

## Real-Time Dose-Verification in Particle Therapy Using an Electron-Tracking Compton Camera

Dose verification in situ is highly required in proton therapy. We have developed an electron-tracking Compton camera (ETCC) which consists of gaseous time projection chamber (TPC) and a position-sensitive scintillator. Since the TPC performs the electron-tracking, the ETCC is able to reconstruct Compton scattering event-by-event, and to reject the back ground strongly. In this presentation, we demonstrate the feasibility of dose verification using the ETCC, and the gamma-ray images are compared between the annihilation gammas and prompt gamma rays of higher energy.

Using the ETCC, we obtained the gamma-ray image for the Polymethyl methacrylate (PMMA) phantom irradiated with 290-MeV/u carbon beam at Heavy Ion Medical Accelerator in Chiba (HIMAC), Japan, with a particle (carbon) rate of up to  $5 \times 10^6$  cps. We succeeded in obtaining gamma-ray imaging (0.4 – 2.0 MeV) in beam, and gamma-ray imaging peak was consistent with simulation data using the PHITS code. In this experiment, we used  $\text{Gd}_2\text{SiO}_5(\text{Ce})$  scintillator as the absorber. Here, angular resolution of the Compton camera is related to be energy resolution of the scintillator. Recently, we have developed novel scintillation material,  $(\text{Gd}, \text{La})_2\text{Si}_2\text{O}_7(\text{Ce})$  with better energy resolution than  $\text{Gd}_2\text{SiO}_5(\text{Ce})$ . To improve the angular resolution of the ETCC, we also show the scintillation properties of the novel scintillator in this paper.

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