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Experiment of the 30 cm-cube ETCC under the Intense Radiations with Proton Beam

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As the MeV gamma-ray telescope in the next generation, we are developing an electron-tracking Compton camera (ETCC). An ETCC consists of a gaseous time projection chamber and pixel scintillator arrays. Since the gaseous time projection chamber measures three dimensional tracks of Compton-recoil electrons, the ETCC can reconstruct gamma rays completely. Moreover, the ETCC has an efficient background rejection power based on Compton-kinematics test, particle identification using energy deposit rate, and high quality image by complete reconstruction.
Proposing an all sky survey satellite, we are planning "Sub MeV gamma ray Imaging Loaded on balloon Experiment (SMILE)." In 2006, the first balloon (SMILE-I) was launched, and it was successful to detect the fluxes of diffuse cosmic and atmospheric gamma rays with a high efficient background rejection. At the next flight, we aim to a clear imaging of a bright celestial object such as Crab nebula (SMILE-II). For SMILE-II, we constructed a middle size ETCC using a 30 cm cube time projection chamber, and the performance test is ongoing.
An observation at balloon altitude or satellite orbit is obstructed by many background. Especially, neutrons exist as many as gamma rays and are detected similar to Compton scattering. For checking the background rejection power, we carried out an experiment at Research Center for Nuclear Physics, Osaka university. We irradiated 140 MeV proton beam with the current of approximately 0.1 nA on a water target, and the SMILE-II ETCC was placed in the intense radiation field similar to the space, which is constructed with gamma rays, neutrons, protons, and so on. In this situation, we operated our 30 cm cube ETCC stably at 5 times higher counting rate than that expected at the balloon altitude, and it was successful to obtain a clear gamma-ray image of a checking source due to particle identification.
We will report the performance of our detector and the efficient background rejection based on electron tracking.
This results are also very important for radiation monitoring and particle therapy.

Primary author: MATSUOKA, Yoshihiro (Kyoto Univ.)

Co-authors: TAKADA, Atsushi (Kyoto Univ.); TOMONO, Dai (Kyoto Univ.); KUBO, Hidetoshi (Kyoto Univ.); PARKER, Joseph (Kyoto Univ.); NAKAMURA, Kiseki (Kyoto Univ.); ODA, Makoto (Kyoto Univ.); IWAKI, Satoshi (Kyoto Univ.); SONODA, Shinya (Kyoto Univ.); NAKAMURA, Shogo (Kyoto Univ.); KOMURA, Shotaro (Kyoto Univ.); SAWANO, Tatsuya (Kyoto Univ.); MIZUMOTO, Tetsuya (Kyoto Univ.); TANIMORI, Toru (Kyoto Univ.); MIZUMURA, Yoshitaka (Kyoto Univ.)

Presenter: MATSUOKA, Yoshihiro (Kyoto Univ.)

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