

AbstractID: 7051 Title: Deliverability Scoring and Dosimetric Investigation of Leaf Sequencing in IMRT

An investigation was undertaken to parameterize two-dimensional fluence profiles obtained from inverse planning. Three scoring indices are defined to evaluate the complexity of the profiles in terms of delivery characteristics such as dosimetric accuracy. The gradient Index (GI) measures the complexity of the profile in terms of gradients. The fraction of the field that is planned to receive less than the minimum level of transmission radiation is scored as a Baseline Index (BI). Finally, the ratio of the cumulative monitor units (CMU) required to the average dose level in the profile is determined.

Sequencing of profiles is performed using an in-house algorithm for constructing the leaf sequences necessary for delivery using an MLC. The user specifies the desired sequencing precision in terms of the RMS difference between the original and sequenced profiles. Tolerance of the leaf positions is also specified. Transmission, interleaf and intraleaf leakage are explicitly accounted for. Leaf movements can be synchronized to reduce tongue and groove effect. The application supports segmented (SMLC), dynamic (DMLC), and a hybrid technique capable of overcoming the finite leaf speed limitation in dynamic mode.

Dosimetric investigations have been performed for intensity profiles ranging from simple to very complex, and with a number of sequencing options. Results suggest there is a clear correlation between the deliverability indices, the accuracy of the delivered dose distribution, and practical factors such as treatment time. Based on this correlation, it may be possible to improve delivery characteristics through appropriate choices of parameters at the sequencing stage.