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

Short-term Foreign Researchers Research Report

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Your Stay Period in Japan: From January 25, 2004 to February 6, 2004 Title of Research in Japan: KamLAND shift operations and preparations for calibration device deployment <u>Abstract</u>: The purpose of this trip was to perform an 8-day KamLAND detector monitoring shift, to start developing a position readout system for a new calibration device and to also do computer and software maintenance on site. No significant incidents occurred during the shift.

All of my time in Japan was spent at the experimental site in Mozumi, in the Gifu prefecture. There were two main purposes for my trip to the experimental site: to do a regular shift period where the detector is monitored by collaborators and to start the development of a new readout system for the 4π calibration system.

The 4π calibration device is a new system being actively developed at LBNL to deploy off-axis calibration sources. The 4π will consist of a multi-segmented pole, up to 8~m long, with two straps on either end which will allow the pole to be positioned throughout most of the KamLAND detector volume. There is also a possibility to place a weight at one end of the pole in order to deploy the system in an asymmetric configuration and make the pole reach close to the balloon edge (at 6.5m radius). The system will deploy both radioactive and LED calibration packages which will be used to characterize the detector response. This will allow a detailed study of the energy and fiducial volume contributions to the systematic uncertainty in the measurement and possibly allow improvements in the vertex and energy fitters. I worked on a system to record the exact position of the 4π calibration device.

The multi-segmented pole will have several LEDs embedded at fixed distances into the titanium tube, these will be visible by the 8 CCD cameras that are inside the steel support sphere. By digitizing the pictures from these cameras and finding the location of the LEDs, the detailed geometry of the pole can be reconstructed. I worked on this part of the calibration system while in Mozumi. We had an existing frame-grabber card and I found an unused PC to host the card and the software. I then wrote and tested software to readout up to 8 cameras simultaneously. The current software does not yet perform the reconstruction of the LED position. However, it records the images from all 8 cameras simultaneously and stores them on disk. Position reconstruction software can then further analyze these images. The system was successfully tested shortly after my departure from Japan. I plan on extending the functionality in the coming months and to write the

reconstruction software as well.

I also spent 8 days on night shift, watching the detector and making sure that the data acquisition was stable. No serious incidents occurred during my shifts. In addition, I also upgraded and performed maintenance on several computer systems.