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Data Acquisition for SuperCDMS-SNOLAB

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The Super Cryogenic Dark Matter Search (SCDMS) experiment uses solid state germanium and silicon detectors to search for Weakly Interacting Massive Particles (WIMPs), a leading candidate to explain dark matter. WIMPs are thought to be streaming through the earth, and CDMS seeks to measure the energy deposited by a WIMP-nucleon collision in sensitive calorimeters. Background particles dominate the potential WIMP signal, where a background rate of $\sim$0.2Hz due to α, β, γ, and neutrons is observed in each detector. This rate is 4 orders of magnitude greater than the WIMP event rate predicted by optimistic WIMP models. High statistics calibration runs with different radioactive sources are crucial to understanding the energy signature of background particles and to ensure that a background event will never be mistaken for a WIMP. Calibration runs involve higher event rates ($\sim$7Hz per detector) than WIMP search runs. We present a zero-dead-time Data Acquisition (DAQ) System that uses Detector Control and Readout Cards (DCRCs). These cards read in waveforms of an event from the detector's 12 phonon and 4 ionization energy channels and write the waveforms to a 3.3 second circular memory buffer. We design a DAQ system to decide, within this 3.3s window, which of the $\sim$140kB events to write to disk in order to keep data throughput under a limit and keep total data volume manageable for the later analysis. In this effort we use different readout methods for the different calibration runs and WIMP search runs. We discuss these methods and also discuss our pileup rejection cuts, which are designed to reject events with overlapping pulses that cannot be easily analyzed.

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