

The 21 Century COE Project
Exploring New Science by Bridging Particle-Matter Hierarchy

Short-term Foreign Researchers

Research Report

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Host Researcher in Tohoku University: Professor Atsuto Suzuki

Your Stay Period in Japan: From 29 December 2003 to 3 February 2004

Title of Research in Japan: Upgrading Facilities at the KamLAND site

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Please write a research report of one or more pages and submit it with this cover to your host researcher till the end of this March.

After my arrival in the Kamioka Area, I began work on the on-site low background detector. The detector is a high-purity, coaxial germanium detector built with special low background materials. The detector is surrounded by a two ton lead hut. The lead is special low background lead. While I installed the detector and lead hut last year, I resealed the copper shield with special RTV to prevent radon contamination. The detector is now almost completely impervious to radon. I changed the cabling to reduce a noise problem we were having. The problem caused excessive dead-time and lost resolution. Lastly, I improved the analysis software for the device. Upon taking a background run, I was able to show the reduction in the amount of radon leaking into the detector.

Next, I participated in the high voltage upgrade for the KamLAND detector. We replaced every high voltage crate by first removing more than 2000 cables from the old system one-by-one. We then, prepared power lines for the new system and attached all cables to the new system. This process took almost one week. Afterwards, we checked all of the connections. The detector then needed to be re-calibrated. In all, this process took more than two and a half weeks.

During the last week of my stay, I operated the detector during 2nd shift. Usually, shift is comprised of several duties to meet the following goals. First, we must maintain detector safety. Next, we must maintain data quality. Finally, we must maintain detector data-taking live-time. During my week on shift, special attention was necessary for detector safety. First, we had a new high voltage system. This system produced more heat than the last one, so we had to monitor the room temperatures in the mine very carefully. Second, we had a water system upgrade in December which gave us increased flow capacity. The increased flow capacity translated into an increased liquid cooling capacity. Since the chimney region of the detector is protruding from a large spherical region, it has similar properties to a thermometer. When the temperature of the liquid increases, the liquid level rises. When, the temperature decreases, the level falls. The level difference between the liquid scintillator and buffer oil region is called the head. As the liquid temperature decreased with the increased water flow capacity to the outer detector, the head

also began to decrease. We had to monitor this situation particularly carefully to prevent damage to the balloon.