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A 10-15 Gsa/s Switched Capacitor Array DAQ System for a Position & Time Sensing Large-Area Photo-Detector

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A data acquisition (DAQ) system using 10-15 Gigasamples/second (Gsa/s) waveform sampling Application Specific Integrated Circuits (ASICs) for the readout of large active-area micro-channel plate photomultiplier tubes (MCP-PMTs) is presented. The development and characterization of these 20x20 sq. cm active-area MCP tiles' are ongoing by the Large-Area Picosecond Photo-Detector Collaboration (LAPPD). Signals from the large-area MCP tile are acquired from a 50-ohm transmission line anode comprised of 30 parallel microstrips. The position, timing, and energy of the incident pulse are extracted from the waveforms that are recorded at both ends of the anode. The target geometry of the DAQ system is the very large-active areaSuper-module', made of a 2x3 array of LAPPD MCP tiles, that requires 60 channels of compact, high bandwidth waveform sampling on both sides of the detector. For this task, a 6-channel, 15 Gsa/s, and 1.5 GHz bandwidth waveform digitizing ASIC, 'PSEC-4', was designed in 0.13 micron CMOS using a 256 sample-per-channel switched capacitor array architecture. Sampled waveforms are digitized on-chip and a region-of-interest in the data buffer is serially read off-chip for downstream analysis. The Super-module DAQ incorporates two hardware levels of FPGA-implemented ASIC control and waveform feature extraction. Ultimately, the reduced event data are sent to a computer via a gigabit Ethernet connection.

for the collaboration

On behalf of LAPPD collaboration

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