

AbstractID: 1618 Title: The Asymptotic Limit of the Number of Field Segments for IMRT Plan Using Direct Aperture Optimization

IMRT provides the ability to produce highly conformal dose distributions with a rapid falloff in dose outside the target. Unfortunately, the dosimetric gains of IMRT often come at the expense of a dramatic increase in the complexity of the plan delivery. It was demonstrated that using direct aperture optimization, the number of field segments can be drastically reduced without compromising the dose conformity. For each patient case, identical beam angles and optimization constraints were used, and the number of apertures was varied. The optimized treatment plans were analyzed by comparing the objective function values and the corresponding DVHs. For simple cases with a convex tumor volume and a separation between the tumor and OARs, there is little improvement in the objective function and the corresponding DVHs beyond three apertures per angle. However, for large and complex tumor volumes, the objective function and its DVHs are converge more slowly as the number of apertures is increased. This is particularly true if the target is concave in nature or if the treatment seeks to simultaneously treat multiple target volumes. For these most complex cases, it has been observed that nine or more apertures per beam angle are often necessary to achieve an IMRT treatment plan of the highest quality. Our study revealed that for the majority of IMRT patient cases, there is little dosimetric gain in increasing the number of apertures per beam angle beyond six. Consequently, highly conformal IMRT treatments can be delivered in an efficient and simplified manner.