

# Development of New Technology for Geoneutrino Directional Measurement

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Neutrino is an elusive particle and it can penetrate even astronomical objects. While neutrino experiments continue to explore the neutrino properties, e.g. oscillation nature of neutrino flavor transformation, mass-square differences and mixing angles, we have begun to utilize neutrino as a tool to look into the Earth. Anti-neutrinos emitted from radioactive isotopes, geo-neutrinos, bring unique and direct information of the Earth's interior and thermal dynamics.

KamLAND, Kamioka Liquid-scintillator Anti-neutrino Detector, has 1 kton ultra pure liquid scintillator. They reported the first experimental study of geo-neutrino in 2005. Later the geo-neutrino signals were used to estimate the Earth's radiogenic heat production and constrain the composition models of the bulk silicate Earth. Following the Fukushima reactor accident in March 2011, the entire Japanese nuclear reactor industry has been subjected to a protected shutdown. This unexpected situation allows us to improve the sensitivity for geo-neutrinos.

The liquid scintillator detectors have the sensitivity for measuring total amount of geo-neutrinos from the Earth's crust and mantle. However, we do not have the technology to track the direction of incoming geo-neutrinos at present due to the high miss-identification in a neutrino's track reconstruction. The direction-sensitive detector can map out the U and Th distribution inside the Earth and this technique is also applicable to resolving crust versus mantle contributions. Recent progress in studying this new technology confirmed that a significant improvement is possible in neutrino tracking identification with a combination of <sup>6</sup>Li-loaded liquid scintillator and imaging detector. We developed prototype detector to measure 3D image of scintillation light and study the methodology for the image reconstruction. We will present recent status of our prototype detector and achievement of dark noise reduction of pixelated detector.

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