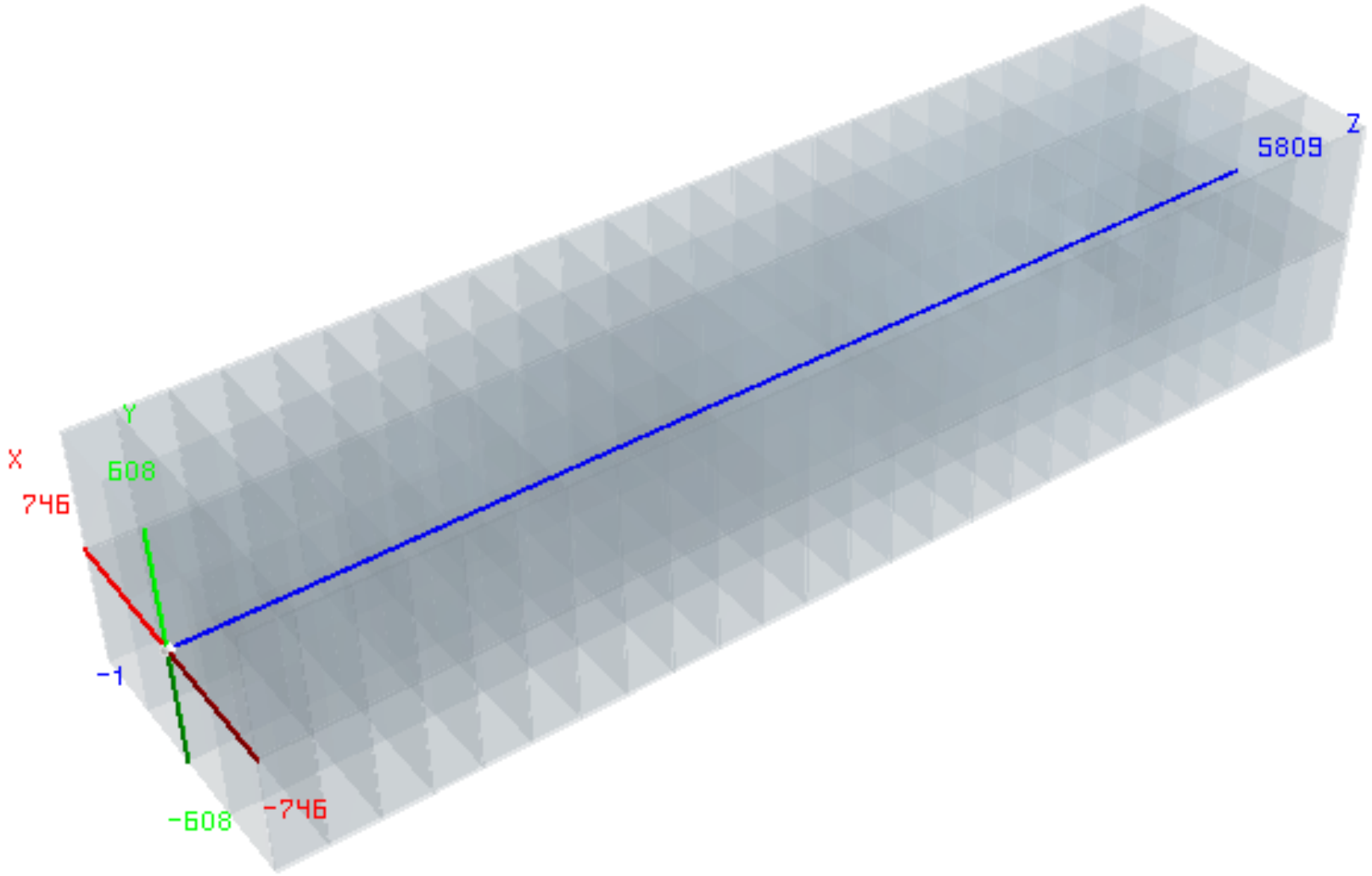
Detector displays

- Made with draw_detector

dune35t4apa_v5



dune10kt_v1



dune10kt_v1_workspace