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R&D of DarkSHINE ECAL

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DarkSHINE, a fixed-target experiment leveraging the SHINE facility for light dark matter (LDM) detection, utilizes an 8 GeV electron beam with a 1-10 MHz repetition rate. Dark SHINE ECAL plays a crucial role in the precise measurement of recoil electron energies. This ECAL, featuring a homogeneous LYSO crystal scintillator structure, is designed for exceptional energy resolution, rapid response, and high radiation tolerance. Radiation background within the ECAL has been estimated using Geant4 simulations, revealing an equivalent 1MeV neutron flux of approximately 10^{13} for the most irradiated cell. Many laboratory experiments have been conducted to evaluate the light yield, uniformity, and dynamic range of the crystal units. Moreover, a LYSO ECAL prototype has been developed and subjected to a beam test with a 4-channel LYSO unit to assess its high-energy beam response. Future efforts will focus on constructing a larger-scale detector prototype to thoroughly validate the proposed design.

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