

Status report : KamLAND-Zen study

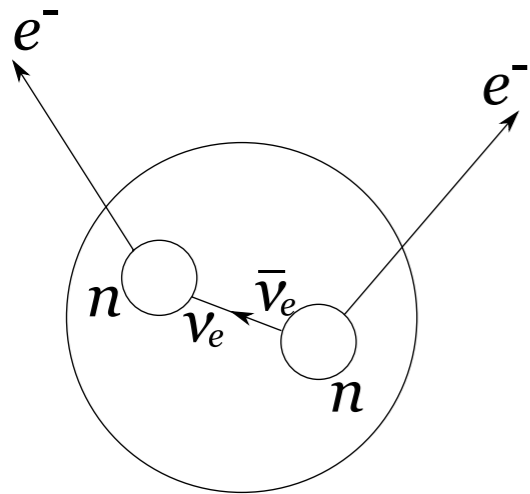
2020 spring GP-PU Progress Status Presentation

B9SD2011 KAMEI Yuto, RCNS

KamLAND-Zen 800 experiment

- ▶ Neutrinoless double beta decay ($0\nu\beta\beta$) search
- ▶ Decay target : Xe136 (740 kg)
- ▶ KamLAND is a large, ultrapure liquid scintillator (LS) detector.

The key of $0\nu\beta\beta$ search is high energy resolution and ultrapure environment.



- ▶ This search is a probe of new physics.
- ▶ $0\nu\beta\beta$ occurs only in case of neutrino is Majorana. ($\nu = \bar{\nu}$)
- ▶ $0\nu\beta\beta$ is very rare event ($T_{1/2} > 10^{21}$ yr).

KamLAND2-Zen experiment

- ▶ Updating plan of KamLAND-Zen
- ▶ New LS, High efficiency PMT w/ Collecting Mirror, Xe ~ 1000 kg

Schedule

KamLAND-Zen 800 work

- ▶ KamLAND-Zen 800 started on January 2019.
- ▶ Now observing for $0\nu\beta\beta$
- ▶ Analysis now on going

- ▶ Continuing analysis
 - ▶ Data updating
 - ▶ Background estimation (e.g. spallation product events reduction)
- ▶ etc...

During GPPU program,
I will report new updated result of limit of $0\nu\beta\beta$ half-life by few year
observed data.

Current Status

KamLAND-Zen 800 work

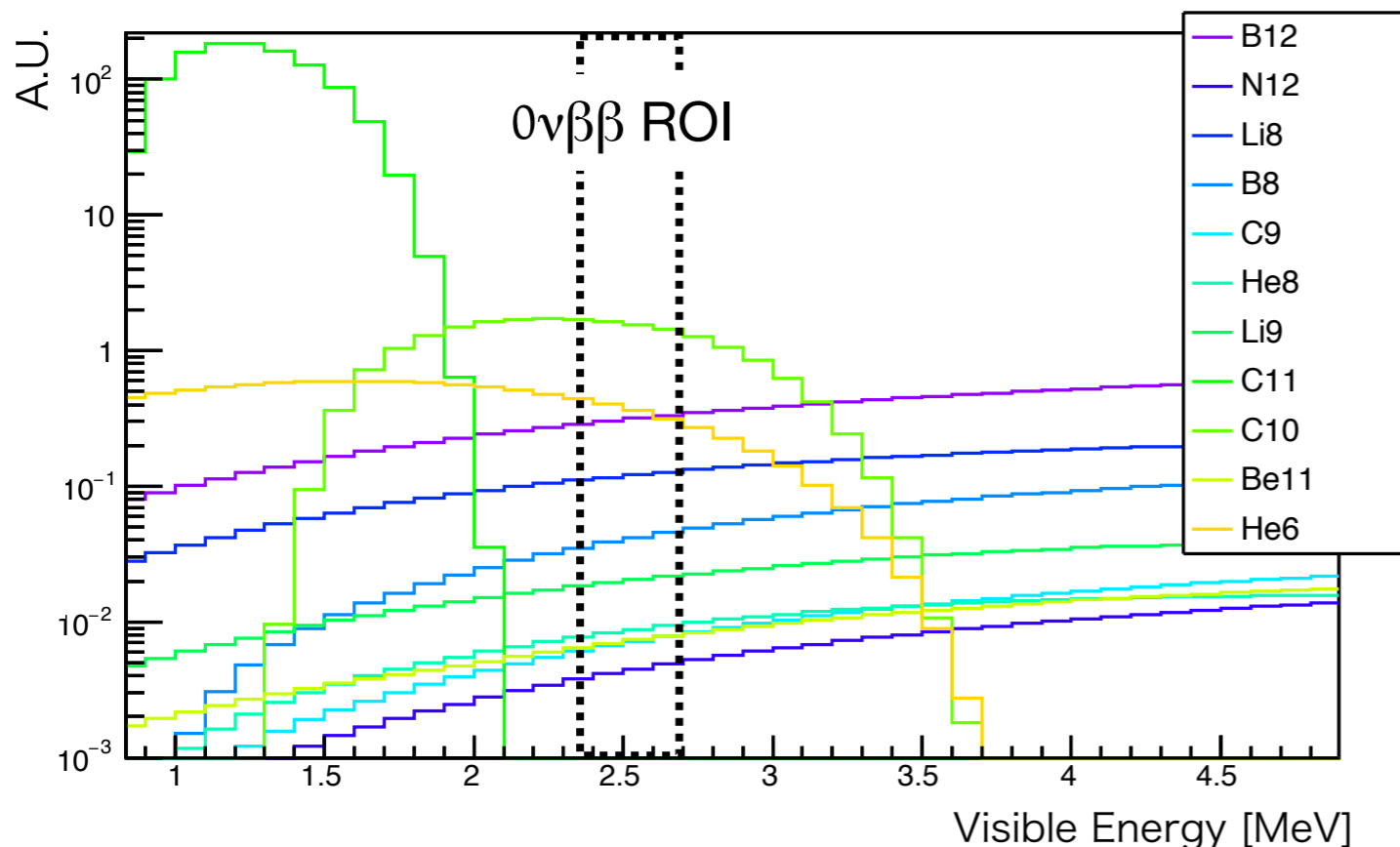
- ▶ Analysis on going
- ▶ Evaluating spallation background in KamLAND-Zen
 - ▶ Cosmic-ray produces spallation productions by breaking up nucleus.

Examples of short lived light isotope BG ;

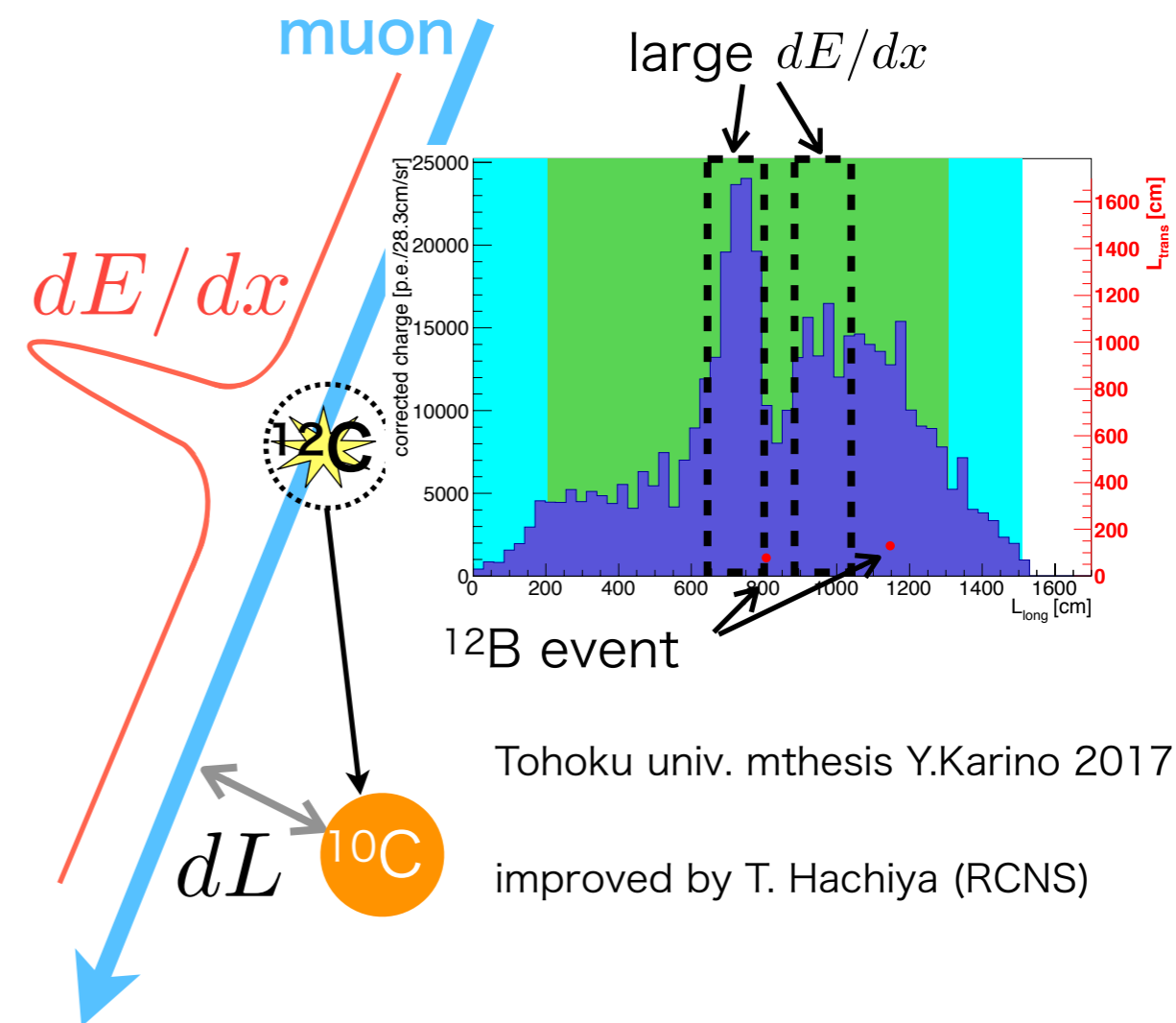
$$^{10}\text{C} \quad Q = 3.7 \text{ MeV} \quad \tau = 28 \text{ sec}$$

$$^{12}\text{B} \quad Q = 13 \text{ MeV} \quad \tau = 30 \text{ msec}$$

$$^6\text{He} \quad Q = 3.5 \text{ MeV} \quad \tau = 1.2 \text{ sec}$$



Rejection method using dE/dx and dL



Tohoku univ. mthesis Y.Karino 2017

improved by T. Hachiya (RCNS)

Plan of study abroad

I have gone ahead with the preparation.

Initially I was going to visit the Nikhef, University of Amsterdam and join the XENON experiment.

Owing to COVID-2019 situation, I postponed going abroad.

Sept. ??

Period : ~~May~~ 2020 - Nov. 2020 (not decided)

I'm preparing remote analysis for when I cannot go.

I will study small homework the professor of Nikhef will give for me before I will go Amsterdam on Sept. (IN CONSULTATION)

XENON experiment is the Dark matter search with liquid Xe TPC detector.