AbstractID: 8777 Title: Volumatric modulated arc therapy: implementation and evaluation for prostate cancer cases

Purpose: Volumetric modulated arc therapy (VMAT) (Otto K, *Medical Physics*, 2008) is an emerging treatment paradigm which modulates MLC aperture and dose rate during gantry rotation. The purpose of this study is to implement and evaluate VMAT relative to the standard IMRT approach.

Method and Materials: A gantry rotation up to 360° is modeled as 360 evenly divided beams. Beam apertures and dose rate are optimized with respect to gantry angles under a DVH constraints based objective. Differences between our VMAT implementation and previous VMAT are: using gradient search for dose rate optimization rather than random search, and sampling multiple MLC leaf positions within the allowed leaf speed constraints rather than a single one in each iteration. A planning study including 5 prostate patients with a prescription dose of 86.4Gy was performed to evaluate VMAT verse the standard 5-field IMRT approach. VMAT treatment plans are normalized such that certain critical organ dose limits are met, and are comparable to IMRT plans. V95, D95 and mean dose of PTV are used to evaluate plans, while monitor unit (MU) and delivery time are used to assess delivery efficiency.

Results: The PTV V95, D95 and mean dose in VMAT plans are 97.0±0.8%, 96.4±0.5%, and 101.7±0.4%, respectively, vs 97.1±0.8%, 97.5±1.0% and 103.0±0.7% in IMRT plans. VMAT and IMRT plans are indistinguishable measured by these dose indices. The advantage that VMAT presents is it reduces MU by 49.8±7.4%. Secondary scatter dose to patient is reduced accordingly. A typical prostate treatment is shortened from about 5 minutes for IMRT to 2.6±0.2 minutes for VMAT. The better delivery efficiency of VMAT is accomplished by having a larger time averaged beam aperture: 49.1±5.2cm^2 vs 19.5±1.5 cm^2 in IMRT.

Conclusion: VMAT technique can reduce treatment time by up to 50% while maintaining comparable dosimetric quality to standard IMRT approach.