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Performance Study of Electron Tracking Compton Camera with Compact System for Environmental gamma-ray Observations

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We have developed an Electron-Tracking Compton Camera (ETCC) that can determine the arrival directions of sub-MeV/MeV gamma rays for the use of environmental gamma-ray observations. It is a hybrid detector consisting of a gaseous TPC, which has a 10 cm square two-dimensional position sensitive micropixel gaseous detector for detecting a recoil electron track, and a positionsensitive scintillation camera, which is set at the bottom of the TPC, for the detection of the scattering gamma ray. We can reconstruct the arrival direction of every incident photon with an angular resolution of several degrees in FWHM, and select a perfect reconstructed compton event. Also, background charged particles such as a cosmic ray can be strongly rejected by using an energy loss rate (dE/dx) in the TPC. The detector has a large field of view (about 3 str). Because of these advantages, the ETCC is the detector suitable for the monitoring gamma-rays from radioactively contaminated soil. In particular, since an ETCC reconstructs all gamma rays including scattered background, we can measure the radiation intensity map over the FoV including energy spectrum. This feature enables us to estimate quantitatively a boundary condition for the necessity of decontamination. For the use of monitoring the environmental gamma-rays in the open, the compactness and portability is needed for the detector. In this conference, we will present the result of the performance study of the ETCC for the environmental gamma-ray observation.

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