AbstractID: 5636 Title: Analytical calculations of dosimetry data for a 6-MV narrow radiosurgery beam with cones

Purpose: To analytically derive narrow beam dosimetry data for a 6 MV radiosurgery beam with cones from broad beam measurements.

Method and Materials: currently radiosurgery dosimetry calculation is commonly done using a radiosugery treatment planning system. Such a planning system is typically commissioned using output factors, TMR, and off-axis ratio measured in water for narrow beams. The experimental measurements in water for small radiosurgery beams are difficult and with large uncertainty due to lack of lateral electronic equilibrium and finite detector size. In this work, an analytical model was used to calculate the cone factors, TMR, and off-axis ratio (OAR) for various cone sizes for a 6 MV radiosurgery unit. The model is parameterized with the measured broad beam cax beam data where lateral dose equilibrium exists and accurate measurement can be performed without much of difficulties. The calculated results were benchmarked with the experimental measurements. The cone size ranged from 4 mm to 20 mm in diameter in this study.

Results: Compared the calculated dosimetry data with those from measurements, the agreement for cone factor was within 1 %, and within 4 %for TMR beyond d_{max}. The agreements for OAR are within typical experiment uncertainties.

Conclusion: The analytical method described here can be used to calculate narrow cone beam dosimetry data in place of the arduous in-water narrow beam measurements. Alternatively, it can be used to validate narrow beam dosimetry measurements if the direct measurements are prefered.