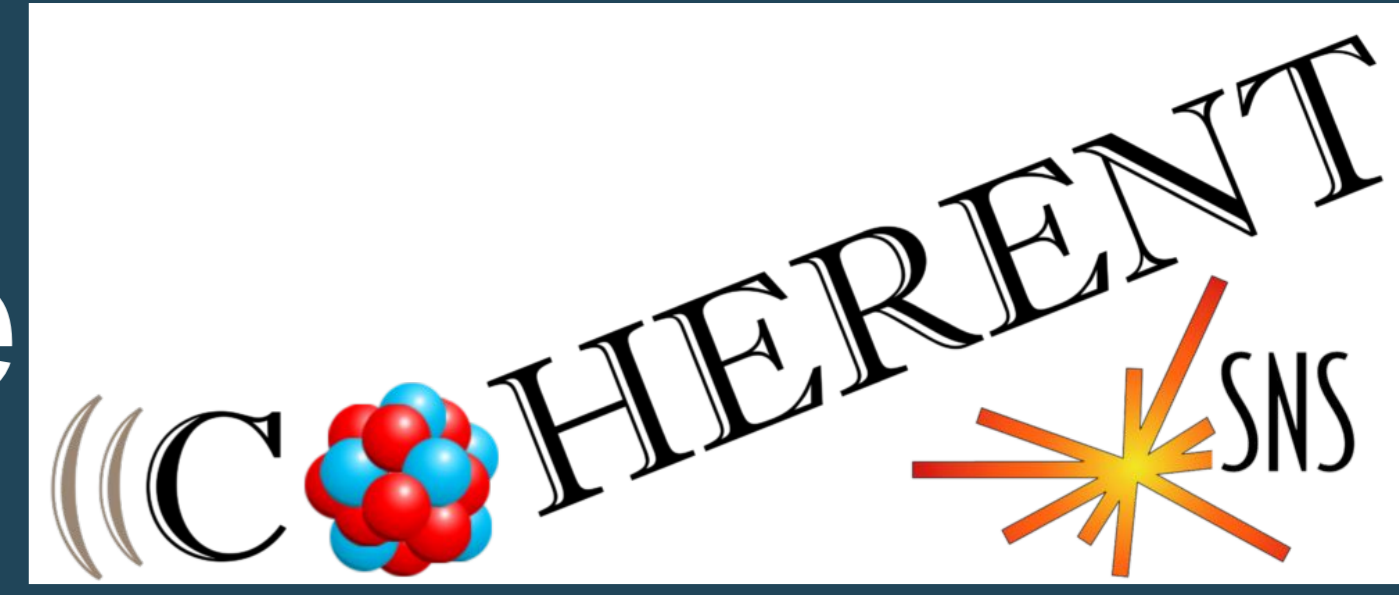


Poster #453

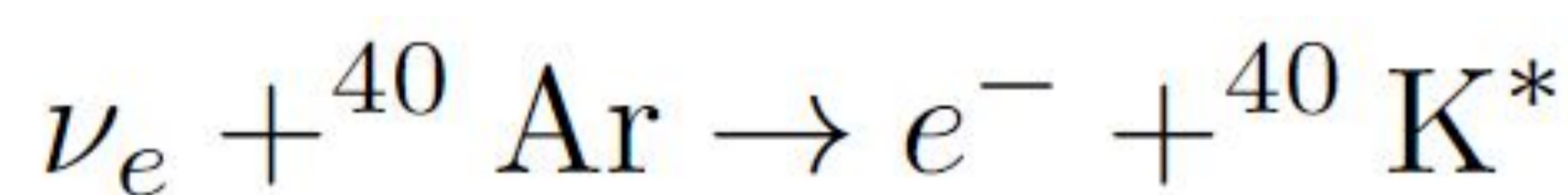
Measuring NueCC-Argon Interactions at 10-50 MeV with the COHERENT 750 kg Detector

Vinicius Da Silva
Tufts University, COHERENT Collaboration



Background and Measurement Motivation

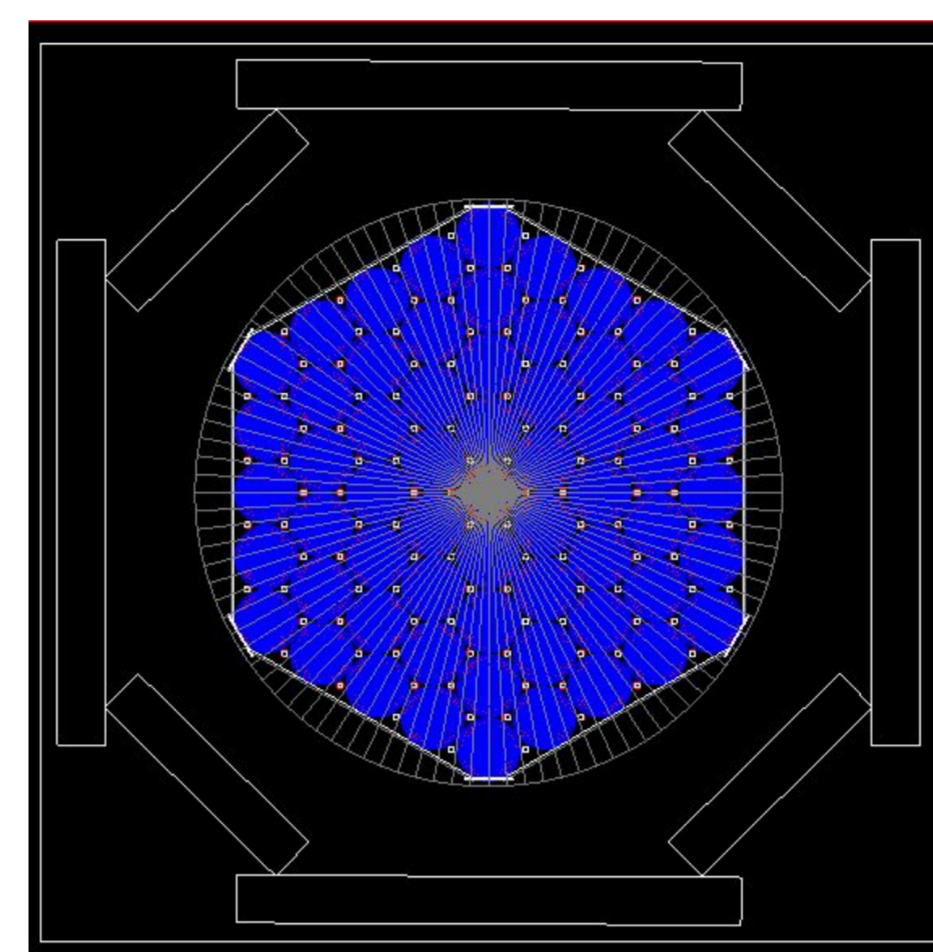
- Measurements of tens of MeV inelastic charged-current electron neutrino interactions (NueCC) are still sparse.
- Tens of MeV NueCC-Argon cross section measurements can provide relevant data for ongoing theoretical work on weak axial current g_A quenching in Gamow-Teller nuclear transitions.
- Measurements of neutrino-nucleus cross sections at these energies are of interest for the interpretation and study of neutrino signals from astrophysical sources, especially supernova neutrinos
- CENNS 750 Argon detector is uniquely sensitive to measure 10-50 MeV NueCC-Argon interactions



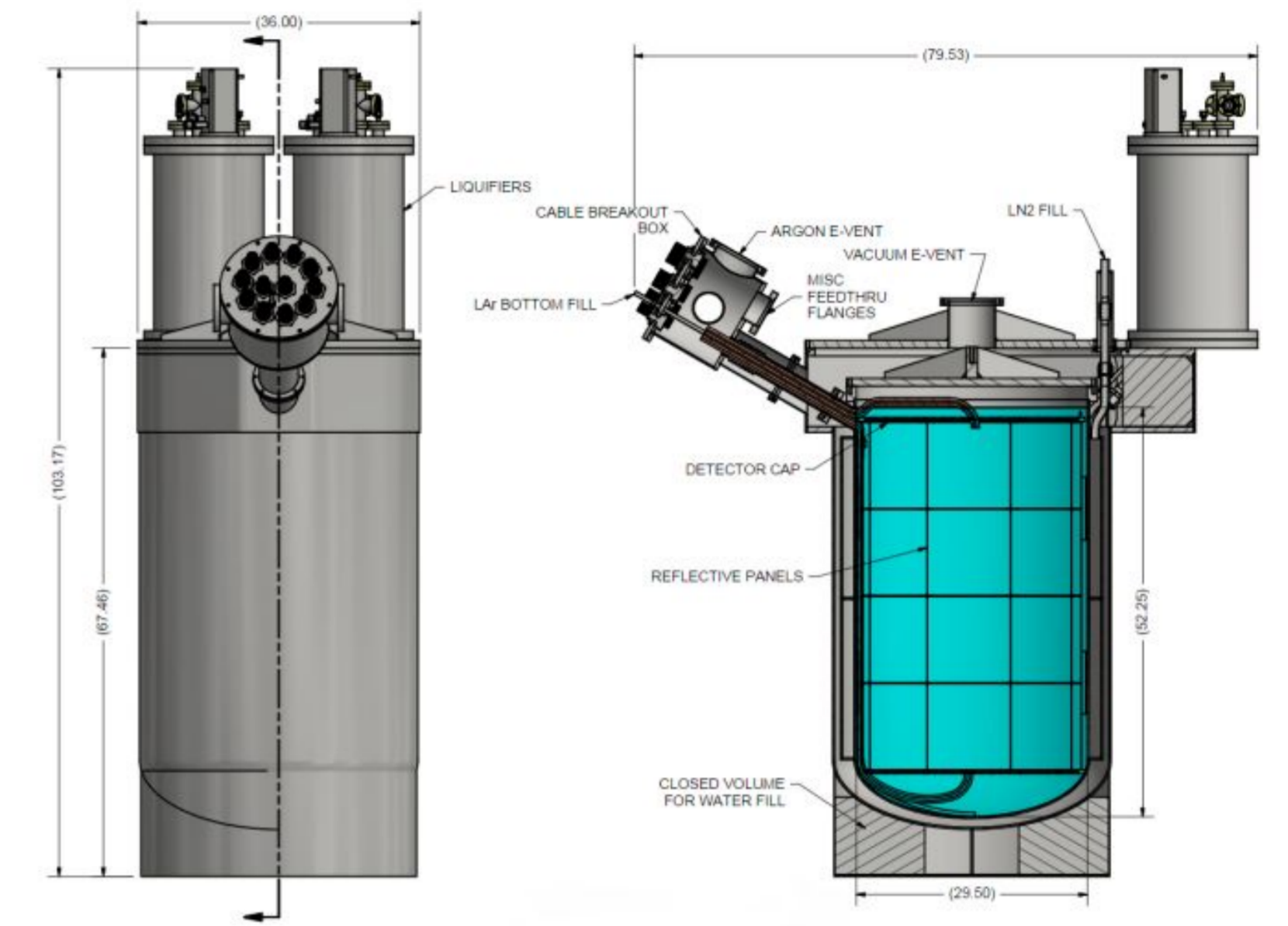
Neutrino Argon Charge Current Inelastic Interaction

CENNS 750 Detector

- Single phase liquid argon scintillation detector
- 750 kg liquid argon cryostat & 610 kg of fiducial volume
- Equipped with 122 photomultiplier tubes PMTs
- TPB coated teflon panels on the sides
- 27.5m from Hg target



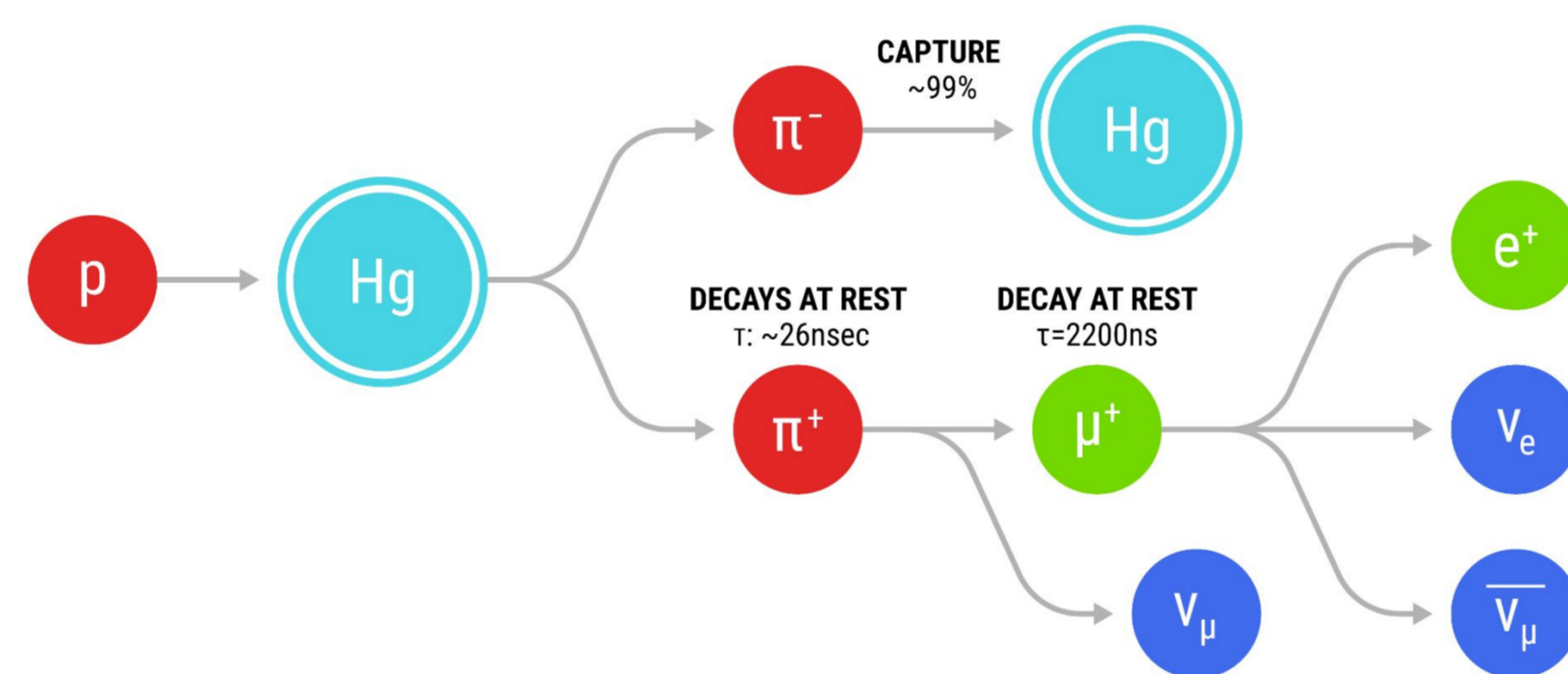
Preliminary Veto Design for CENNS 750 - Top View



Rendering of the 750 kg LAr Detector Cryostat

Neutrino Production with the SNS Beam

- Spallation Neutron Source (SNS) is located at Oak Ridge National Laboratory's neutrino alley
- High flux of pulsed neutrinos: 4.3×10^7 neutrinos/cm²/s at 20 meter
- Stopped Pion provides tens of MeV neutrino source
- Pulse structure is used for background rejection



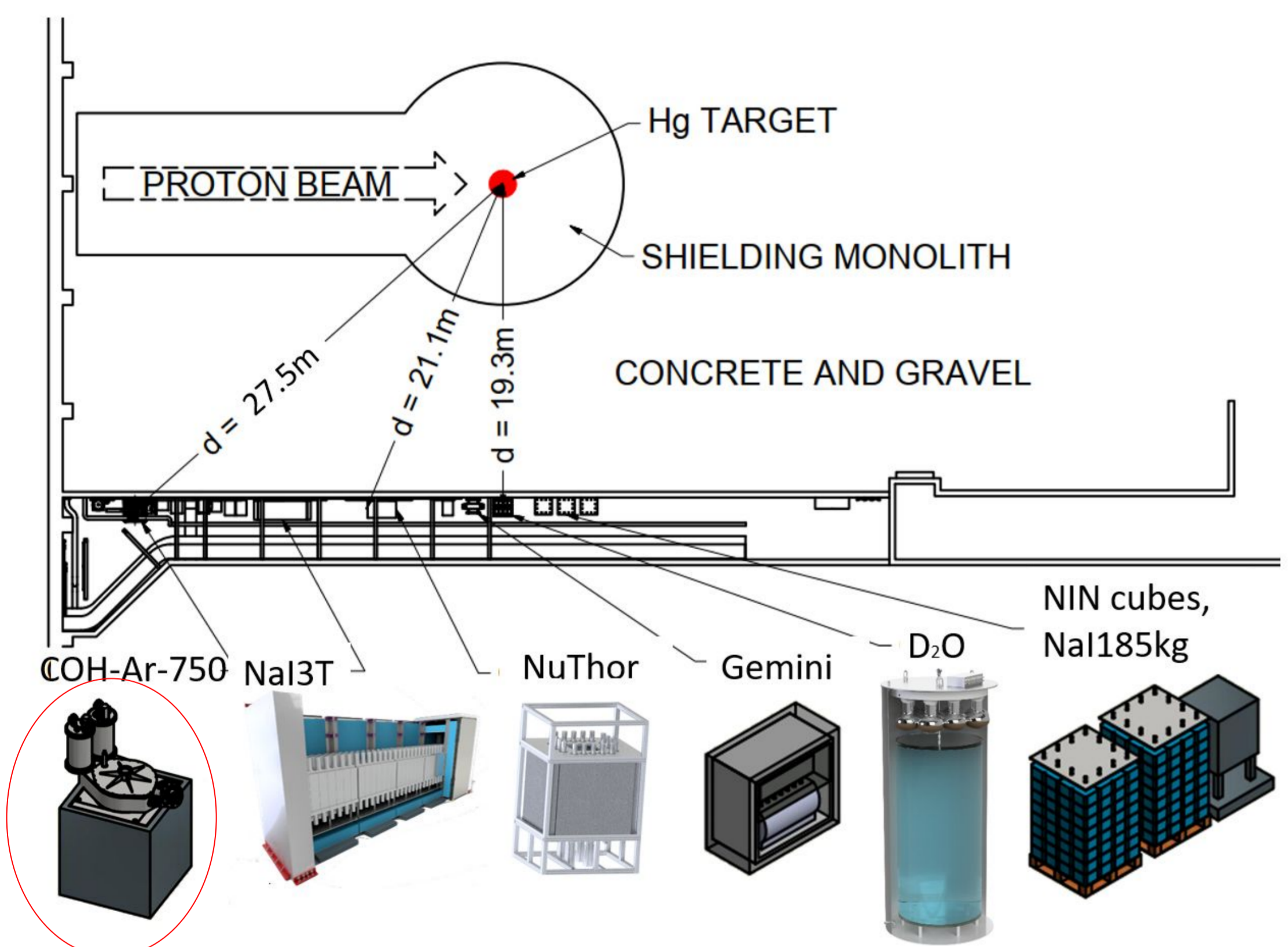
SNS Neutrino Production

Simulation Study of Inelastic Measurement

- Main impediment to cross section measurement is the presence of cosmic ray background which mirror neutrino signature
- 9 Plastic scintillator panels used to veto cosmic rays
- 10,000 MARLEY (Model of Argon Reaction Low Energy Yields) signal events simulated
- 27,000 Cosmic background events were simulated using CRY (Cosmic Ray Shower Library)

Expected Signal Estimate

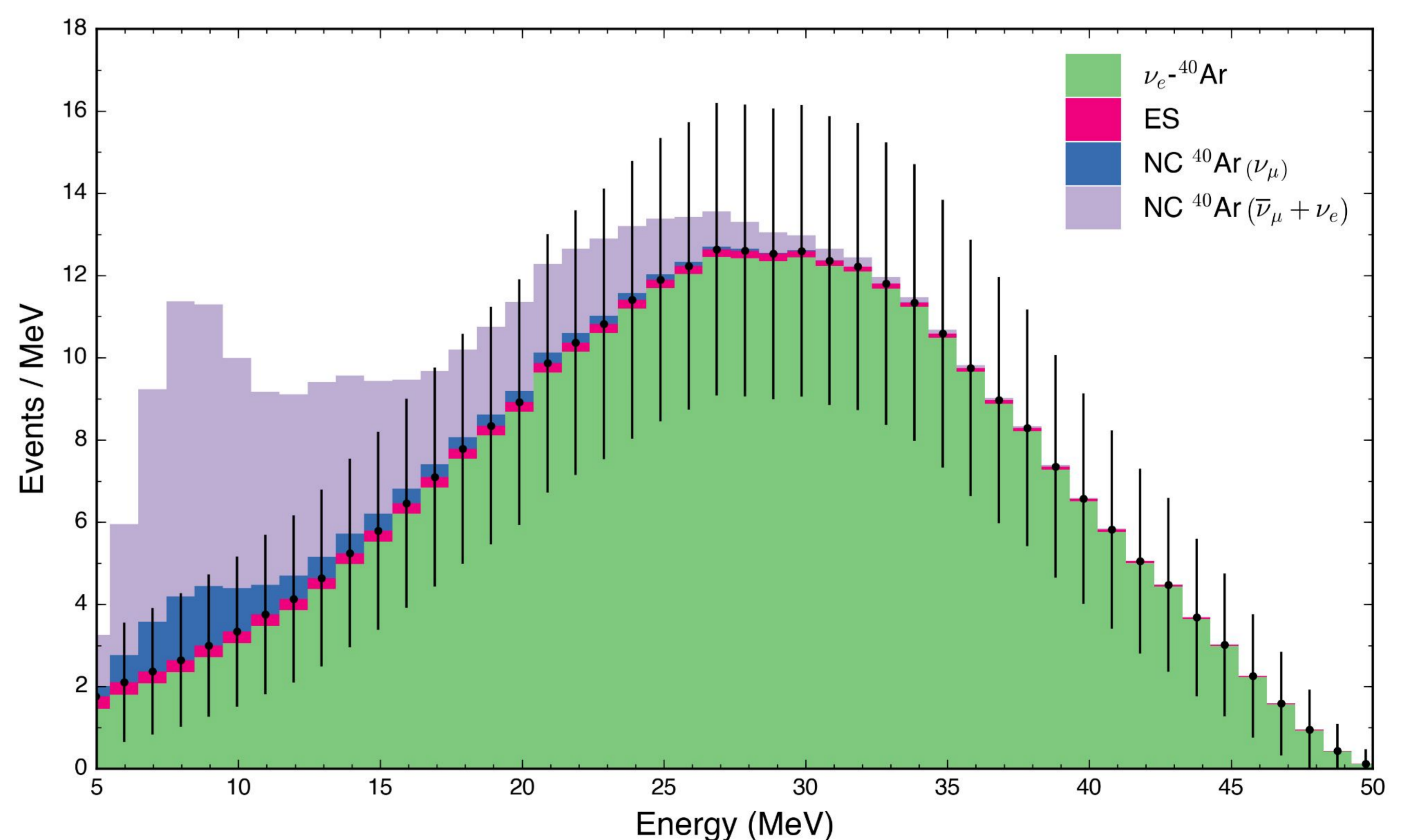
- Waveforms were summed over 122 PMTs
- Pulse recorded after a threshold trigger value is met



Location of COHERENT Detector Systems in Neutrino Alley

Future Work

- Finish analysis of background cosmic simulation to evaluate the expected signal/cosmic background ratio
- COHERENT will make CENNS measurements at Kev energies as well as at inelastics at MeV energies so modeling PMT performance is crucial
 - Model the effect of non-linearity of PMTs on inelastic cross section measurement
 - Model performance of PMTs at high dynamic range



Predicted Energy Distribution for Inelastic NueCC-Argon events for COH-750

Acknowledgements & References

Barbeau PS, et al 2023 *Annu. Rev. Nucl. Part. Sci.* 73:41-68 <https://doi.org/10.1146/annurev-nucl-101918-023518>



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