

# The readout system of the DUNE experiment

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The Deep Underground Neutrino Experiment (DUNE) is a neutrino experiment under construction with a near detector at Fermilab and a far detector at the Sanford Underground Research Facility that will observe neutrinos produced at Fermilab. The far detector electronics are streaming out a constant rate of ADC data at 2 MHz. As the signals can be very small, no zero suppression is applied. The new technical design of the DAQ system for the experiment has major differences compared to its prototypes. Its interfaces with the front-end electronics rely on high-speed I/O cards that are hosted in commodity servers. Data is received over DMA to memory buffers dedicated to the devices, from where it is serialized and moved to a parallel processing pipeline that implements data driven algorithms like hit-finding or calibration and error handling. After that, data is stored in high-performance software buffers. The parallelized request-response domain answers to data requests, based on unique identifiers (e.g.: timestamp) in the front-end frames. The latency buffer lookup mechanism copies out the requested data and forms responses with additional metadata. This experiment must also be capable of persisting, upon a specific request, incoming data for up to 100 seconds, with a throughput of 1.5 TB/s, for an aggregate size of 150 TB. The modular nature of the apparatus enables splitting the problem into 150 identical units operating in parallel, each at 10 GB/s. These numbers correspond to one detector super module. Two are planned for initial construction and four is the final configuration of the experiment. In order to maintain the performance requirements of such a system, a generic, modular and scalable readout system was designed and developed.

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