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Simulation Studies of the Effect of SiPM Dark Noise on the Performance of a Highly Granular Crystal ECAL

A proposed highly-granular crystal ECAL for CEPC uses SiPMs to detect photon signals. Radiation-induced SiPM dark noise degrades calorimeter performance. A simulation study was performed to estimate the expected degradation in linearity of response and resolution due radiation damage to SiPMs. Simulations show dark noise causes up to 45% error in reconstructed energy for a 1 GeV electron shower at 1×10^{10} cm^{-2} fluence. Stochastic and noise resolution terms increase minimally by 0.2% and 1% respectively over the range $1 \times 10^{7} - 1 \times 10^{10}$ cm^{-2} fluence. Without irradiation, dark noise from temperature variations within normal operating conditions is negligible.

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