

## Search for neutrino-less double beta decay of $^{48}\text{Ca}$ – CANDLES –

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CANDLES is the project to search for neutrino-less double beta decay ( $0\nu\beta\beta$ ) of  $^{48}\text{Ca}$ .  $0\nu\beta\beta$  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  $^{48}\text{Ca}$ , we proposed CANDLES system by using  $\text{CaF}_2$ . The CANDLES system aims at a high sensitive measurement by a characteristic detector system and  $^{48}\text{Ca}$  enrichment. The system realizes a complete  $4\pi$  active shield by immersion of the  $\text{CaF}_2$  scintillators in liquid scintillator. The active shield leads to a low background condition for the measurement. On the other hand,  $^{48}\text{Ca}$  enrichment is also effective for the high sensitive measurement, because natural abundance of  $^{48}\text{Ca}$  is very low (0.19%).

Now we have developed the CANDLES III system, which contained 350 g of  $^{48}\text{Ca}$  without enrichment, at the Kamioka underground laboratory. In the CANDLES III system, a candidate of remaining background is high energy  $\gamma$ -rays, which were emitted from neutron capture on surround materials. In 2015, in order to reduce the background events by the high energy  $\gamma$ -rays, we installed a shielding system, which consists of lead shields and boron sheets against  $\gamma$ -ray and neutron, respectively. The system will reduce the background events from neutron capture by two orders of magnitude.

Here we will report detector performance after the upgrade, the expected sensitivity and future prospects.