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GEANT4 Simulation of Energy Deposition in Lead Fluoride Calorimeter for g-2 Experiment

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We continue our investigation of the calorimeter system for the muon g-2 experiment. In our previous work we have shown the excellent spatial distribution of photons at the calorimeter crystals back surface, which is of a certain importance for the precise measurement of primary positron energy. We have also evaluated both photon energy and angular distributions as well as the time distribution, which has shown a nanoscale time resolution.

In this work we report on Geant4 simulations of charged particles, such as 3 GeV muons, protons, electrons and positrons, passage through the calorimeter module. The module consists of a Delrin front panel for installation of the laser calibration system, 54 PbF₂ Cherenkov crystals wrapped by the black paper, and silicon photo-multiplier sensors. Aluminum exit of the storage ring is also taken into account during the simulation. The main goal of our simulations is to evaluate the energy deposition of various particles in different parts of described system.

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