AbstractID: 9364 Title: Configuration of a treatment planning system with Monte Carlo simulations for a compact proton therapy unit

Purpose: A compact proton therapy unit Monarch^{250} (Still River Systems, Littleton, MA) is under development and the first unit will be installed at our institution. Our purpose is to generate dose profiles and test beam characteristics for the proton therapy unit with Monte Carlo simulation and configure a commercial treatment planning system (Varian, Palo Alto) using the simulated beam data.

Method and Materials: Since the beam delivery apparatus is not installed yet, we used the design data provided by the manufacturer to model the beam line and calculate machine specific parameters such as water equivalent thickness of each component. We modeled the range modulator, second scatterer, range shifter, applicator, aperture and other components in detail. A Monte Carlo code (MCNPX, Los Alamos National Laboratory) was used to simulate the beam profiles. Up to 10^8 proton histories were tracked per simulation to achieve < 2% statistical uncertainties. The dose profiles and machine-specific parameters were then entered into the treatment planning system for configuration.

Results:

A complete set of configuration parameters and beam profiles will be generated. The beam characteristics such as flatness, symmetry and penumbra and spread-out Bragg peak will be evaluated against the machine specifications. The treatment planning system will be configured with the dose profiles from Monte Carlo simulation and machine specific parameters provided by the manufacturer.

Conclusion:

The Monte Carlo tool allows us to test the beam characteristics and configure a treatment planning system for a compact proton therapy unit before it is constructed. Validation of the Monte Carlo modeling will commence. Using a validated MC model to (partially or fully) commission the treatment plan and proton therapy machine is under investigation, which could significantly reduce the overall time and cost to model and commission proton beams for clinic use.

Conflict of Interest (only if applicable):