AbstractID: 7416 Title: Dose Verification in Proton therapy via Imaging Gamma-ray Emission

Purpose: To investigate gamma-ray emission image during the treatment of proton therapy as a possible method to verify dose delivering, such as dose value and its distribution

Method and Materials: In this study, MCNPX 2.5 was used to simulate a simplified broad beam proton therapy treatment system, in which two broadening scatters were used to broad the initial mono-energy 200 MeV beam. The beam was broadened from initial radius of ~5 mm to that of ~40 mm. In this simulation, protons, neutrons, electrons, and photons have been transported. In front of water phantom there is a water telescope to adjust the range of the broadened bream of proton before it ejects in to a water phantom. The images of emitted gamma-ray were obtained on the two image planes which were 20 cm from the surface of the phantom and were parallel and perpendicular to the beam respectively. The gamma-ray lines emission from annihilation of positrons and inelastic scatter of protons with oxygen nuclei were investigated. Additionally the image of gamma-ray line emission from neutron capture was obtained also

Results: Association between the gamma-ray emission images and delivered dose was found. The intensity of image was related to the energy and flux of the beam. The longitude distribution of intensity of image related to the energy spectrum of ejected beam. For a beam with a given energy spectrum, the image intensity is proportional to the flux of beam. The image of gamma-ray from neutron is closely related to the secondary dose that was mainly attributed to the neutrons generated in the treatment nozzle

Conclusion: The simulation shows that the image of gamma-ray emission is closely related to the energy and flux of proton beam. The projected 2-D distribution of delivered dose could be estimated based of the observed emission images.