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Implementation of the trigger system of the ICARUS-T600 detector at Fermilab

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The ICARUS T600 LAr TPC is located at shallow depth along the Booster Neutrino Beam (BNB) and NuMI off-axis beam lines at Fermilab with the aim to search for sterile neutrinos in the context of SBN program. A system based on 360 large area Hamamatsu R5912-MOD Photo Multiplier Tubes (PMTs) is used to detect the VUV scintillation light emitted by ionizing particles, allowing for the trigger and timing of the neutrino events and for the reduction of the cosmic rays background due to the ICARUS T600 operations at surface.

The ICARUS trigger system exploits the coincidence of the BNB and NuMI off-axis beam spills with the prompt scintillation light as detected by the PMT system. This system is based on PXIe logical modules processing PMT signals discriminated by CAEN V1730 digitizers. The logical system consists of: a INCAA Computers SPEXI PXIe board based on CERN project, handling the beam extraction information needed for the time synchronization; three FPGA boards (NI model PXIe-7820), processing the PMT information to recognize an event interaction in coincidence with the beam spill. This provides a global trigger starting the acquisition of the TPC and PMT signals; a PXIe RT controller implementing all the features for the communication with the DAQ.

The SPEXI and FPGAs are programmed according to the different requests for debugging, calibration and data taking using VHDL and NI LabVIEW FPGA packages. The implementation of the ICARUS T600 trigger system, the logical block diagram and its possible upgrades, as well as its performance, will be reported.

Collaboration

ICARUS

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