AbstractID: 6408 Title: Dose Variations from Passively Scattered Proton Beams due to Changes in Beam Size and Orientation

Purpose: For passively scattered proton beam delivery, day-to-day fluctuations in beam size extracted from the proton accelerator and changes to the orientation of an elliptical beam profile may cause variations in the delivered dose. The purpose of this study was to determine the magnitude of the variations in the dose delivered due to changes in size and orientation of the beam that is injected into the treatment nozzle.

Method and Materials: A model of a clinical passive scattering treatment nozzle was developed using the MCNPX Monte Carlo code. This model was based on original manufacturer design documents. Monte Carlo calculations were used to study changes of the beam's in-air energy distribution and spatial fluence profiles at isocenter, as well as, the central axis depth dose profiles in water resulting from changes in the incident beam size and orientation.

Results: No significant changes in central axis dose, the in-air lateral fluence profile, or the energy distribution at isocenter were observed due to changes in the orientation of the elliptical incident beam resulting from rotation of the treatment gantry. However, our results indicated that the energy profile of the beam hardens with increasing beam size. Also, for large increases in beam size, a decrease in the 90% proximal to 90% distal width of the SOBP was observed.

Conclusions: Our findings indicate that the dose distribution is not sensitive to changes in the size and orientation of an incident elliptical proton beam that results from either rotation of the gantry or small day-to-day fluctuations of the beam size. However, for large increases (outside of clinical treatment limits) of the incident beam profile, the width of the delivered SOBP decreases.