

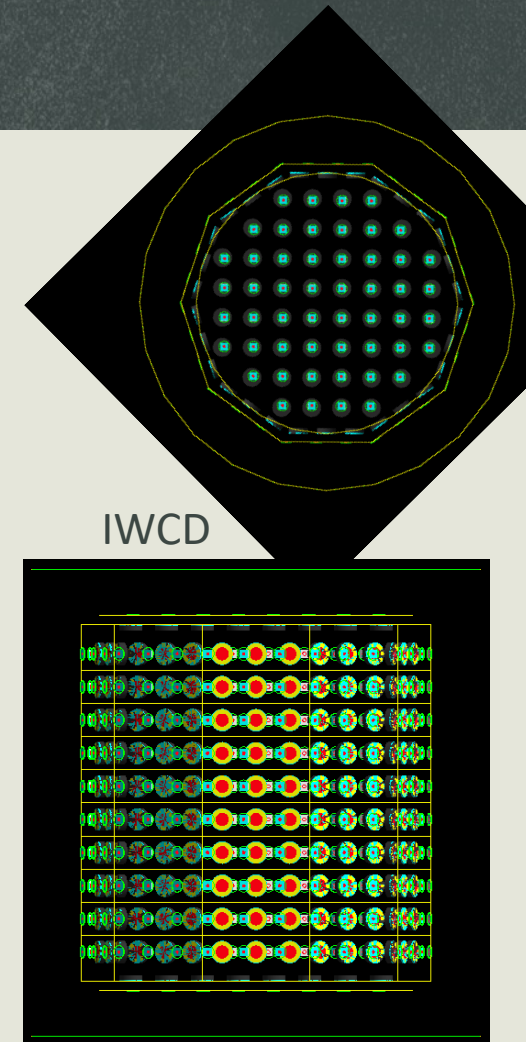
# WCTE-WCSim Overview and Status

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# WCSim

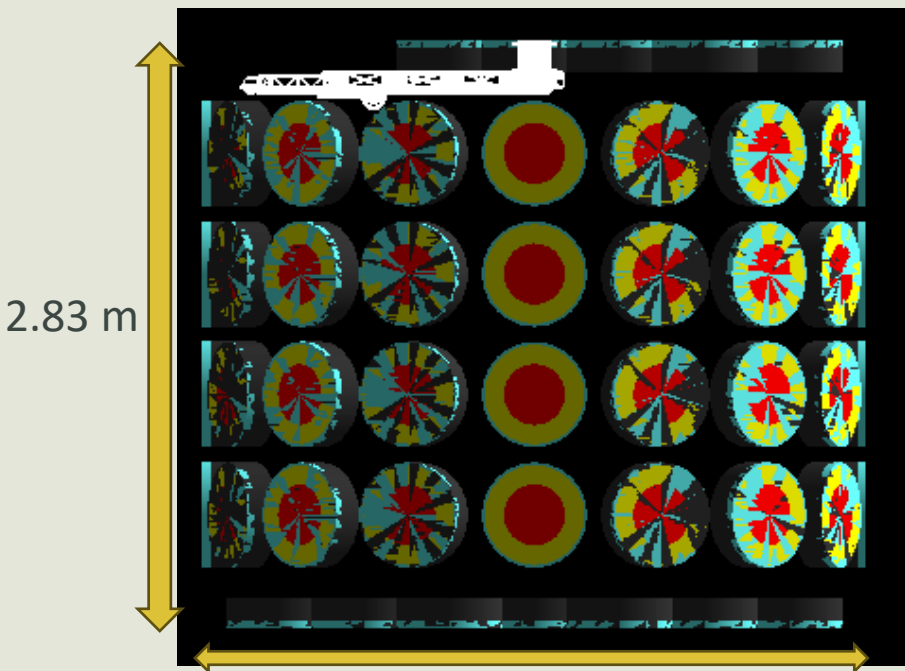
- [Open source](#) water Cherenkov simulators for Hyper-K, IWCD, WCTE
- Contains inner detector (ID), PMTs on detector wall (blacksheet), deadspace + OD if any
- Particle simulation + photon production/propagation  
→ Photon detection at PMTs + electronic response (reprocessing possible with [MDT](#))



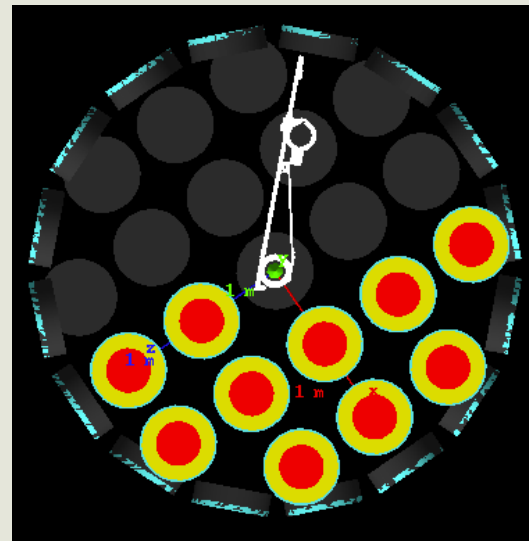
# (Current) WCTE geometry in WCSim

- 16 × 4 barrel mPMTs + 21 bottom endcap mPMTs + 19 top endcap mPMTs + CDS

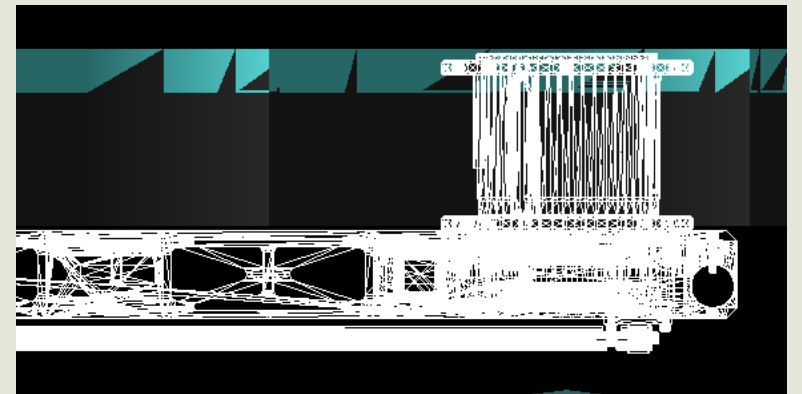
- Not final yet due to mPMT model mismatch



2024/03/18 3.19 m

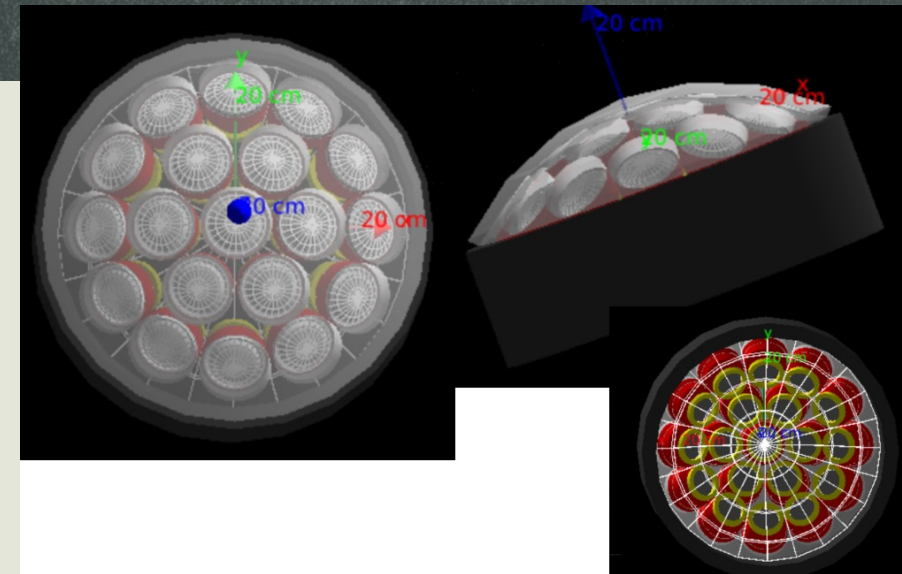
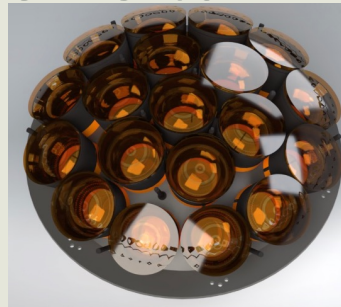


CDeR-ML CM

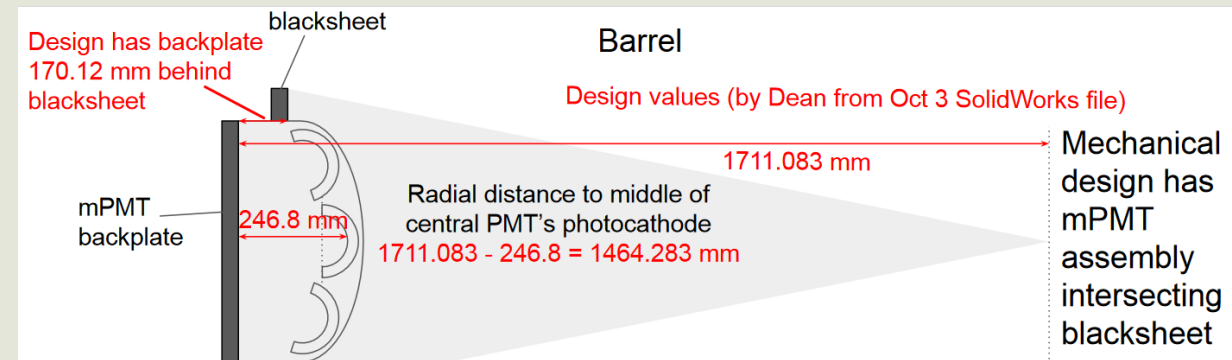


# Realistic mPMT model develop in progress

- Two types of mPMT: in-situ vs. ex-situ

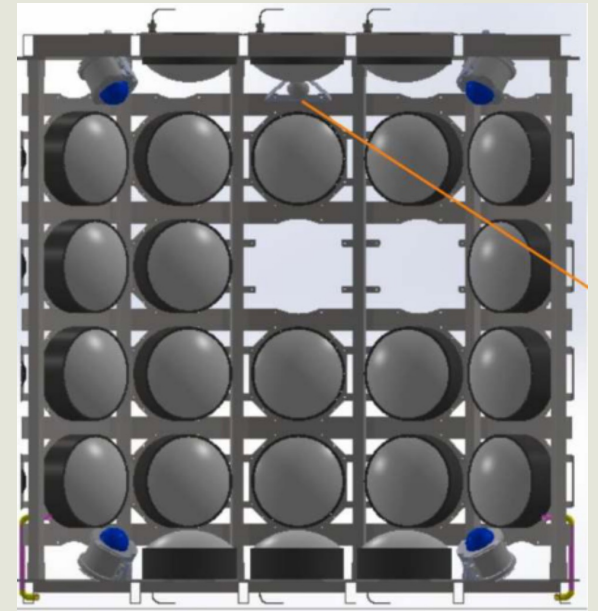


- Ex-situ mPMT model available → need to implement in WCSim
- Need to modify WCSim tank to put mPMT behind blacksheet
- Tune QE, material properties

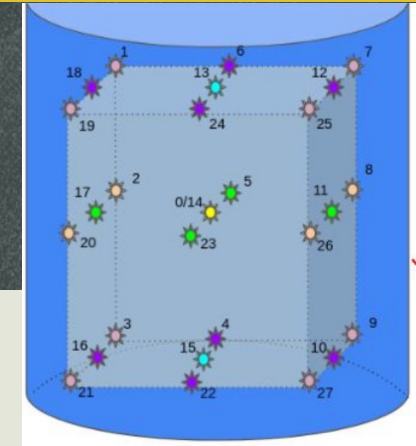
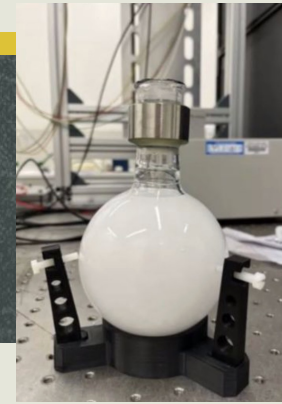


# Development plan

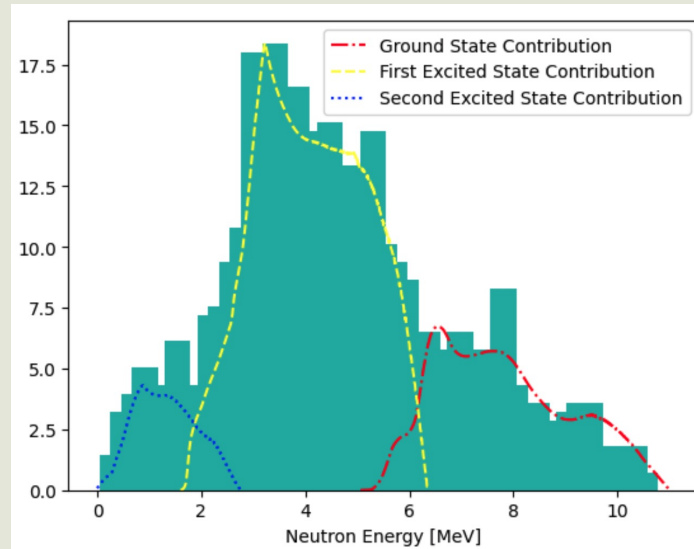
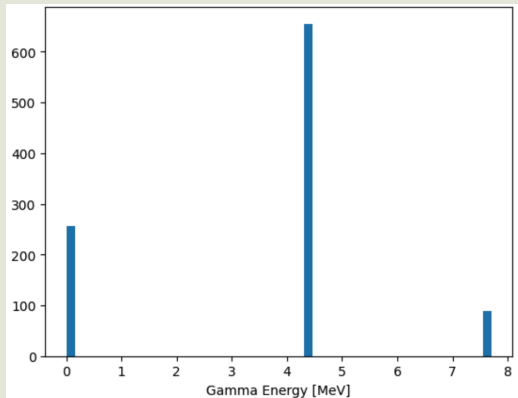
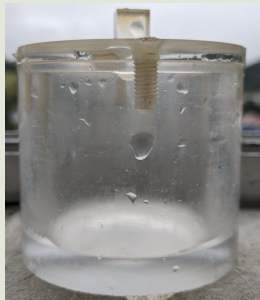
- Beam pipe design
  - Important for electron scattering, and photon reflection
- Photogrammetry camera CAD model
  - Stainless housing + acrylic dome
- PMT-by-PMT electronic response, waveform simulation & pulse fitting (MDT)



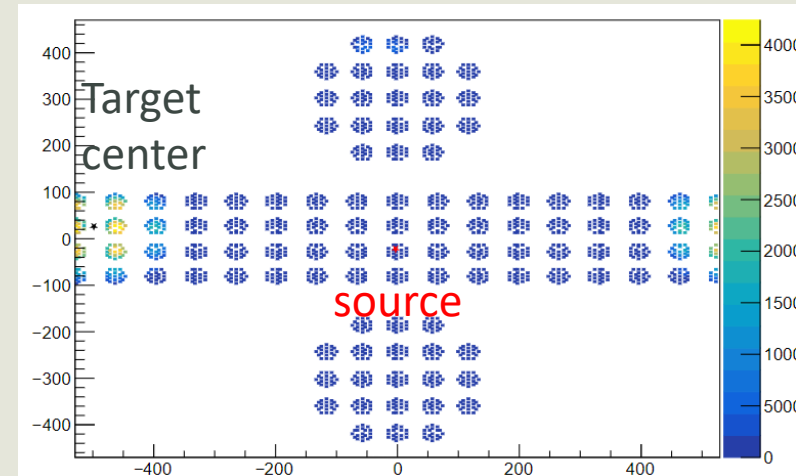
# Calibration sources



- AmBe source (PR387)
  - Primary gamma + neutron inside BGO



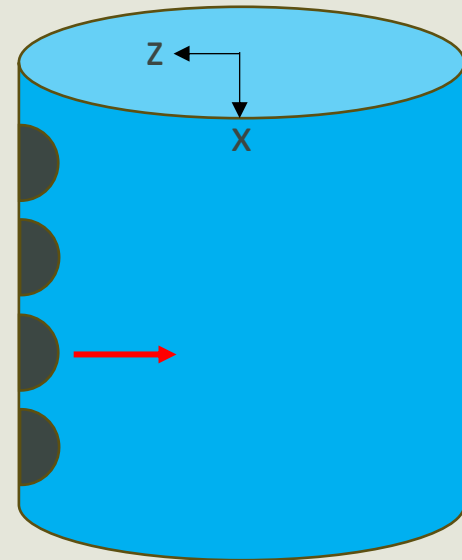
- Diffuser ball
- LED inside mPMT



- Cosmic muon

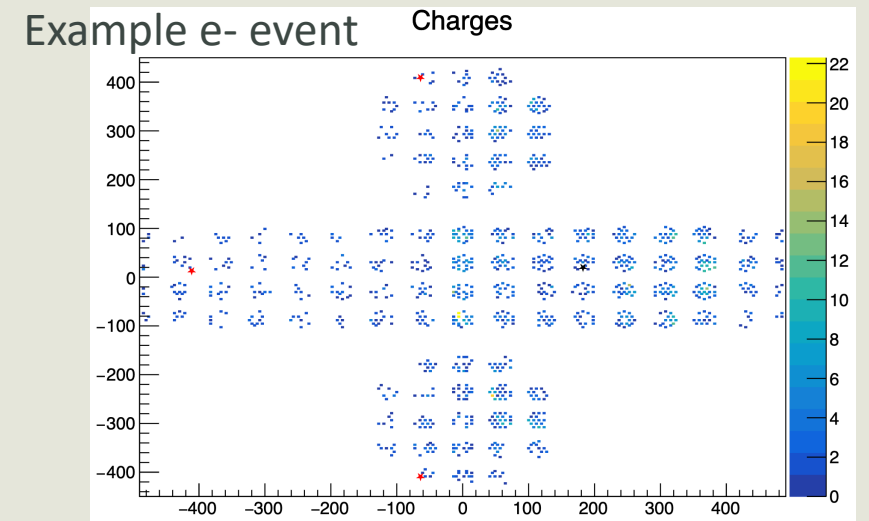
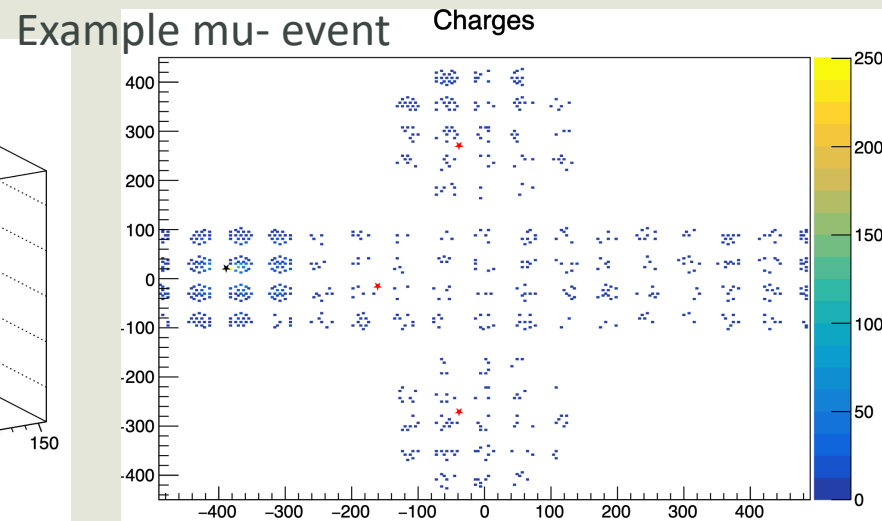
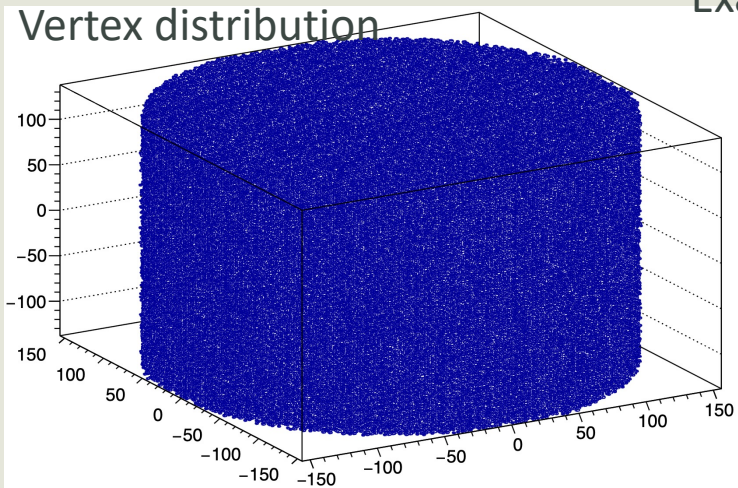
# MC production

- Container with WCSim & fiTQun (+ eos later) used in production
- Two sets of particle gun simulation
  - Vertex approximate beam window position and direction
  - Random vertex in detector



# MC production

- Random vertex in detector volume, isotropic direction, w/o CDS (1M per particle done)
  - mu-: uniform KE from 50 to 1550 MeV
  - e-: uniform KE from 0 to 1500 MeV



# MC production

- Beam simulation
  - Particles:  $e^\pm$ ,  $\mu^\pm$ ,  $\pi^\pm$  (gamma?)
  - Momentum: 260, 420, 560, 700, 800, 1000 MeV
  - Vertex: 20 cm, 30 cm, 40 cm from blacksheet
  - w/o & w/ CDS geometry
  - $1e5$  events per setup

