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Time of flight Measurement Electronics for Back-n at CSNS

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Back-n is a white neutron beam line at China Spallation Neutron Source (CSNS). The time structure of the primary proton beam make it fully applicable to use TOF (time-of-flight) method for neutron energy measuring. We implement the TOF measurement on the general -purpose readout electronics system which is designed to adapt all of the seven detectors in Back-n. The general-purpose readout electronics system is based on PXIe (Peripheral Component Interconnect Express eXtensions for Instrumentation) platform, which is composed of FDM (Field Digitizer Modules), TCM (Trigger and Clock Module), and SCM (Signal Conditioning Module). T0 signal synchronous to the CSNS accelerator represents the neutron emission from the target. It can be considered as the start time of TOF. The trigger and clock module (TCM) receives, synchronizes and distributes the T0 signal to each FDM based on the PXIe backplane bus. Meantime, detector signals after being conditioned are fed into FDMs for waveform digitizing, which can be considered as the time of capturing neutrons, i.e. the stop time of TOF. FPGA-based TDC is implemented on FDM to accurately acquire the interval between the time of T0 arriving at FDM and the time of neutrons being captured. There is also a FPGA-based TDC on TCM to accurately acquire the interval between asynchronous T0 signal and the measurement electronics. These results are used for TOF measurement. This method for TOF measurement is efficient and not needed for additional modules. Test result shows the accuracy of TOF is sub-nanosecond and applicable for Back-n.

Minioral

Yes

Description

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