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Neutrino-less double beta decay of ^{48}Ca studied by CaF_2(pure) scintillators

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Neutrino-less double beta decay ($0\nu\beta\beta$) 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 detector by using CaF_2(pure).
The CANDLES detector aims at a high sensitive measurement
by an active shield and ^{48}Ca enrichment.
The complete 4π active shield is realised
by immersion of the CaF_2 scintillators in liquid scintillator.
The active shield leads to a low background condition for the measurement.
On the other hand,
^{48}Ca enrichment is also effective for the high sensitive measurement,
since natural abundance of ^{48}Ca is very small (0.19\%).

Currently we have been developing the CANDLES III detector,
which contained 350 g of ^{48}Ca without enrichment,
at the Kamioka underground laboratory.
In 2015, we installed a shielding system in the CANDLES III detector
to reduce background events by the high energy γ-rays,
which were emitted from neutron capture reaction in surrounding materials.
Using this shielding system, we reduced the background events from neutron capture
by two orders of magnitude.
After this upgrade, we started a double beta decay measurement in 2016.

In this paper,
we will report result of the double beta decay measurement
after the upgrade.

Primary author: Dr UMEHARA, Saori (Tohoku University)

Co-author: CANDLES COLLABORATION

Presenter: Dr UMEHARA, Saori (Tohoku University)

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