



INDIANA UNIVERSITY

Comp Graph Module for protoDUNE-VD PDS

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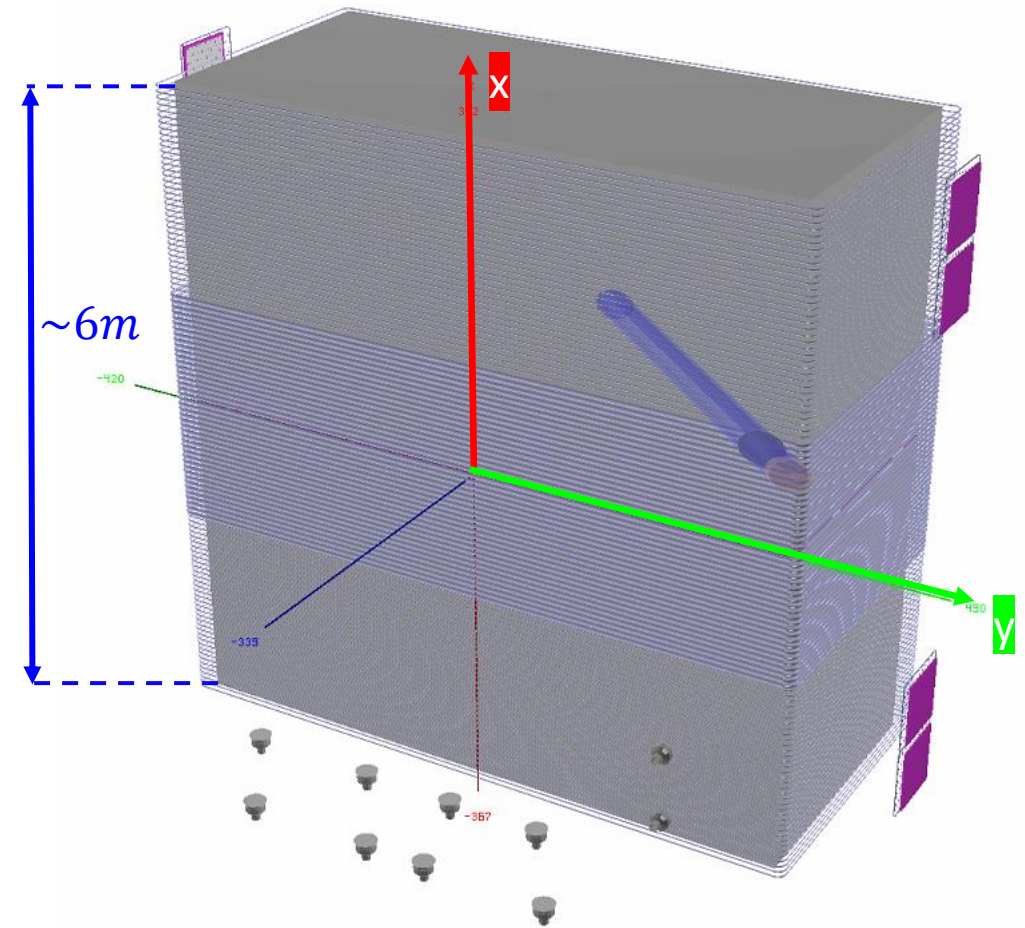
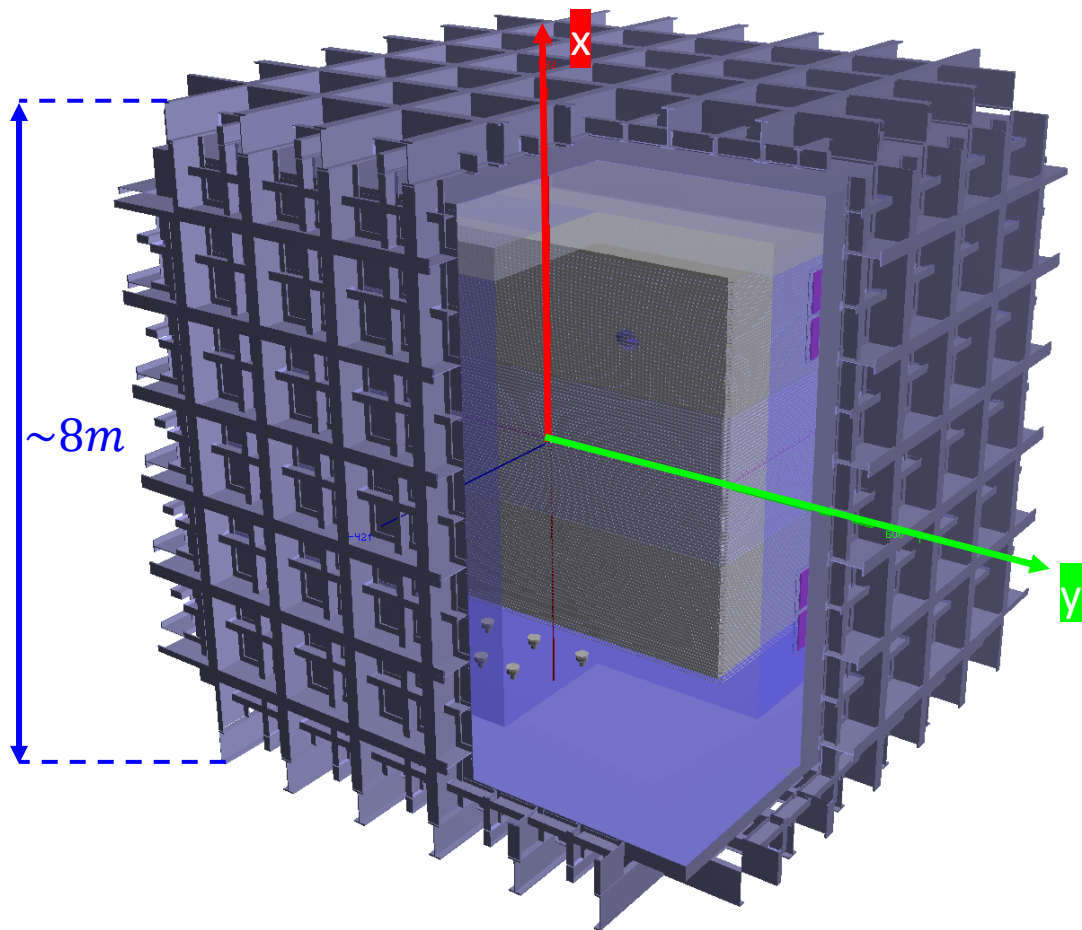
Indiana University

ProtoDUNE PDS Sim/Reco meeting

Oct 30, 2023 (Mon)

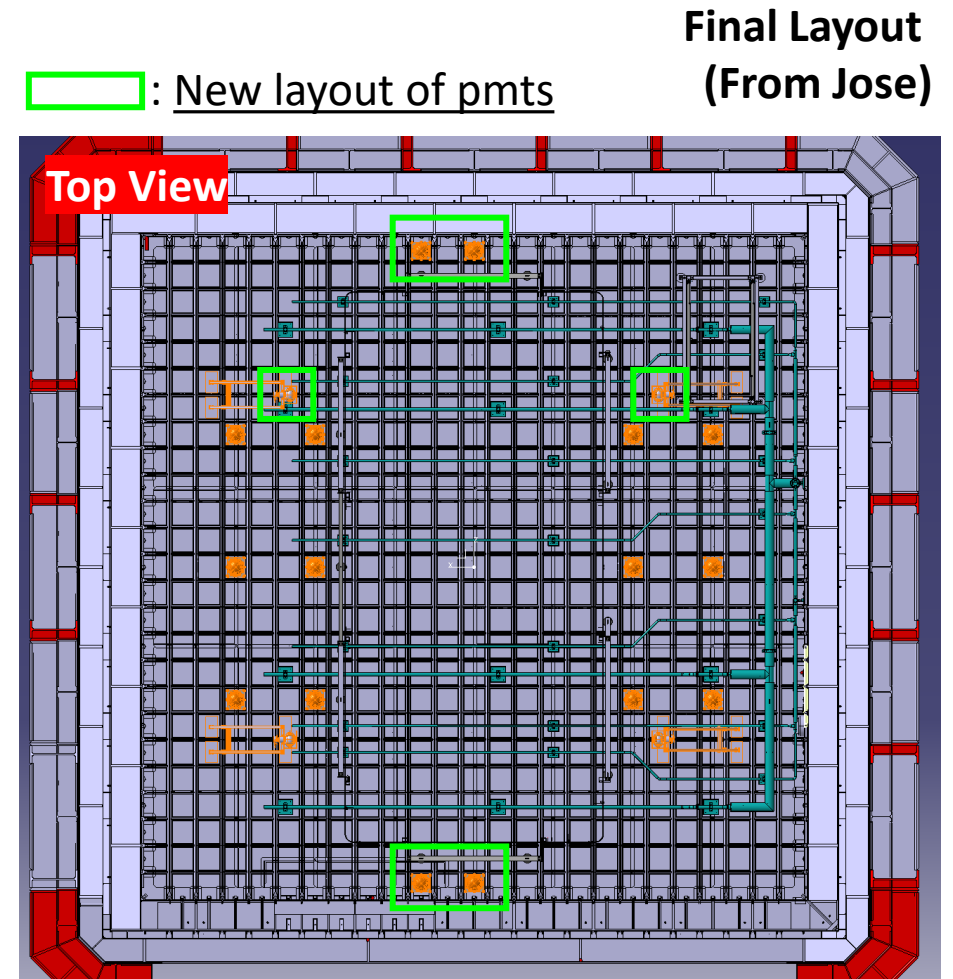
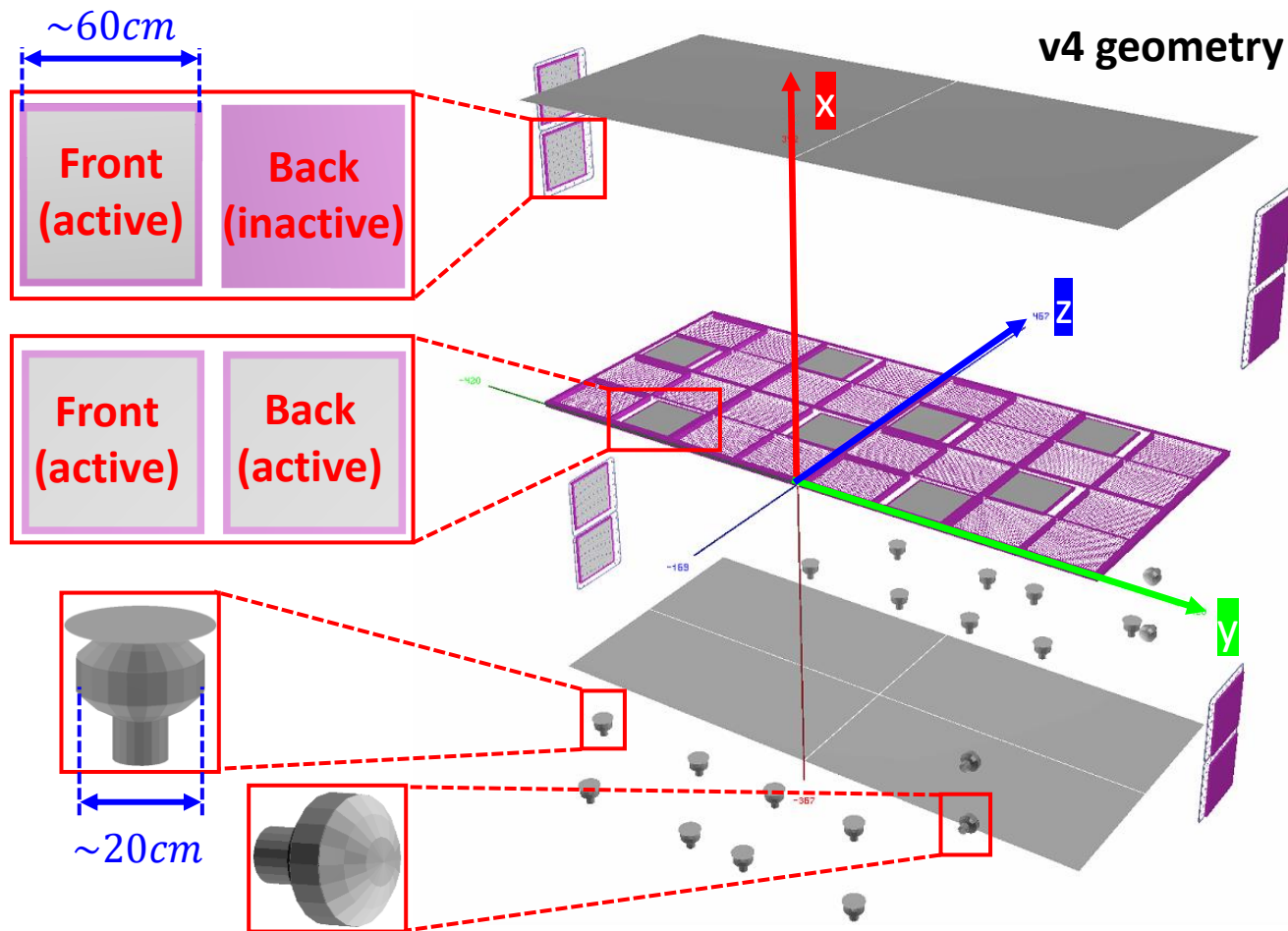
Layout of X-Arapucas & PMTs (I)

□ protodunevd_v4_refactored_nowires.gdml



Layout of X-Arapucas & PMTs (II)

- ❑ 16 X-Arapucas (**Final layout**): 8 (double-side active) on Cathode, 8 (single-side active) on Membrane
- ❑ 24 pmts (**Final layout**): 16 (with PEN foils on top) on the ground, 8 (with TPB coating) pointing toward field cage



Final Layout
(From Jose)

: New layout of pmts

Comp Module Training Details

- ❑ Purpose of computational Graph module for PDS in protoDUNE-VD:

Fast simulation of photon propagation (from emission vertex to optical detectors)

- ❑ New geometry: **preparing** (Hamza, Pablo)

- ❑ Training & evaluation sets: fhicl and xml files: **ready**

Simulation:	Full optical simulation; based on Geant4
Photon emission vertex	10^6 γ /vertex; isotropic emission
Distribution of photon vertex	Uniformly distributed in geometry (initial plan)
Rayleigh scattering length	99.9cm of 128nm photon
Absorption length	20m of 128nm photon
Reflectivity	Considered

- ❑ Network of training: **preparing** (based on network of v2 geometry)

- ❑ Evaluation script: **upgrading** (based on script of v2 geometry)

Summaries

❑ Previous v2 geometry: **16** optical channels (X-Arapucas), mature graph module trained for it



Final geometry (newer than v4):

40 optical channels (16 X-Arapucas + 16 PEN pmts + 8 TPB pmts)

❑ Final geometry: preparing (Hamza, Pablo) [**1~2 weeks**]

❑ Training & evaluation sets: waiting [**~2 weeks since this week**]

❑ Neural network of training: ongoing [**2~4 weeks since this week**]

❑ Evaluation script upgrade: ongoing [**~4 weeks since this week**]

❑ Pure LAr training at first; then train for Xe doping [**~6 weeks since this week**]

Thank you!

Backups

Training Sets parameters

Rayleigh scattering length:

```
118 services.LArPropertiesService.RayleighEnergies: [1.18626, 1.68626, 2.18626, 2.68626, 3.18626, 3.68626, 4.18626, 4.68626, 5.18626, 5.68626, 6.18626, 6.68626, 7.18626, 7.68626, 8.18626, 8.68626, 9.18626, 9.68626, 10.1863, 10.6863, 11.1863]
119 services.LArPropertiesService.RayleighSpectrum: [1200800, 390747, 128633, 54969.1, 27191.8, 14853.7, 8716.9, 5397.42, 3481.37, 2316.51, 1577.63, 1092.02, 763.045, 534.232, 371.335, 252.942, 165.38, 99.9003, 51.2653, 17.495, 0.964341]
```

Absorption length:

```
127 services.LArPropertiesService.AbsLengthEnergies: [4,5,6,6.5,7,7.5,8,9,10,11]
128 services.LArPropertiesService.AbsLengthSpectrum: [2000,2000,2000,8000,8000,8000,2000,2000,2000,2000]
```

For more, refer to:

/dune/data/users/szh2/rsl_Oct2023/work/graphModule_training/trainingSample_protodunevd.fcl