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Theia

NNN 2018

International workshop on Next Generation Nucleon Decay and Neutrino Detectors

Poster presentation

R&D on Water-based Liquid Scintillator for the Theia experiment

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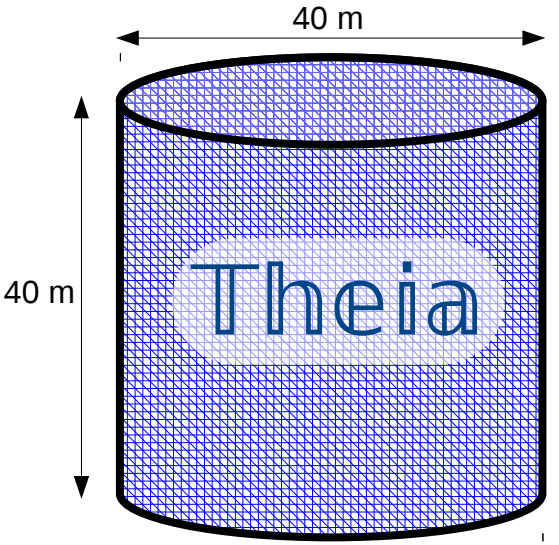
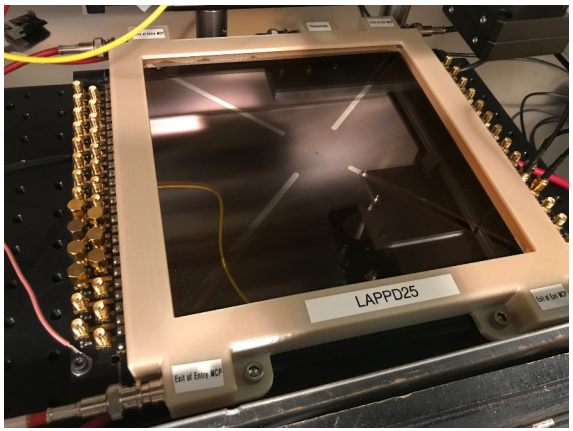
Overview of Theia

Theia

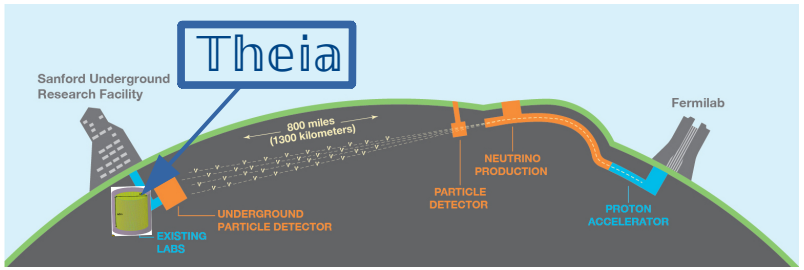
- **Theia** is a project for a large multi-purpose water-based liquid scintillator detector
- **Physics goals:** CP violation, mass hierarchy, solar neutrinos, double-beta decay, sterile neutrinos, geoneutrinos, etc..
- **~50-100 kilotonnes** of water-based liquid scintillator (**WbLS**)
- Possible location: **Sanford Underground Lab**
- **WbLS**: Mixture of scintillator and water exploiting advantages of both
- Use of fast-timing photosensors such as **LAPPDs** for event reconstruction and interaction imaging



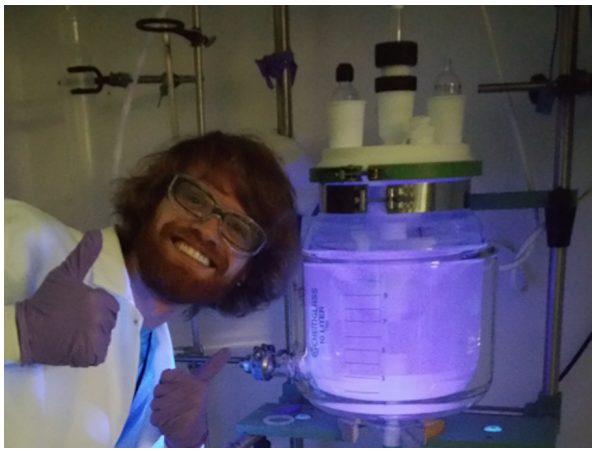
Theia detector design



LAPPD being tested at Iowa State University
Credit: Matt Wetstein (ANNIE experiment)



Theia on the **LBNF** beam line


Morgan Askins working on **WbLS** at BNL

More details: **Talk by Gabriel Orebi Gann**

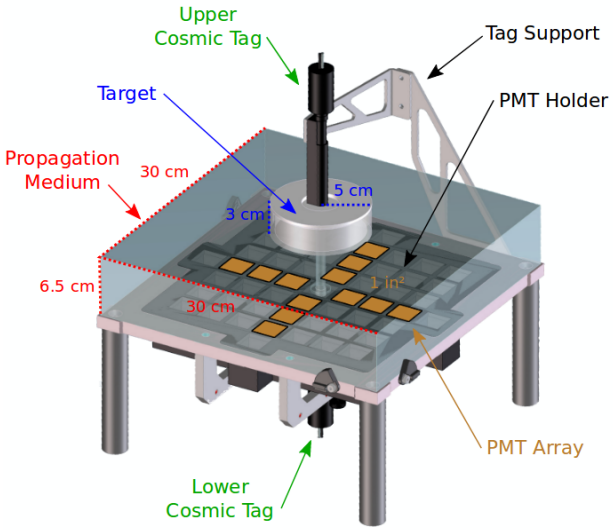
R&D on Water-based Liquid Scintillator

As a mixture of liquid scintillator and water, **WbLS** exhibits the **properties of both** (low light attenuation, low cost, high light yield) and **emits both Cherenkov and scintillation light!**

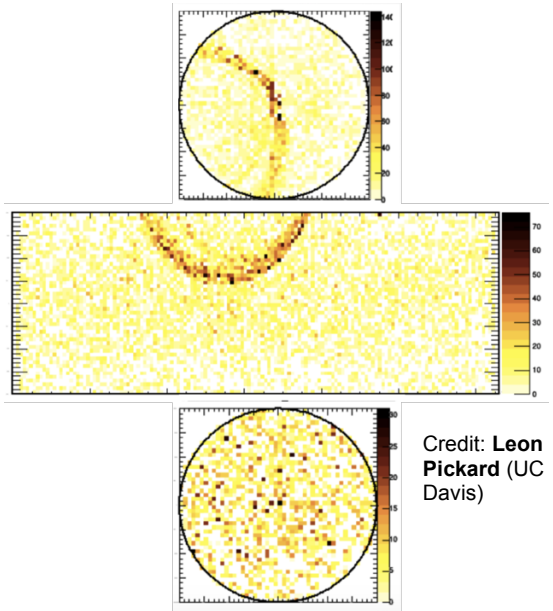
2 major R&D focuses (in this poster)

Cherenkov/Scintillation reconstruction

- **Separating Cherenkov and scintillation** light will be a **crucial** tool to better reconstruct charged particles
- **CHESS** experiment at **Berkeley**: Separation of both components using **fast photosensors**
- **Simulation** work at **UC Davis**: Energy, track and PID reconstruction using both components



The CHESS setup



Credit: **Leon Pickard** (UC Davis)

Simulated CC interaction in WbLS

WbLS filtration and purification

- WbLS **cannot be purified like water** because of the LS content
- **R&D at UC Davis**: Use **nanofiltration** to separate water and LS and purify both separately
- **Requirements**:
  - Doesn't damage WbLS
  - Scalable to Theia