AbstractID: 11611 Title: Quality Evaluation of Unflattened Photon Beam Model

Purpose: Unflattened external photon beams provide extra high dose rate and greatly reduce the treatment time. The purpose of this project is to verify the feasibility of unflattened photon beam modeling for treatment planning and delivery.

Method and Materials: Profiles of a set of square open fields are used to determine parameters of the unflattened beam model for Pinnacle^3 TPS. The Gamma-index is used to evaluate the beam model. Decision maps and gamma-indices are calculated for planned and measured 20x20 cm^2 open and jagged fields in order to assess the dosimetric accuracy. Ten cases of gated IMRT liver cancer treatment plans are used to verify the feasibility of clinically using unflattened beams.

Results: All PDD and in-field cross-plane profiles pass the 2.4mm/2.4% gamma-index test for the unflattened beam model (NF) while the flattened beam model (WF) passes at 3mm/3%. The 20x20 cm^2 open field and the jagged field pass the 3mm/3% decision map check. The ion chamber measurement and the Pinnacle^3 calculated profiles passing the middle of the blocked areas in the jagged field agree very well. All points pass the 2.4mm/2.4% gamma-index test. The percentage dose differences between the prescribed and delivered dose at the isocenter for ten gated IMRT liver cancer cases are within 3% except for one unflattened case, which is 3.9%. This might be due to the uncertainty in the ion chamber set-up. Both flattened and unflattened cases pass the 3mm/3% decision map check. The passing rate is 83.15% for the WF case and 93.46% for the NF case in the 3mm/3% check and 93.99% for the WF case and 98.45% for the NF case in the 5mm/5% check. The average time reduction is 60%.

Conclusion: Clinically, the unflattened external photon beam can be modeled as well as the flattened beam.