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Performance of the NOvA Data Acquisition System with the full 14 kT Far Detector

The NOvA experiment studies neutrino oscillations with 2 functionally identical detectors separated by a baseline of 810km. The 14 kT far detector in Ash River, Minnesota, comprises 344,064 channels of liquid scintillator detection cells read out via wavelength-shifting fiber into 32-channel Avalanche Photo Diodes (APD). A custom designed Front End Board (FEB) continuously digitizes and zero-supresses the output signals from each APD. The smaller near detector located at Fermilab has 20,192 channels that are readout in an identical manner. Both detectors are internally synchronized by a GPS-based timing system with maintains a readout-to-readout synchronization to better than 15.6 ns across the full detector. The timing system also provides a universal time base, which is used provide synchronization and correlation between the geographically separated detectors and the Fermilab accelerator complex.

The NOvA Data Acquisition (DAQ) system for the far detector comprises 168 powerPC-based custom computers for reading out and collating data from FEBs, a farm of 196 COTS linux nodes for buffering data for trigger decisions and event building, another 10 for dedicated DAQ functions such as run control, data logging, and DAQ system monitoring. Data is transferred between the detector and the DAQ computing via a multiple bandwidth multilayer networks and fabric routing.

The performance of the recently completed DAQ on the full near and far detectors will be reviewed. The scaling characteristics of the network data flow, event building systems, and DDS based message passing layers will be covered in detail highlighting the computing and operational challenges of bringing the full DAQ and readout system online.

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