

Leaf Sequencing For Fluence Modulated Radiation Therapy

In Fluence Modulated Radiation Therapy (FMRT), the radiation field is shaped using a multileaf collimator (MLC) by varying the exposure time throughout the field while maintaining constant beam intensity. Exposure time variation results in fluence and dose modulations throughout the field. We have developed a new algorithm for constructing the leaf sequences necessary for FMRT delivery using a multileaf collimator. The algorithm is an enhancement of the sliding window technique and supports several accelerator/MLC combinations. The input format is the output of our in-house developed inverse planning system, which can be modified to support other desired input formats. Several factors are addressed in this application. The user specifies the RMS difference between the desired profile and the profile obtained with translated MLC motion before transmission correction. Tolerance above which the accelerator will turn the beam down allowing leaves to catch-up is also user input. Transmission through MLC leaves is being corrected using an iterative method. Leakage between opposing and neighboring leaves is minimized. Individual leaves are synchronized by varying their relative starting and ending times reducing tongue and groove effect. The application supports Fixed Gantry Step-and-Shoot, Fixed Gantry Dynamic, and Fixed Gantry Optimized modes. During Fixed Gantry Optimized mode, the delivery is dynamic but switches to step-and-shoot in instances where MLC leaves cannot meet tolerance specification. Verifications have been performed using film dosimetry and amorphous Silicon (a-Si:H) 2D array detector acquisitions.