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Development of electronics and data acquisition system for the J-PARC T59 (WAGASCI) experiment

The J-PARC T59 experiment, named WAGASCI, is a neutrino detector with a water target, and it is planed to start taking the neutrino beam data from October 2017 at J-PARC neutrino beamline. Its goal is to measure the cross section ratio of charged current neutrino interaction on nucleus between water target and plastic target with the accuracy of a few percent. The detector adopts three-dimensional grid structure of 3-mm-thick scintillator bars around water and plastic targets, to obtain large angular acceptance. As a photodetector a 32-channel arrayed MPPC has been developed for the WAGASCI detector, and the total number of channels is 1280 for each module. In the J-PARC neutrino beamline, neutrinos are delivered with an 8-bunch structure with 581ns time gaps, every 2.48 seconds. There is a beam timing trigger delivered about 30us before neutrino arrives, in addition to a pre-beam trigger delivered exactly 100ms before the beam trigger. By using these two trigger signals, only the data around the neutrino beam will be recorded. Our front-end electronics is SPIROC2D, a product of Omega, which is an auto-triggered, bi-gain, 36-channel ASIC, allowing to measure the charge from one photoelectron to 2000 and the time with a 100ps accurate TDC. It contains a 16-deep analog memory array, which allows to store 16 hits in an acquisition gate. Front-end electronics boards have been developed with the SPIROC2D chip, and all necessary boards have already been fabricated. The back-end boards control the data output from the front-end ASIC and reception of trigger signals for neutrino beam. Their main functions are implemented into Spartan6 FPGAs, and its firmware have been developed. The data acquisition system has almost been completed, and its operation test has been performed with a test bench of scintillators and J-PARC neutrino beam in April 2017. In this presentation, the performance and status of the WAGASCI electronics and the data acquisition system will be described.

Experimental Collaboration

T2K, J-PARC T59

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