

Design, assembly, and installation of the PROSPECT antineutrino detector

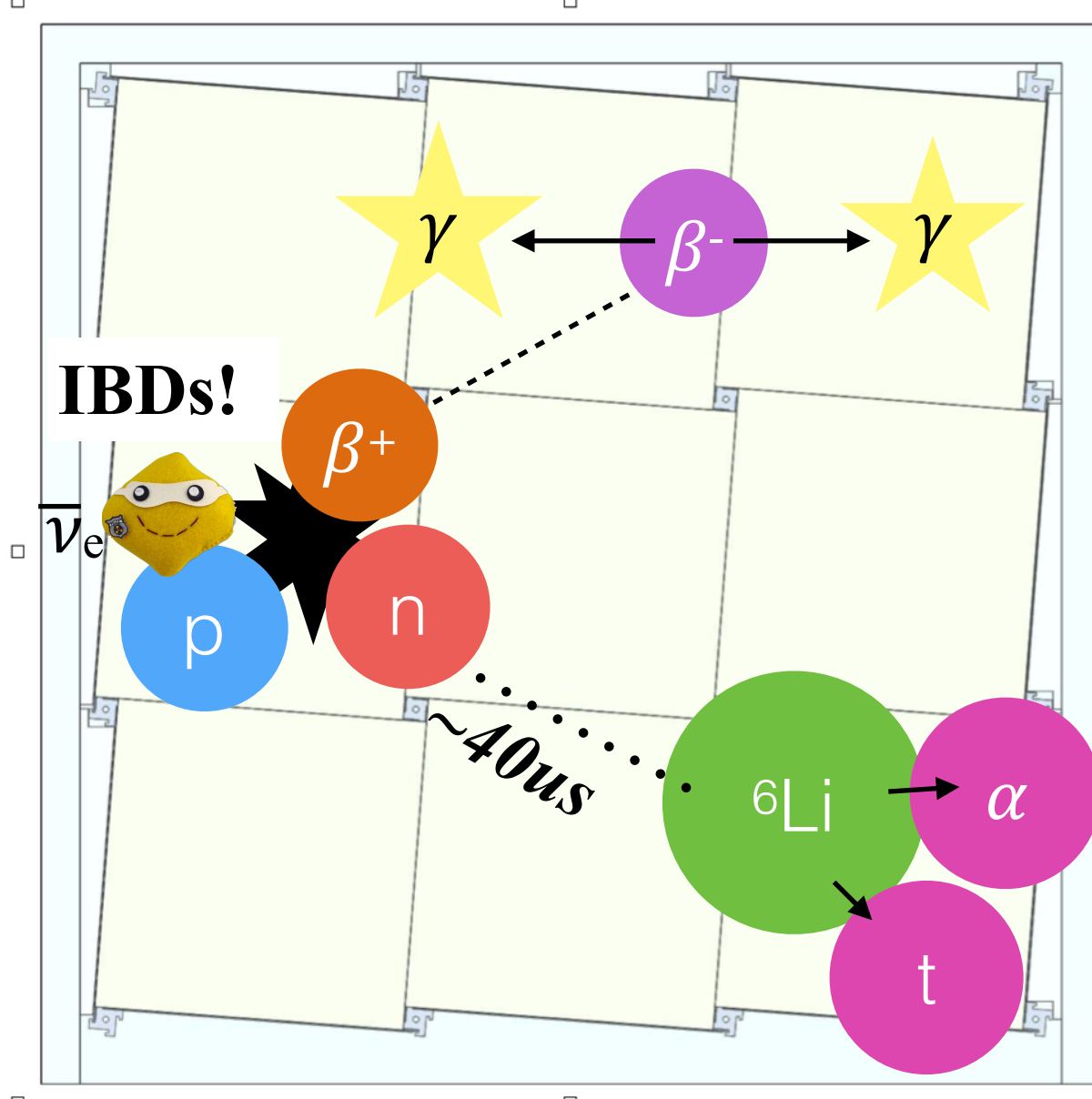
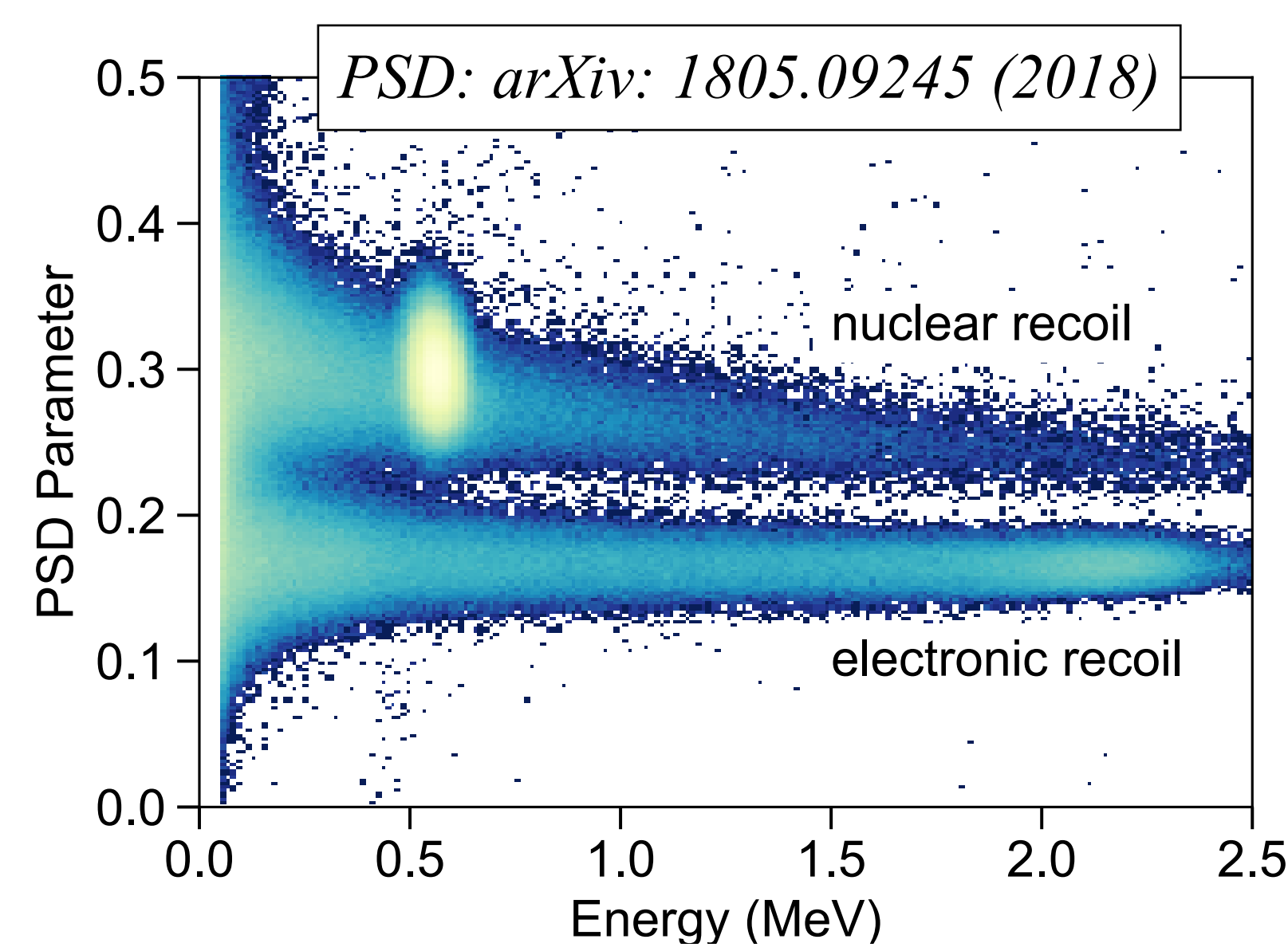
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Detector design considerations

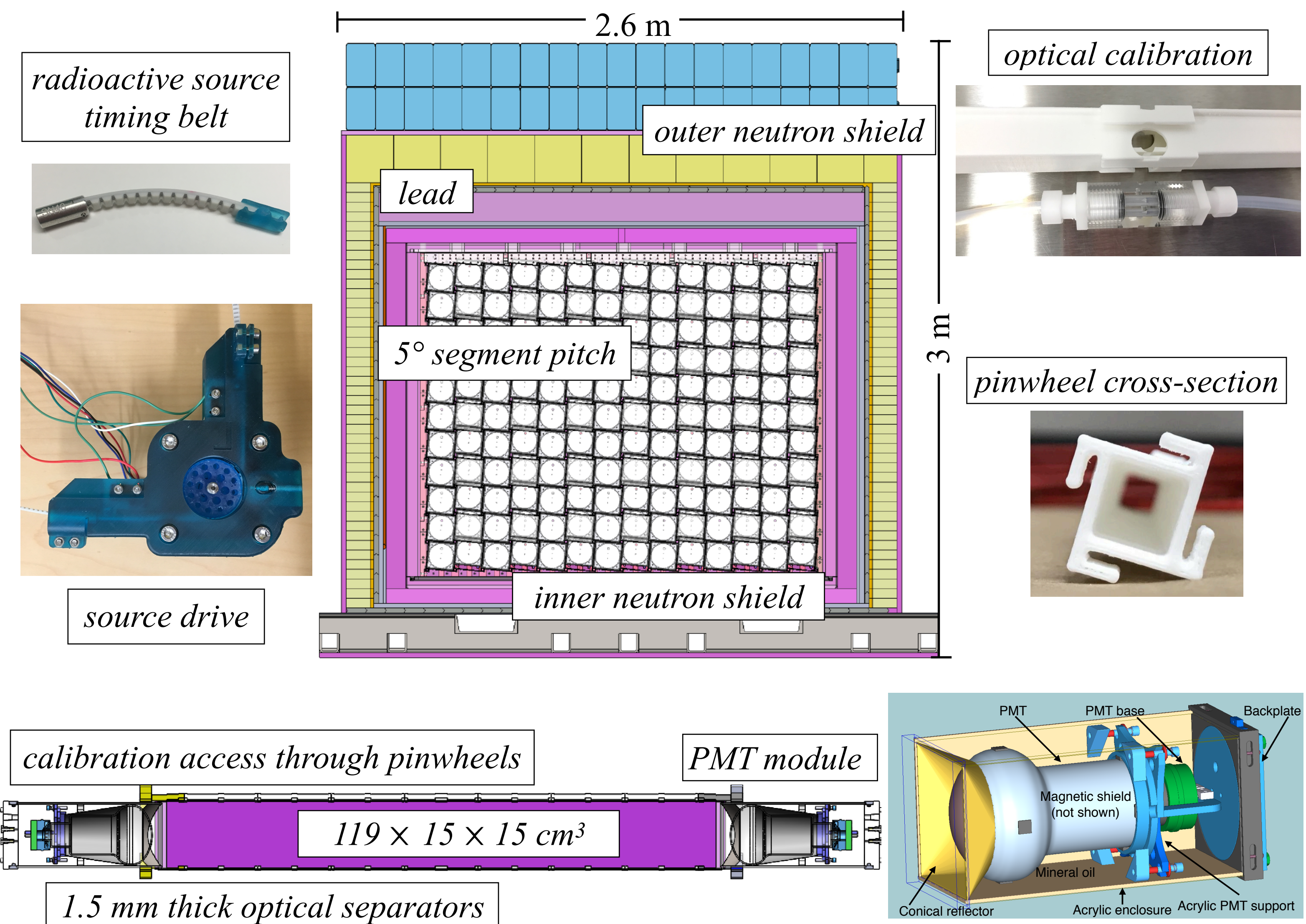
Challenge: detect inverse beta decays (IBDs) in limited space at the Earth's surface, ~7m from a reactor

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



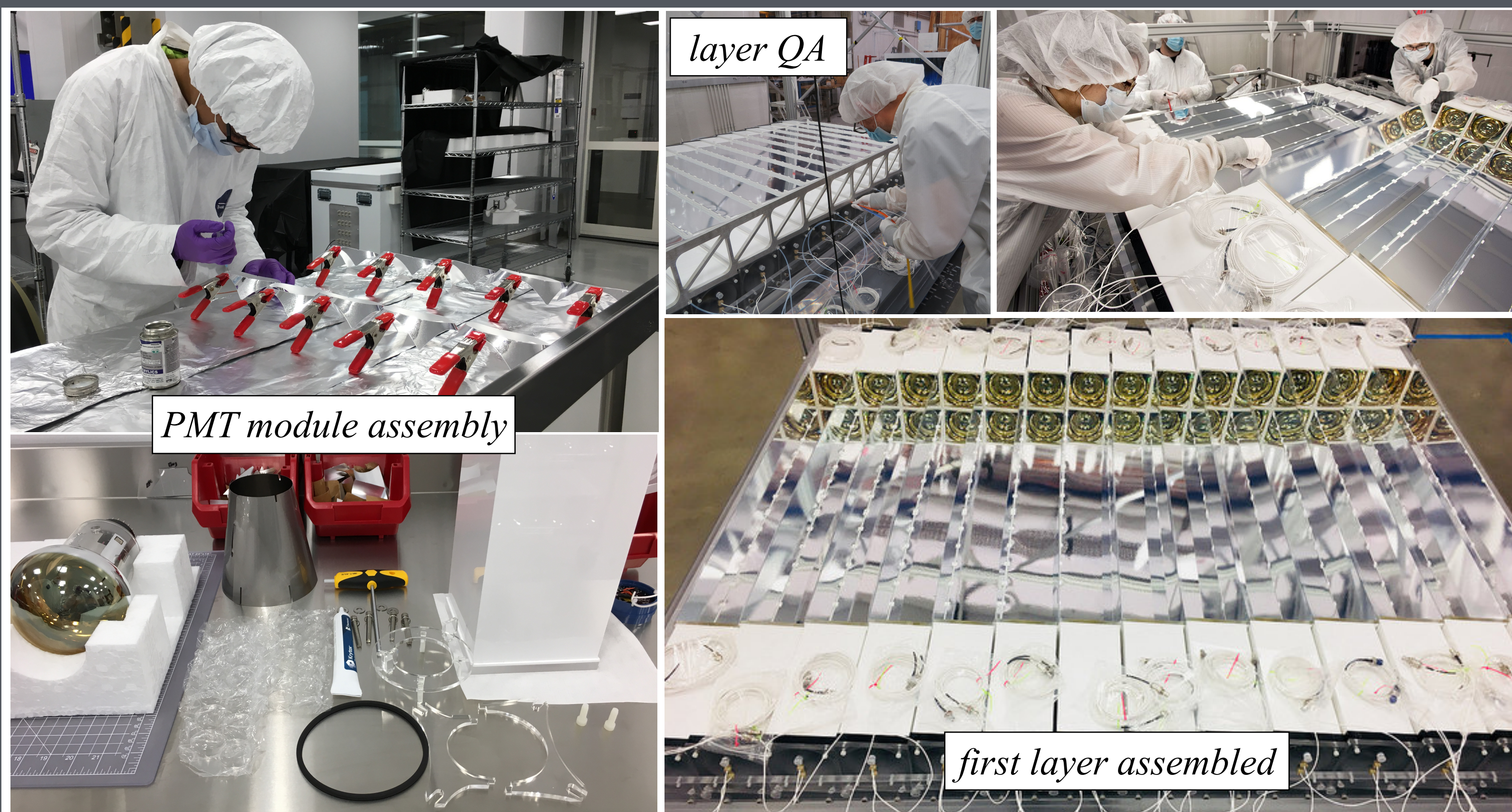
Physics goals require excellent light collection (resolution), < 5% dead material, and *in-situ* calibration options.

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

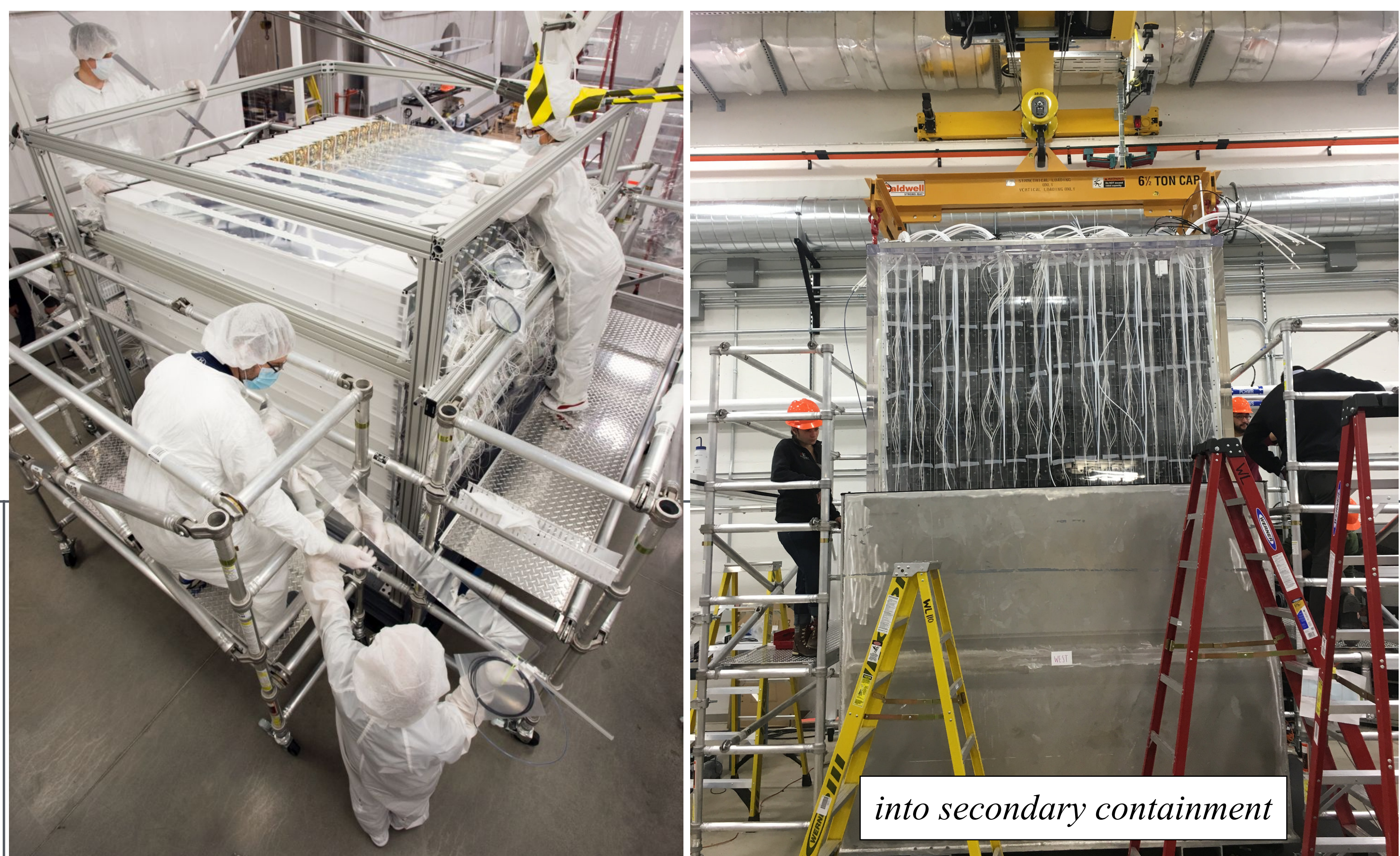


Compatible materials: acrylic, FEP, PTFE, PEEK, PLA

Assembly of detector package at the Yale Wright Laboratory

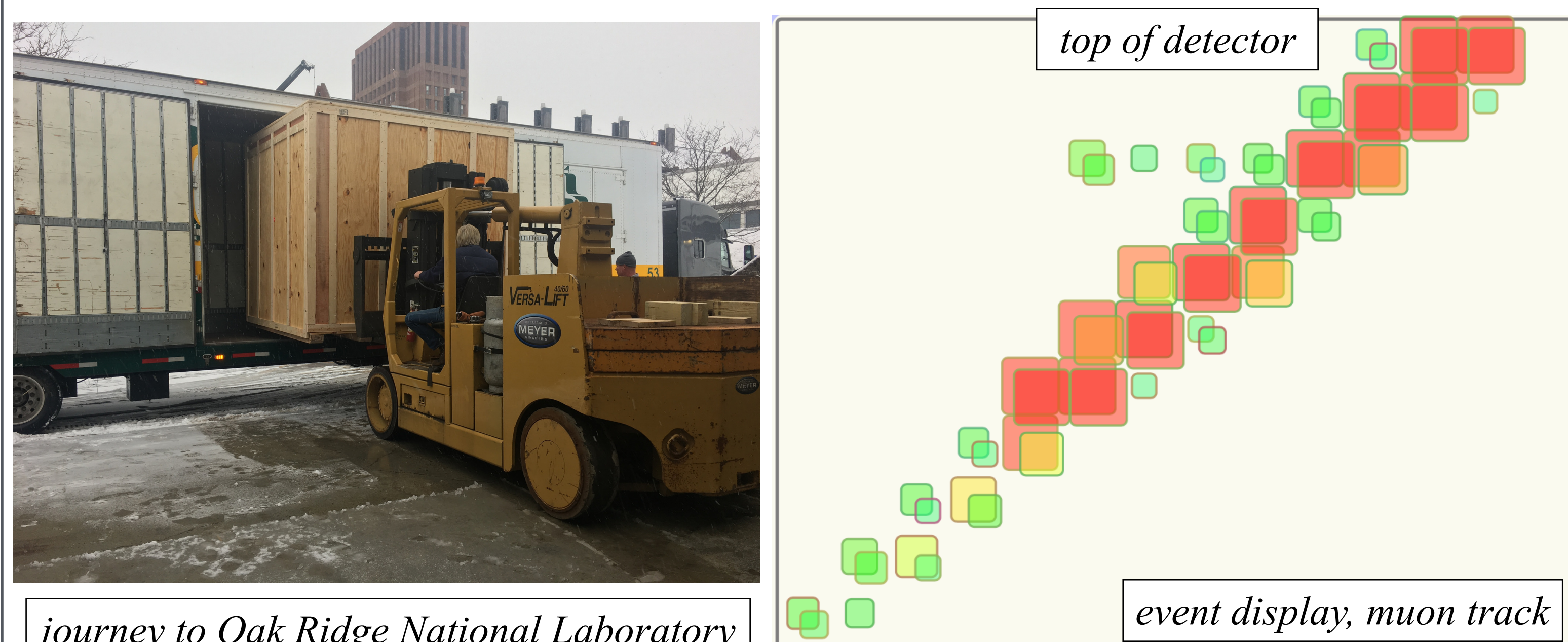


- PMT module, optical separator, and pinwheel production time ~1 year, detector package assembly ~3 months
- Each piece assembled by PROSPECT collaborators, significant material cleaning and building QA/QC



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



- 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

Acknowledgements

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