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Gain-temperature relationship of an Avalanche Photodiode developed for the ERG mission

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We have been developing an instrument for the observations of the medium-energy electrons (8-80 keV) in our coming radiation belt mission ERG (Energization and Radiation in Geospace). The mission goal is to understand the radiation belt dynamics during space storms. The medium-energy electron measurement is one of the most important issues in this mission since these electrons generate whistler chorus wave, which is believed to play significant roles in the relativistic electron acceleration and loss during storms. On the other hand, the medium-energy electron measurement has been a challenging issue since the quantum efficiencies of classical detectors (CEM, MCP, and conventional SSDs) are generally low and ambiguous in this energy range. Avalanche photodiode (APD) is a promising device for medium-energy electron detection, and we have developed a new APD particularly for the ERG mission. The area and thickness of the detector were optimised to cover the medium-energy range and minimise the gamma ray background at the same time. We report the performance of this new device obtained through laboratory tests, with a special emphasis on the gain dependence of the temperature, which is essential for the calibration sequence in energy determination.