AbstractID: 11231 Title: An independent Program for MU check of pencil-beam for IMPT

Purpose: We have developed an empirical algorithm to calculate patient specific monitor unit (MU) for intensity modulated scanning proton beam (IMPT).

Method and Materials: The algorithm is based on a well-established formula for proton output calculation. It adds additional data for a broad range of SSD, depth, and off-axis. All beam data are generated using GEANT4 Monte-Carlo (MC) simulation. Pristine percentage depth doses (*PDD*) for several ranges and off-axis ratio (*OAR*) at several depths of the pencil proton beam are used. This algorithm adopts the concept of proton head-scatter factor, $H_p(r,f)$, to characterize the proton fluence variation with lateral distances (*r*) and source-to-detector distance (*f*).

Results: Input beam data for the empirical program, *PDD* and *OAR* are examined for the proton energies and ranges suitable for the modulated scanning proton beam. *OAR* is the dose measured in water at depth *d* and *r* is the lateral distance of the pencil-beam. H_p is the energy fluence for the same conditions. The program can import DICOMRT plans from the IMPT treatment planning system. Modulated scanning beam generated SOBP depth dose curves for widths between 9 and 12 cm are evaluated. IMPT plans for clinical sites (e.g., prostate) are evaluated.

Conclusion: This algorithm is ideally suitable for calculating patient-specific MU for pencil-beam based treatment planning system for protons.