Contribution ID: **27** Type: **Oral presentation**

Radiation Hardness Tests of Si-PMs with a Proton Beam for Future Satellite Missions.

Thursday, 3 October 2019 18:20 (20 minutes)

A scintillation detector for a gamma-ray satellite mission should have low power-consumption and be compact.
For observing the gamma-ray sky, low energy threshold and high energy resolution are required furthermore. Silicon Photomultipliers (Si-PMs) are considered as a solid-state sensor alternative to photomultiplier tubes in a future satellite using scintillation materials as a radiation detection medium. Many of the Si-PMs fill these requirements. However, the performance-deterioration caused by the radiation damage is expected in the satellite orbit, since Si-PMs are directly exposed to the bombardment of galactic cosmic rays that mainly consist of the nuclear particles with the energy of several 100 MeV/ nucleon. In this experiment, we irradiated a dose of a few krad of 200 MeV protons to two of the latest Si-PMs developed by Hamamatsu Photonics K.K.: S14160-6050HS and S13360-6050CS. We compared the proton-irradiated and the non-irradiated Si-PMs in terms of the dark-current and the energy spectra by measuring the ^{241}Am radiation sources with a CsI scintillator.
The results showed that the dark-current and the energy threshold got worse by proton irradiation even the proton dose is only 300 rad.
We report that the radiation hardness of these two Si-PMs in terms of the dark-current and energy spectrum.

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Session Classification: Astroparticle and space applications