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A Highly Programmable SiPM Readout ASIC for Neutron Imaging Applications

Silicon Photomultiplers (SiPMs) are now widely accepted photodetection replacements for photomultipler tubes (PMTs) depending on end use application. Various scintillators are also currently being developed and improved for fast neutron/gamma discrimination applications. In parallel, there is a need for compact electronics to operate as front-end systems for high density SiPM array readout and to provide particle classification. The latter is a much needed capability for neutron camera systems operating in a high gamma background environment. PSD_CHIP has been designed to demonstrate these two key components. It integrates a scalable multi-channel SiPM readout front-end system and a novel fast analog pulse shape discrimination (PSD) method. The chip's front-end system is explicitly designed for readout of SensL SiPMs, which have two outputs: a capacitively coupled fast output (FOUT) and a resistively coupled standard output (SOUT). The ASIC features a high level of programmability on-chip to allow for adaptability of the chip for use with various scintillators for a final end use application. Current targeted end use applications include neutron cameras and active neutron-tagging systems for nuclear recoil calibration work of dark matter and neutrino experiments.

Primary experiment

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