

Super Kamiokande Experiment

The Super-Kamioka-Neutrino Detection Experiment (Super-Kamiokande) is a Neutrino Observatory located approximately 1,000m underground at Mount Kamioka near Hida City in Gifu Prefecture, Japan. The Experiment consist of a 41.4 m high tank with a diameter of 39.3 m filled with ultra-pure water. If a Neutrino interacts with the water in the tank it can produce a charged particle that moves faster than the speed of light in water, creating Cherenkov light. This Cherenkov light is detected within the Inner Detector with the help of 11,146 Photomultiplier tubes with a size of 20 inch each. Additionally, there is an Outer Detector consisting of 1,885 Photomultiplier tubes with a size of 8 inch which is used to discriminate events created by Neutrinos from Cosmic Ray Muons.

With this Experiment it is possible to measure Neutrinos coming from the Sun (Solar Neutrinos), Neutrinos generated in Earths Atmosphere by cosmic rays (Atmospheric Neutrinos), Neutrinos coming from the K2K Experiment (KEK-to-Kamioka, finished) and Neutrinos coming from the T2K Experiment (Tokai-to-Kamioka, running).

The Experiment is an international collaboration of Universities and Research Facilities in Japan, the US, Canada, China, South Korea, Poland and Spain and was designed for the study of solar and atmospheric Neutrinos, Proton Decay and Supernovae. The Experiment started taking Data in 1996 and is since then taking data (with some breaks for maintenance).

More Information about the Experiment can be found on the collaborations homepage:

<http://www-sk.icrr.u-tokyo.ac.jp/sk/index-e.html>

Participation of iseg in Super Kamiokande Experiment

1. Requirements

The Photomultiplier tubes used for the detection of Cherenkov light need to have highly stable low noise high voltage power supplies to be able to detect the very small amounts of photons created by Neutrinos. The voltage which has to be applied is between 1800V and 2300V, depending on the PMT.

2. Refurbishment of the power supply system for the Inner Detector

In 2012 the Super-Kamiokande collaboration decided to replace the whole power supply system, to regain and further improve the reliability of the whole system. The collaboration compared several manufacturers and their products and finally decided for the company offering superior specifications, long term maintenance and a reasonable price. This was iseg Spezialelektronik, Germany.

3. Products used for the power supply system for the Inner Detector

iseg developed a 24-channel High Voltage power supply module based on the existing EDS series (<http://iseg-hv.de/en/products/detail/EDS>). The modules have been adapted for a maximum output voltage of 2.5kV and an output current of 0.5mA as well as using a specific connector requested by Super-Kamiokande collaboration. Other than that, the units are standard modules of the EDS series. 10 of these modules are placed in a 19 inch chassis providing power, remote control and cooling for the modules. The total system consists of 51 chassis and 510 HV modules.

4. Additional requests

Due to some quality problems with the previous hardware, the Super Kamiokande collaboration requested additional measures to ensure long term operation of the HV system. For this reason, every used component was tested before soldering, several manufacturing stages of the units

have been tested again and each of the final products had to pass through a long term “burn-in test” under full load (maximum voltage/ maximum current per channel).

5. Operation

The full system was installed at the Experiment facility at Kamioka Mountain in early August 2013 and is since then operating without any shutdowns. We hope, iseg modules will help the scientists of Super-Kamiokande collaboration to continue doing outstanding research and unlock further secrets of the universe. iseg Spezialelektronik GmbH is proud to have played a humble part in that.



EDS 3kV Distributor High Voltage
Power Supply Module with Common
Floating Ground