AbstractID: 10962 Title: Comparison of Eclipse Step-and-Shoot IMRT plans with Direct Aperture Optimized treatment plans

Purpose: The purpose of this work was to investigate possible improvements in plan quality and efficiency for step-and-shoot IMRT plans computed using a Direct Step-and-Shoot (DSS) optimization engine to those calculated by Eclipse TPS.

Method and Materials: Eclipse uses a gradient based fluence optimization algorithm for IMRT planning, followed by a Leaf Motion Calculation Algorithm to compute MLC segments, followed by Monitor Units (MU's) calculation for the optimal fluence maps obtained. IMRT plans previously delivered in our clinic for different target complexities ranging from prostate, head and neck and abdomen were re-planned using the same target and normal tissue constraints with a commercially developed DSS algorithm based IMRT planning prototype software. The DSS planning software was further constrained to produce less than or equal to the number of segments as the clinically treated Eclipse treatment plan. These plans were compared using several dose-volume based plan comparison parameters for both the PTV and Organs at Risk (OAR), along with the total number of MU's and segments required to deliver a comparable or better plan. For comparison purpose, the DSS plans were scaled to have the same D50 as the Eclipse plans.

Results: Our results show that DSS always result in better quality plans than the fluence based optimization. The DSS plans gave more homogenous PTV coverage, reduction of hot spots, and better dose sparing in most OAR's e.g. H&N (spinal cord, brainstem), Pelvis (bladder, rectum). The total MU's calculated by the DSS plans in our cases were sometimes less or greater than the Eclipse plans.

Conclusions: For our study DSS consistently resulted in overall better quality, compared to our Eclipse fluence based optimized plans. There was no consistent improvement of plan efficiency. However, further optimization of constraining the number of segments may yield more efficient plans.