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Development of new data acquisition system at Super-Kamiokande for nearby supernova bursts

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

Recently, it is reported that Betelgeuse (640ly) is shrinking 15% in 15 years (C. H. Townes et al., 2009). Although this report does not immediately imply the supernova explosion of Beteleuse, it triggered the possibility of the nearby supernova. The simulation study based on the Livermore model predicts the 30MHz neutrino event during a burst from a supernova within a few hundred light years. The current SK data acquisition (DAQ) system can record only the first 20% of these events and a large fraction of the data afterwards will be lost. To overcome this problem, we developed a new DAQ system to record the number of hit PMTs. This system enabled us to store high-rate events and study a time profile of the number of neutrinos emitted at the supernova.

This new system uses the number of hits from existing frontend electronics modules as inputs and is synchronized with them. Therefore, we can easily correlate the data from the new system and the existing system. The data is transferred to the computers via Ethernet with SiTCP. High frequency detailed data are stored for 1 minute in the 4GB DDR2 memory and they are transferred when a supernova burst is detected. The summarized data are constantly read out by the computers and stored in the disk for a week. We will monitor the event rate by this data and pre-scale the data of the existing DAQ system. The controlled pre-scaling enables us to measure the energy spectrum. Now the system is under commissioning. We will report the status of the operation.

Collaboration

– not specified –

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