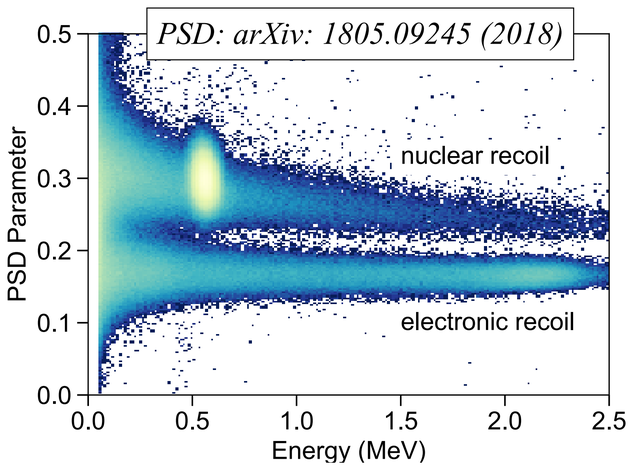
Design, assembly, and installation of the PROSPECT antineutrino detector

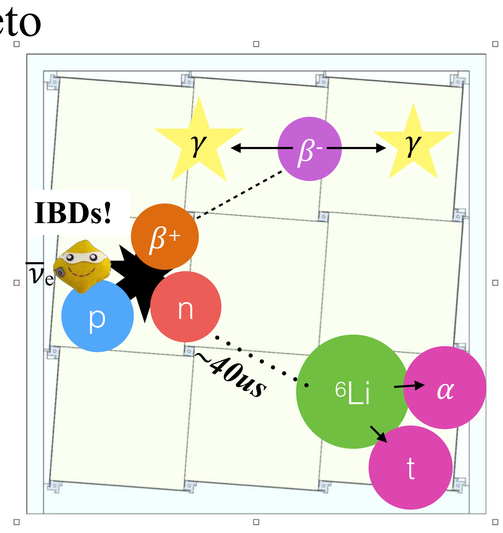
Danielle Norcini† for the PROSPECT Collaboration (prospect.yale.edu)
Department of Physics, Wright Laboratory, Yale University, New Haven, CT 06511

Detector design considerations

Challenge: detect inverse beta decays (IBDs) in limited space at the Earth's surface, ~7m from a reactor

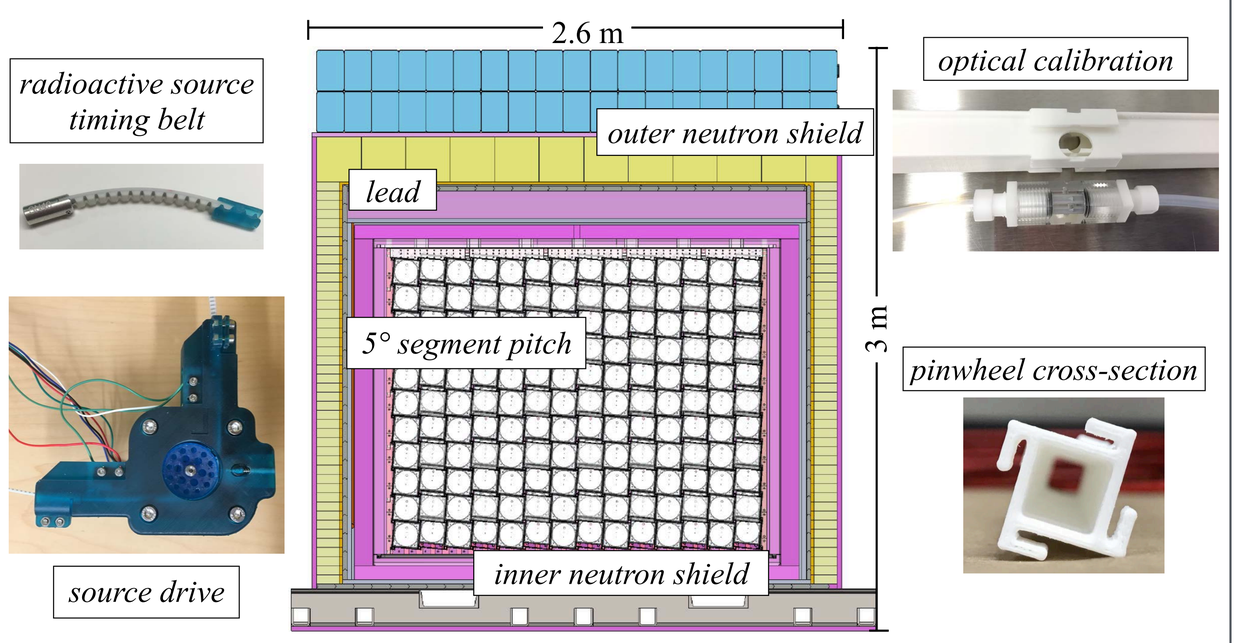
- energy containment (n + ^{6}Li → α + t + 0.55 MeV$_{ee}$)
- pulse-shape discrimination for particle ID
- event topology and course tracking information
- fiducialization with an active veto





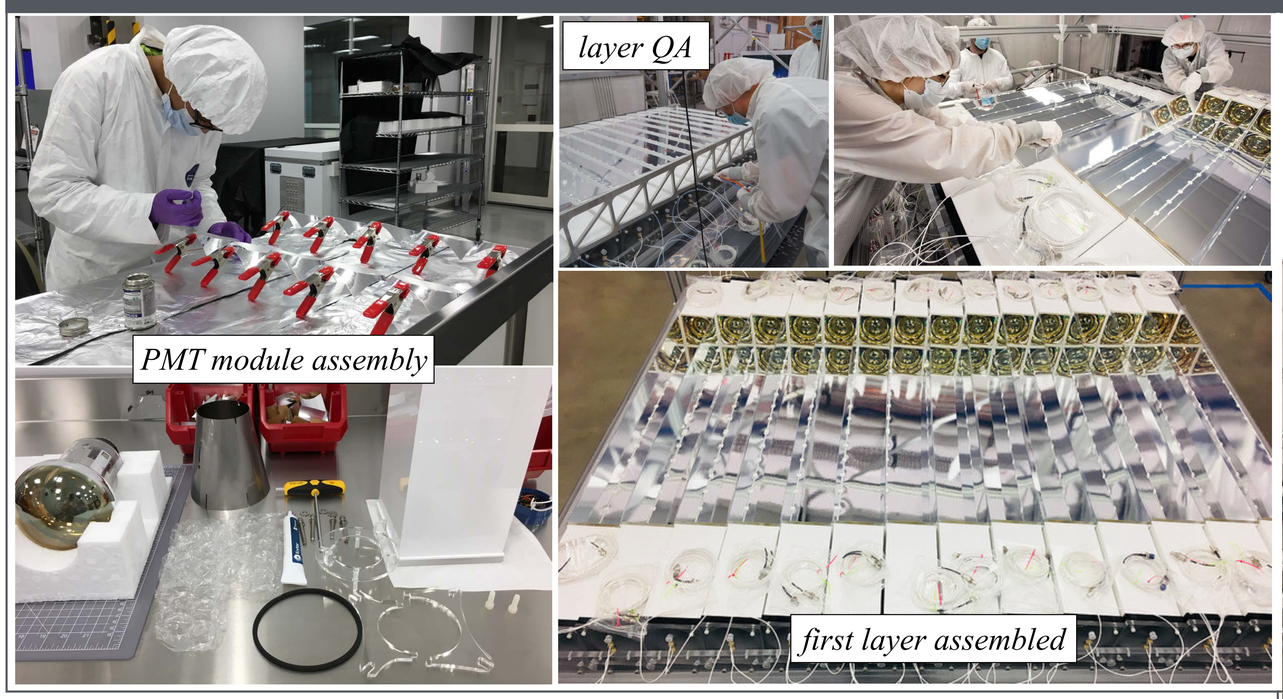
Physics goals require excellent light collection (resolution), < 5% dead material, and *in-situ* calibration options.

4-ton segmented ^{6}Li liquid scintillator detector



Compatible materials: acrylic, FEP, PTFE, PEEK, PLA

Assembly of detector package at the Yale Wright Laboratory



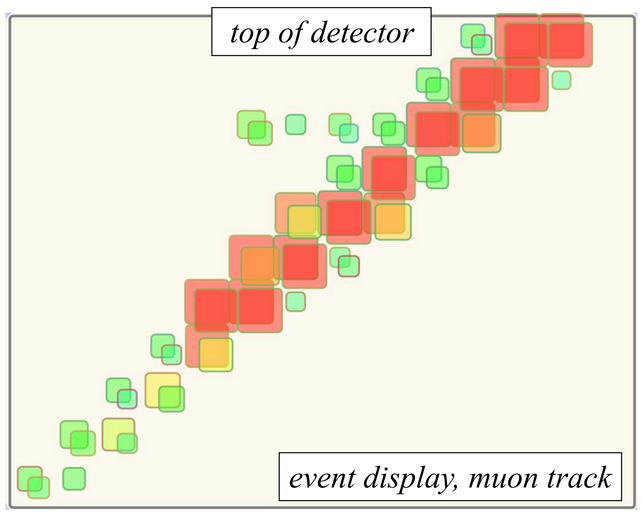
- PMT module, optical separator, and pinwheel production time ~1 year, detector package assembly ~3 months
- Each piece assembled by PROSPECT collaborators, significant material cleaning and building QA/QC

- Secondary containment gas/light tight via blackened silicone
- Installed environment sensors (temp, humidity, pressure)
- Data taken without scintillator to validate optical calibration, HV control, and DAQ system

Installation at the High Flux Isotope Reactor, USA

- Detector shipped and filled with scintillator at HFIR on-site
- Built shielding package: lead, borated poly, water bricks
- Installed source calibration system with gamma sources
- Commissioned in March, online since beginning of May

journey to Oak Ridge National Laboratory



Acknowledgements

This material is based upon work supported by the U.S. Department of Energy Office of Science and the Heising-Simons Foundation. Addition support is provided by Illinois Institute of Technology, LLNL, NIST, ORNL, Temple University, and Yale University. We gratefully acknowledge the support and hospitality of the High Flux Isotope Reactor, managed by UT-Battelle for the U.S. Department of Energy.

†danielle.norcini@yale.edu

See posters: 112, 139, 146, 188, Talk: Friday 12:15pm

Neutrino 2018