

PMT Base with Integrated Waveform Capture for IceCube-Gen2

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A PMT base with integrated waveform recording has been designed for next-generation multi-PMT modules in the IceCube Neutrino Observatory at the South Pole. The base has a single ribbon cable connection for low voltage power supply, timing synchronization and communication signals. A Cockcroft-Walton multiplier provides high voltage for a 10-stage PMT, following the design of current IceCube multi-PMT modules. The new design includes a 2-channel ADC, FPGA and ARM microcontroller, together providing full readout of PMT waveforms with extended dynamic range. The FPGA captures ADC data and a high-resolution discriminator-based time stamp for each hit. The microcontroller performs basic data processing and buffering, and also operates and regulates high voltage generation. The design uses off-the-shelf components chosen for low power consumption and cost. It will be included in new version multi-PMT prototype modules that will be installed in the near-term IceCube Upgrade project.

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