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Finding Neutrinos: The Design of the NOvA Timing and Synchronization System

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NOvA is an accelerator-based, long-baseline neutrino oscillation experiment designed to probe the mass hierarchy and mixing structure of the neutrino sector. The experiment consists of a at Fermilab and a far detector 810 km away in northern Minnesota positioned to receive neutrinos from Fermilab's NuMI beam. In order for NOvA to measure neutrino oscillations, these two detectors must have very precise timing and must be synchronized so that the channel-to-channel variations are less than 10 ns. A GPS-based timing system has been designed and built to synchronize the 10,749 far detector readout elements and 631 near detector readout elements to such precision. This is done while simultaneously synchronizing the readout timing of the near and far detectors to the Fermilab accelerator complex to allow for the detection of the individual neutrino beam spills in each of the detectors. This presentation will outline the design of NOvA's timing system and discuss the means by which we monitor its performance to ensure the quality of the physics data being collected.

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