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DUNE trigger and data acquisition systems

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The Deep Underground Neutrino Experiment (DUNE) is a next-generation long-baseline neutrino experiment currently under construction in the US. The experiment consists of a broadband neutrino beam from Fermilab to the Sanford Underground Research Facility (SURF) in Lead, South Dakota, a high-precision near detector, and a large liquid argon time-projection chamber (LArTPC) far detector. Two prototypes of the DUNE far detector (DUNE-FD) were constructed to assess candidate technologies and methods in advance of the DUNE detector build: Proto-DUNE single-phase horizontal-drift (ProtoDUNE-HD) and ProtoDUNE single-phase vertical-drift (ProtoDUNE-VD). Each prototype cryostat comprises two primary sub-detectors: a single-phase LArTPC and a companion photon detector system.
DUNE has a broad physics program that includes determining the neutrino mass hierarchy, measuring with sufficient precision to discover leptonic CP violation, making precise measurements of the oscillation parameters governing electron neutrino appearance and muon neutrino disappearance, detecting neutrinos from a core-collapse supernova, searching for baryon number violating processes such as nucleon decay and neutron-antineutron oscillation, and searching for other physics beyond the Standard Model.
The Trigger and Data Acquisition (TDAQ) systems are responsible for the acquisition and selection of data produced by the DUNE detectors, as well as for their synchronization and recording. The main challenge for the DUNE-TDAQ lies in the development of effective, resilient software and firmware that optimize the performance of the underlying hardware. The TDAQ is composed of several hardware components. A high-performance Ethernet network interconnects all the elements and allows them to operate as a single, distributed system. At the output of the TDAQ the high-bandwidth Wide Area Network (WAN) allows the transfer of data.

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