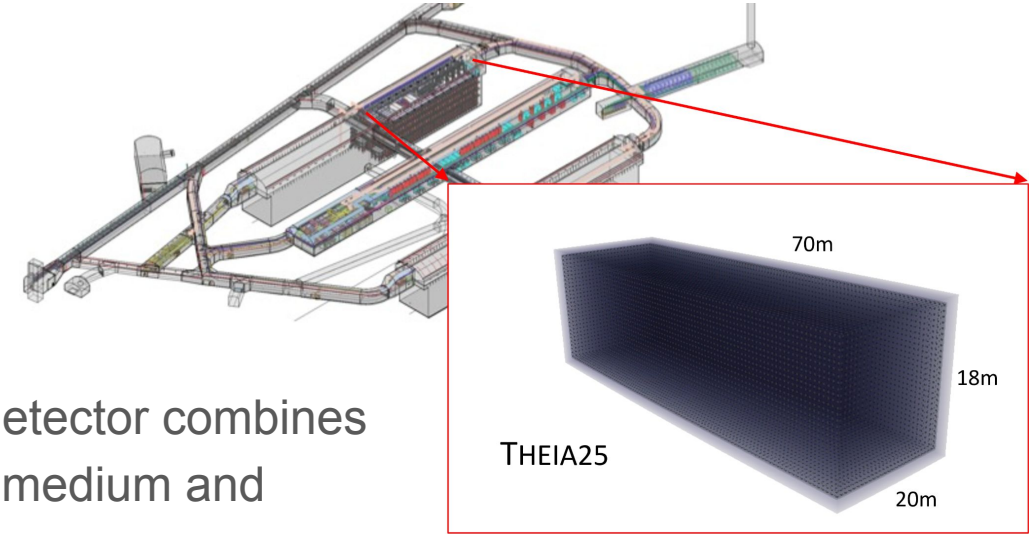
Fourth DUNE Cavity Theia



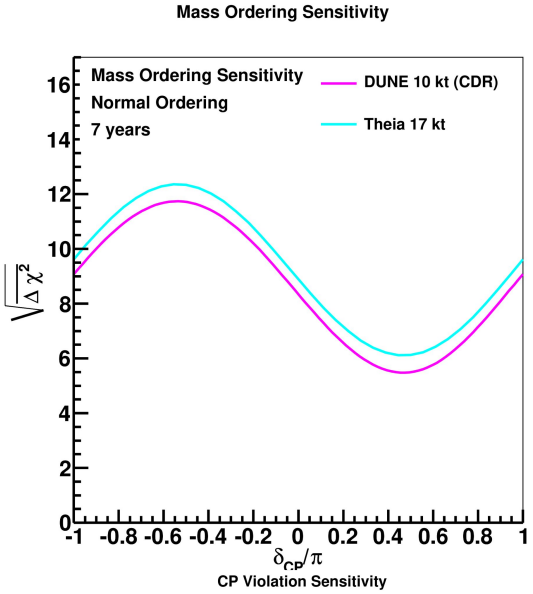
- Could fit a ~25 kt detector in the additional cavern.
- Water-based liquid scintillator detector combines known technology with a novel medium and electronics.
- Supplement DUNE physics with similar sensitivities but separate systematics.
- Acts a demonstration / testbed for larger variations of Theia (Hyper-K scale)

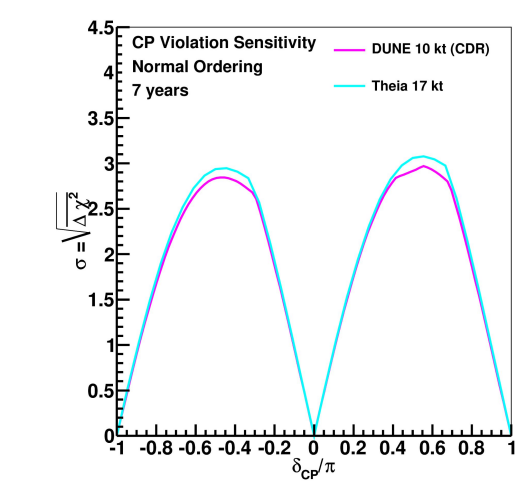
Physics Program

Cherenkov + Scintillation light separation as well as depth are both key in opening up Theia to unique measurements.

- Long-baseline oscillations
- High precision solar neutrino measurements
- Supernova burst (and DSNB)
- Nucleon decay
- Neutrinoless double beta decay

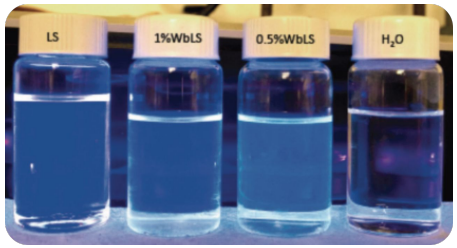
Of these, only 0νββ would require additional deployment (contained pure scintillator bag), and can be observed in the smaller Theia. Most signals scale like sqrt(volume).

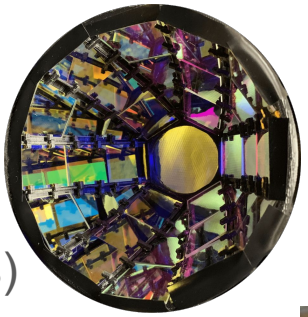


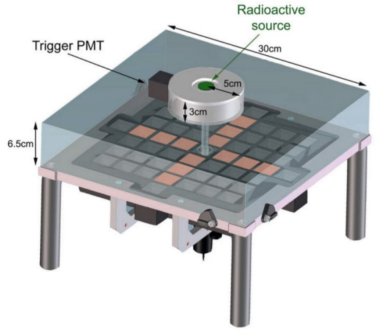


Technology R&D

- Key technologies required for Theia are
  1. Separation of Cherenkov / Scintillation Light
  2. High light-yield WbLS with good optical properties (long attenuation, low absorption).
  3. Low-background / High cleanliness.







- Ongoing LBNL research projects (Chess, Eos) focused on understanding the optical and timing properties of WbLS cocktails.