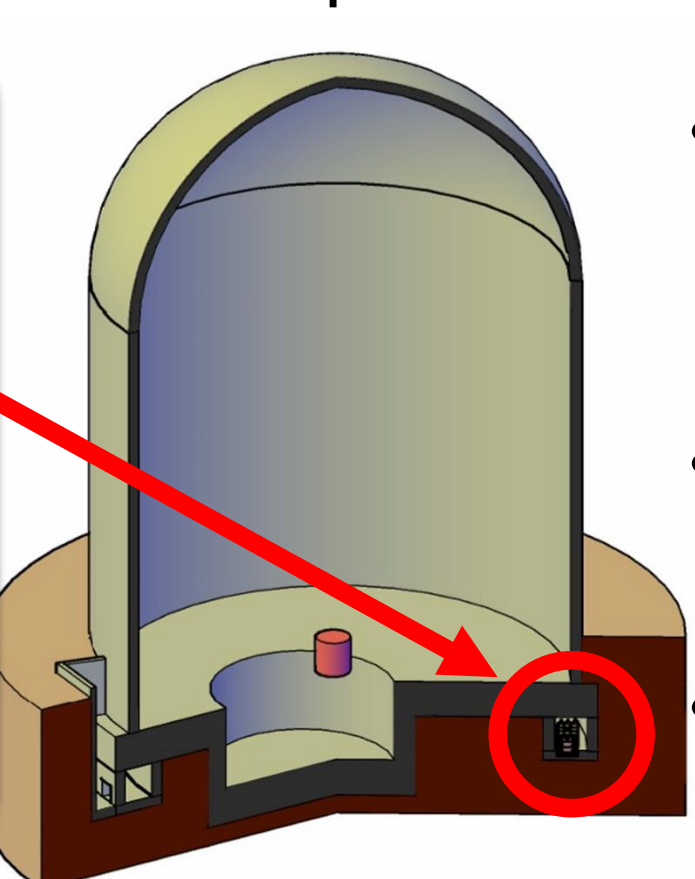
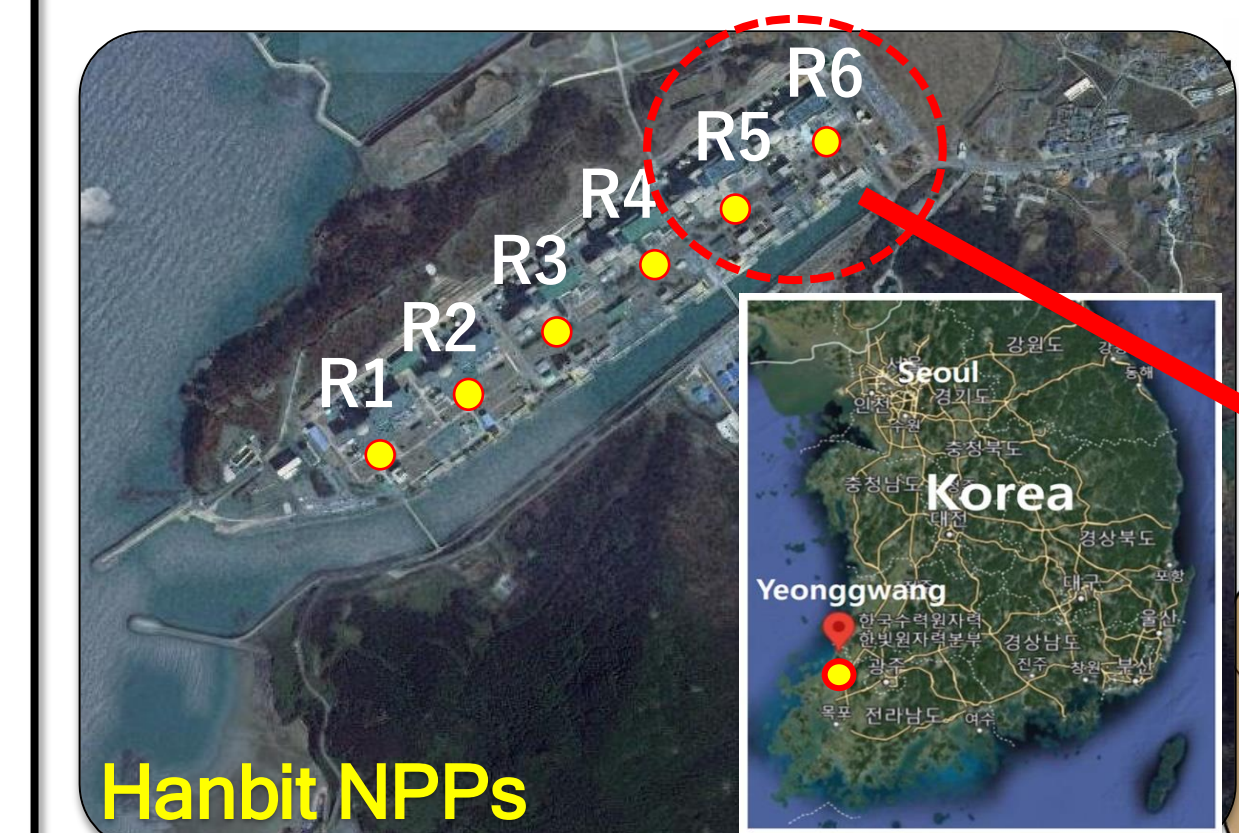
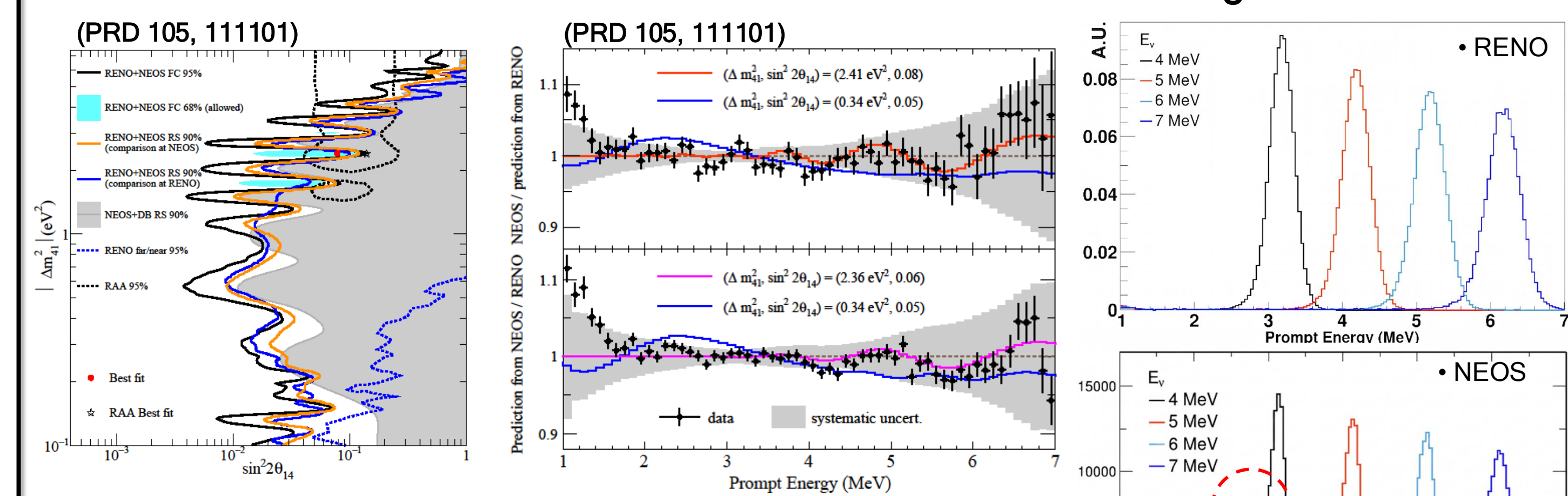


Introduction

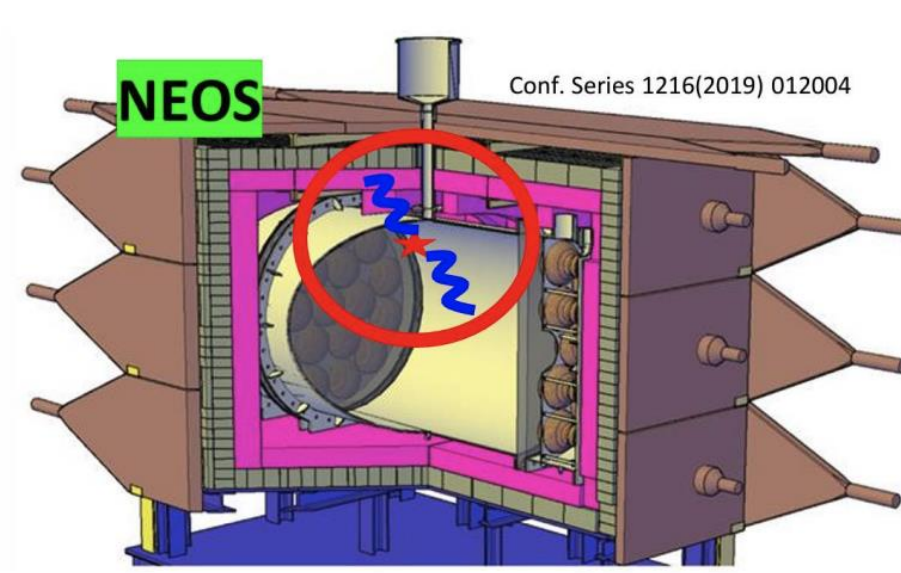
Reactor Experiment for Neutrinos and Exotics



- Detector will be installed in tendon gallery at Hanbit nuclear power plant.
- ~ 24 m baseline; distance from a reactor to the detector.
- Utilize Gd-loaded liquid scintillator (Gd-LS) target with LS gamma catcher.

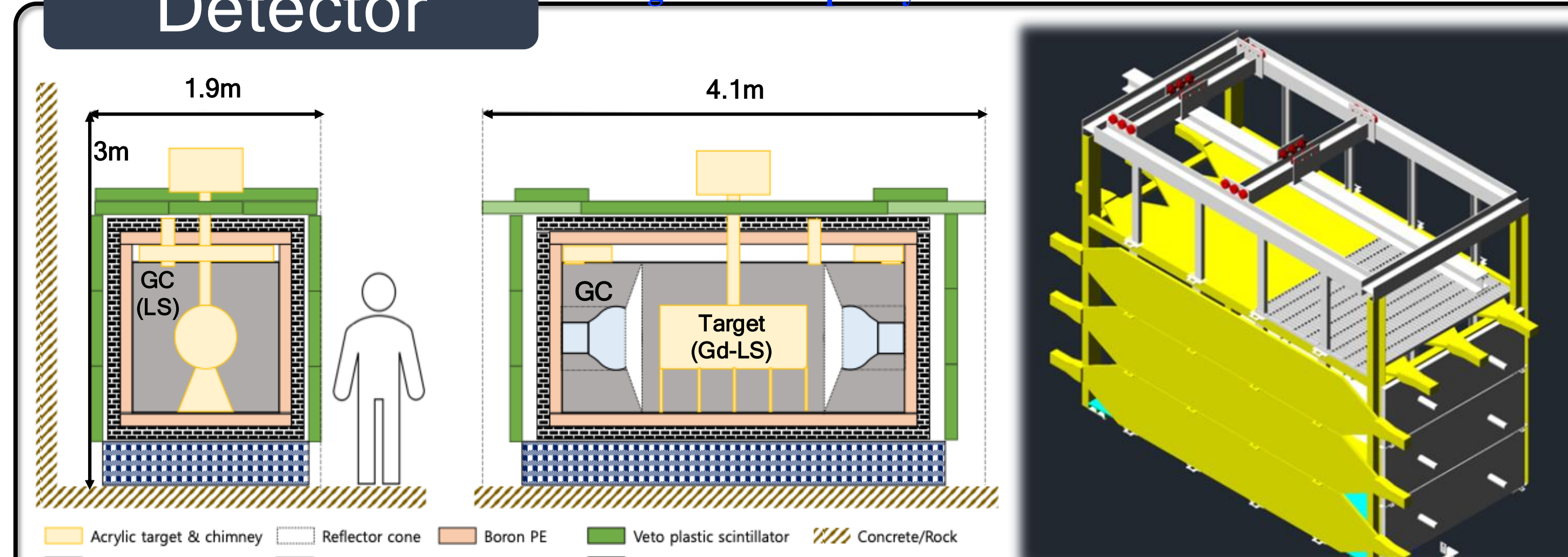


- RENO-NEOS joint analysis hint for the sterile neutrino at $\Delta m_{41}^2 \sim 2 eV^2$.
- To cross-check RENO-NEOS result, need to improve systematics.
- NEOS and RENO detector responses to monochromatic ν energies.
- NEOS detector has 2nd peaks, which come from the escaping gammas, in the main peak. \rightarrow "Gamma catcher" is needed.



Detector

* Prog. Theor. Exp. Phys. 2025 093C03



- 2 20-inch PMTs for the target.
- 0.5 % Gd-loaded LS target.
- Box-shaped LS gamma catcher.
- Plastic scintillators with 2-inch PMTs for VETO detector. (From NEOS)
- Shielding with 100 mm Borated PE & High Density PE & Lead bricks.

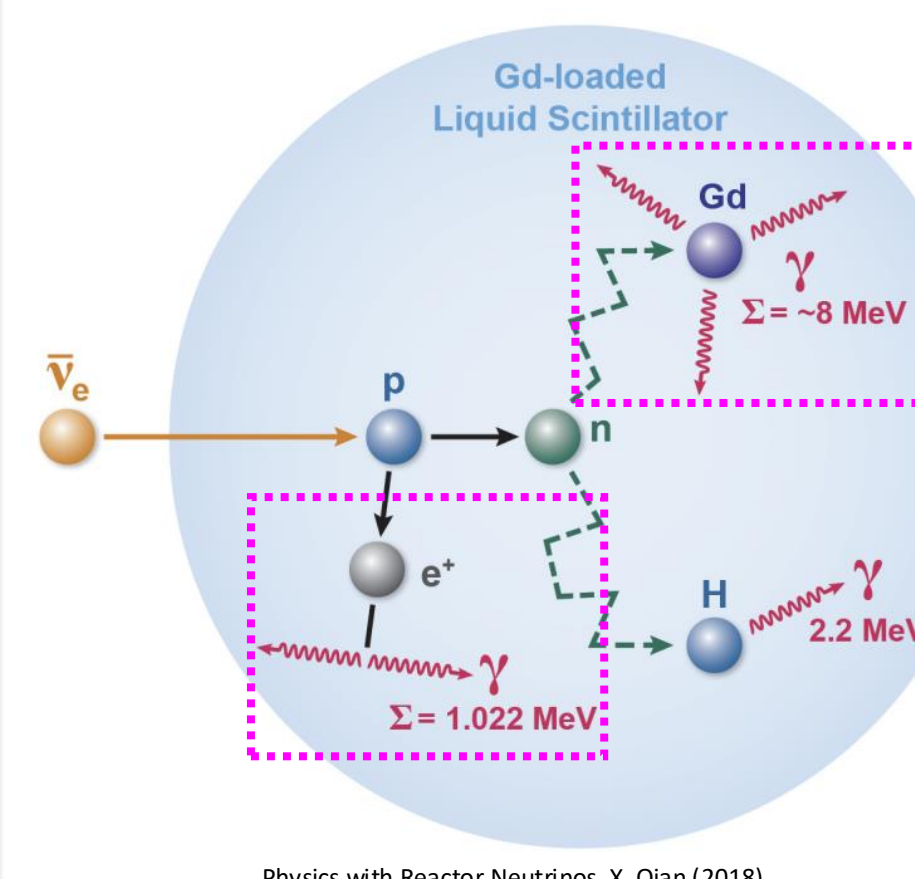
20-inch PMT (R12860)

- Gain: 0.7×10^7 , Q.E.: $\sim 30\%$
- Box and Line Dynode

RENE DAQ: NOTICE NKFADC 500

- 4+4 channels, 12bit, Sampling rate 500MS/ch/s

Detection Method: Inverse Beta Decay (IBD)



- $\bar{\nu}_e$ interacts with a proton via IBD \rightarrow produces a positron + neutron
- Neutron: O(keV) kinetic energy \rightarrow thermalized
- Positron: deposits energy \rightarrow prompt signal
- Neutron: captured after thermalization \rightarrow delayed signal
- Signal pair (prompt + delayed) \rightarrow clear identification of neutrino interaction event

20 inch PMT performance

* Prog. Theor. Exp. Phys. 2026 053H02

Charge response (SPE)

Gain curve

Time Response

Trigger Time - PMT Falling Time

* SPE Fitting Function

$$f(x) = \sum_{i=1}^2 A_i \cdot \exp\left(-\frac{x - \mu_i}{\sigma_i}\right) + A_3 \cdot \left\{ \operatorname{erf}\left(\frac{x - \mu_3}{\sigma_3}\right) - \operatorname{erf}\left(\frac{x - \mu_2}{\sigma_2}\right) \right\}$$

- Applied Voltage (A, B): 1680 V, 1642 V
- Single Photoelectron (A) : 1.17 ± 0.0029 pC
- Single Photoelectron (B) : 1.21 ± 0.0028 pC
- Peak to Valley (A, B) ≈ 3
- Waveform integration with 80 ns

VETO detector

- VETO detector consists of a plastic scintillator (from NEOS) and a 2" PMT.
- 9 PS A type: 4140 mm x 600 mm x 30 mm, EJ 200
- 6 PS B type: 1660 mm x 600 mm x 50 mm, EJ 200
- Totally, 32 2-inch PMTs will be used for VETO.
- PMTs were fixed using 3D printed PMT supports.

Radioactive Source

RI Source

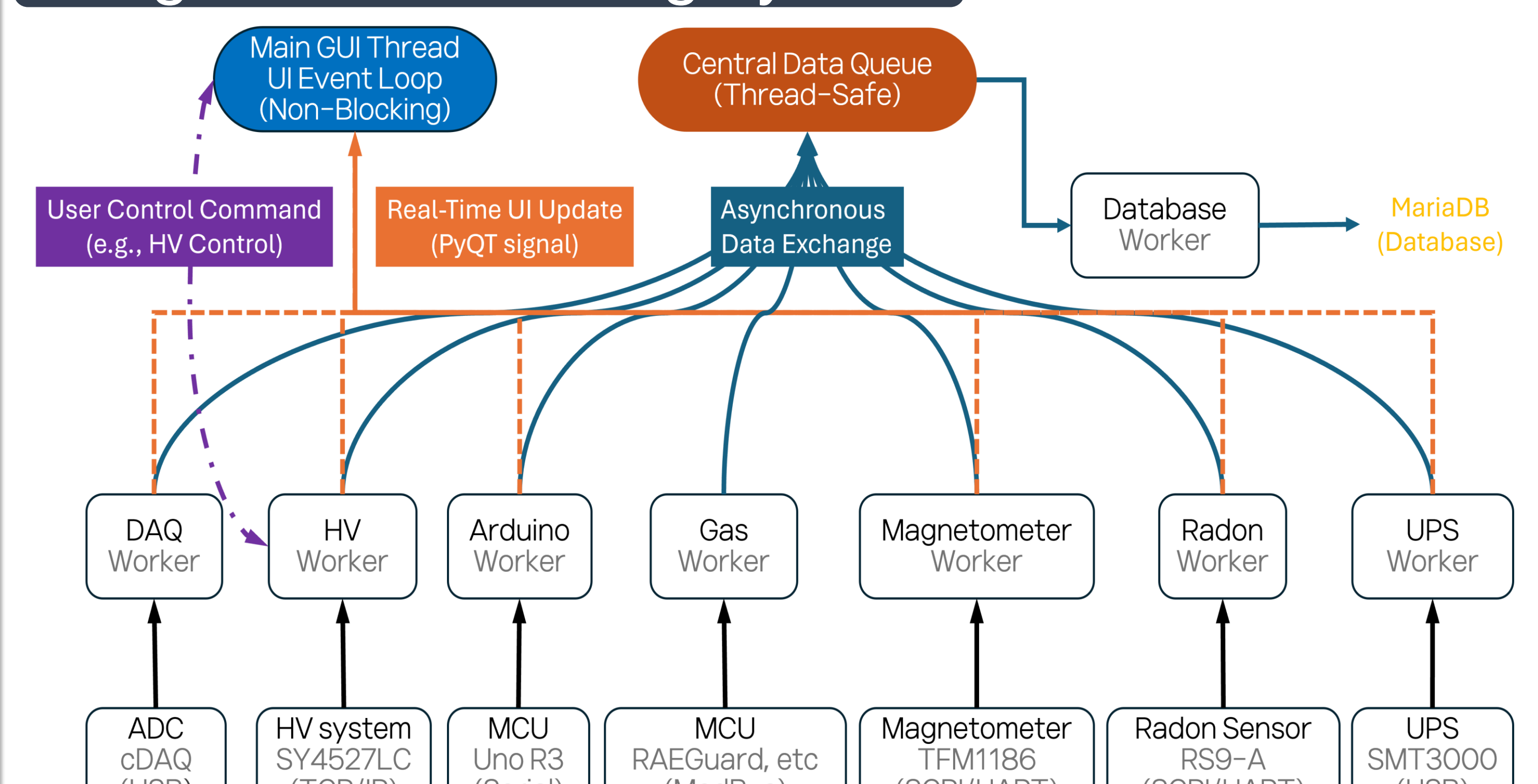
Waveform

- ^{238}U & ^{235}U
- ^{137}Cs (0.662 MeV)
- ^{60}Co (2.5057 MeV)
- ^{65}Zn (1.115 MeV)
- ^{22}Na (2.296 MeV)
- ^{252}Cf (neutron source)
- n-H (~ 2.2 MeV)
- n-Gd (~ 8 MeV)

• PMT gain : 0.7×10^7 , Threshold : 36 mV (~ 0.1 MeV), Source position : target center.

Integrated Monitoring system

* Prog. Theor. Exp. Phys. 2026 033C01



Summary

- RENE experiment: search for the sterile neutrino at $\Delta m_{41}^2 \sim 2 eV^2$.
- Detector construction completed
- Commissioning in progress (DAQ tuning, calibration, etc.)
- Installation & start of data taking in tendon gallery (2026)