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Front-End Electronics Scheme for the Mu2e Straw Tracker

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The Mu2e tracking chamber consists of ~21,000 thin straw drift tubes to precisely measure the ~105 MeV/c electron, the distinct experimental signature of coherent muon to electron conversion in the field of a nucleus. The tracker is designed to reconstruct the momentum of conversion electrons with a resolution of <180 keV/c. To achieve this requirement the distance of an electron track from the straw sense wire must be measured with a precision of ~200 μm . The timing of the straw signals is recorded using a TDC implemented in FPGA. Both ends of the straw are read out for a time division measurement which yields the hit position along the straw within 3 cm. The straws are also instrumented with an ADC for charge deposition measurements, which allow the separation of electrons from highly ionizing proton hits. The Mu2e tracker is highly modular with the basic unit being a panel of 96 straws. After amplification and shaping of the straw signals, all the digitization and readout for a panel occur on a high-density integrated board, the DRAC – Digitizer Recorder Assembler and Controller. Interface for data and slow controls communication with the DAQ is provided by a pair of duplex optical fibers, minimizing penetrations through the vacuum where the Mu2e tracker is operated. We will present the scheme for the front-end electronics mounted directly on each basic tracker module, along with performance results from existing prototypes.

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