

Theia Overview

On behalf of the Theia Collaboration

- Theia Detector Concept
 - Large liquid scintillator/water-based LS detector
 - Deep underground (SURF)
 - New technologies: photon detection, LS, reconstruction
 - Cherenkov + scintillation
- Physics Program $\sim 100 \text{ keV} \rightarrow \text{GeV}$
 - Solar neutrinos (pp, CNO)
 - Long-baseline (LNBF)
 - Mass ordering, δ_{CP}
 - Supernovae & DSNB
 - Nucleon decay
 - **NLDBD** targeting **NH** sensitivity

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Regular Article - Experimental Physics

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THEIA: an advanced optical neutrino detector

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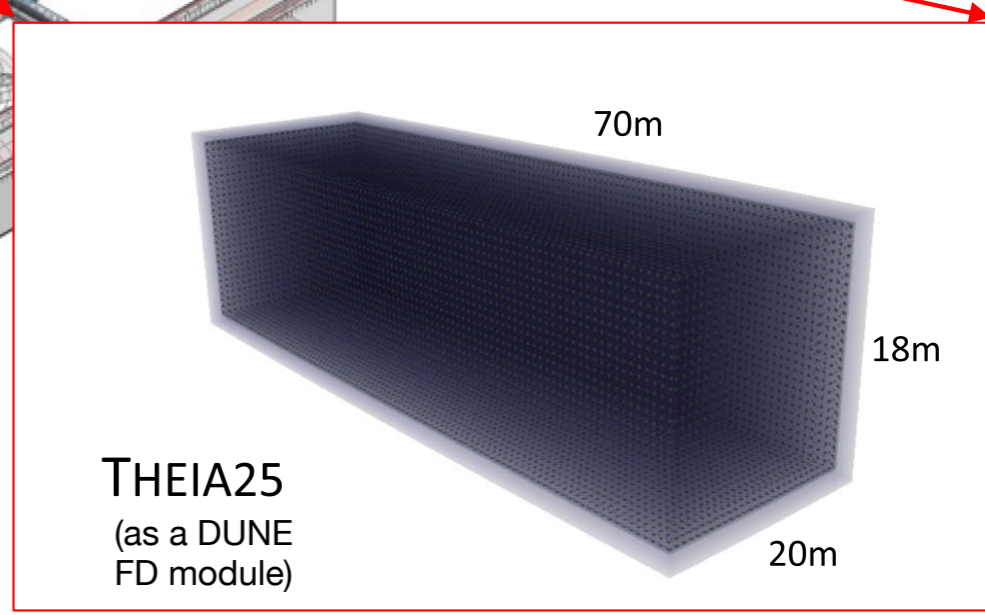
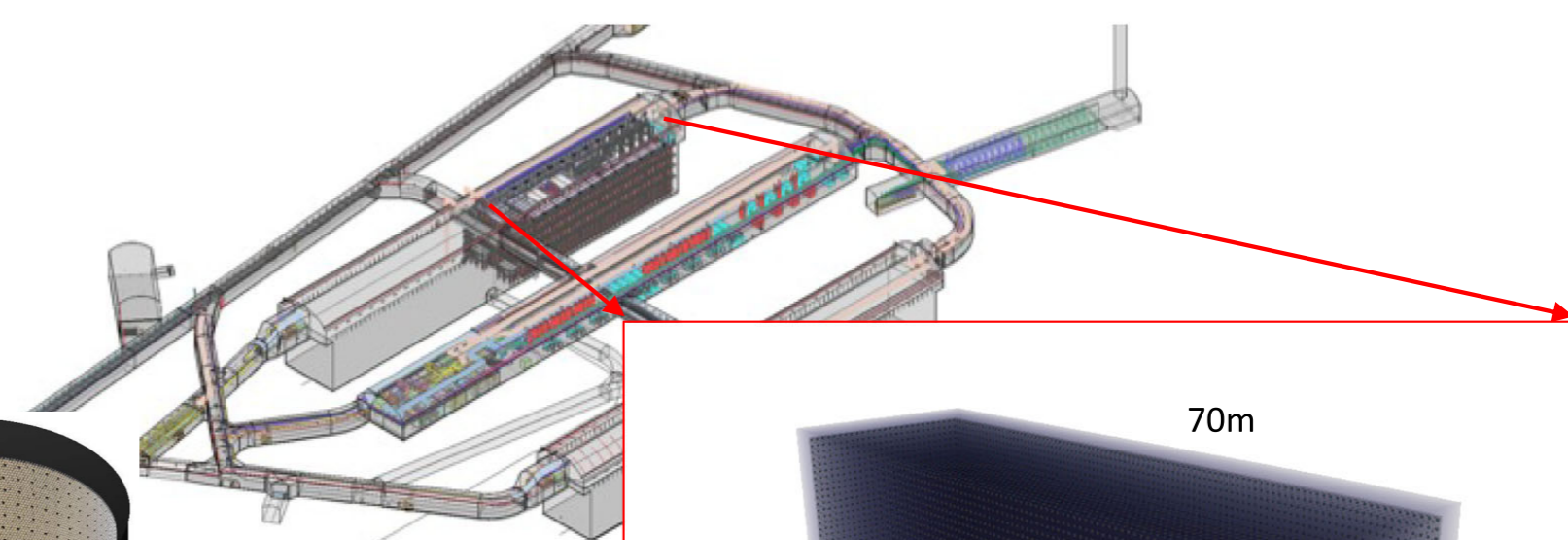
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Theia100
(100 kton at SURF)



THEIA25
(as a DUNE FD module)

Physics sensitivity paper
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Theia NLDBD

- Detector
 - Deploy LS balloon in WbLS
 - Load LS with $^{nat}\text{Te}/^{enr}\text{Xe}$
 - Targeting $\sigma_E \sim 3\%/\sqrt{E}$ @ $Q_{\beta\beta}$
 - $\hat{m}_{\beta\beta} \lesssim \mathbf{5\ meV}$ at 90% CL (near **NH**)
 - Confirm by swapping isotope

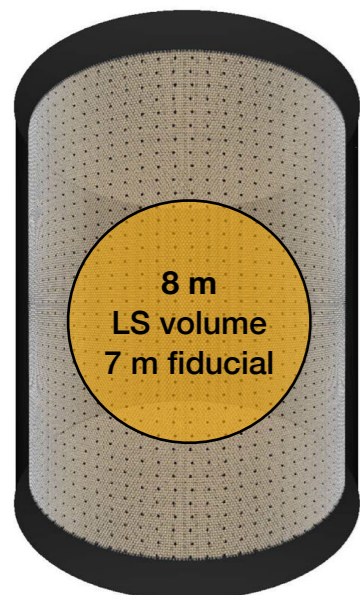
- **New enabling technologies**
 - Direction reconstruction
 - Cherenkov+scintillation PID
 - Optics e.g. spectral sorting
 - Scintillator tuning (timing, yield)
 - Advanced reconstruction

Te : $T_{1/2}^{0\nu\beta\beta} > 1.1 \times 10^{28}$ y, $m_{\beta\beta} < 6.3$ meV

Xe : $T_{1/2}^{0\nu\beta\beta} > 2.0 \times 10^{28}$ y, $m_{\beta\beta} < 5.6$ meV.

Sensitivity (counting) analysis for: Xe, Te, Nd, Se, Mo

- Potential to switch isotopes to confirm a discovery
- Can be improved by performing a fit in E, r, PID, \dots



Theia100
(100 kton at SURF)

