

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 Nov 18, 2003 to Dec 5, 2003 _____

Title of Research in Japan: Reactor Neutrino Study at KamLAND

Report

KamLAND is a large reactor neutrino experiment located in Kamioka, Japan. In December 2002, KamLAND announced its first physics results and has conclusively demonstrated for the first time the disappearance of reactor neutrinos and identified the so-called LMA region in the neutrino mixing parameter space as the solution to the long-standing Solar Neutrino Problem. Since the publication of this result, the KamLAND experiment has been running to improve on the statistical and the systematic uncertainties. Also a number of upgrades to the detector are being planned in order to meet these experimental goals.

During the tenure of this COE fellowship, I carried out a number of activities related to these goals at the KamLAND detector. These activities are briefly described in the following.

An upgrade of the high voltage system was planned for late 2003 and early 2004. A number of preparation tasks were performed to ensure that the upgrade could be carried out smoothly. Working with Dr. Bruce Berger at the Lawrence Berkeley National Laboratory, we established the hardware inventory list for this upgrade and had arranged to have the missing (but necessary) equipment for this upgrade delivered to site.

Monitoring the temperature gradient in the liquid scintillator is an important task for understanding the long-term characteristics of the KamLAND detector. One of the problems is to devise a measurement strategy that would minimize the effect of scintillator mixing. Working with Dr. E. Yakushev onsite, we have determined such strategy and the temperature measurement was carried out.

Efficient data archival is central to the data acquisition process. There are two data archival streams onsite: one on the “raw” data, and on the “reduced” data. The stream on the “reduced” data is written to tape through the computer *bear*. The speed on which data was written through this latter stream was very slow during my stay onsite. Working with Dr. Christopher Mauger, we tried to optimize the speed of such archival process.

For over two weeks while I was onsite, I had also performed regular detector operation duties including close monitoring of the detector behavior, assuring the quality of the acquired data, and archiving of the acquired data.

Upon completing the field work at the KamLAND detector, I traveled to Osaka and gave the Nuclear and Particle Physics Colloquium at the Kishimoto Laboratory at the Osaka University. This colloquium focused on the results and their implications from the KamLAND experiment. I also had informal discussions on the KamLAND electronics and neutrino physics with Professor H. Ejiri, Professor T. Kishimoto, Dr. I.

Ogawa, and Dr. R. Hazama in Osaka.