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Development of New Data Acquisition System at Super-Kamiokande for Nearby Supernova Bursts

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Super-Kamiokande (SK), a 50-kiloton water Cherenkov detector, is one of the most sensitive neutrino detectors. SK is continuously collecting data as the neutrino observatory and can be used also for supernova observations by detecting supernova burst neutrinos.

It is reported that Betelgeuse (640ly) is shrinking 15% in 15 years (C.H.townes et al. 2009) and this may be an indication of the supernova burst. Based on the Livermore model, the simulation study predicts 30MHz neutrino events observed in the SK detector for the neutrino burst from a supernova within a few hundreds of light years.

The current SK data acquisition (DAQ) system can record only about first 20% of the events. To overcome this inefficiency, we developed a new DAQ system that records the number of hit PMTs so that we can store high-rate events and obtain a time profile of the number of neutrinos emitted at the supernova.

This system uses the outputs from the number of hits from existing electronics modules as inputs and it is synchronized to the existing DAQ system. Therefore the data is easily checked the correlation to that from the existing electronics. The data is transferred to the computers with SiTCP, an implementation of TCP/IP stack in FPGA without CPU. Part of the data are stored in the 4GB DDR2 memory before it transferred and this makes it possible to record detailed time structure of the superonva signal. The design and the production of the new modules were completed and we tested basic functions and the interference with the existing system. The firmware for the module is prepared and now being installed in SK. We will report the development and the status of the operation.

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