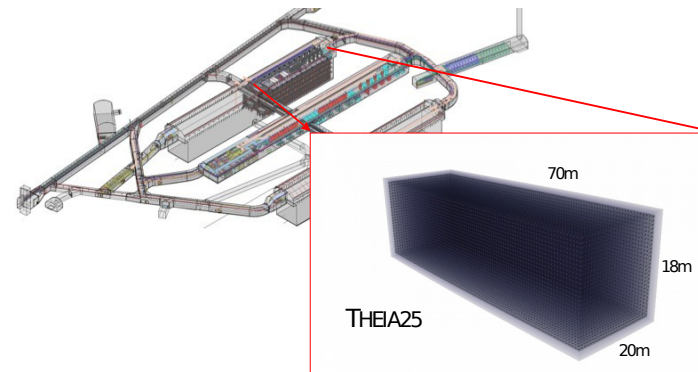


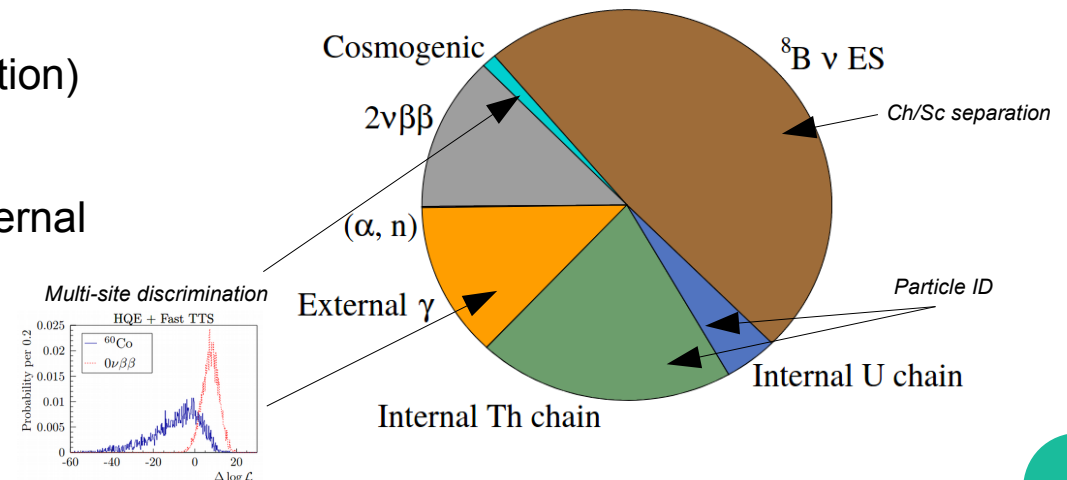
$0\nu\beta\beta$ with Theia

Theia is a proposed 25 – 100 ktonne scintillation-based, monolithic neutrino detector, capable of performing a sensitive $0\nu\beta\beta$ measurement

- Theia would likely deploy a KamLAND-Zen style balloon of loaded liquid scintillator within the larger WbLS detector
- Bench-top demonstrations of very high (5-10%) Te loading in LAB+PPO with high light yields have been performed by SNO+
- Dominant background expected to be ^8B solar neutrinos
- Direction reconstruction (via Ch/Sc separation) critical for Theia program
- Multi-site discrimination for rejection of external and comogenic $\beta\gamma$ events
- Particle ID for α/β separation

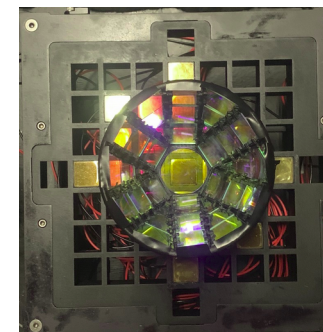
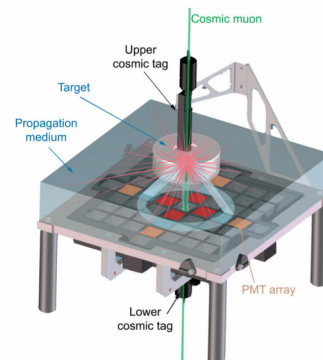
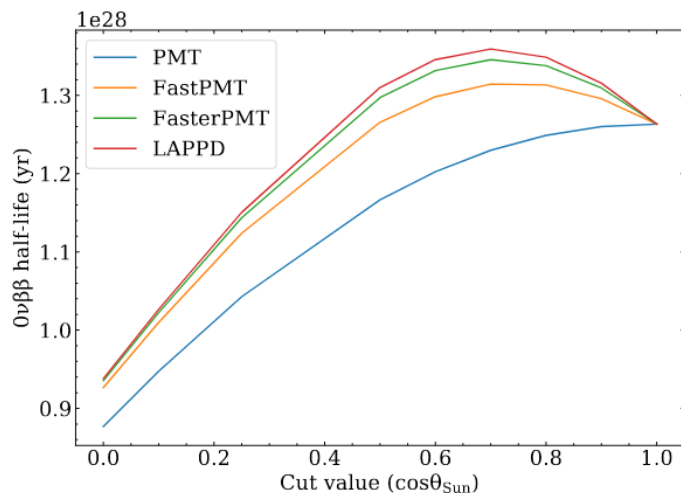
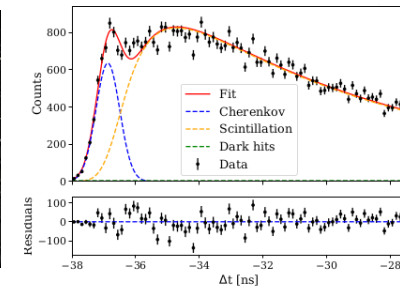
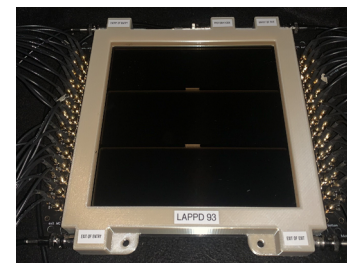
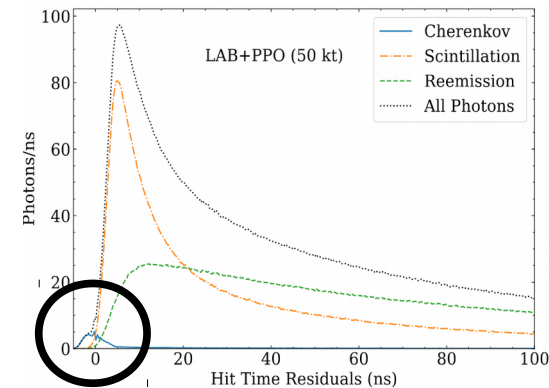


SNO+ Background Budget



Theia Sensitivity & Bench-top Demonstration of Technology

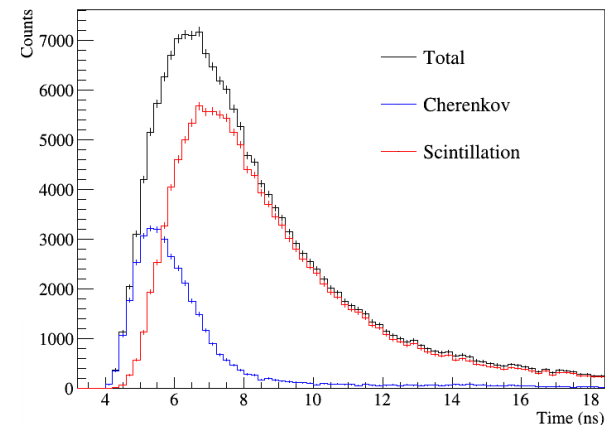
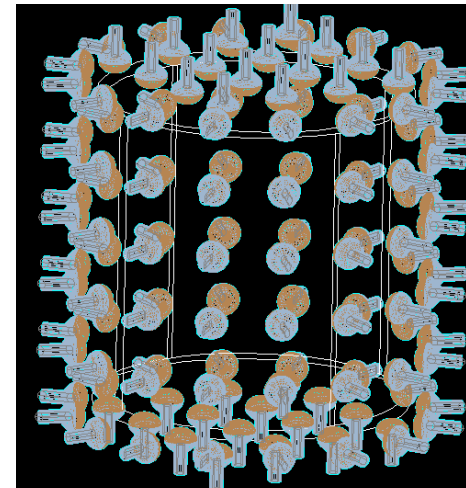
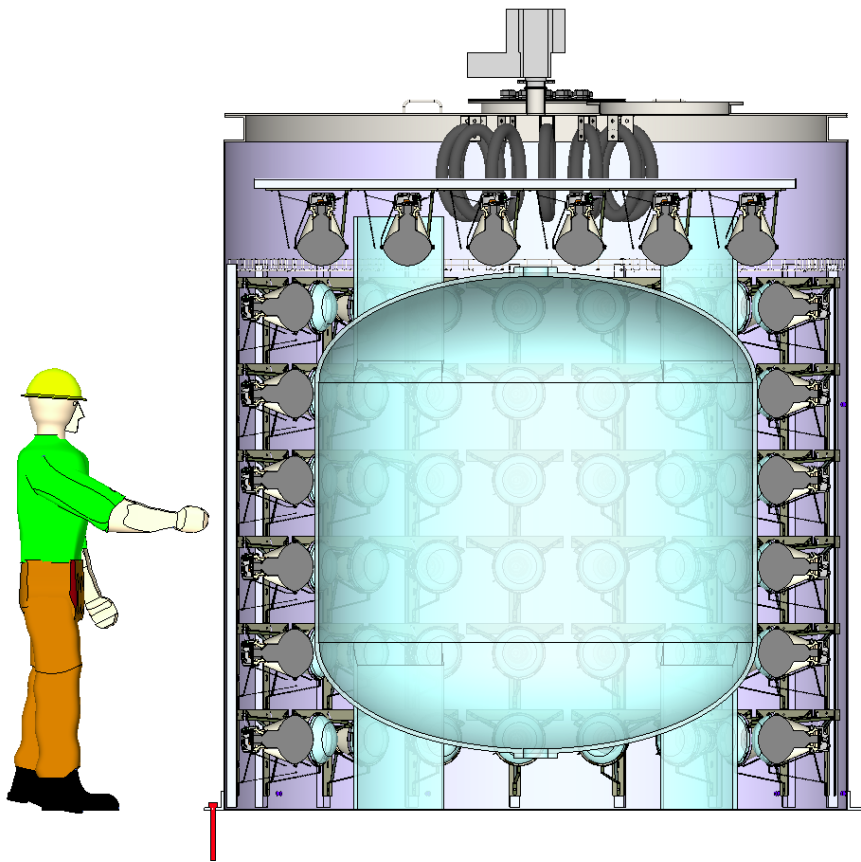
- Initial MC studies show Ch/Sc separation is possible in 50 ktonne Theia filled with LAB+PPO
- Theia half-life sensitivity with Te-loaded scintillator is expected to be $> 10^{28}$ years
- Demonstrations of Ch/Sc separation and particle ID on bench-top using CHESSE with fast PMTs, LAPPDs, red-sensitive PMTs, and the dichroicon



Dichroicon + Chess result here for LAB+PPO

Tonne-Scale Demonstrator: Eos

Several tonne demonstrator called **Eos** to be constructed at Berkeley and taking data within the next three years. Will provide a test-bed for key technologies.



Example PMT hit times for central ^{90}Y β source