AbstractID: 13411 Title: GEANT4 Monte-Carlo simulation of dosimetry parameters of the passively scattered beam lines at the Proton Therapy Center in Houston

Purpose: To use the Geant4 Monte-Carlo simulation (MCS) program to generate proton dosimetry data of the passively-scattered beams of the Hitachi ProBeat machine at the Proton Therapy Center in Houston. **Method and Materials:** The hardware components of the double scattering beam nozzle of the ProBeat machine and a water phantom were modeled for MCS using GEANT4. The electromagnetic and hadronic models in GEANT4 were used to simulate the interaction among proton and other particles. Transportation histories of 20 million particles were tracked and spatial dose depositions in a large water phantom were recorded. Results from simulation are compared with the beam data measured using an ionization chamber, which includes Pristine Bragg Peaks (PBP), spread out Bragg Peaks (SOBPs), and transverse profiles for proton beams with energy between 100 and 250 MeV to validate the GEANT4 beam model, which was then used to generate clinical dosimetry data. We implemented a phase-space-based approach to speed up the simulation. The phase-space-based output files contain information about particle's energy, momentum and positions for different combination of incident proton energy and SOBPs. These files were used to calculate the change in the dose output due to the presence of range shifters known as range shifter factor (RSF), which were compared with the measured values. **Results:** The distal ranges obtained from the GEANT4 agreed within 1 mm both for PBP and SOBP. The profiles agree within 3% or 2 mm in most of the regions. The simulation speed was found to be about 10 times faster in phase-space-based approach than particle source model approach. The difference between the simulated and measured values of RSFs was found to be less than 2%. **Conclusion:** The new phase-space-based simulation procedure is found to be a useful approach to generate the needed proton beam dosimetry data for clinical application.