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A Fast Simulation of Scintillation Counters with Embedded Wavelength-Shifting Fibers Read out by Silicon Photomultipliers

We will describe a complete end-to-end simulation of the response of scintillator counters to charged particles. These counters were extruded with a titanium dioxide surface coating and two channels for the embedded wavelength-shifting fibers which are read out by silicon photomultipliers. The simulation includes the production and propagation of scintillation and Cerenkov photons, the response of the silicon photomultipliers, and the generation of the signal waveforms. Probability lookup tables are used to speed up the simulation of the photon propagation inside the counters. The simulation was tuned to match measured data obtained from a test-beam study in the Fermilab Meson Test Beam Facility using 120 GeV protons. The counters are intended to be used in the cosmic-ray veto detector for the Mu2e experiment at Fermilab.

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