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## Studies of an array of PbF<sub>2</sub> Cherenkov crystals with large-area SiPM readout

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The electromagnetic calorimeter for the new muon (g-2) experiment at Fermilab will consist of arrays of PbF<sub>2</sub> Cherenkov crystals read out by large-area silicon photo-multiplier (SiPM) sensors. We report here on measurements and simulations using 2.0 – 4.5 GeV electrons with a 28-element prototype array. All data were obtained using fast waveform digitizers to accurately capture signal pulse shapes versus energy, impact position, angle, and crystal wrapping. The SiPMs were gain matched using a laser-based calibration system, which also provided a stabilization procedure that allowed gain correction to a level of 1e-4 per hour. After accounting for longitudinal fluctuation losses, those crystals wrapped in a white, diffusive wrapping exhibited an energy resolution  $\sigma/E$  of  $(3.4 \pm 0.1) \% \text{ per } \sqrt{E/\text{GeV}}$ , while those wrapped in a black, absorptive wrapping had  $(4.6 \pm 0.3) \% \text{ per } \sqrt{E/\text{GeV}}$ . The white-wrapped crystals—having nearly twice the total light collection—display a generally wider and impact-position-dependent pulse shape owing to the dynamics of the light propagation, in comparison to the black-wrapped crystals, which have a narrower pulse shape that is insensitive to impact position.

### Collaboration

New G-2 Experiment at FNAL (E989)

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