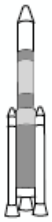

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Radiation-Hard Scintillator Crystals and SiPM Array Readout for High-Energy Calorimetry

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Lead tungstate (PbWO4) is an exceptional material for high-energy physics detectors, particularly in the construction of electromagnetic calorimeters. The combination of high density, fast decay time, good energy resolution, and radiation hardness makes lead tungstate an ideal material for electromagnetic calorimeters used in high-energy physics experiments.
We report a novel readout circuit tailored primarily for PbWO4 scintillation detectors in high-energy experiments. The design integrates a 4x4 SiPM array directly coupled to a preamplification stage, housed within a compact electronics module. The readout circuit is design to work with independent number of the SiPMs without affecting the timing output. This module incorporates bias control for SiPMs and adjustable gain and offset controls via USB/RS485 interfaces. The optimization efforts for the readout circuit aimed to achieve the following objectives: high spectral resolution, rapid response, compactness, and low energy consumption. Key features include a fixed bias voltage, externally adjustable preamplifier settings stored on EEPROM and output signal compatibility up to 1V/50Ω. We fabricated a prototype with a 3x3 array of 20 mm x 20 mm x 200 mm PbWO4 crystals coupled to individual sensor arrays and readouts, subjected to thorough testing in energy range 50MeV to 5GeV. Comprehensive characterization measurements will be presented.

Author: Dr PHILIP, Olivier (Crytur USA)

Presenter: Dr PHILIP, Olivier (Crytur USA)

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