

PSD Capabilities of a SiPM-based Readout Board



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General Overview

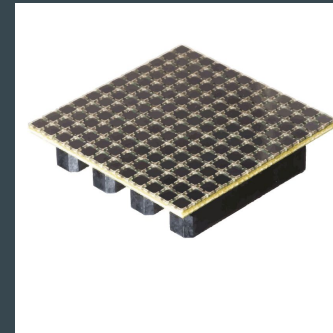
In support of Sandia National Lab's ongoing effort to develop mobile fast neutron imagers, we are currently developing SiPM-based readout ASICs.

These imagers are used to detect and localize special nuclear materials (SNM). Sandia currently has a working imager, MINER, that uses PMTs for photodetection.

Our goal is to increase mobility and decrease size by shifting to using SiPM arrays for photodetection.



Above: The current fast neutron imager, MINER, developed at Sandia. (Image from Sandia National Lab website)

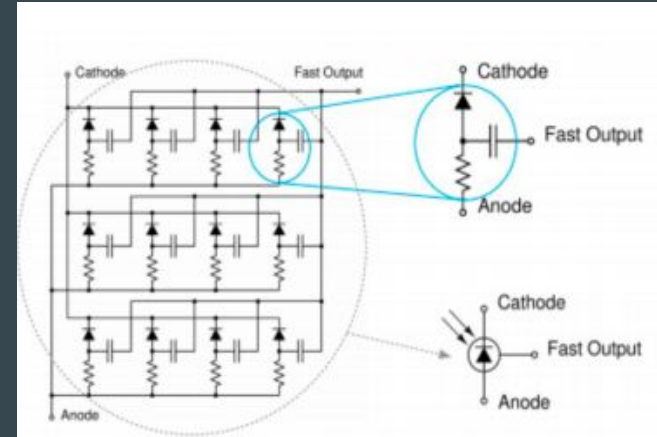


Left: An example of a SiPM array (Image from SensL website)

General Overview Cont.

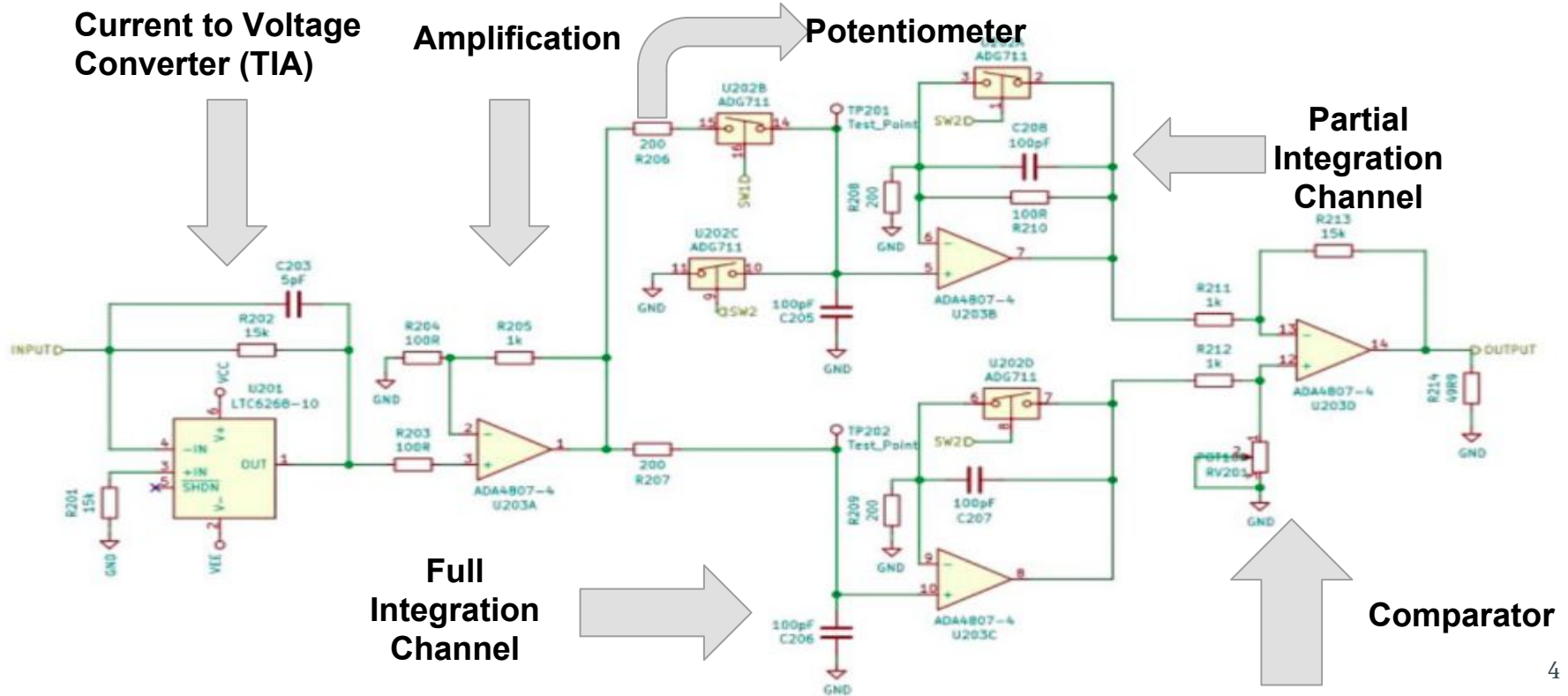
SensL SiPMs have a capacitively coupled fast out (FOUT) and a resistively coupled standard out (SOUT), used for timing and energy measurements, respectively.

A readout design for SOUT will provide analog PSD of fast neutron signals from background gamma signals. The FOUT signal will be used as a trigger for the SOUT ASIC.

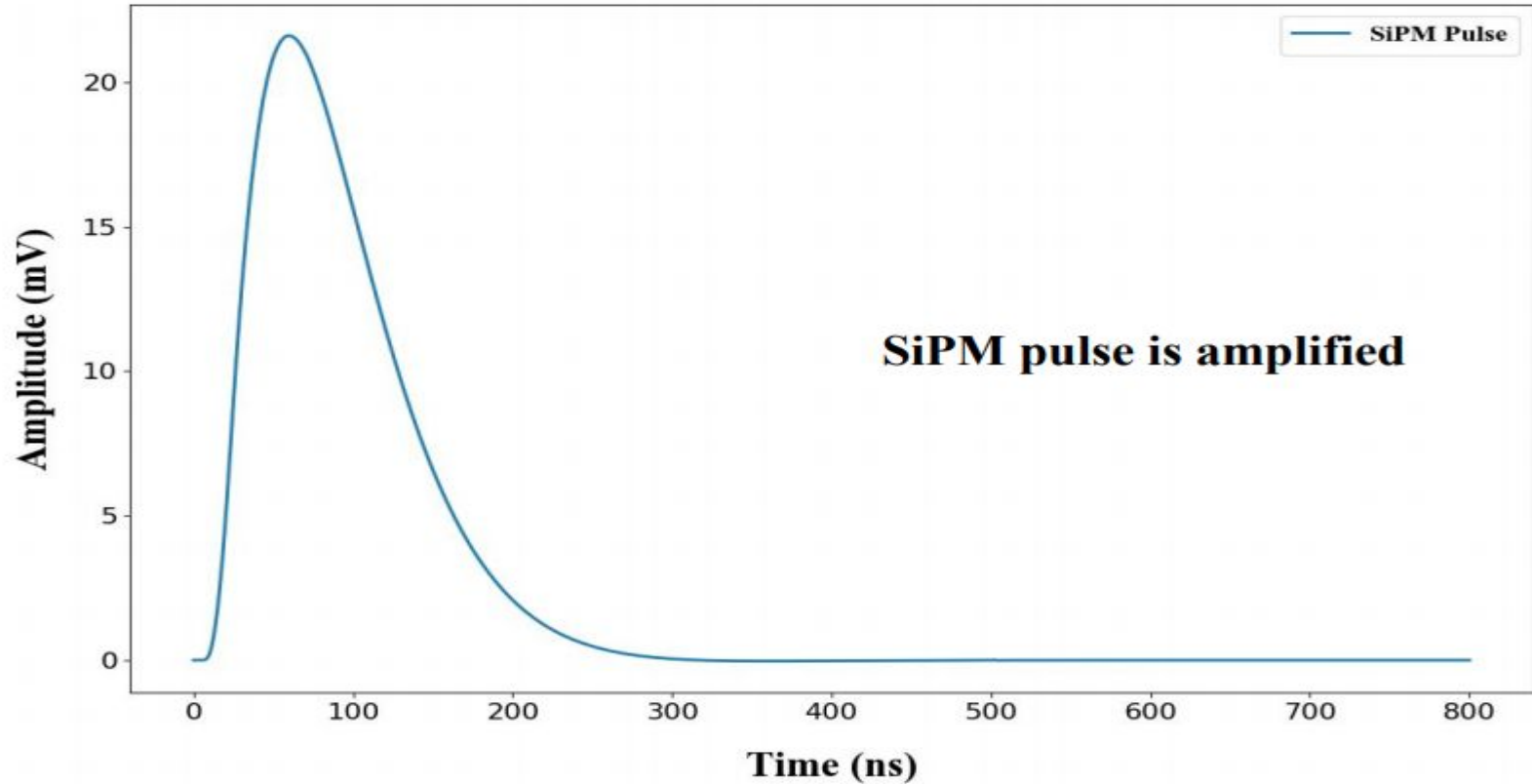


Simplified circuit schematic of a SensL SiPM (left) showing each microcell which is composed of the avalanche diode, quench resistor and fast output capacitor (top right). The SensL SiPM component symbol is shown (lower right). Image reproduced from Introduction to SiPM Technical Note

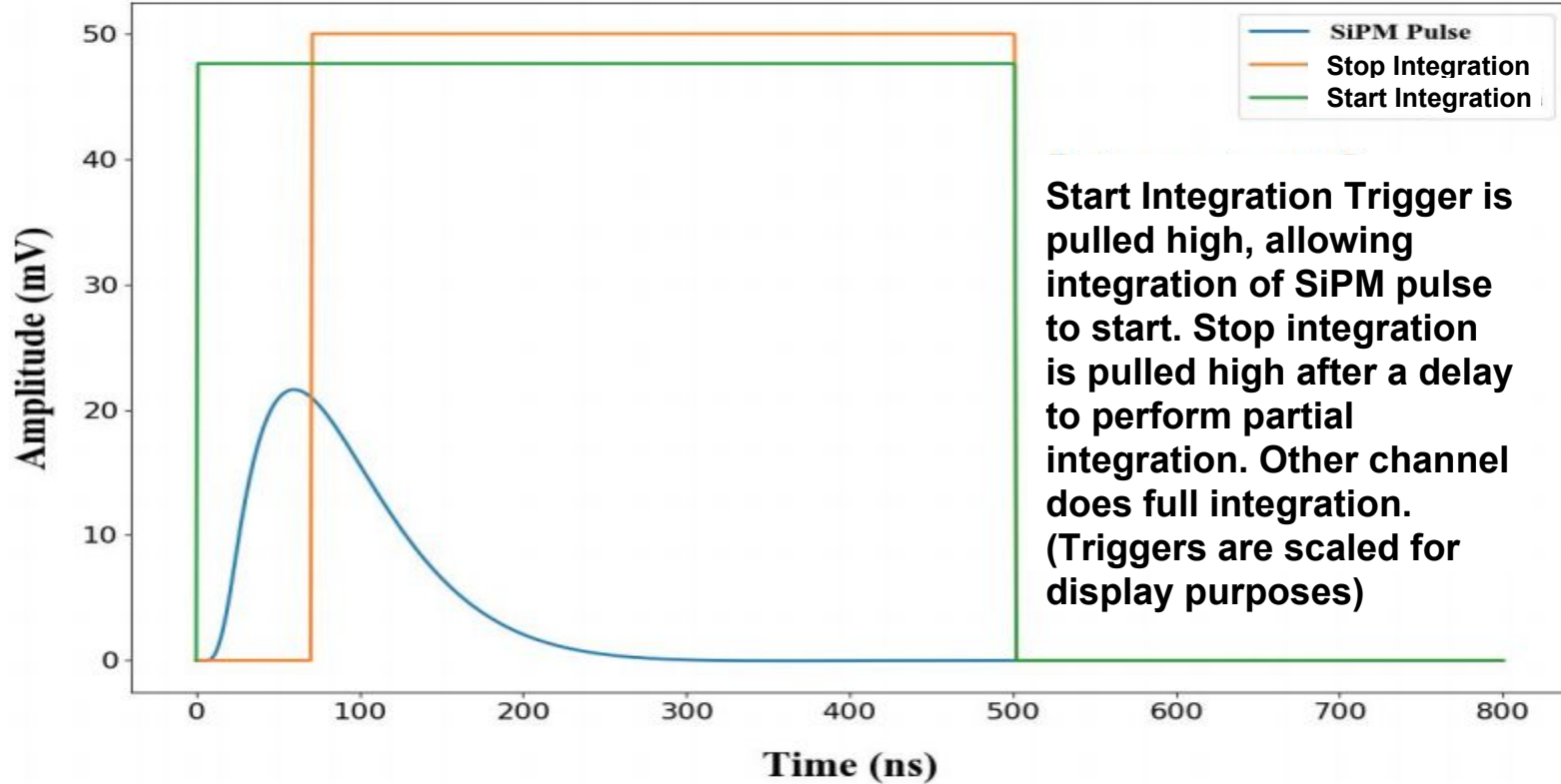
Current SOUT Readout Board Design



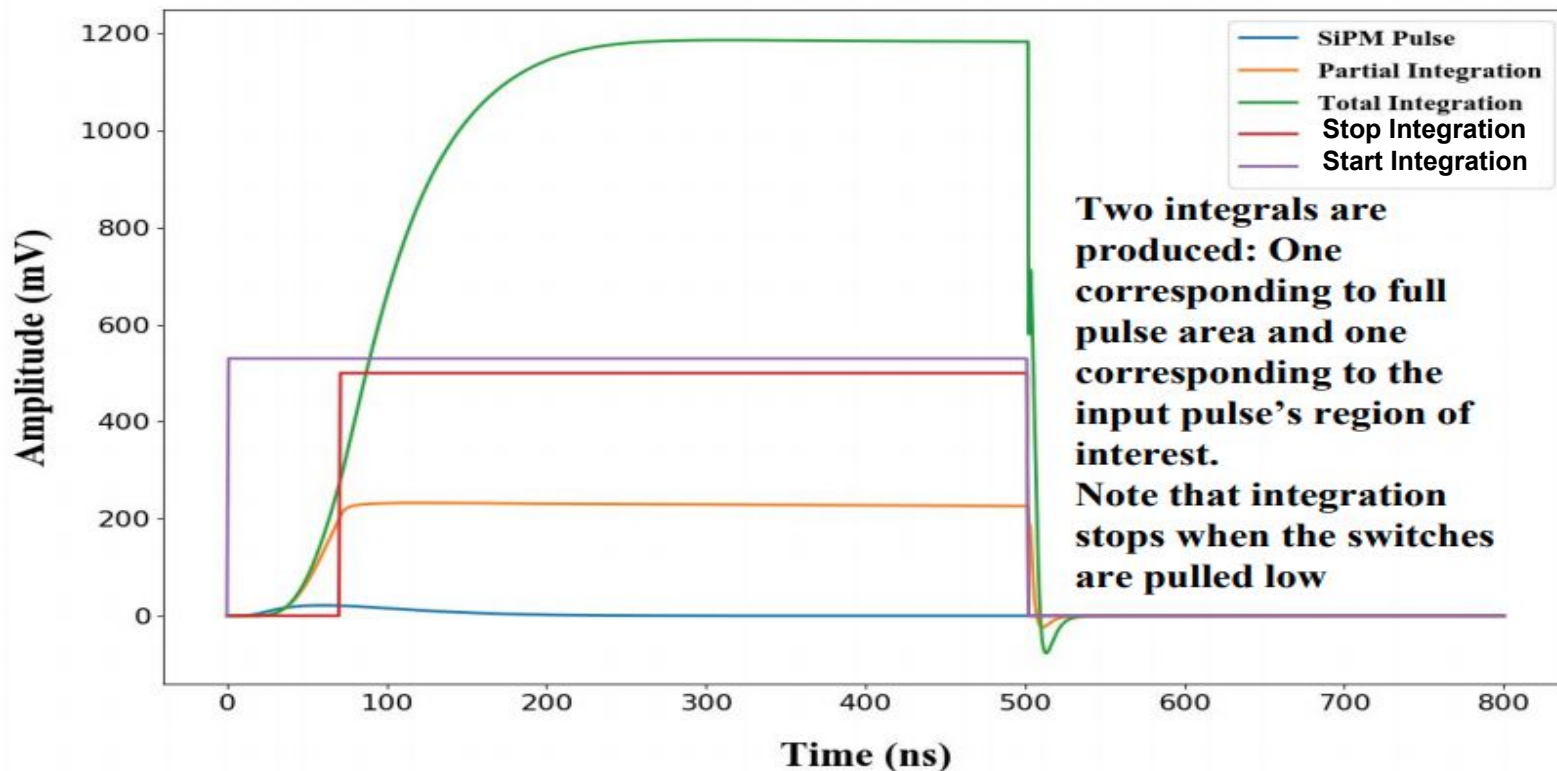
Principle of Operation



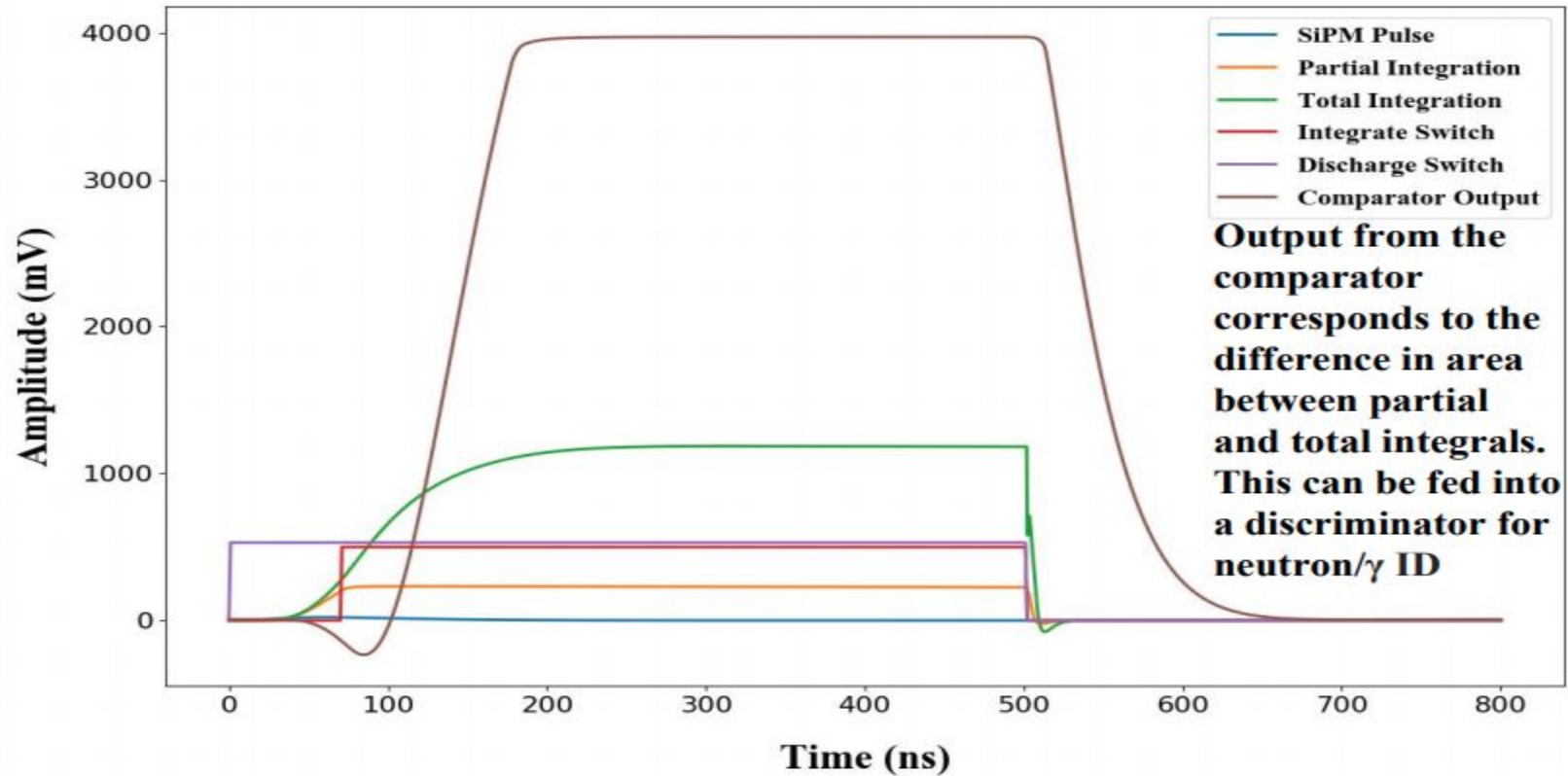
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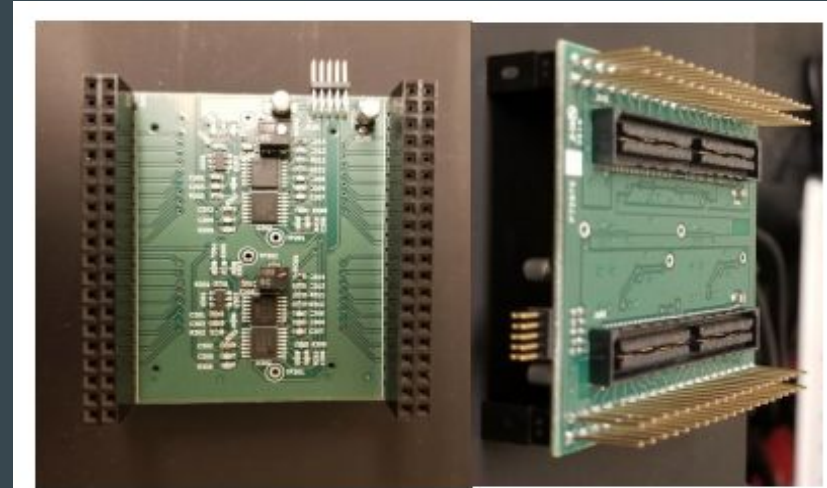


Current Status

SOUT readout board has been fabricated.

Initial testing using arbitrary waveform (AWGs) and function generators to generate test pulses and triggers to test the response of the board is currently ongoing.

FOUT board has been designed but not fabricated yet.



Top and bottom pictures of prototype SOUT board