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# Research of Front-end Signal Conditioning for BaF2 Detector at CSNS-WNS

The BaF2 detector array that is one of the detector systems at CSNS-WNS (White Neutron Source at China Spallation Neutron Source), mainly aiming at measuring the cross section of (n,γ), consists of the BaF2 crystals and photomultiplier tubes (PMTs) with 92 channels, the front-end electronics, readout electronics, and the data acquisition system (DAQ). To maintain as much information of the physical instances as possible, the full waveform digitization is achieved by the field digitization modules (FDMs) that are a critical section of the readout electronics. Facing with data rate as high as 12Gbps per channel, trigger system is necessary, which needs analog signals to generate trigger signals. For simplifying the readout structure, all FDMs and trigger modules are located in backend PXIe crates. Analog signals from detectors need to be transmitted from front-end to back-end crates over about 20m distance. To meet the requirements above, the front-end electronics need the capacity of conditioning the fast signal from detectors and fanning out for corresponding processing. The front-end signal conditioning method should have good performance of low noise, high bandwidth, low power consumption and long range driving.

In this paper, the method of front-end signal conditioning for BaF2 detector at CSNS-WNS is proposed. Firstly, the front-end signals are received, amplified and driven to back-end over long distance twisted-pair cable by fast preamplifiers. Each pre-amplifier may be implemented with small size and located near detector. Secondly, signals from preamplifiers are fanned out to FDMs for digitizing and trigger system for triggering respectively, by analog fan-out modules that may be implemented as standard NIM modules. Preliminary tests of prototype circuits show that the bandwidth can reach up to about 300MHz that is suitable for front-end signal conditioning for BaF2 detector application.

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