

AbstractID: 11727 Title: Evaluation of a new metric for assessing IMRT modulation complexity and plan deliverability

Purpose: A single metric, the modulation complexity score (MCS), has been developed to quantitatively define the segmentation complexity in IMRT treatment plans. The goal of this study is to evaluate the utility of the MCS in the quality assurance (QA) process, via dosimetric measurements.

Method and Materials: The MCS, and associated metrics, have been tabulated for 38 clinical IMRT lung plans. Ten of these plans were selected for dosimetric analysis, representing a range of plan complexities, as assessed by typical qualitative surrogates for plan complexity such as number of beams, segments and monitor units (MU). The MCS, which is calculated based on segment shape, segment area and segment weight, was calculated for each beam using a QA tool. Dose measurements were acquired using a 2D diode-array (MapCheck, Sun Nuclear, Melbourne, FL) and compared to the dose calculated by the treatment planning system (Pinnacle³, Phillips, Madison, WI). The MCS and simple beam characteristics were compared with the dose measurement results using multiple percentage dose difference and distance to agreement criteria.

Results: On average, 98.9% of the diodes met the 3%/3mm criterion for comparison between planned and measured dose. The average difference in maximum dose was 0.8 cGy. No clear relationship was evident between treatment beam parameters and deliverability. However, MCS scores in the top 20% of plans correlated with more accurate dose delivery. These plans maintained a high pass rate (>84%) even under stringent evaluation criteria (2%/0mm), thus providing a link between complexity and robust delivery.

Conclusions: The MCS allows for simple, quantitative assessment of beam complexity, and is applicable to all treatment sites. Scores can be used to assess the degree of complexity and its potential impact on accurate, robust and efficient dose delivery. This tool can be incorporated into various stages of the treatment planning and QA process.