WCTE Introduction

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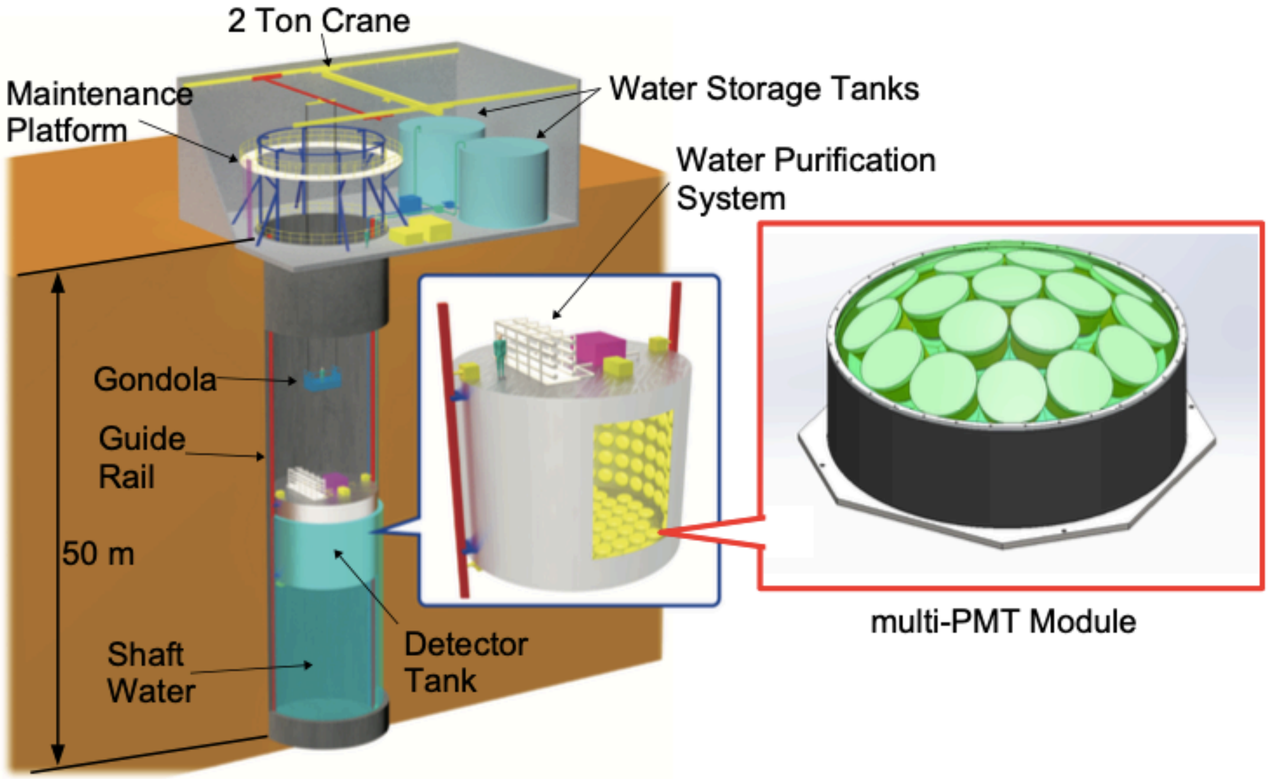
Motivation

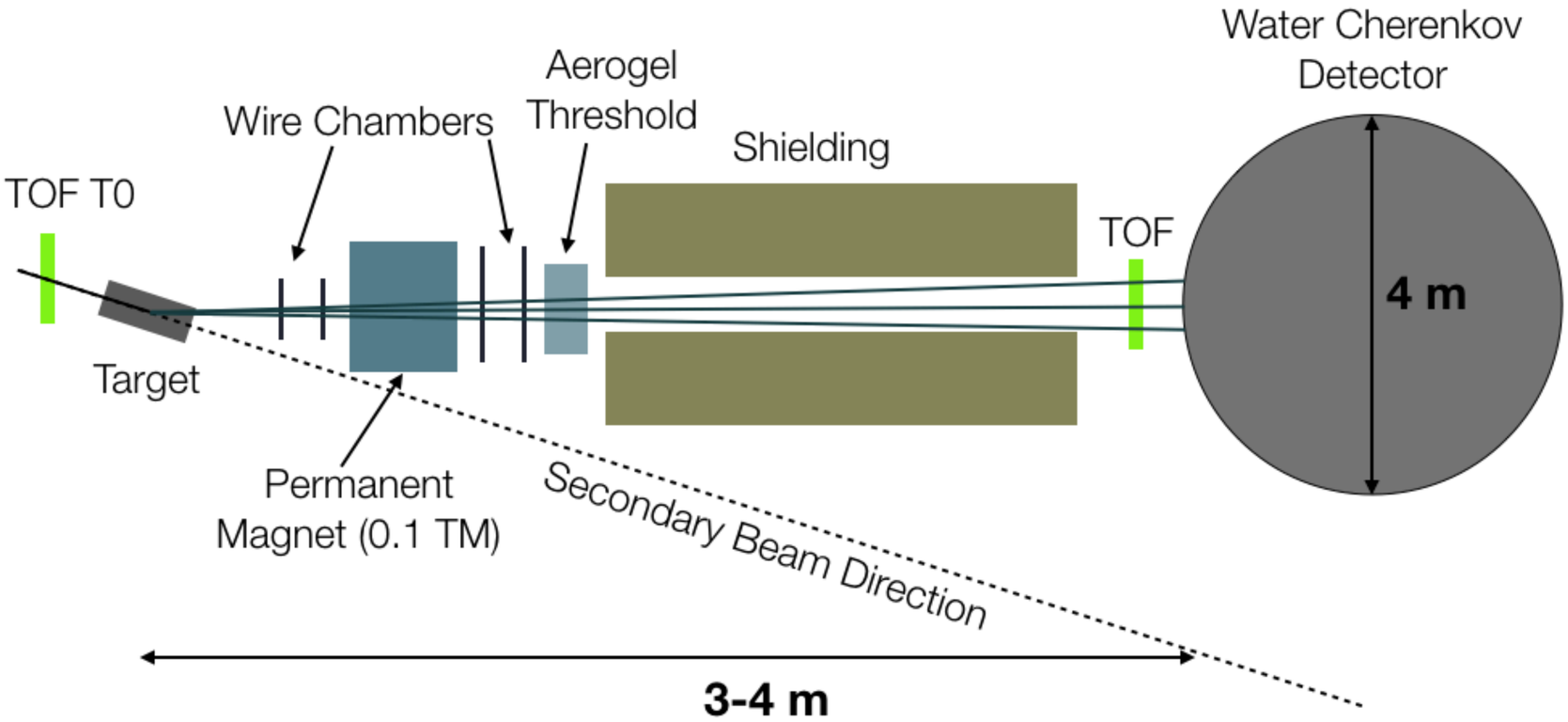
- The next generation of neutrino experiments will use new water Cherenkov detectors
- Including 1 kton scale near detectors
  - Hyper-K IWCD, ESSnuSB near detector
- Detectors requirement 1% level calibration
- Detectors will deploy new technologies
- Need a platform to study the performance and calibration of detectors and measure properties of particle propagation in water Cherenkov detectors

Hyper-K Intermediate Water Cherenkov Detector



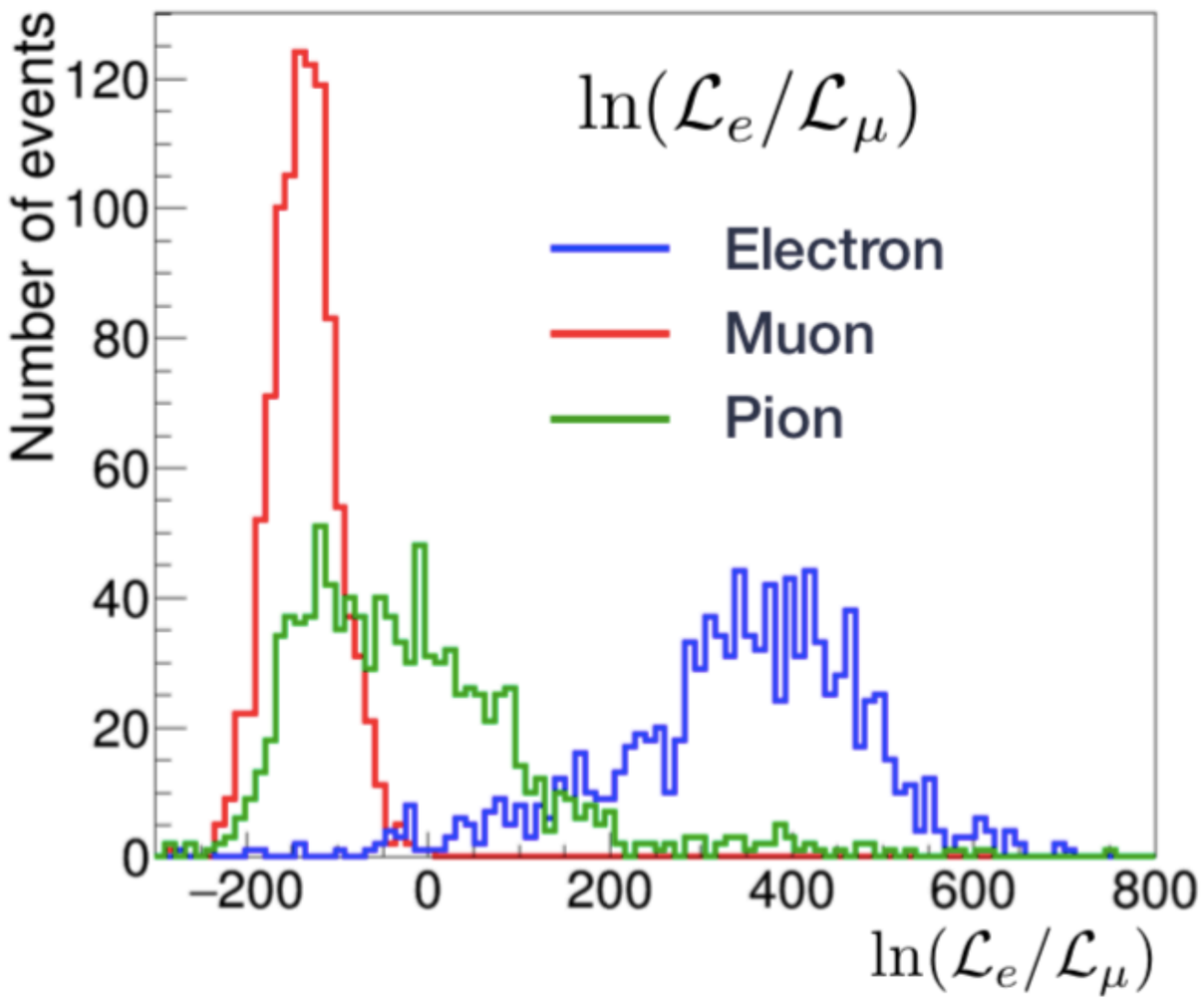
Water Cherenkov Test Experiment

- Operate a 4 m diameter x 4 m tall scaled version of IWCD in a charged particle test beam
- Interested in particle momenta of ~200 MeV/c to 1 GeV/c
- Tertiary particle production as shown below
  - Spectrometer to measure particle momentum
  - TOF and Aerogel Cherenkov threshold (ACT) detectors for PID



Requirements, Particle Types

- Muons, electrons and pions are all produced in neutrino interactions of Hyper-K
- Need to measure the detector response for each species
- Example is PID (right), which shows how charged pions populate the region between muons and electrons
  - **Require π/μ mis-ID as electrons to be ~1e-4**
- **Require fluxes of electrons, pions, muons, protons**

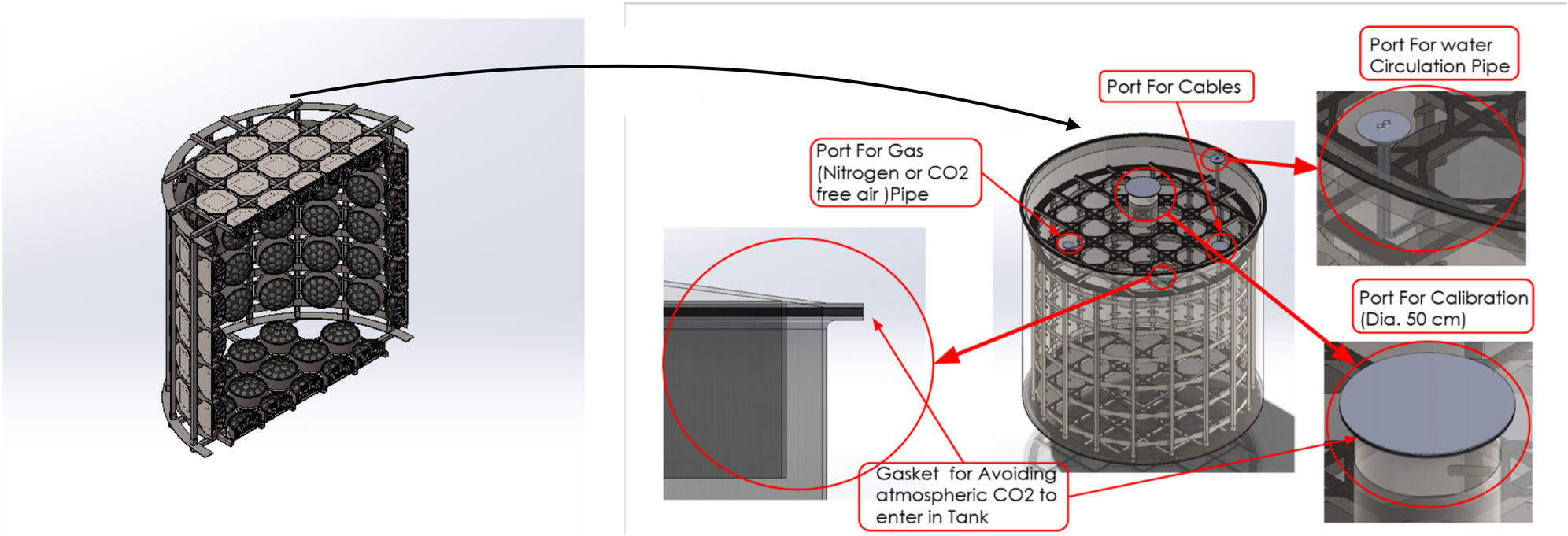


Other Beam Requirements

- For IWCD analyses, we set minimum thresholds for event selection:
  - Muon-like: 200 MeV/c (momentum)
  - Electron-like: 100 MeV (energy)
- Ideally we operate with **beam momenta down to 200 MeV/c or even below**
- We will study biases in momentum reconstruction down to 0.5%
  - We need **spectrometer resolution of ~5% or better** to minimize statistics necessary for 0.5% bias study
- We plan to use muons directly from the T9 secondary beam line
  - Need to **bend mouns through ~450 mrad to aim at detector** (match angle for tertiary production)

Experimental Area Requirements

- 50 ton, 4 m diameter x 4 m tall detector
- Beam enters detector at height of ~ 2 m above floor
- Plan to assemble support frame and PMTs first (8 tons) and then crane into tank (>8 m clearance from ground to crane)



WCTE Schedule