

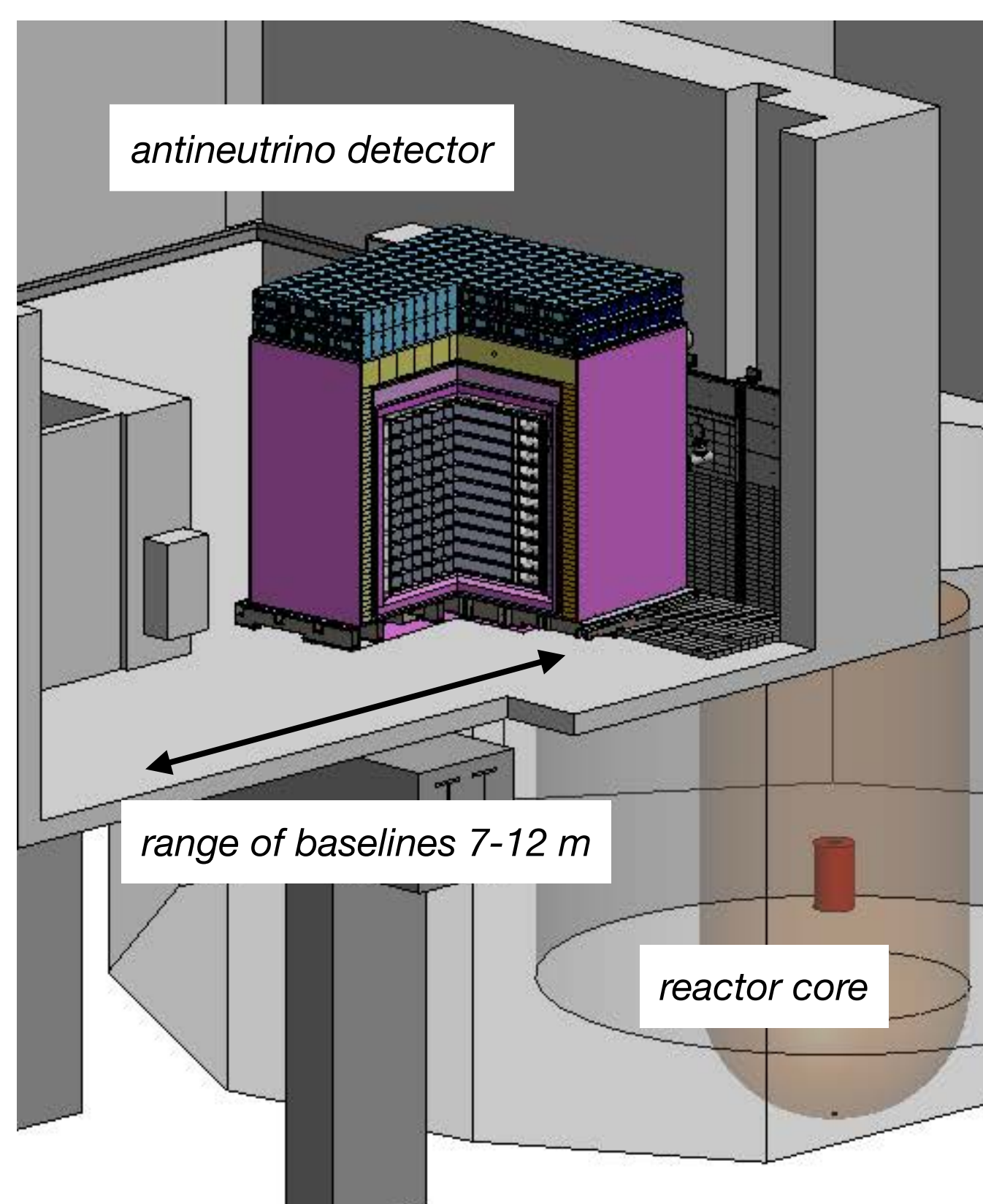
Towards a Precise Measurement of the ^{235}U Spectrum with PROSPECT

Karsten M. Heeger, Yale University for the PROSPECT Collaboration

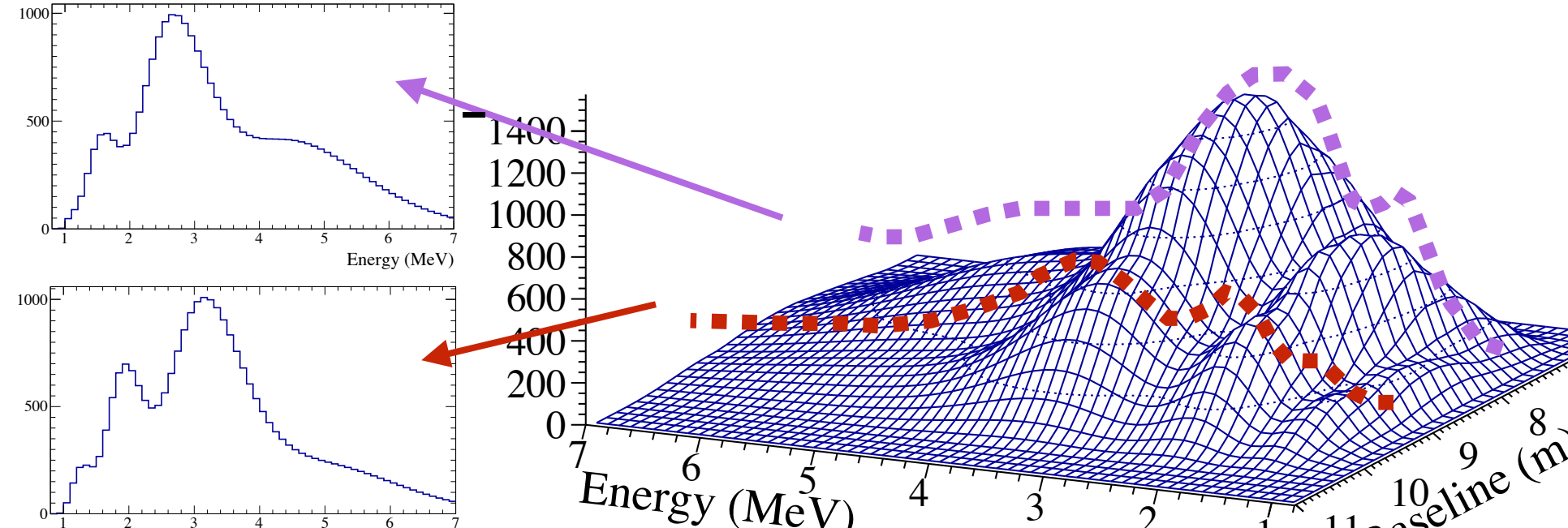
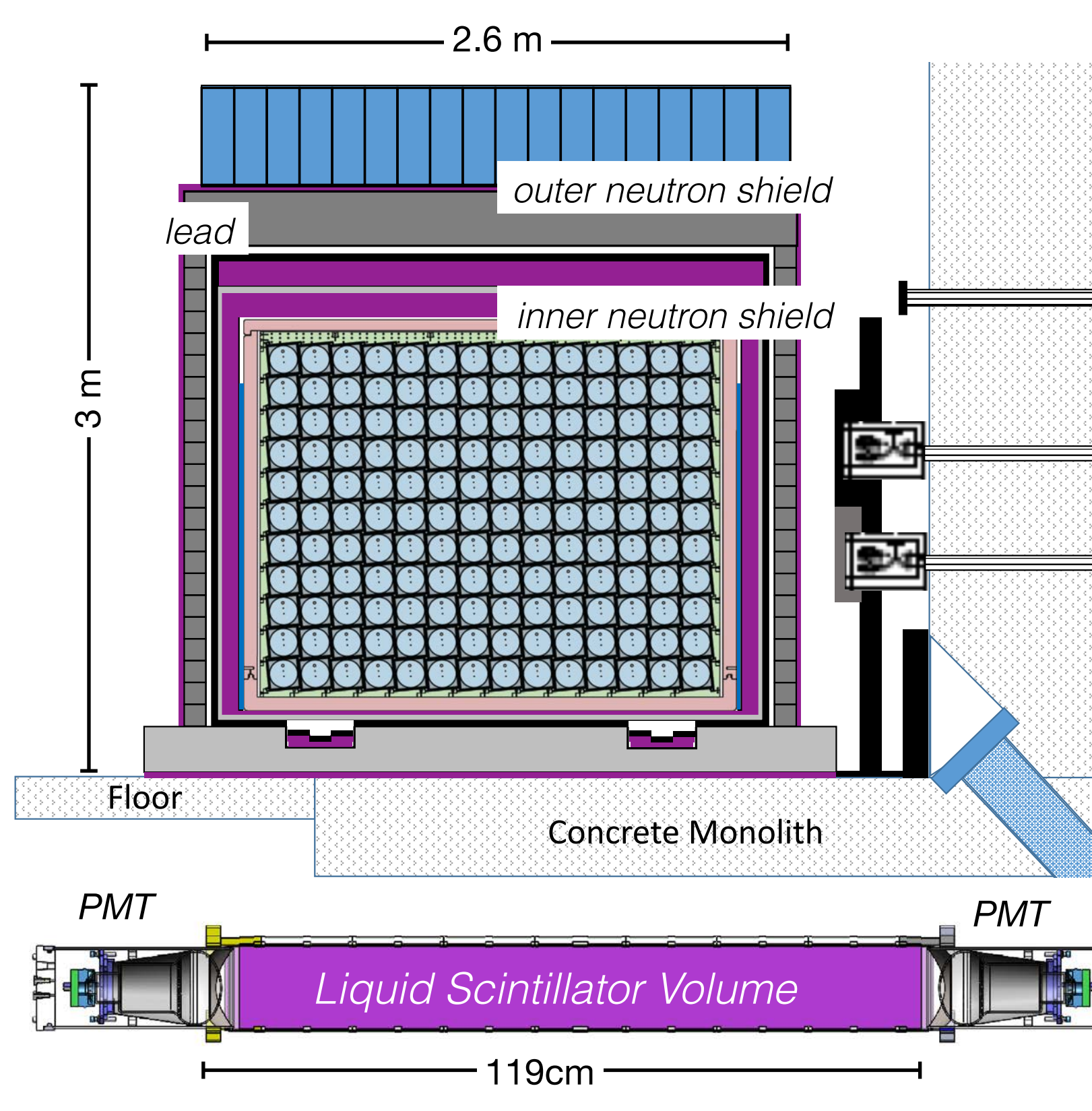


prospect.yale.edu

A Segmented Antineutrino Detector



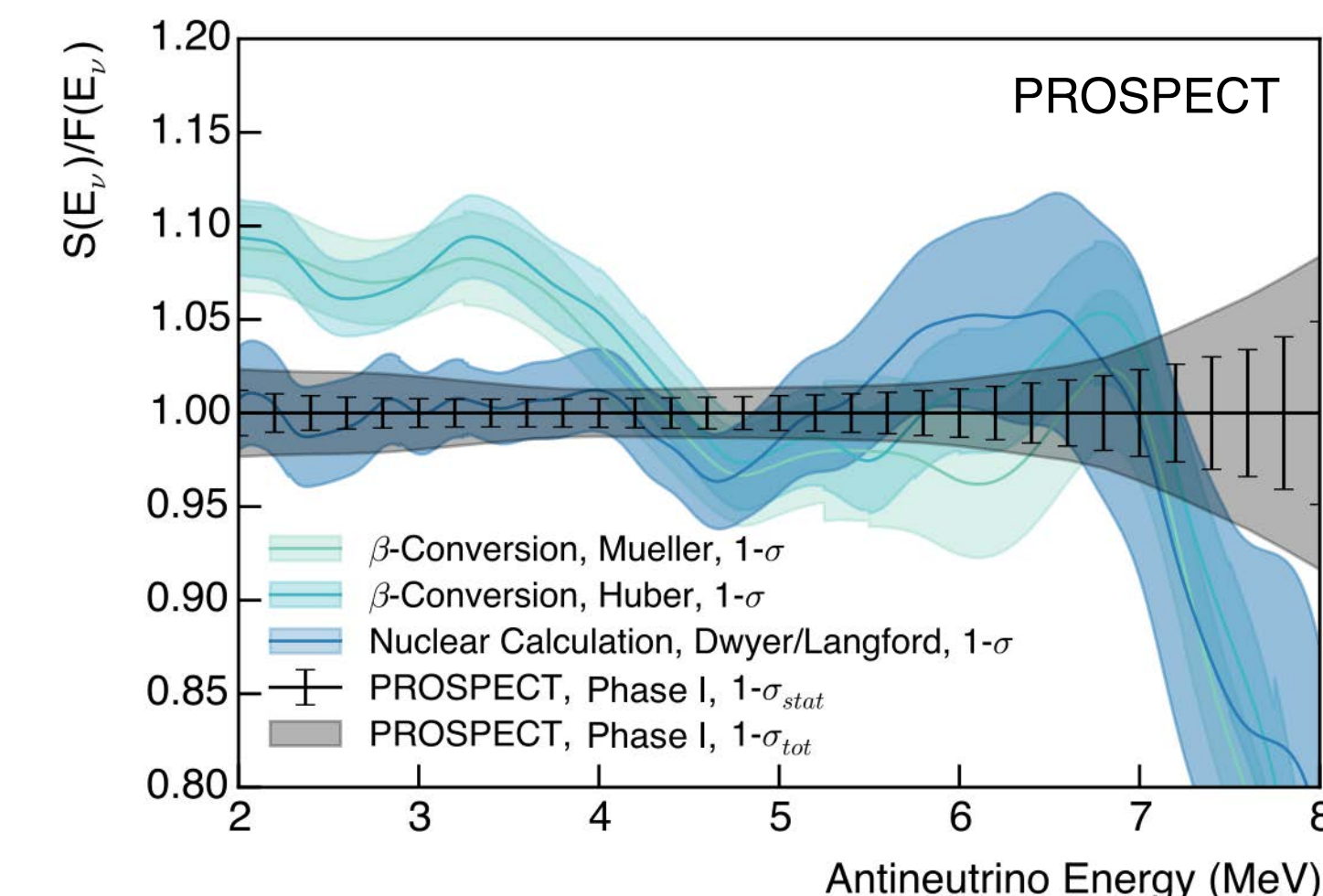
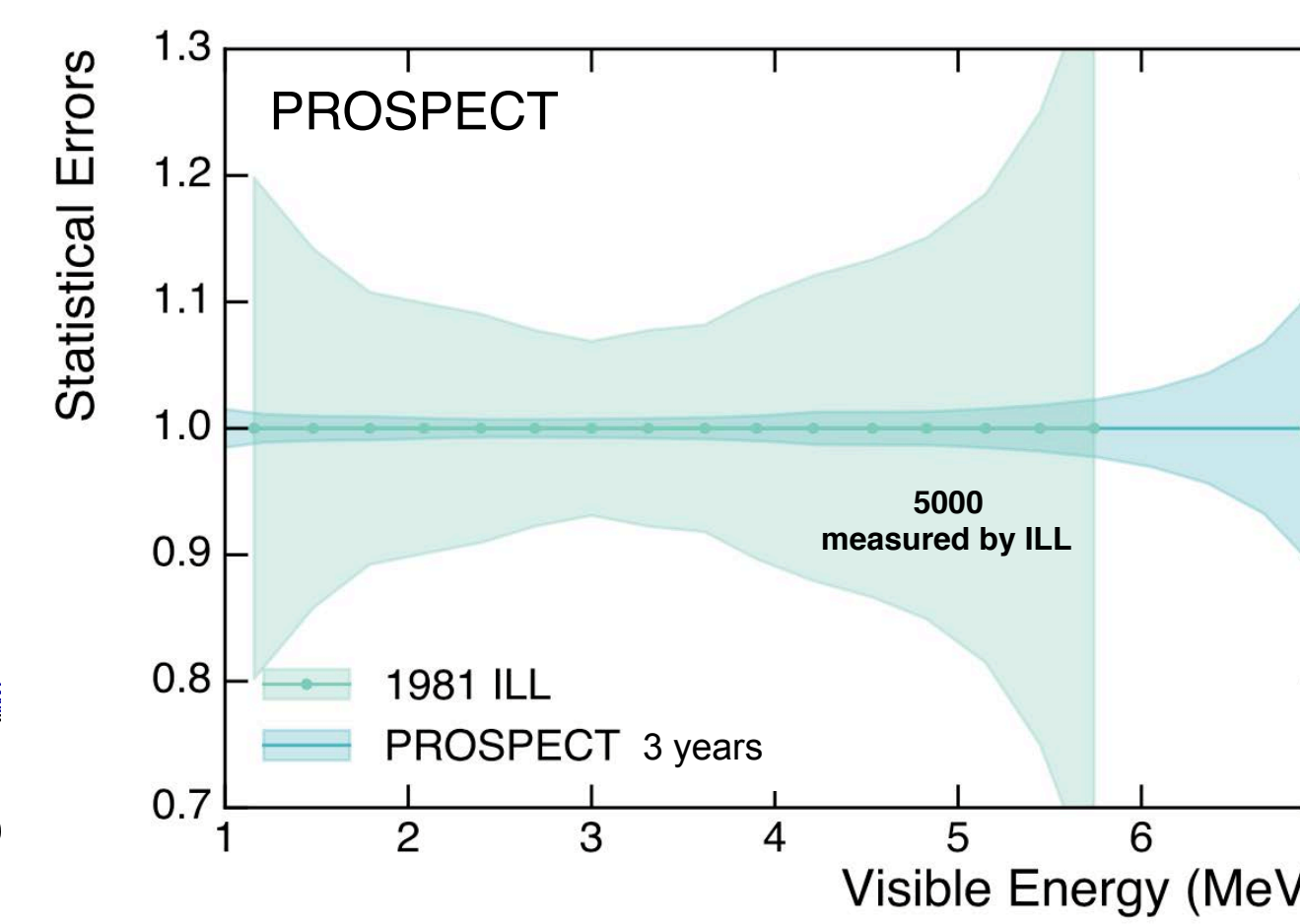
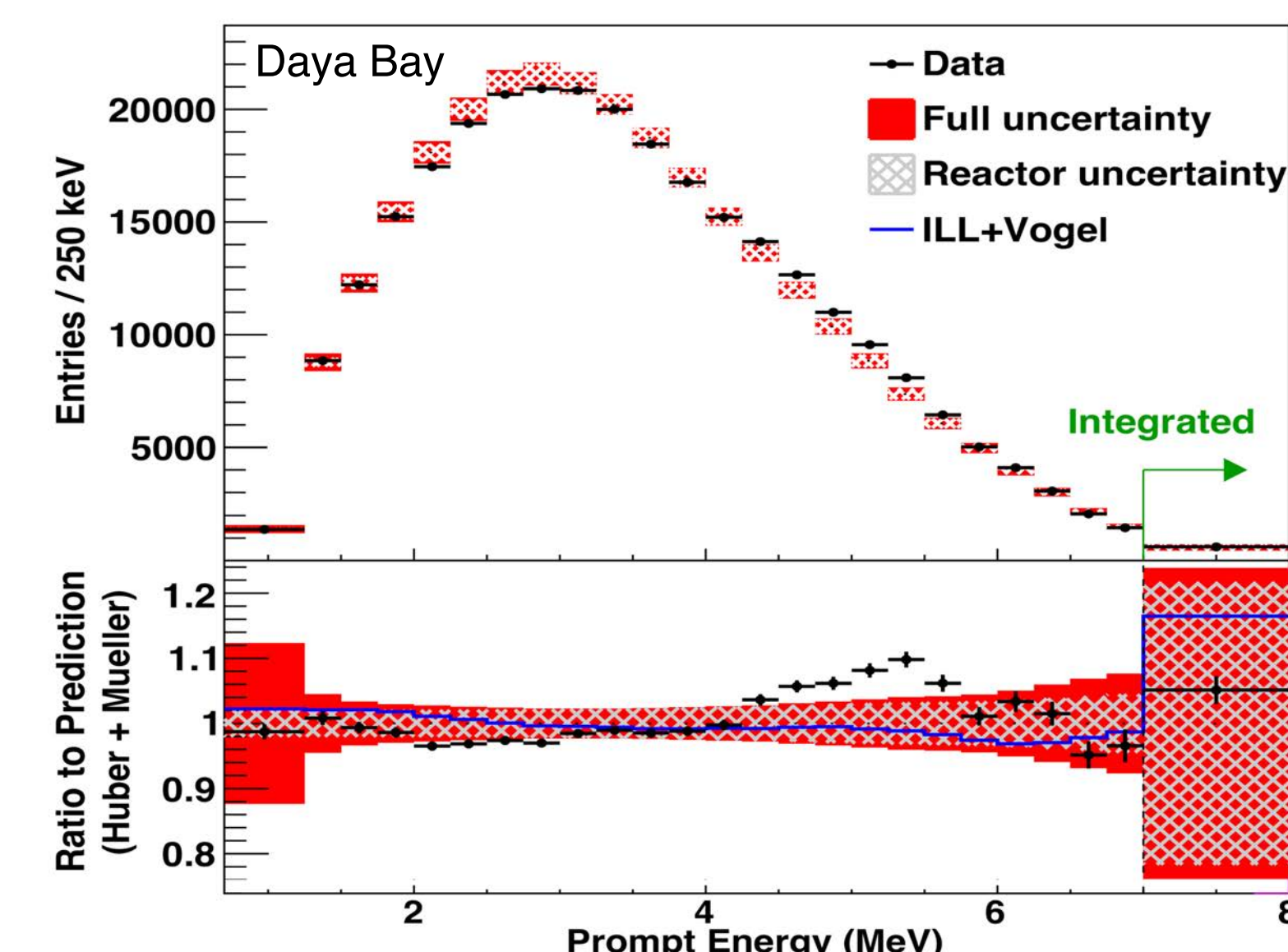
PROSPECT measures $\bar{\nu}_e$ energy spectrum with energy resolution $< 5\%/E$ in 154 segments at baselines 7-12m from HEU reactor (^{235}U) at the High Flux Isotope Reactor (HFIR) at ORNL. ~ 640 inverse beta decays detected per day.



Understanding the Reactor Antineutrino Spectrum

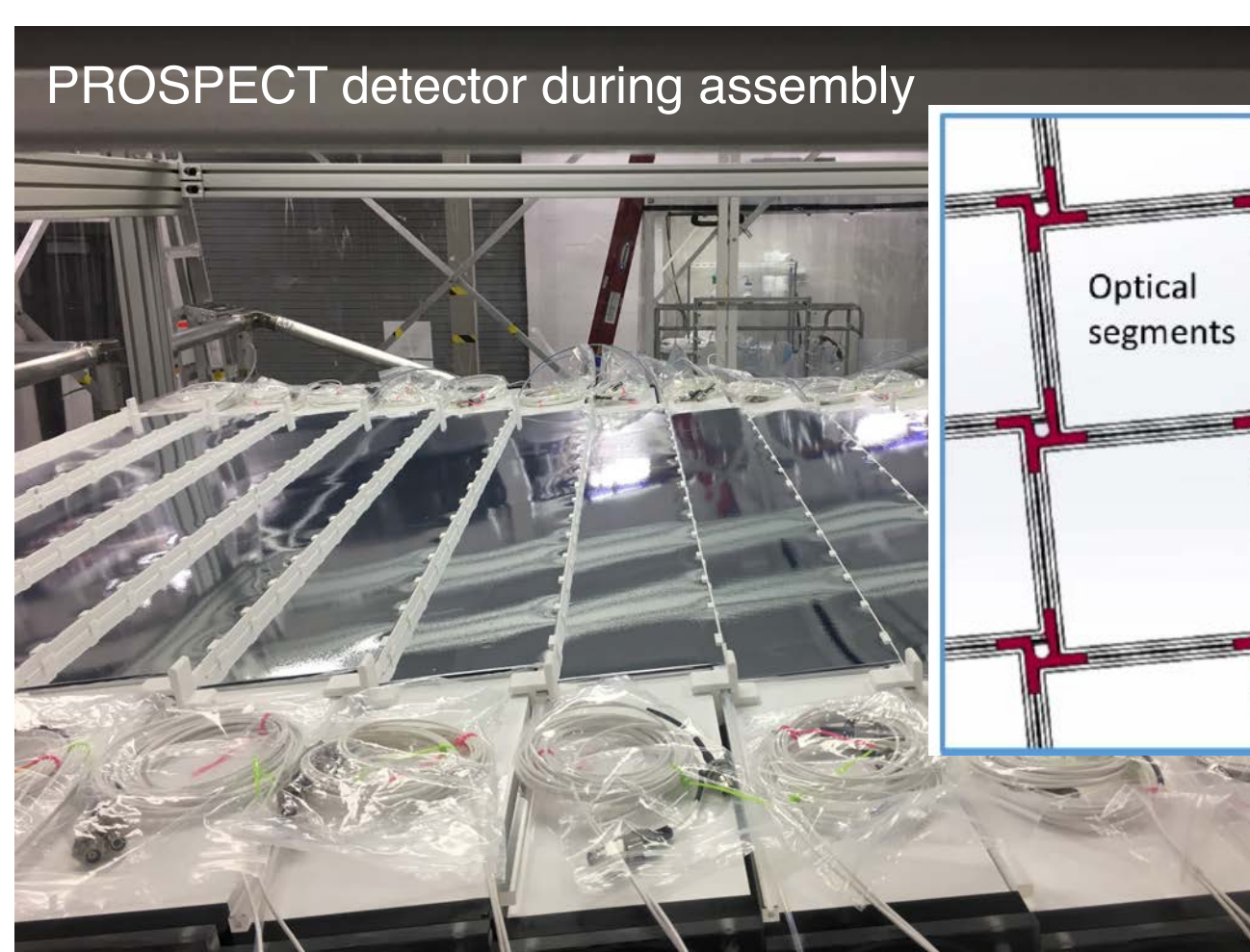
Daya Bay and other reactor experiments measure anomalous spectrum ("bump") at PWR reactors compared to current models. *Phys. Rev. Lett.* 116, 061801, 2016, Daya Bay

PROSPECT will make high-statistics measurement of HEU spectrum with excellent energy resolution and test reactor models. Understanding detector energy response is critical. *J.Phys. G* 43 (2016) no.11, 113001

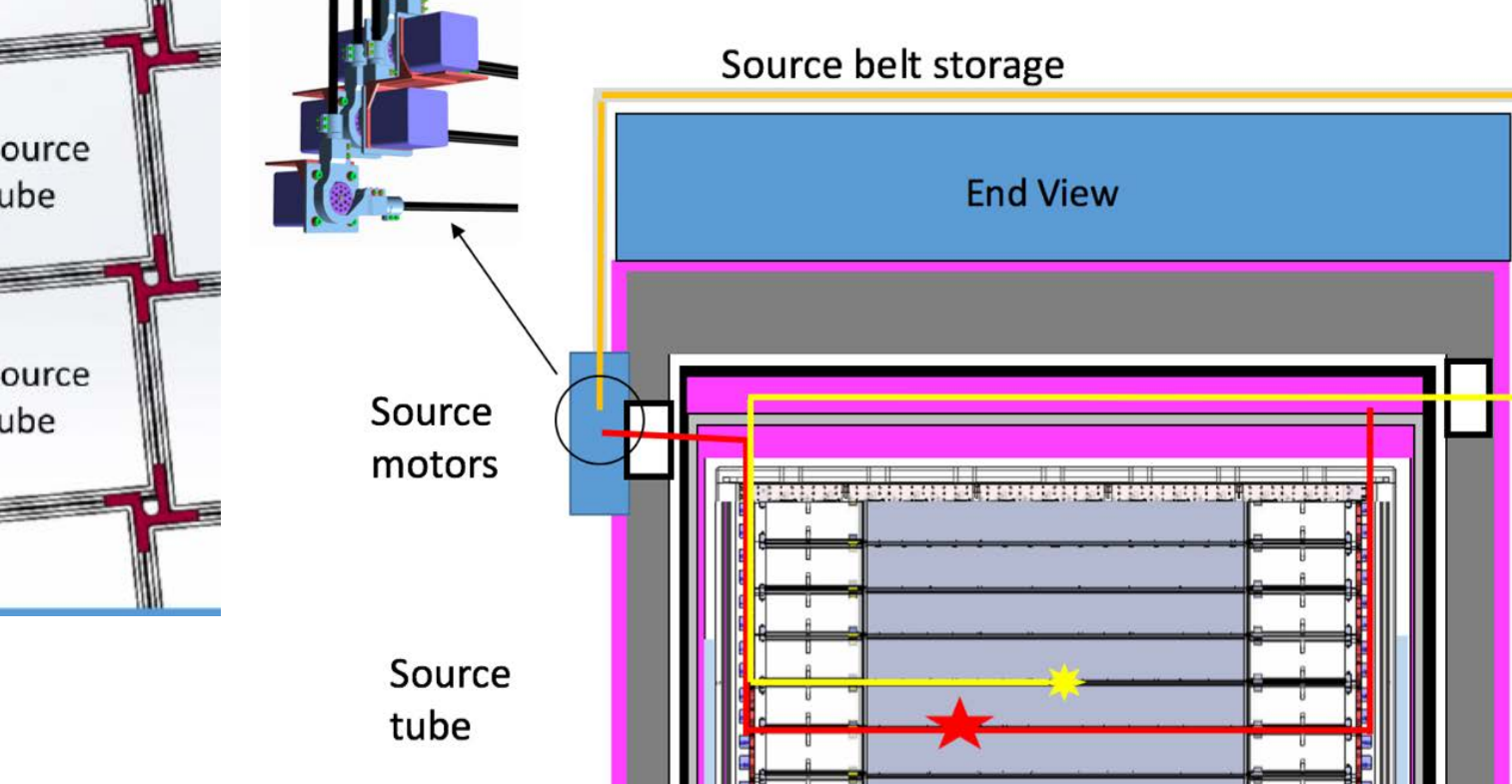


Source Calibration of PROSPECT

Individual detector segments calibrated with radioactive and optical sources.



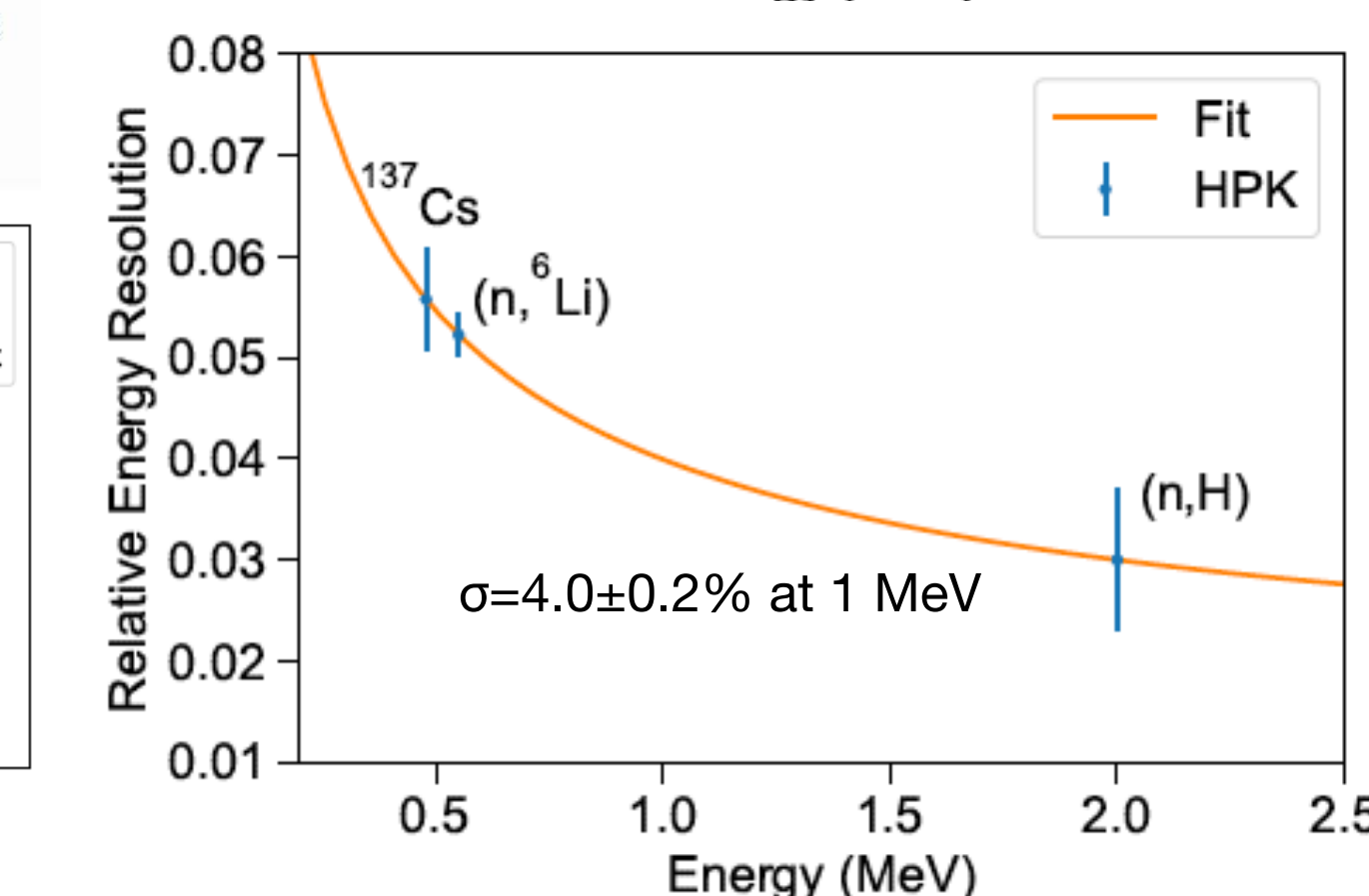
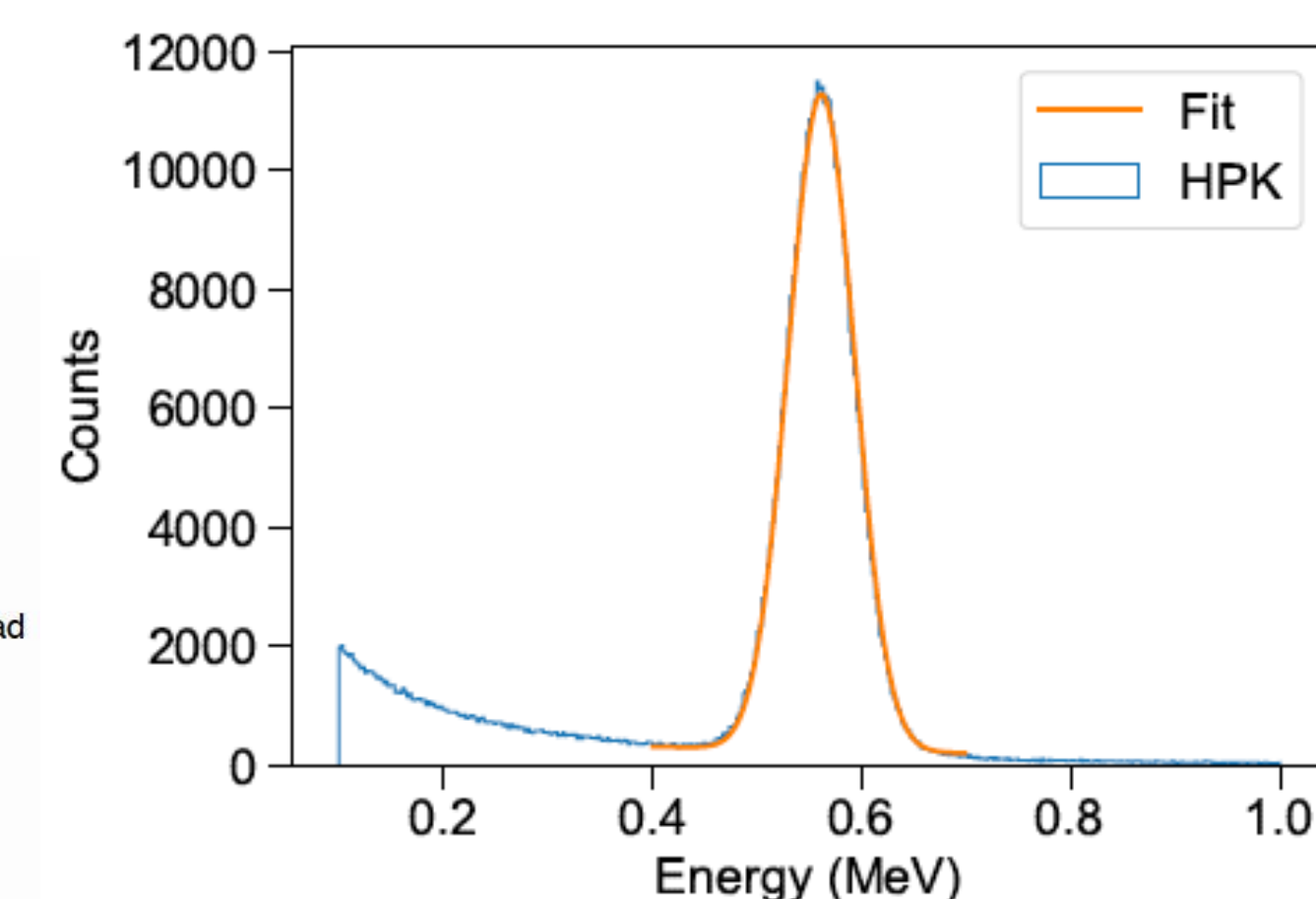
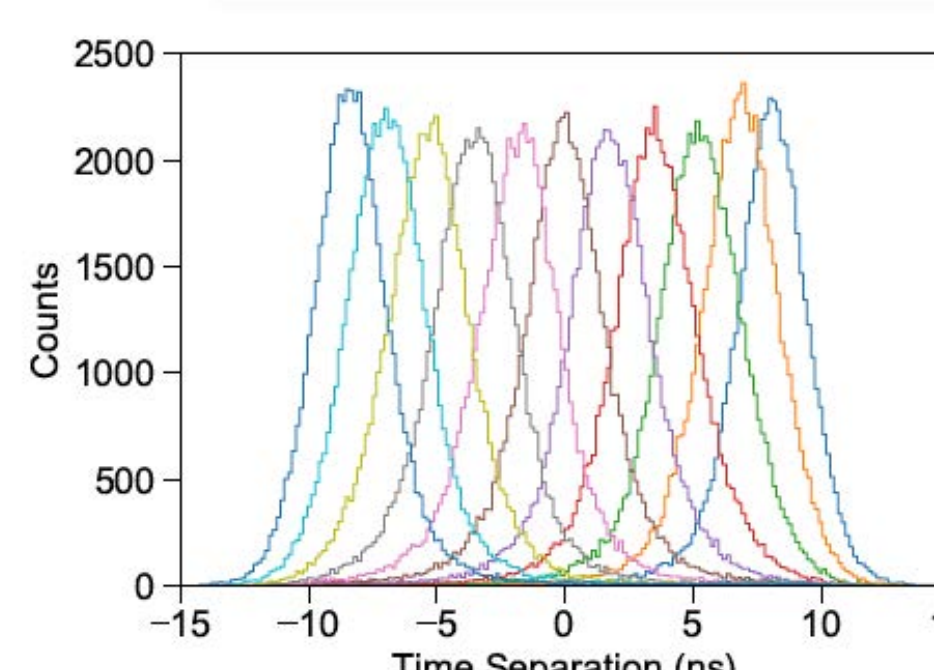
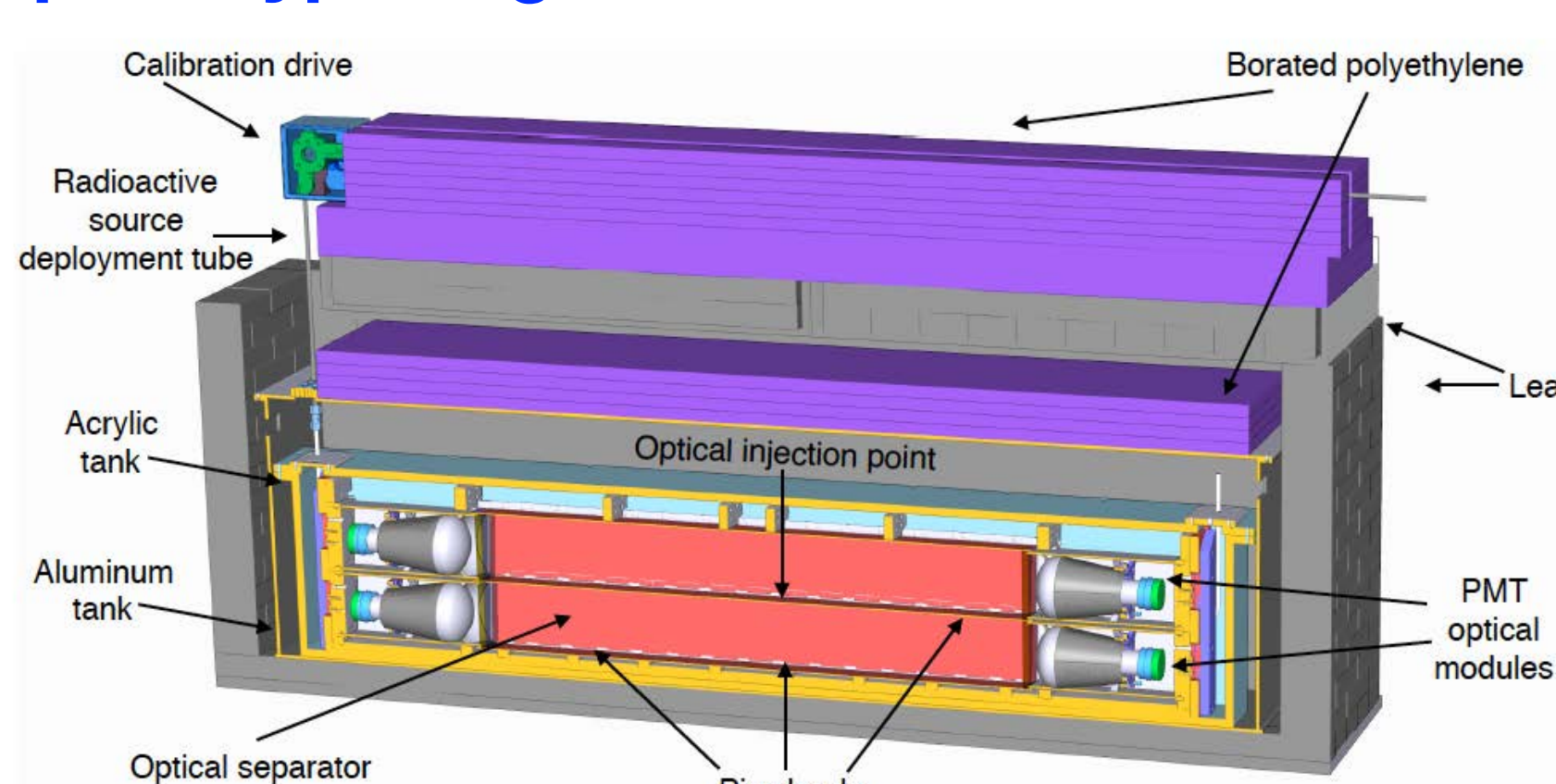
PROSPECT source capsule and deployment belt. Can be deployed along side of segment.



Source	Decay [keV]
^{22}Na	$e^+ \rightarrow 511 \gamma, 1274 \gamma$
^{60}Co	1173 γ , 1332 γ
^{137}Cs	662 γ
^{68}Ge	$e^+ \rightarrow 511 \gamma$
^{252}Cf	Spontaneous fission $\rightarrow n$

Performance of Detector Segment (P50 Prototype)

Calibration studies of PROSPECT prototype segment *arXiv: 1805.09245*

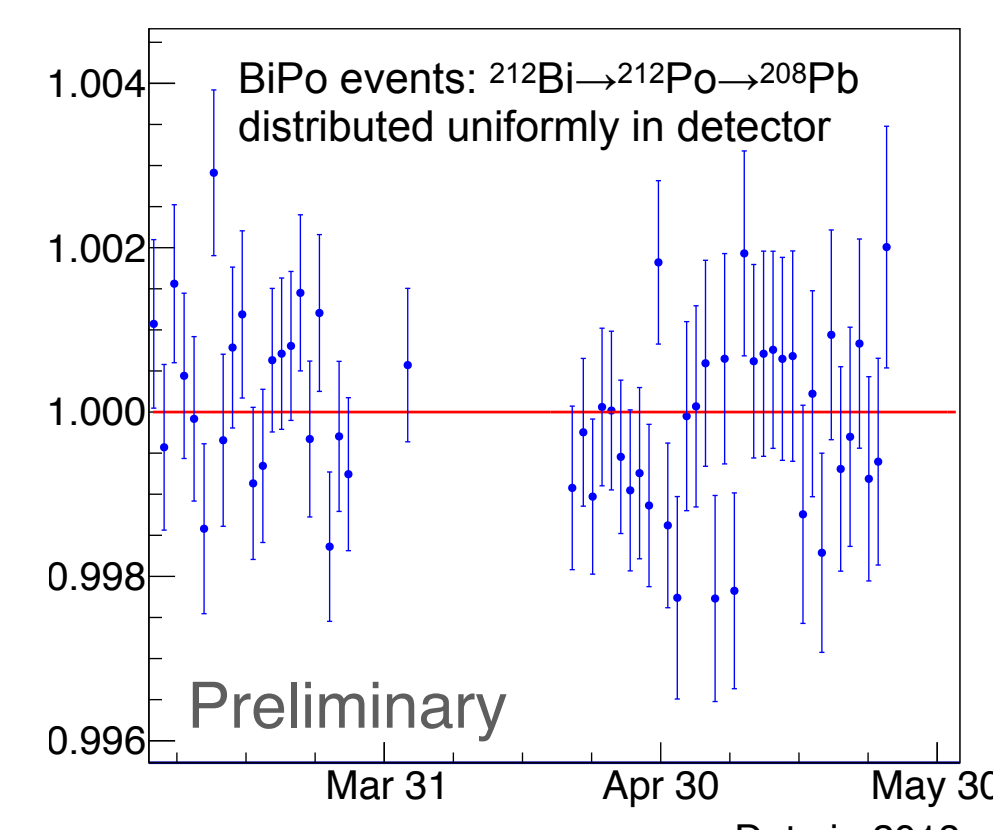
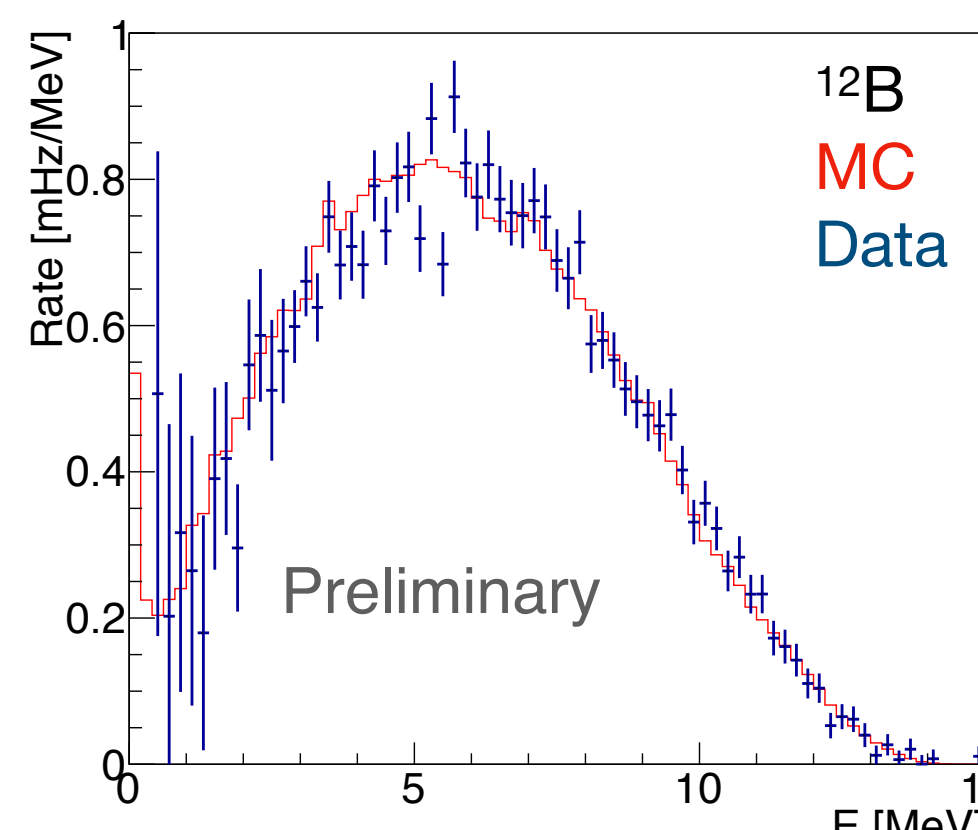
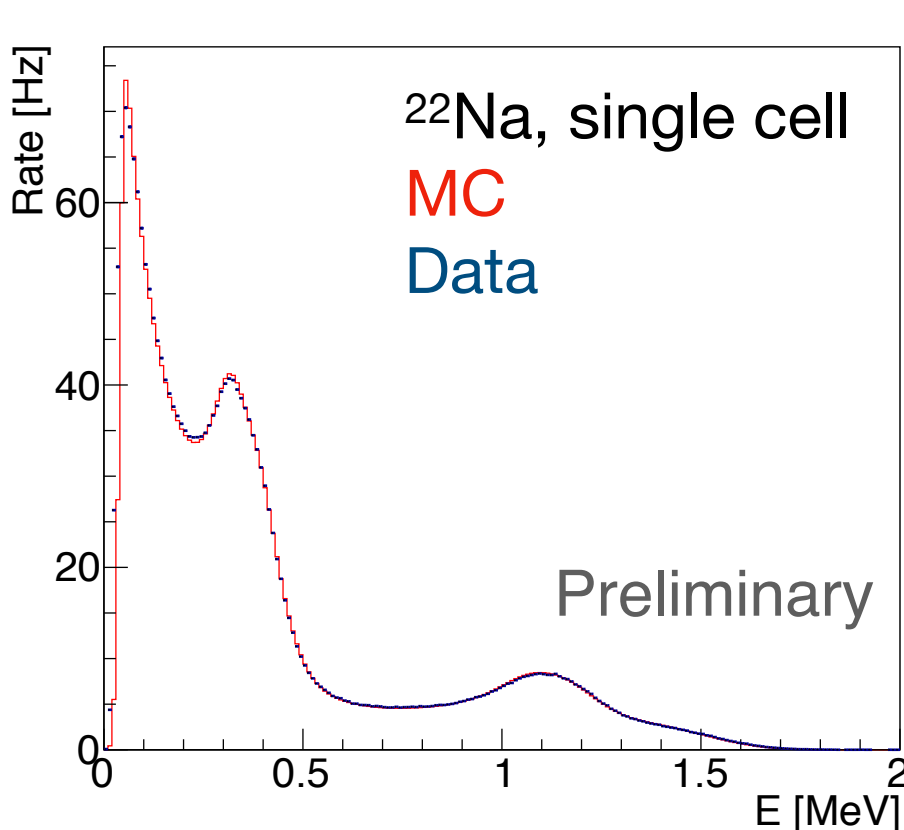


Energy Response: Scale, Resolution, Stability

Single Cell Calibration

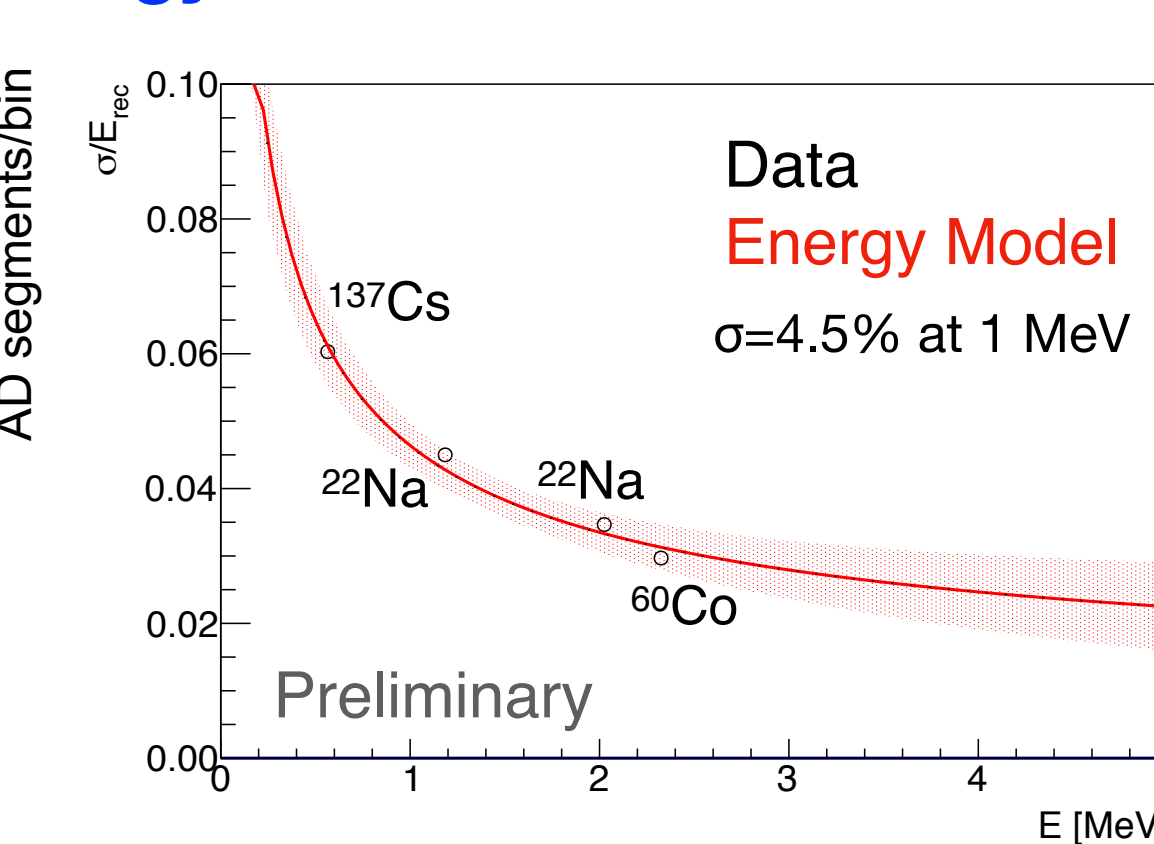
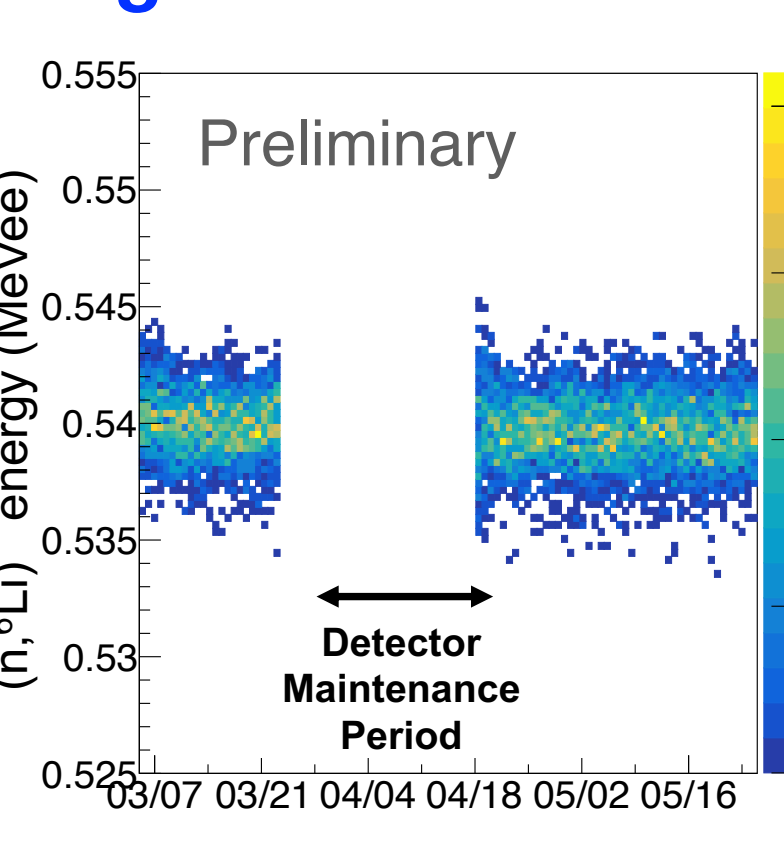
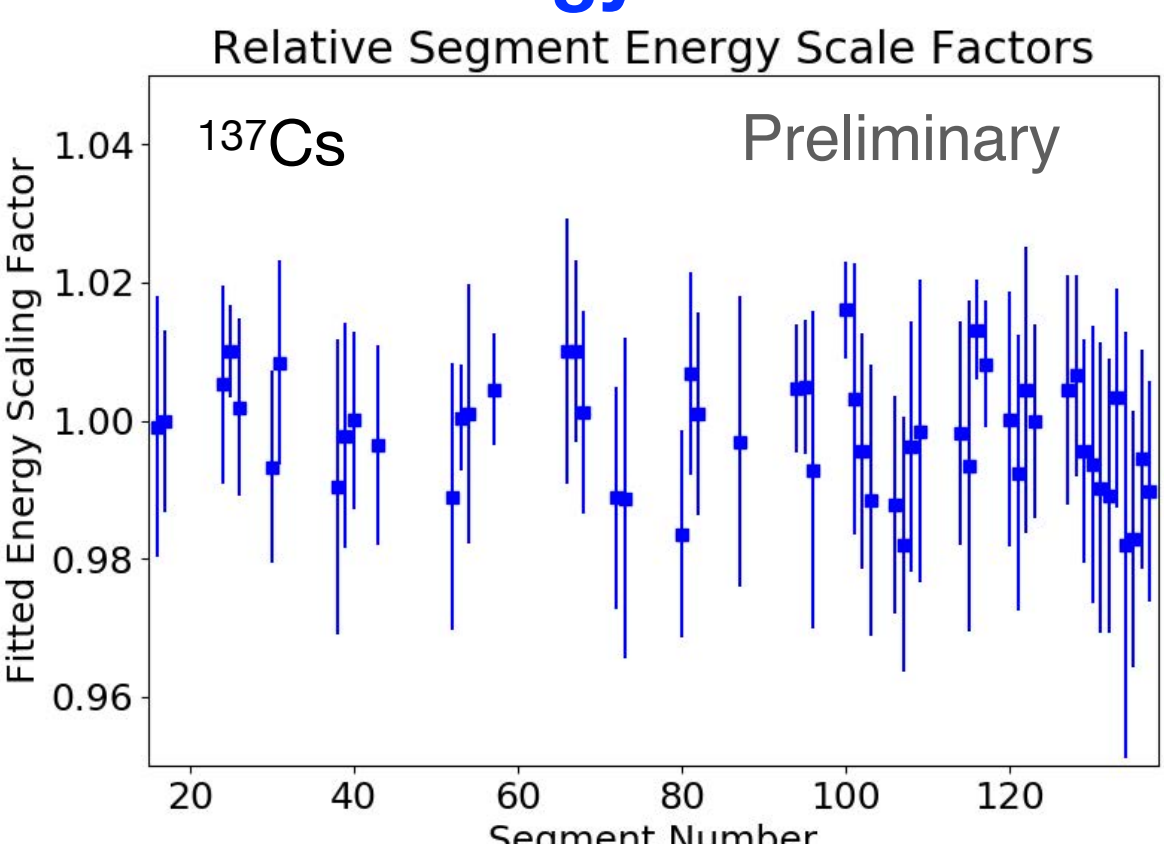
^{12}B Cosmogenics

Time Stability of E Reconstruction



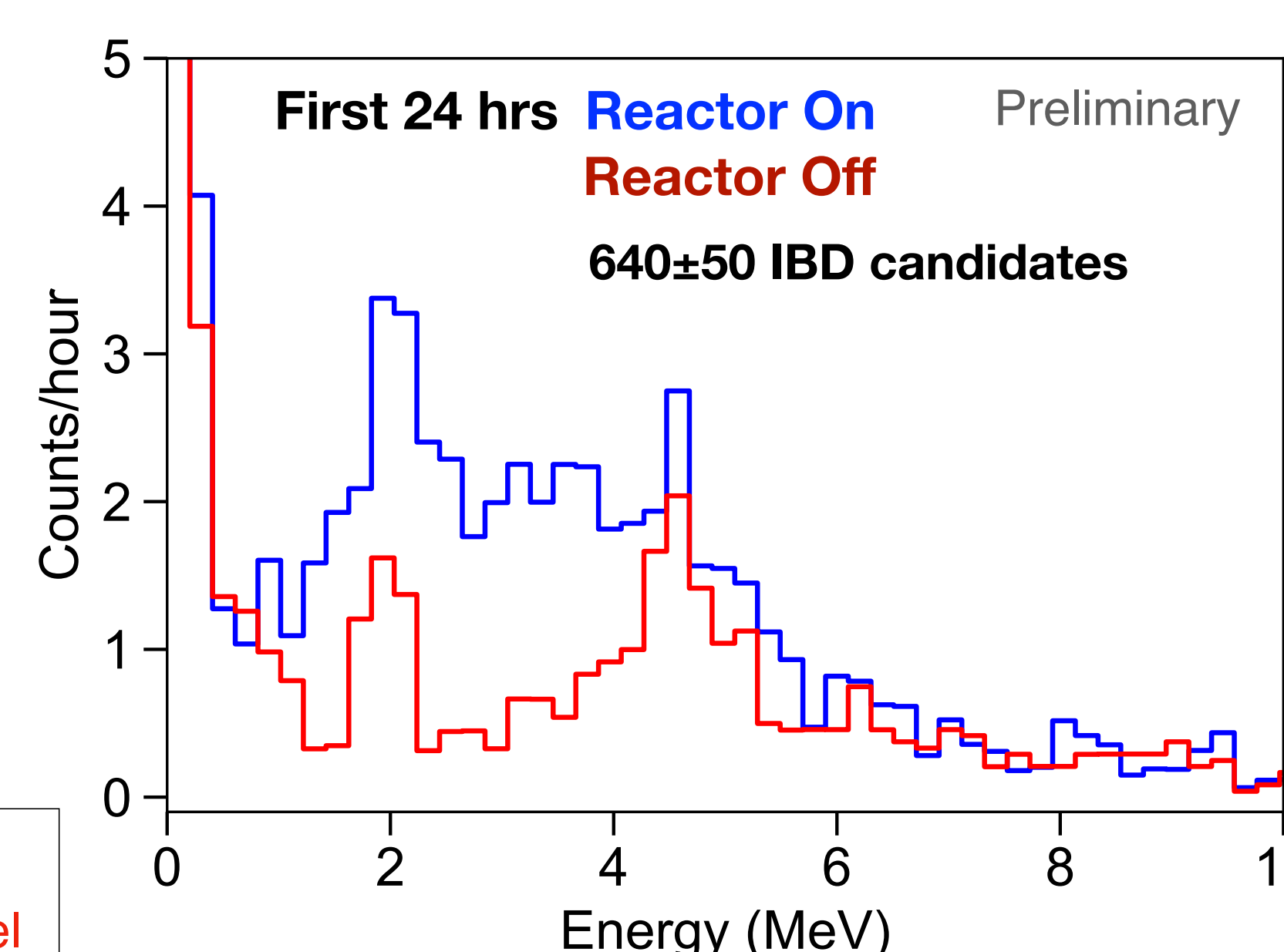
Relative Energy Scale between Segments

Energy Resolution



Observation of Reactor Antineutrinos at HFIR

First day of reactor antineutrinos at HFIR



First observation of antineutrinos from HFIR at $>5\sigma$ in ~ 4 hrs.

Radioactive source calibration, cosmogenics, and optical calibration used to characterize response of individual detector segments.

Excellent E resolution $< 5\%$ at 1 MeV. S/B > 1.3 in first round of analysis.

Stay tuned for more data!

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PROSPECT talk: Friday 12:15pm

Posters: 112, 139, 146, 188, 194

Neutrino 2018