

Search for Neutrino-less Double Beta Decay with CANDLES

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CANDLES is the project to search for neutrino-less double beta decay ($0\nu\beta\beta$) of ^{48}Ca .

$0\nu\beta\beta$ is acquiring great interest

after the confirmation of neutrino oscillation

which demonstrated nonzero neutrino mass.

Measurement of $0\nu\beta\beta$ provides a test for the Majorana nature of neutrinos

and gives an absolute scale of the effective neutrino mass.

In order to search for $0\nu\beta\beta$ of ^{48}Ca ,

we proposed CANDLES system by using CaF_2 scintillators.

The CANDLES system aims at a high sensitive measurement

by a characteristic detector structure and ^{48}Ca enrichment.

The detector structure realizes a complete 4π active shield

by immersion of the CaF_2 scintillators in liquid scintillator.

The active shield by the liquid scintillator

leads to a low background condition for the measurement.

On the other hand,

^{48}Ca enrichment is also effective for the high sensitive measurement,

because natural abundance of ^{48}Ca is very low (0.19%).

This means that an improvement of sensitivity by enrichment

is a maximum of 20 times for the neutrino mass.

However ^{48}Ca enrichment is generally difficult and expensive.

Therefore we started the study of ^{48}Ca enrichment

and succeeded in obtaining enriched ^{48}Ca although it is a small amount.

We have developed the CANDLES III system,

which contained 350 g of ^{48}Ca without enrichment,

at the Kamioka underground laboratory.

In 2012

we installed a light-concentration system in the CANDLES III system

in order to improve a energy resolution.

A photo-coverage was about twice larger than the one

without the light-concentration system.

And we started a $0\nu\beta\beta$ measurement

and have data of a measurement time for 3 months.

Here we will report the detector performance

for background rejection,

the result of the measurement

and the expected sensitivity with the light-concentration system.

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