

AbstractID: 11888 Title: Prompt Gamma Measurements for the Verification of Dose Deposition in Proton Therapy

The proton beam radiotherapy has a merit in that the dose deposit falls off at the end of the beam range. However, mismatch of the falloff location with the prescribed dose boundary can cause adverse effects. Measurement of gamma-rays emitted by nuclear reactions of the incident proton beam with target materials is the only method to verify the dose distribution in situ. We have investigated two different methods of measuring the prompt gamma distribution: 1) multi-layer collimation method, which measures the 1D distribution of gamma production at the target, to assure the endpoint of the dose deposition, 2) electron-tracking Compton camera, which can reconstruct gamma trajectories, to verify the dose distribution. The collimation method can be effectively used when the background neutron flux is low. Hence, it can be more readily applicable to the scanning method in terms of the therapy beam delivery compared to the scattering method. Secondly, the Compton camera is a powerful tool to image the prompt gamma distribution. A preliminary experiment has been carried out with a water phantom at the beam energy of 150 MeV, and images of prompt gamma generation are attained. The clinical application could be considered with further improvement of detection efficiency.

This lecture will review the uses of multi-layer shielding and the Compton camera in the measurement of prompt gamma-rays emitted from the target to verify the dose deposition during proton therapy.

Educational Objectives:

1. Understand the physics of dose deposition by the proton therapy
2. Understand multi-layer shielding techniques to measure the prompt gamma distribution for the verification of the proton dose.
3. Understand the use of an electron-tracking Compton camera for imaging the prompt gamma generation by a proton beam.