AbstractID: 13062 Title: Effects of the MLC leaf offset on IMRT dose distribution

Purpose: The purpose of this study is to investigate the dosimetric-effective leaf offset of the multi-leaf-collimators (MLC) and its effects on accurate dose delivery and reliable patient-specific quality assurance (QA) for intensity-modulated radiation therapy (IMRT).
Methods: The effective MLC leaf offsets were determined by simulating the picket-fence film measurement with variable leaf offsets and comparing with the measured dose profiles. The IMRT dose distributions were calculated using intensity maps built from the actual deliverable IMRT leaf sequences with and without considering the MLC leaf offset. The mean dose of the treatment target and voxel doses in the high dose regions were compared and evaluated for 7 IMRT plans generated for Varian 21EX and Siemens Primus linear accelerators.
Results: By comparing the calculated picket-fence dose profiles with film measurements, leaf offsets of 1mm and -0.3mm were determined for the Varian 21EX and Siemens Primus machines, respectively. The mean target dose was increased by up to 7.8% and the standard deviation of the voxel dose discrepancy was about 5% for Varian IMRT plans when the MLC leaf offset was applied in the dose calculation. These effects will be reduced to half if only 0.5mm leaf offset is considered in the dose calculation. The effects on Siemens IMRT plans were smaller due to the smaller leaf offset. The mean dose was reduced by up to 2.3% and the standard deviation of the voxel dose discrepancy was about 0.5%.
Conclusions: It can be concluded that the MLC leaf offset can affect the mean dose significantly and cause uncertainties in individual voxel doses. The dose uncertainties caused by MLC leaf offset are one of the major uncertainty sources for measurement-based IMRT QA because it is usually not fully considered in the treatment planning system.