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Annealing of proton radiation damages in Si-PM at room temperature

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nbsp; CAMELOT (CubeSats Applied for MEasuring and LOcalizing Transients) project plans to launch a group of nano-satellites for detection and position determination of short gamma-ray bursts and other transients. Detector is designed to consist of CsI (TI) scintillator and Silicon Photomultipliers (Si-PMs). Si-PMs can be driven with low voltage (˜50 V), high gain (10e6) and small size (˜mm), which are suitable for the nano-satellite platform. However, they have been little used in space, and their damages of orbital radiations have not been investigated in detail. As a purpose of this study, we investigated how Si-PM performance recovers after proton-beam irradiation.
nbsp; In this experiment, we irradiated Si-PMs (Hamamatsu Photonics K.K: S13360-6050CS) with dose of 300, 1000 and 5000 rad of 200 MeV protons in The Wakasa-wan Energy Research Center in November 2018. The dose of 100 rad is yielded by 6.2e8 200 MeV protons and equivalent to the same number of irradiation with 1 MeV neutron. Then, we measured the performance at two epochs, just after irradiation and after 7 month. Si-PMs were stored at room temperature during these 7 months.
nbsp; We measured the energy spectrum of X-ray of 241Am by using 1 cmˆ3 CsI (TI) and Si-PM irradiated with 300 rad of proton. It shows recovery of the energy threshold by a factor of ˜2. Si-PM irradiated by 5000 rad protons had a higher noise and 241Am signals were not able to be detected just after irradiation. As a result of room-temperature annealing during 7 month, a lower energy threshold is achieved and 59.5 keV peak of 241Am is visible. In this paper, we report the recovery of various properties of Si-PM.

Submission declaration

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