Contribution ID: **314** Type: **POSTER**

Performance evaluation of recoil electron track detection with an electron tracking Compton camera using an SOI pixel sensor

Saturday, 14 December 2019 14:10 (1 minute)

Sub-MeV gamma rays are produced by nucleosynthesis processes caused by high energy phenomena in the universe such as supernova explosions. As the details of such nucleosynthesis processes can be inferred from their spectral line features, improved spectral performance in the sub-MeV range is vitally important. However, observations in this energy band have lagged by some decades because of difficulties in removing considerable detector background with a conventional Compton camera. One of the solutions is an advanced Compton camera because it enables high background rejection by detecting recoil electron tracks produced by Compton scattering processes. Therefore, we developed an electron tracking Compton camera using semiconductor sensors with high energy resolution. The selected sensors were XRPIX2b pixel sensors with a fine pitch (30 μm), high energy resolution, and a trigger capability enabled by silicon-on-insulator (SOI) technology. The in-pixel trigger circuit enables an event-driven readout allowing us to use the coincidence technique to select candidate Compton events and reject background events. We developed a prototype camera using XRPIX2b sensor to verify the recoil electron detection performance of the sensor for sub-MeV gamma rays. This prototype comprises a scatterer using XRPIX2b and an absorber using a 1 cm^2 CsI(Tl) scintillator with a photomultiplier tube. Using this prototype, we measured the $^{22}\mathrm{Na}$ of a 511keV line gamma ray source and confirmed imaging of the recoil electron tracks. We will report the imaging capability for various gamma ray scattering angles and the dependence on rotational angles of the detector, and show the comparison with Monte Carlo simulations.

Submission declaration

Original and unpublished

Primary author: KATO, Ryo (Ibaraki University)

Co-authors: KATAGIRI, Hideaki (Ibaraki University); MIKA, Kagaya (NIT Sendai College); TOJO, Naomi (Ibaraki University); ARAI, Yasuo (KEK); UCHIDA, Tomohisa (KEK); TAKEDA, Ayaki (Miyazaki University); TSURU, Takeshi (Kyoto University)

Presenter: KATO, Ryo (Ibaraki University)

Session Classification: POSTER

Track Classification: Pixel sensors for imaging