Particle simulation for calibrating the HEP data onboard the ARASE satellite

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Understanding the detailed characteristics of the HEP (High-Energy electron Experiment) instrument onboard the Arase satellite is crucial for data calibration. Due to difficulties of reproducing the severe radiation environment of the inner magnetosphere on the ground, computer simulation is the best method to understand instrument responses to the ambient radiation environment. Through Monte-Carlo simulations using the Geant4 tool, we have reconstructed the geometry of the HEP instrument and modeled the high-energy particle environment. Using the developed model, we have studied the efficiency of the detectors, the angular resolution, and the g-factors, which depend on the particle energy and the sensor channels. While the previous studies were based on a uni-direction simulation with electron pencil beams, this study adopted all the detector channels and energy bends of HEP thus resulting in more advanced simulations. Based on the results, we have made a new calibration table depending on the angle of incident particles. We have also estimated the g-factor which depends on the incident particle energy. The updated calibration table and g-factors are important for calibrating the HEP data as well as inter-calibrations with other particle instruments' data.

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