

AbstractID: 7485 Title: Study of dose distribution in passively scattered proton beams for small field sizes

Purpose: To investigate the characteristics of the dose distribution of passively scattered proton beams for field sizes smaller than $5 \times 5 \text{ cm}^2$ through measurement and comparison with the results of calculation by the Eclipse treatment planning system (TPS).

Method and Materials: The spread out Bragg peak (SOBP) curves and profiles of the passively scattered proton beams were measured using PTW Markus and PinPoint ion chambers in a PTW MP3 water tank for field sizes of $10 \times 10 \text{ cm}^2$, $5 \times 5 \text{ cm}^2$, $2 \times 2 \text{ cm}^2$ and other small fields used in patient treatments. The profiles of small fields were also measured by film dosimetry to assess the detector size effect. The field size factors (FSF) were measured using the ionization chambers. Measured SOBPs and profiles were compared with the results of Eclipse TPS calculation. SOBPs of different field sizes were compared to assess any significant change in the dose distribution with field size.

Results: Both measured and Eclipse TPS calculated small field SOBPs show significant dose non-uniformity between the distal 90% to proximal 95% as compared to those of the larger fields. The penumbra widths did not change significantly in reducing the field size from 10×10 to $2 \times 2 \text{ cm}^2$. Profiles calculated by Eclipse TPS agree very well with the measured data validating the accuracy of the TPS for small field dose calculation. FSF were found to be insensitive to the decrease in field size up to $5 \times 5 \text{ cm}^2$, but is reduced significantly in going from 5×5 to $2 \times 2 \text{ cm}^2$. FSF for small fields has a complex dependence on energy and snout position.

Conclusion: Small field proton dose distributions were found to have certain unique features that require special attention while using them for treatment planning.