Measurement of reactor neutrinos with neutron captures on hydrogen at RENO

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For the RENO Collaboration

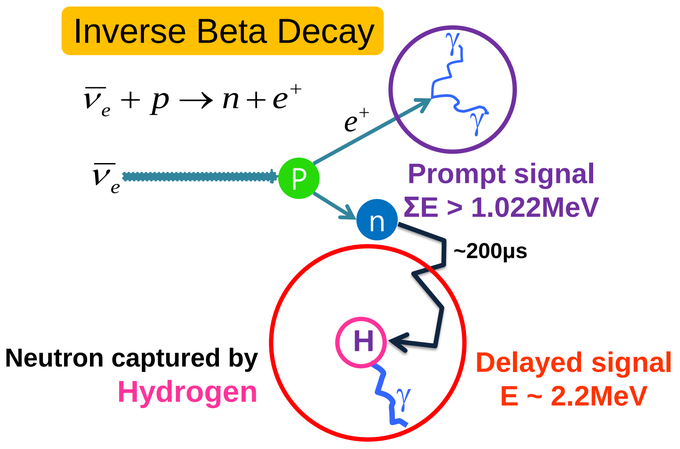
RENO ν θ_{13}

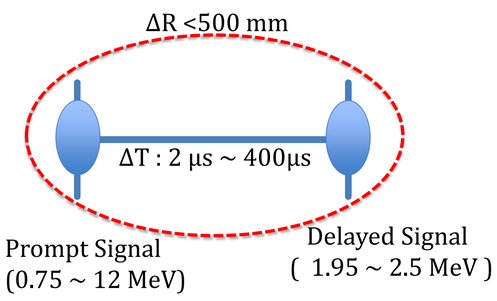
KNRC Korea Neutrino Research Center

Detection Method & Motivation

Inverse Beta Decay

$\bar{\nu}_e + p \rightarrow n + e^+$





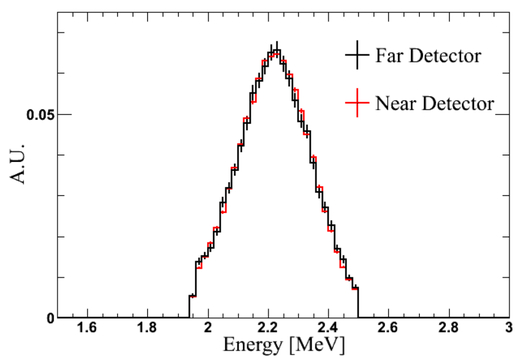
Coincidence(Pairing)

- Independent Measurement of θ_{13}

Successful purification of LS & detector materials
Raw radioactivity PMT glass
} Low accidental rate ➔ Identification of Neutron capture on Hydrogen against large backgrounds

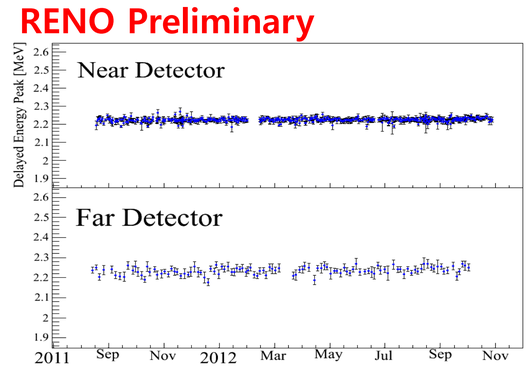
Delayed Event Spectra and Stability

- The delayed energy spectra match well between far and near detectors.
- Peak value is 2.2 MeV as expected



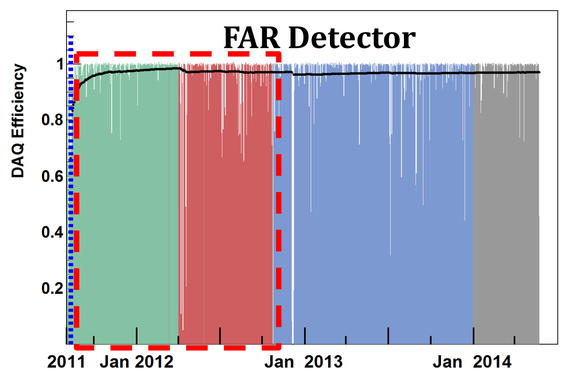
Delayed Energy Spectra

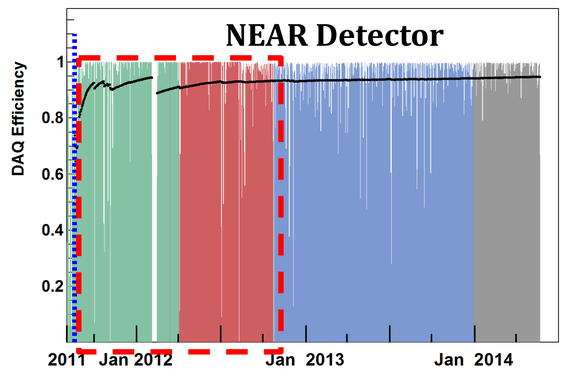
RENO Preliminary



Stability of n-H captured energy

Data Set





- ❑ Data taking began on Aug.11, 2011 with both far and near detectors.(DAQ efficiency: ~95%)
- ❑ DAQ Live-Time : [FAR : 384.473 (days)], [NEAR : 379.663 (days)]

Candidates and Backgrounds

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	Near(~12MeV)	Far(~12MeV)
Live time (/day)	379.663	384.473
IBD Candidate (Total)	245281	55545
IBD Signal (/day)	584.67	66.48
Accidental (/day)	40.87 ± 1.74	72.69 ± 0.83
Fast Neutron (/day)	5.63 ± 0.09	1.28 ± 0.10
Slow Neutron (/day)	6.42 ± 0.35	1.04 ± 0.47
Li/He (day)	7.24 ± 0.92	3.17 ± 0.35

Data Selection Criteria

n-H Capture cut criteria	
Prompt Energy [MeV]	0.7~12
Delayed Energy [Mev]	1.95~2.50
deltaT [us]	2~400
deltaR [mm]	< 500
Qmax/Qtot	< 0.08
Muon Veto time [ms]	1
Shower Muon Veto time [ms]	700
Trigger Veto Time cuts	

Observed Reactor Neutrino Spectra

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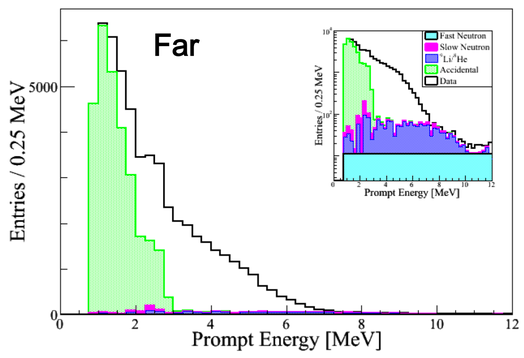
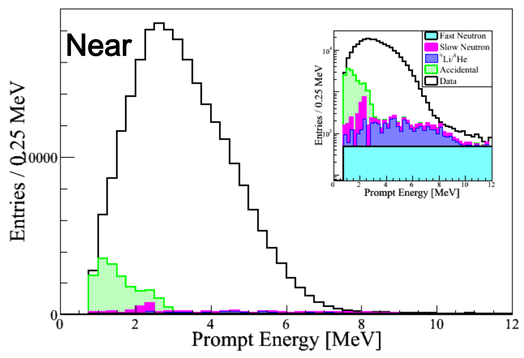
- Stacked histogram of each backgrounds and signal. Inset is logarithmic view point.





Hydrogen Capture Performance

- Capture Time.

* Fitting result shows same tau values of 206 us at both detectors.
* Capture time matched well with the expected tau value : ~ 200us

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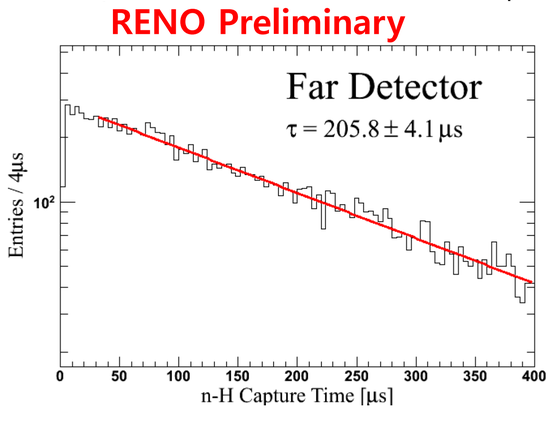

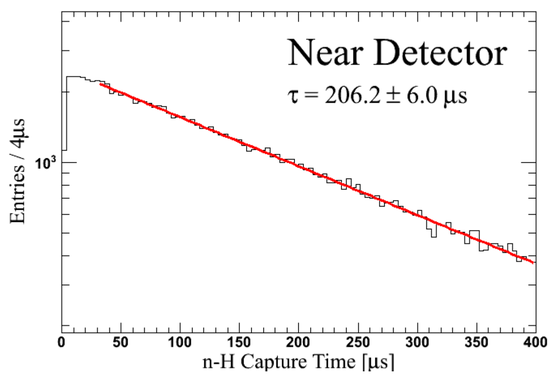

- Vertex Distribution.

* Most event was occurred at the Gamma-catcher region as expected.

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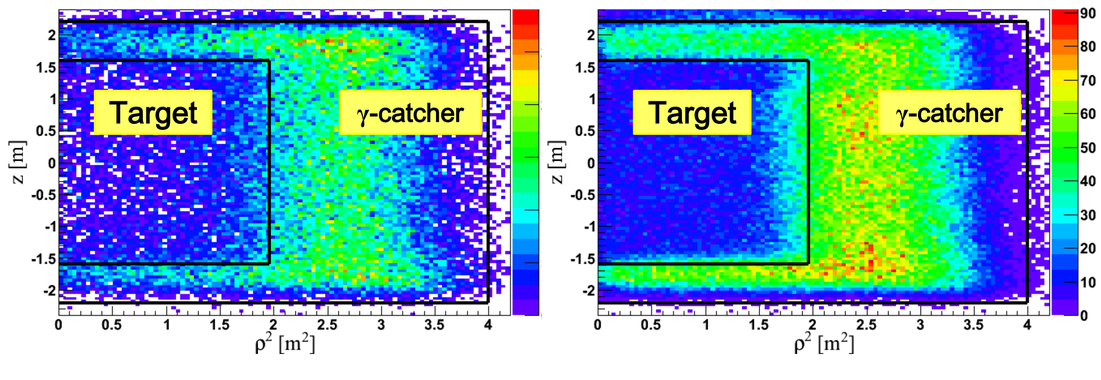

Far Detector

Near Detector

Comparison of Background Subtracted Data and Oscillated MC

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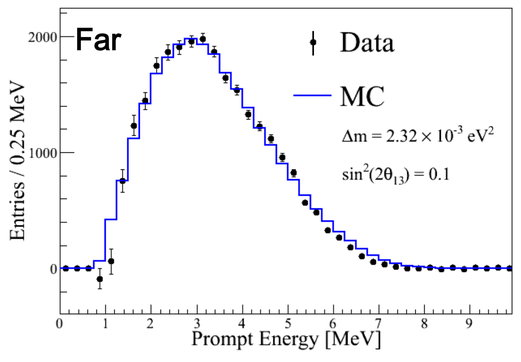

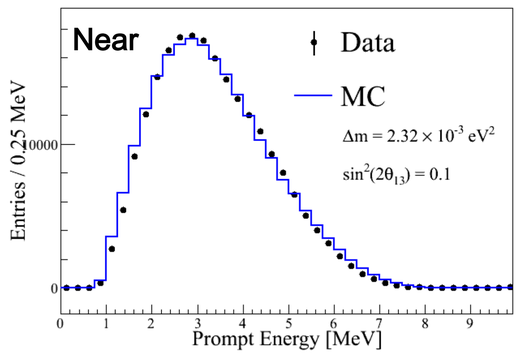

θ_{13} Measurement

RENO Preliminary

- Rate only Analysis

* We performed χ^2 fitting of rate only analysis with ~400 days data set.

* Preliminary rate only analysis result is
$\sin^2(2\theta_{13}) = 0.095 \pm 0.015$ (stat.) $\pm$ 0.025 (sys.)