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Performance of Scintillation Counters with Silicon Photomultiplier Readout

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The performance of scintillator counters with embedded wavelength-shifting fibers and read out using silicon photomultipliers (SiPMs) have been measured in the Fermilab Meson Test Beam Facility using 120 GeV protons. The counters were extruded with a titanium dioxide surface coating and two channels for the fibers at the Fermilab NICADD facility. The signals were amplified and digitized by a custom-made front-end electronics board. We report on the photoelectron yield from: (1) four different extrusion/coating mixtures; (2) extrusions with 5×2 cm2 and 6×2 cm2 profiles; (3) 1.0, 1.4 and 1.8 mm diameter fibers; (4) 2×2mm2 and 3×3 mm3 SiPMs; (5) transverse and longitudinal scans; (6) different reflectors at the counter far end; and (7) different SiPM biases. The position resolution obtained from timing differences from the SiPMs at both ends of the 3-m-long counters will also be presented. The counters are intended to be used in the cosmic-ray veto detector for the Mu2e experiment at Fermilab.

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