

Direct measurement of topological information using HUNI-ZICOS detector for ^{96}Zr neutrinoless double beta decay experiment

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A liquid scintillator containing a tetrakis (isopropyl acetoacetato) zirconium ($\text{Zr}(\text{iPrac})_4$) has been developed for ZICOS experiment which will search for neutrinoless double beta decay ($0\nu\beta\beta$) events using ^{96}Zr isotope. The liquid scintillator has 10wt.% concentration of $\text{Zr}(\text{iPrac})_4$, which corresponds to 1.4wt.% of natural zirconium.

In order to investigate a half-life of $0\nu\beta\beta$ over 10^{27} years, which corresponds to neutrino mass less than 0.01eV, we have to use tons scale of ^{96}Zr isotope, and have to reduce 95% of backgrounds from ^{208}Tl beta decay whose energy overlaps with the signal region.

For latter case, we have developed new technique to use Cherenkov light in order to reduce those backgrounds using the topology of location for photomultipliers received Cherenkov light, and have obtained that 93% of ^{208}Tl decay events could be reduced with 78% efficiency for $0\nu\beta\beta$ events. In order to realize this technique, we have developed the pulse shape discrimination to extract Cherenkov signal among scintillation, and have measured those topology using the hemisphere detector HUNI-ZICOS.

Here we report recent progress from those measurements, explain the status of demonstration of background reduction using UNI-ZICOS detector, and discuss about prototype ZICOS detector which will measure signal from $2\nu\beta\beta$ as physics program.

Reference to paper (DOI or arXiv)

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