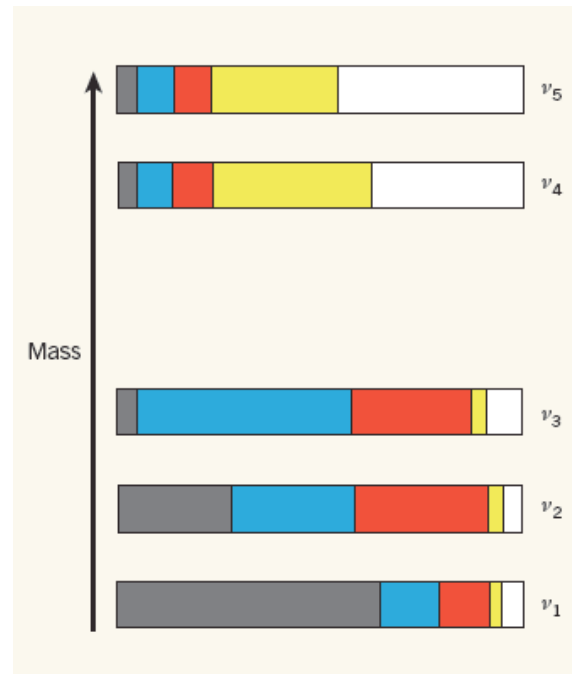


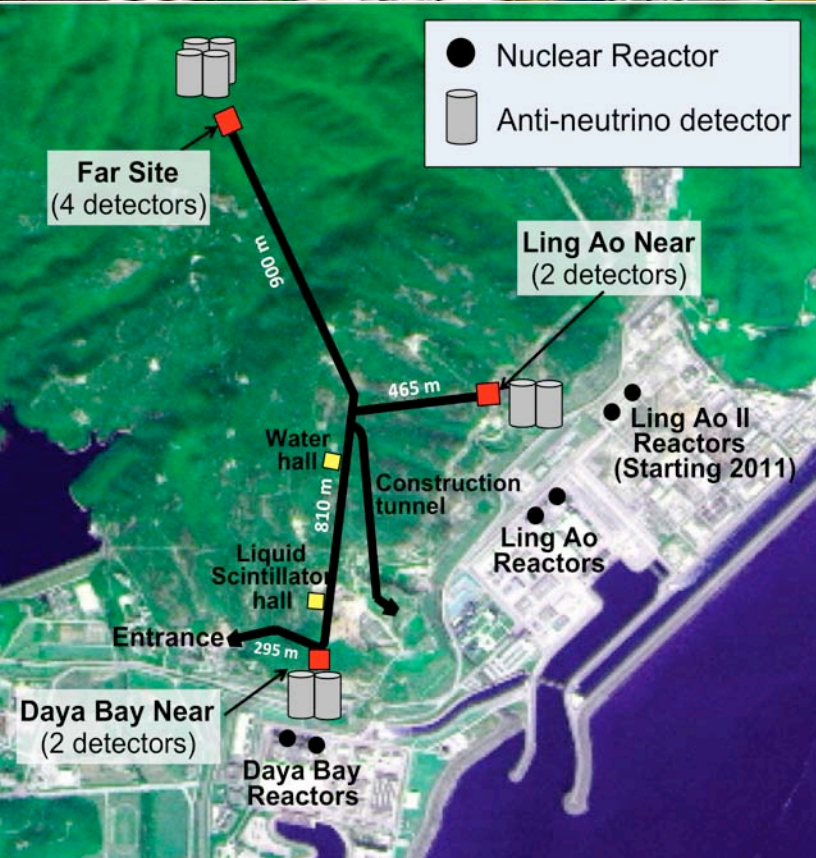
Search for Sterile Neutrinos with a Radioactive Source at Daya Bay



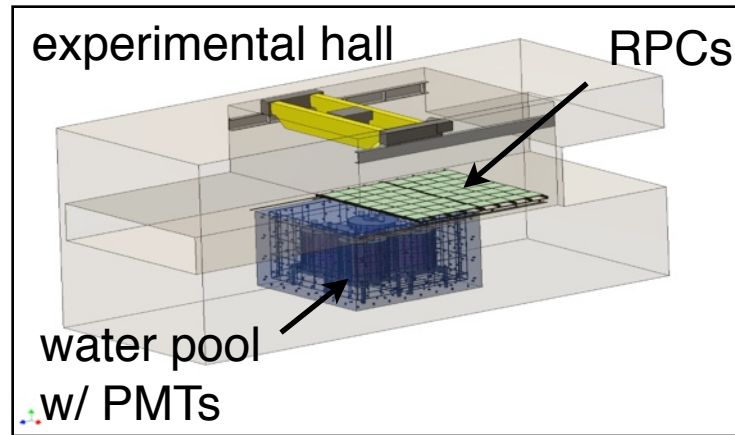
Karsten M. Heeger
University of Wisconsin

based on arXiv:1109.6036, Dwyer, Littlejohn, Vogel, and KMH

Daya Bay Reactor Antineutrino Experiment

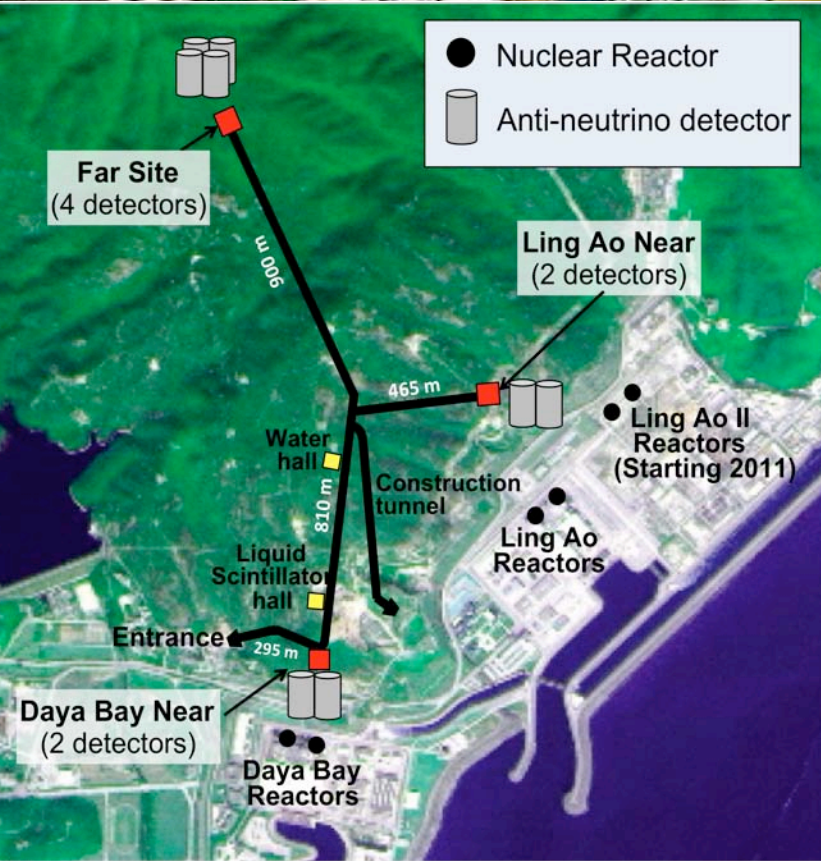


Daya Bay is a China-US reactor experiment to measure θ_{13} funded by DOE HEP

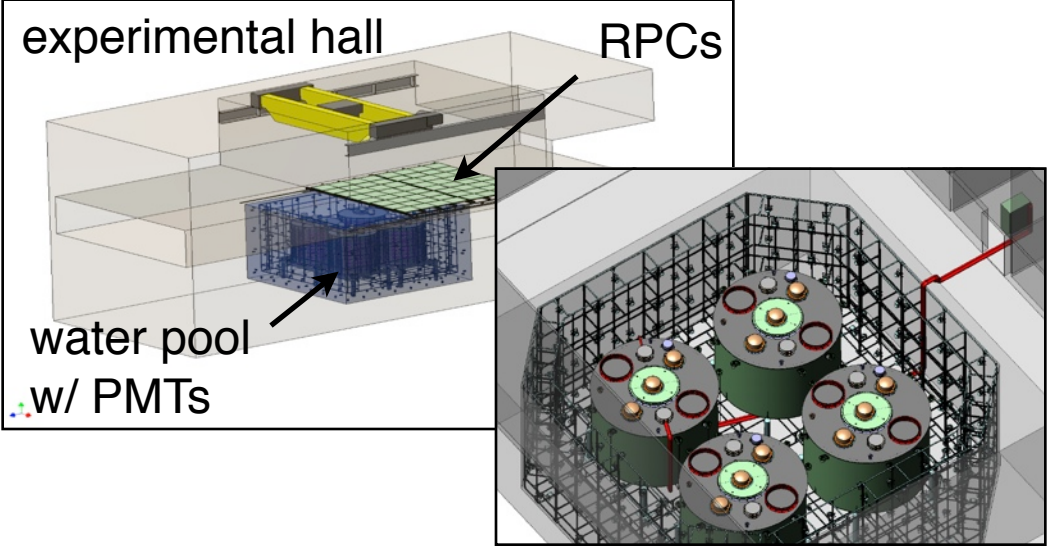


multiple detectors in each hall with ~ 6 m distance

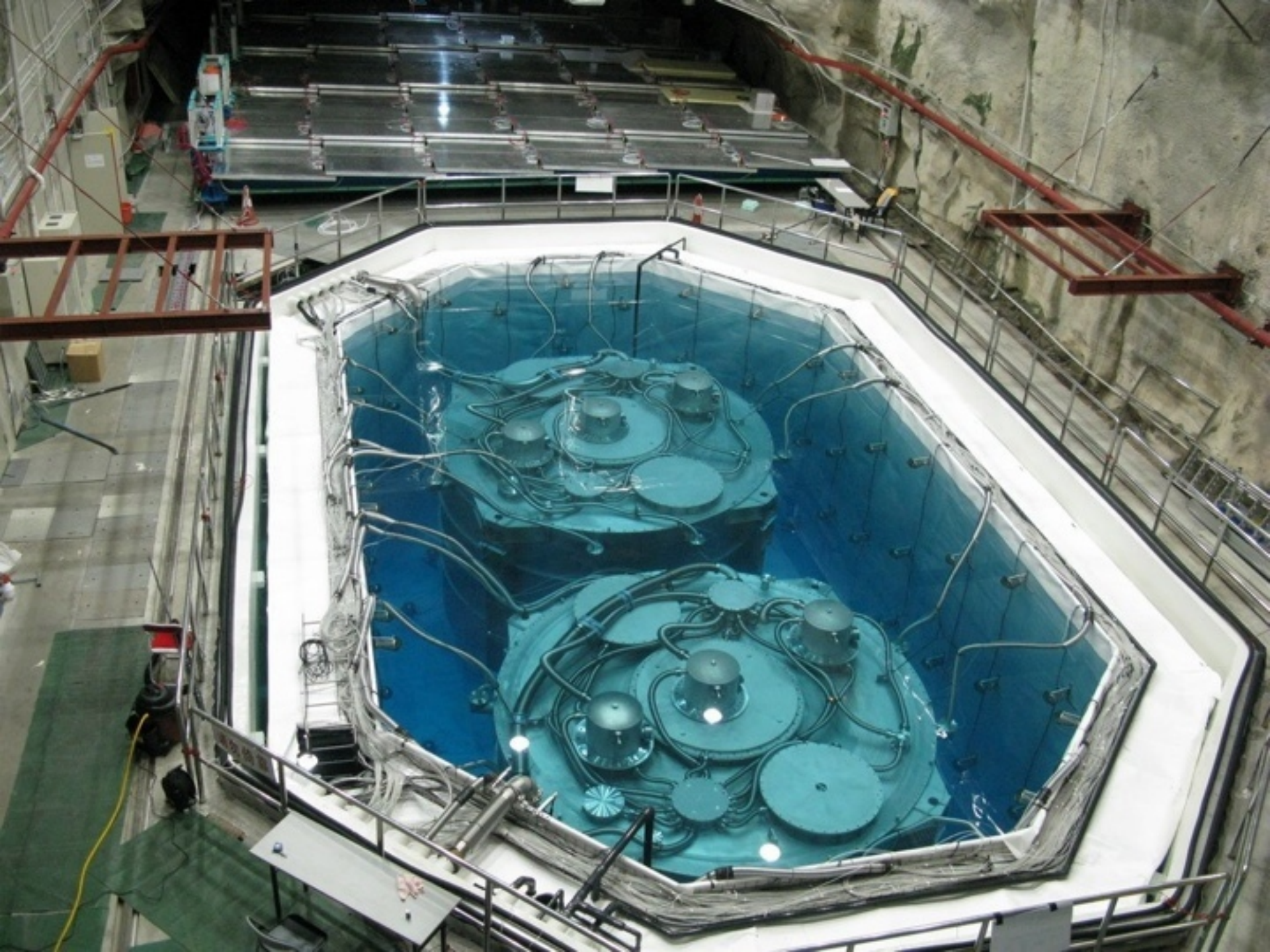
Daya Bay Reactor Antineutrino Experiment



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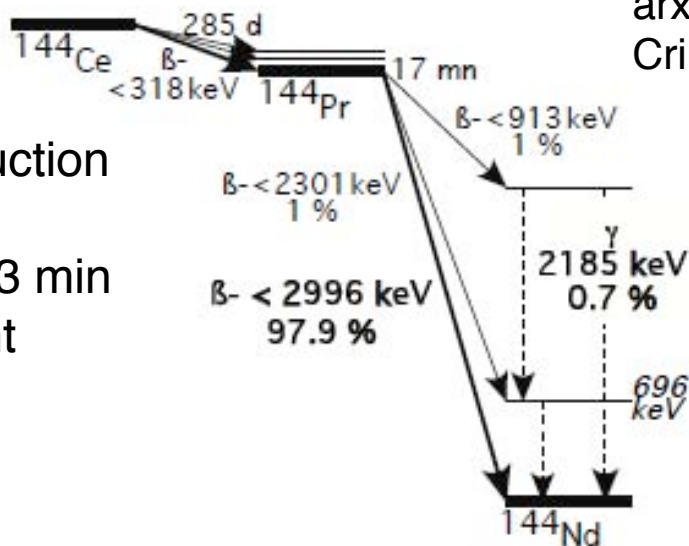
multiple detectors in each hall with ~6 m distance



Antineutrinos from a Radioactive Source

^{144}Ce - ^{144}Pr Antineutrino Source

- $Q_\beta > 1.8$ MeV (IBD threshold)
- lifetime long enough to allow for production and transport
- $T_{1/2} (^{144}\text{Ce}) = 285$ days, $T_{1/2} (^{144}\text{Pr}) = 17.3$ min
- contained in fission fragments of spent nuclear fuel



arxiv:1107.2335
Cribier et al

18 PBq ^{144}Ce source at the Daya Bay far site

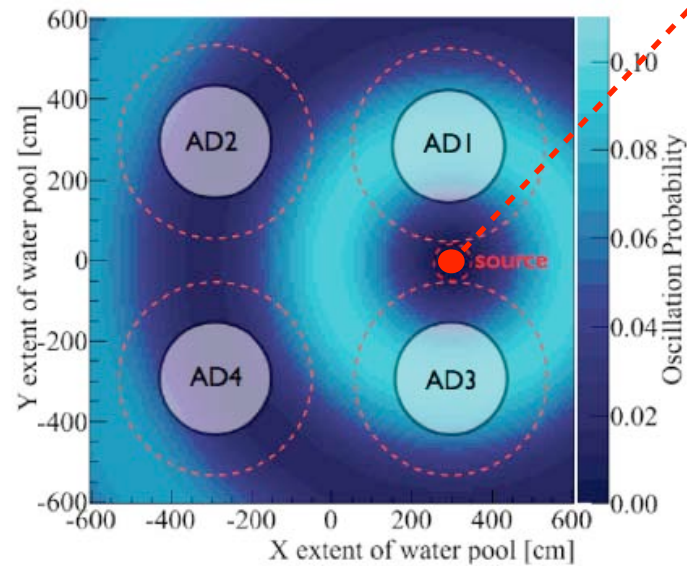
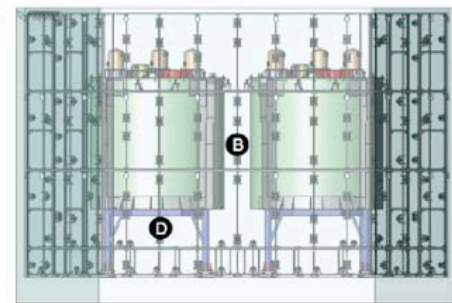
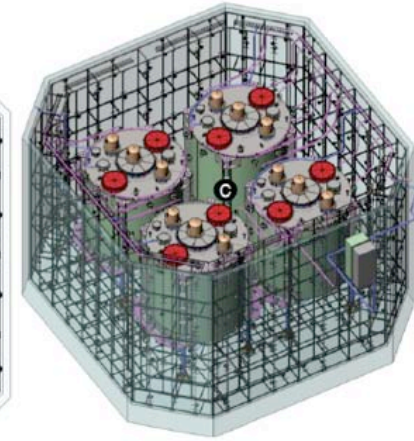
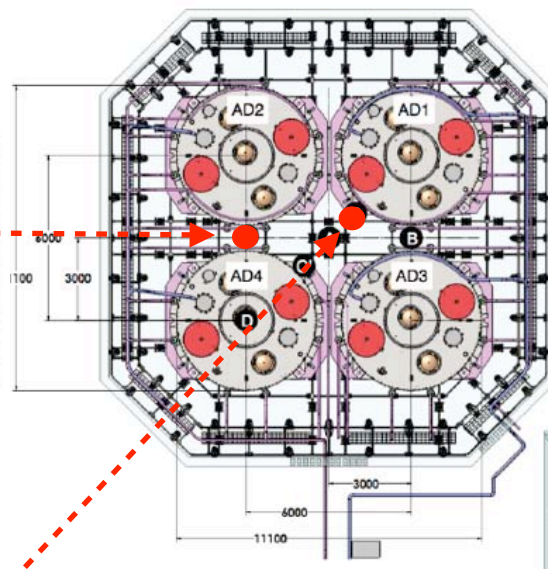
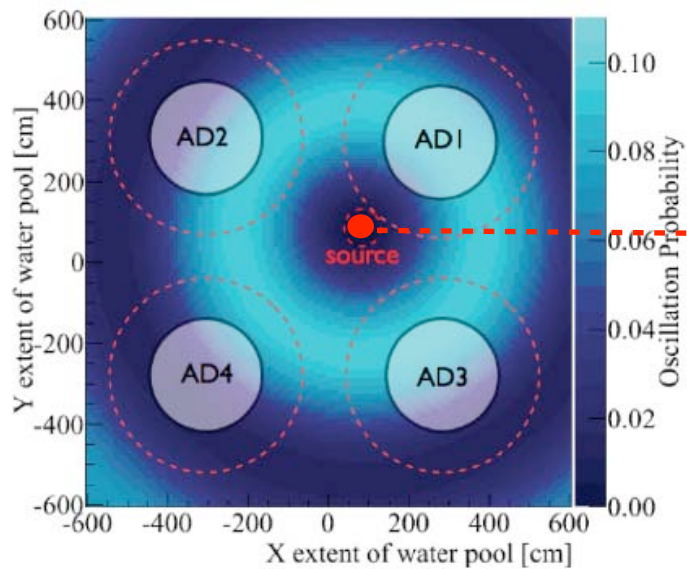
Signal

- baseline range: $\sim 1.5 - 8$ m
- $\bar{\nu}$ energy range: 1.8 - 3 MeV
- 30k - 40k inverse beta-decay (IBD) detections per year

Background

- ~ 0.5 m thick shielding makes source gammas negligible
- Water pool also shields, cools source outside detector
- Reactor neutrino 'background' well-known to $< 1\%$ from near detectors

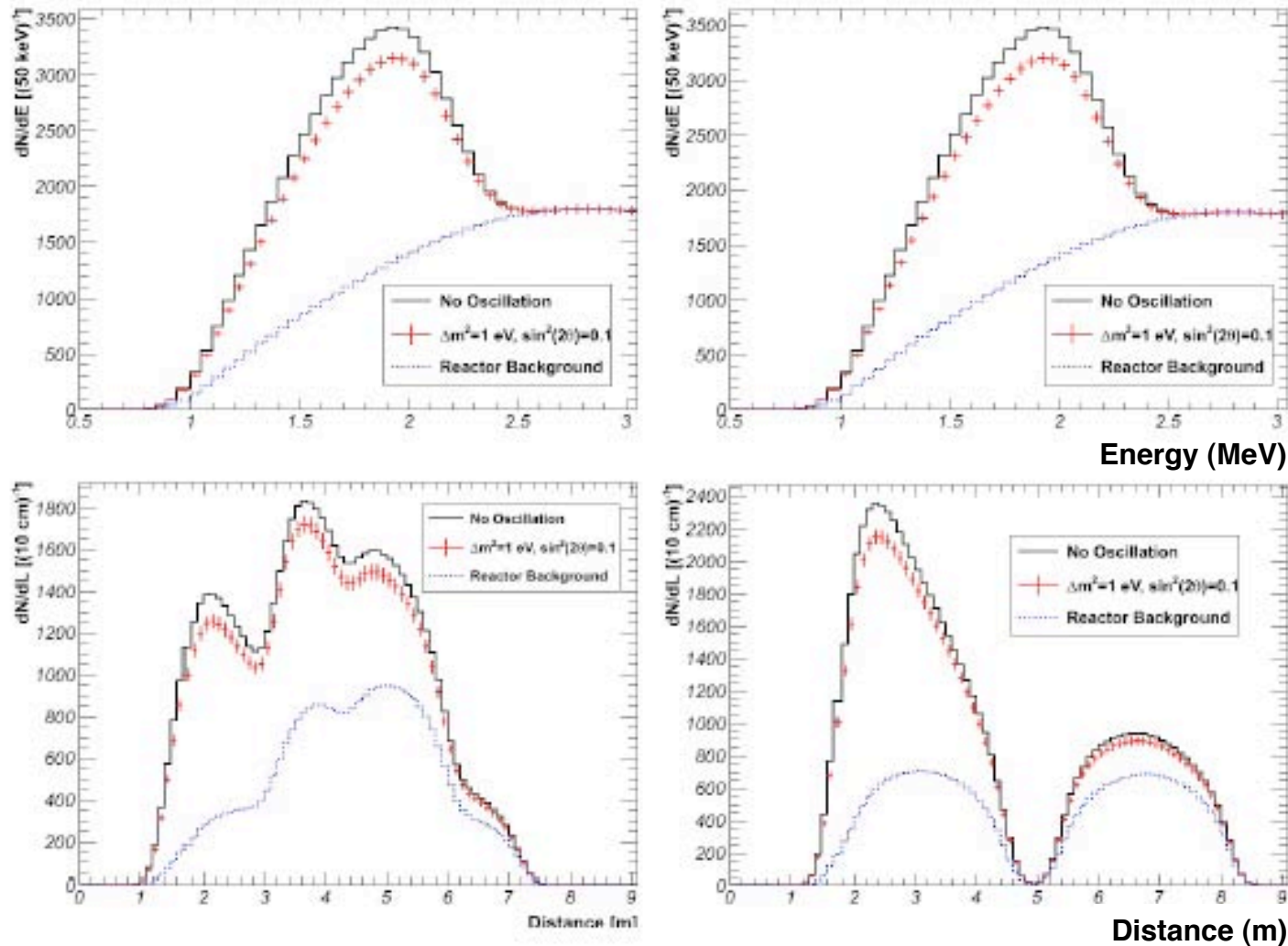
A Source Experiment in the Daya Bay Far Hall



- Probing baselines from 1.5-8 m with an antineutrino source in the water pool of the Daya Bay Far Hall
- Advantageous to place source outside detectors in water pool.
- Multiple detectors allow for control of systematics.

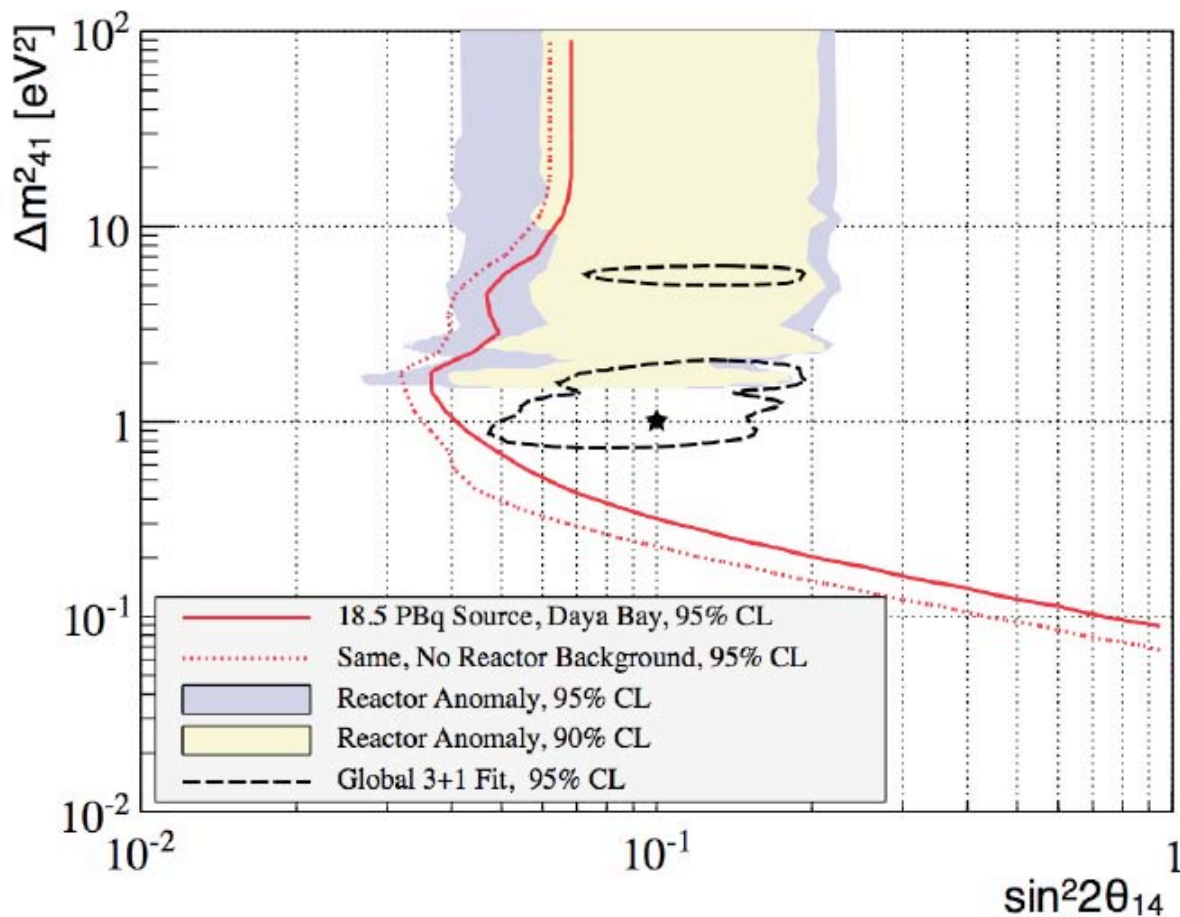
Signature for Sterile Neutrino Oscillation

Reconstructed Event Distributions Versus Energy and Distance



arXiv:1109.6036

Sensitivity of a Source Experiment at Daya Bay



arXiv:1109.6036
Dwyer, Littlejohn, Vogel, KMH

- Sterile neutrino oscillations with mass > 1 eV can be tested using ^{144}Ce source in the Far Hall of the Daya Bay experiment after θ_{13} measurement.
- Advantageous to place source outside detectors in water pool.