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FELIX based readout of the Single-Phase ProtoDUNE detector

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Large liquid argon Time Projection Chambers have been adopted for the DUNE experiment's far detector, which will be composed of four 17 kton detectors situated 1.5 km underground at the Sanford Underground Research Facility. This represents a large increase in scale compared to existing experiments. Both single- and dual-phase technologies will be validated at CERN, in cryostats capable of accommo- dating full-size detector modules, and exposed to low-energy charged particle beams. This programme, called ProtoDUNE, also allows for extensive tests of data acquisition strategies. The Front-End LInk eXchange (FELIX) readout system was initially developed within the ATLAS collaboration and is based on custom FPGA-based PCIe I/O cards, connected through point- to-point links to the detector front-end, hosted in commodity servers. FELIX will be used in the single-phase ProtoDUNE setup to read the data coming from 2560 anode wires organized in a single Anode Plane Assembly structure. With a continuous readout at a sampling rate of 2 MHz, the system must deal with an input rate of 96 Gb/s. An external trigger will preselect time windows of 5 ms with interesting activity expected inside the detector. Event building will occur for triggered events, at a target rate of 25 Hz; the readout system will form fragments from the data samples matching the time window, carry out lossless compression, and forward the data to event building nodes over 10 Gb/s Ethernet. This paper discusses the design and implementation of this readout system as well as first operational experience.

Description

FELIX (FE Link eXchange)

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Yes

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