Development of Geant4 application for particle detector design

*PARK INCHUN[1], Yoshizumi Miyoshi[1], Takefumi Mitani[2], Takane Hori[1], Mariko Teramoto[4], Satoshi Kurita[1], Satoshi Kasahara[3], Nana Higashio[5], Fajardo Taipia Isai[4], Keiichi Okuyama[4]

1. Nagoya University Institute for Space-Earth Environmental Research, 2. Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science, 3. The University of Tokyo, 4. Kyushu Institute of Technology, 5. Japan Aerospace Exploration Agency

Developing particle detectors for space mission requires testing them in the actual particle environment. Although the environment cannot be reproduced on the ground facility, it can be simulated by using computer simulation, which is an essential step in designing the detectors. Geant4 is a widely used tool that simulates the high-energy particle environment, but it is difficult to use for unskilled researchers.

In this research, we developed a G-factor Analysis tool using Geant4 (GAG) simulation to make it easier to test the particle detector's characteristics. For easy operation, the GAG has two main features. The one is that GAG can be read the detector geometry from a CAD file which is difficult to adapt to Geant4 simulation. And the other is the automatic calculation of results such as detector's efficiency, G-factor, and spectral characteristics, etc. These features are based on the result of the calibration studies of the HEP instrument onboard the Arase satellite, which allows the GAG application to be used to determine the characteristics of the detectors as well as to perform the calibration.

Using these application's features, we examine the characteristics of particle detectors such as XEP and TENKOH, as well as HEP. The results of the simulation provide cross-calibration information. We report the preliminary result of these simulation results

Keywords: Geant4 simulation, Particle detector, Satellite instrument, Detector calibration