



KamLAND-Zen Analysis

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KamLAND-Zen

Neutrinoless double beta decay ($0\nu\beta\beta$)

A mode of double beta decay, which can happen only when neutrinos are Majorana particles ($\nu = \bar{\nu}$).

- Lepton # violation (beyond SM)
- related to baryon asymmetry of the Universe
- information about neutrino' mass (mass scale, hierarchy...)

Acquirement for $0\nu\beta\beta$ search

- Very low background environment
- Large amount of double beta decay nucleus
- High energy resolution



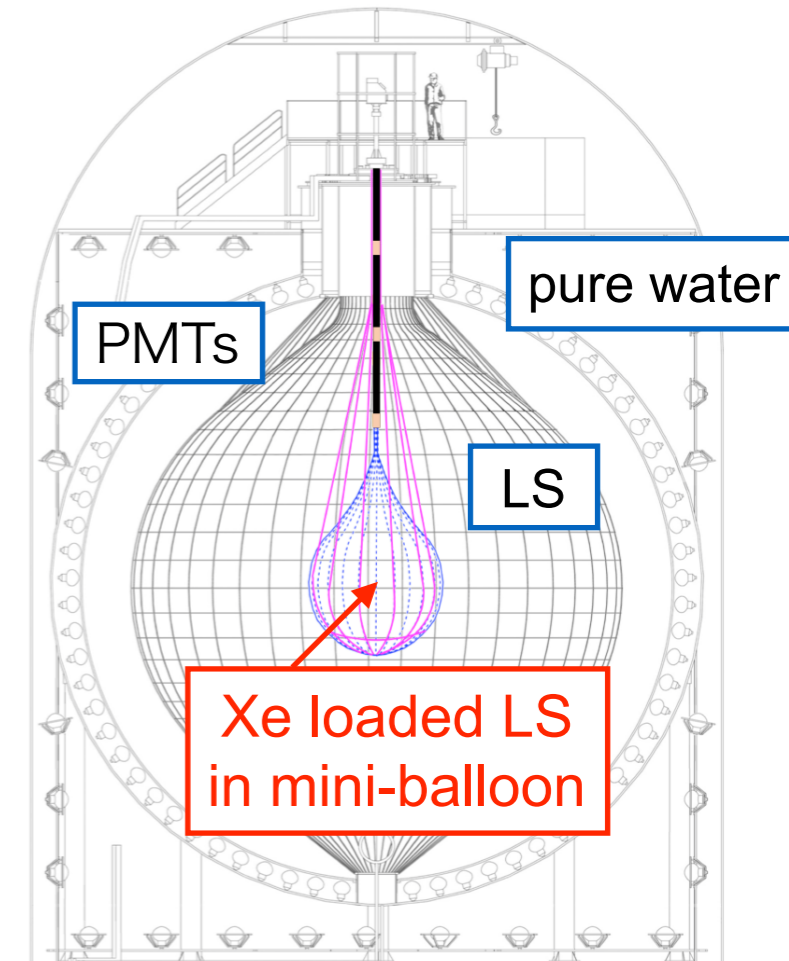
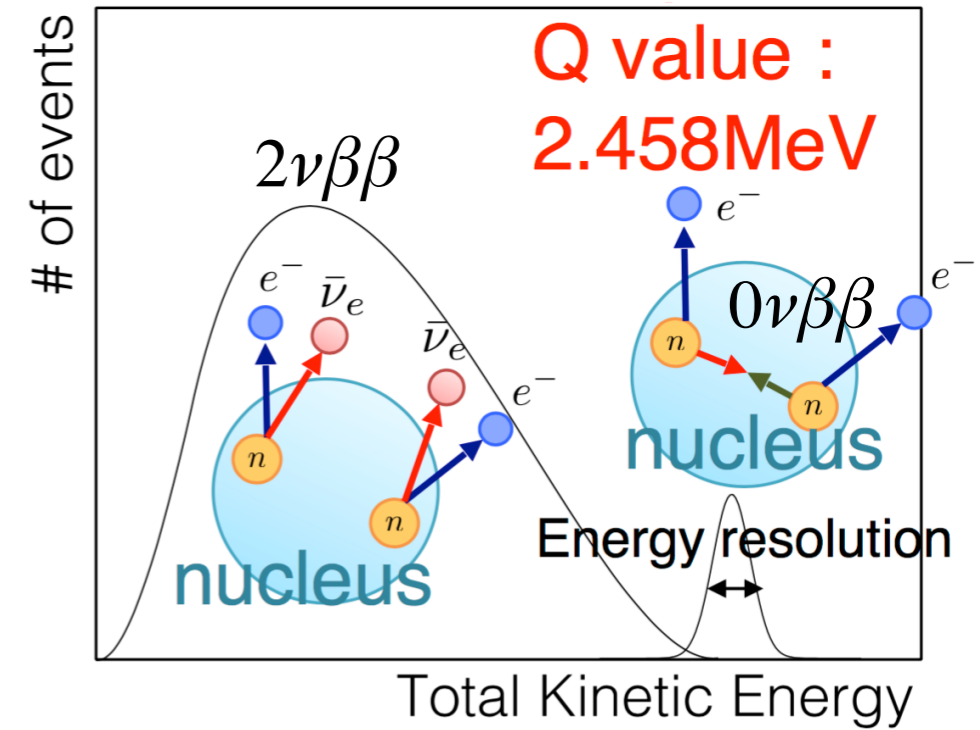
KamLAND-Zen

- $0\nu\beta\beta$ search w/ KamLAND (low BG liquid scintillator detector)

- Very low background environment
 $^{238}\text{U} : 5.0 \times 10^{-18} \text{ g/g}$, $^{232}\text{Th} : 1.3 \times 10^{-17} \text{ g/g}$
- Large amount of double beta decay nucleus
Scalability ... can accommodate 1000 kg Xe

Set the very strict limit to the half-life of ^{136}Xe $0\nu\beta\beta$ in KamLAND-Zen400

And we started KamLAND-Zen800 with ~745kg enriched Xenon this year!

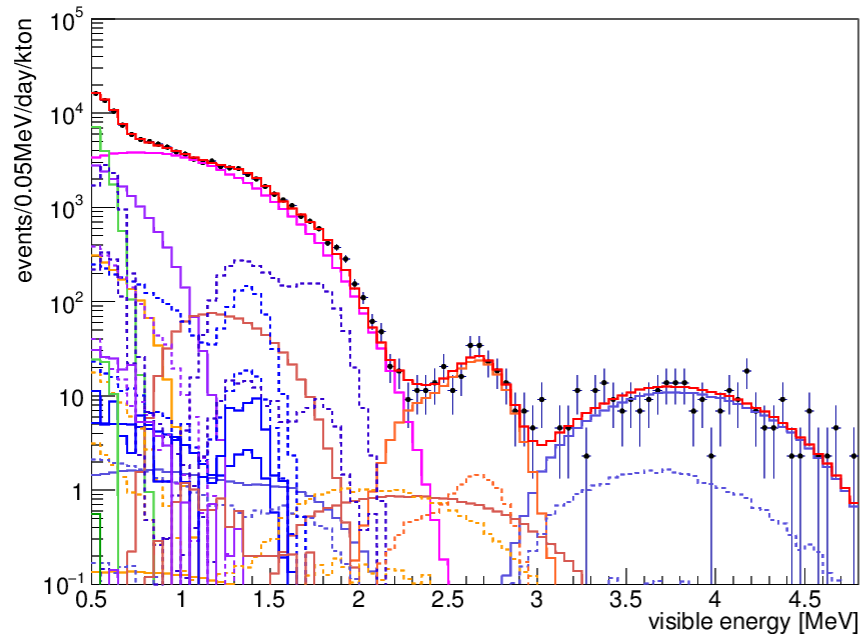


Time Line

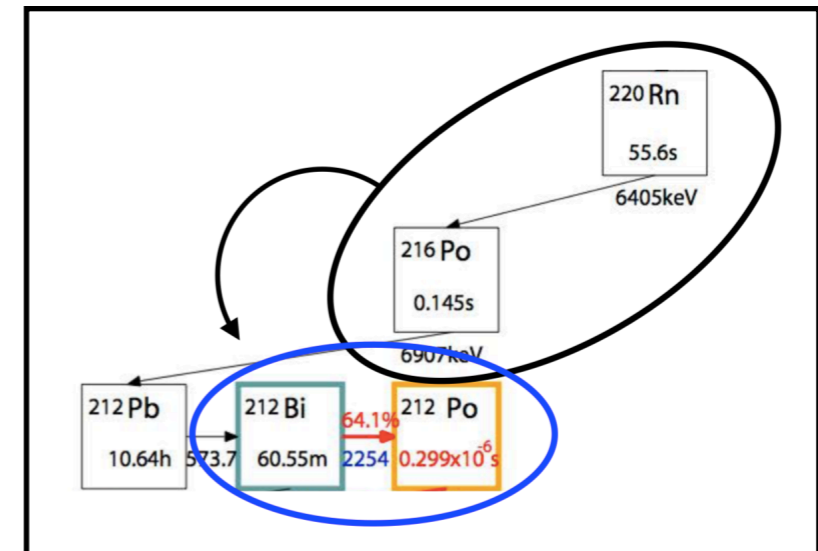
Preparation for KamLAND-Zen800

PMT study for KamLAND2-Zen

Zen400 Analysis



BG rejection for Zen800



- Summarize Zen400.
- 海外研修

Prospect

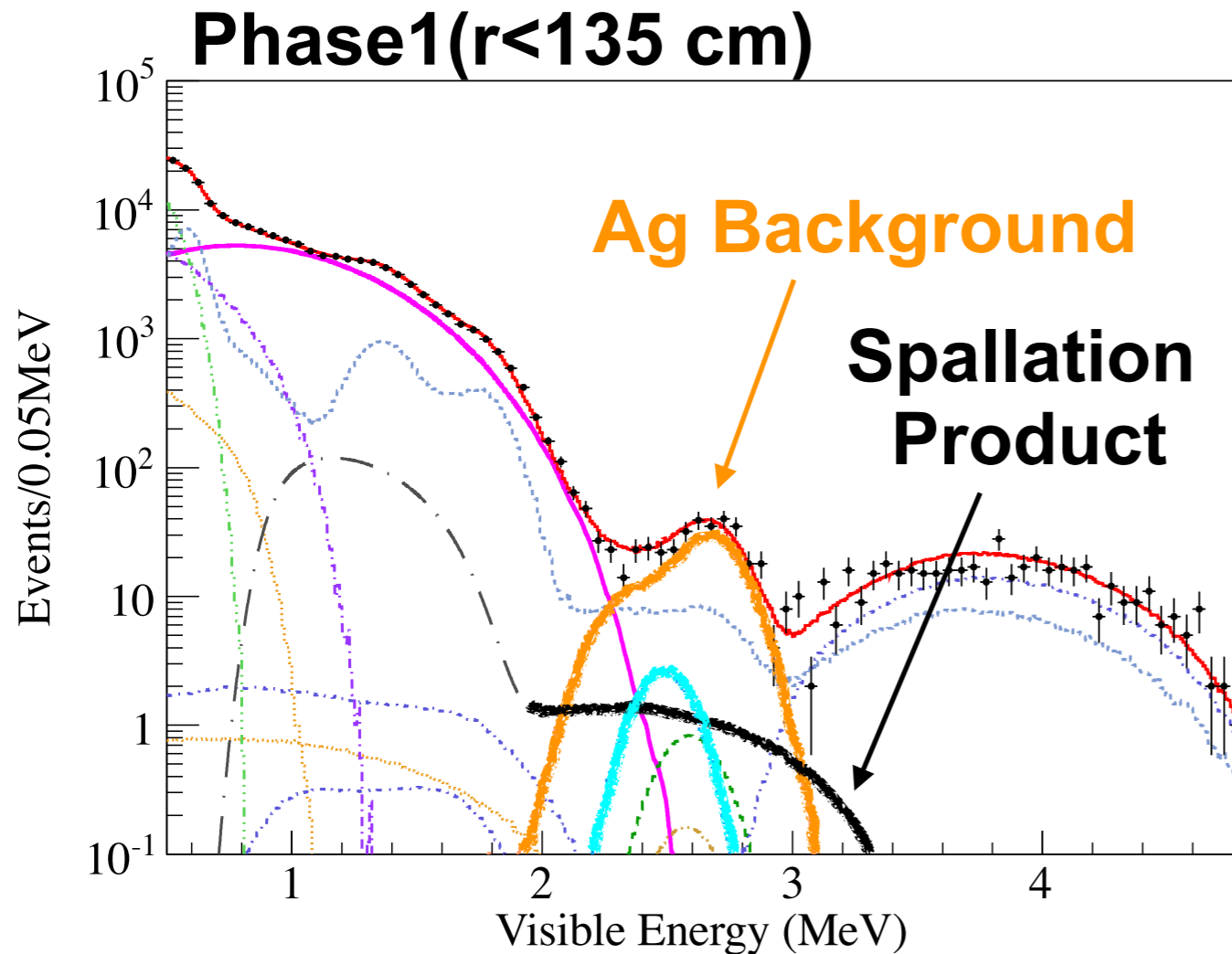
Zen800 Analysis

- Write a Ph.D thesis.
- ^{136}Xe $0\nu\beta\beta$ discovery ?

Current Status

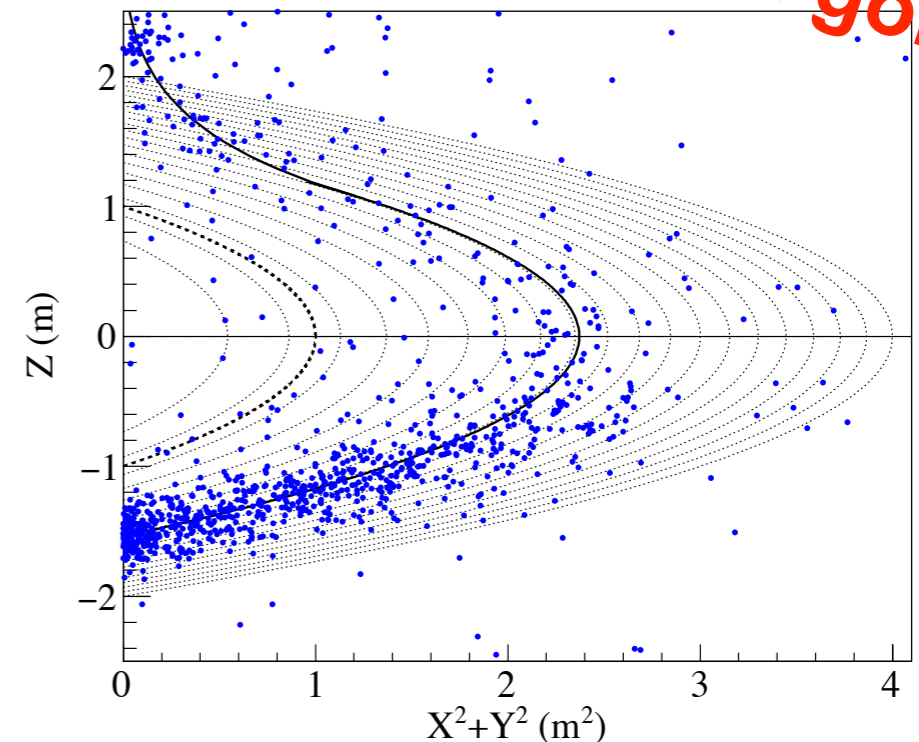
Re-analysis of KamLAND-Zen400

There is room for improvement of limit by KamLAND-Zen400!



- Only $r < 135$ cm was used as a fiducial volume.
- ^{110m}Ag and spallation are dominant in $0\nu\beta\beta$ region.
- Data quality has been improved.

All volume analysis by 2D fit



On going

- precise BG investigation
- increase of fiducial volume

New BG reduction method

- β/γ discrimination by neural network
- spallation cut by correlation with muon

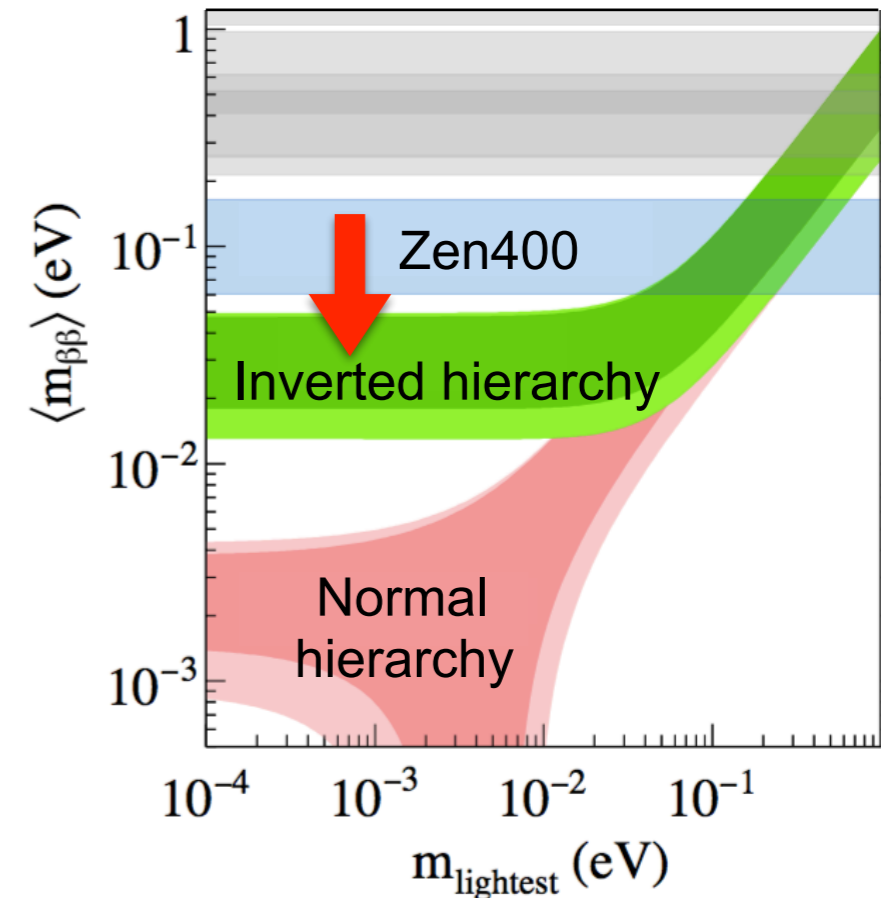
Prospect & 海外研修について

Prospect

- Finish the analysis of Zen400 ASAP.
- Then shift to analysis of Zen800.

A lot of ideas !

- Background rejection by neural network
- New reconstruction method
- Electronics upgrade



海外研修

- So far : APS/JPS joint meeting and DBD(international workshop)
- Not decided yet.
- interested (not only in $0\nu\beta\beta$ but also) in axion search, cosmology, and so on.
- Would like to go by a former part of DC 2nd grade.

Others

- Point : GSP+GASP = 12pts, GEP = 4pts (+ 9pts)
- International Conference : TAUP2019(will write proceedings)、新学術