

AbstractID: 1793 Title: A method for improving simplified pencil beam dose in IMRT treatment planning

As a method of speeding up the calculation, approximated pencil beam dose omitting side scatter is often used in IMRT treatment planning for optimizing the intensity profiles. However, the resulting deliverable dose distribution is possibly degraded compared to the optimized distribution. To study the importance of the accuracy of dose calculation in IMRT treatment planning, a simple technique is developed to modify the primary pencil beam dose to restore the side scatter. A universal superposable function is used to describe the pencil beam profiles using fan-line coordinates. A “penumbra-tuning” parameter is chosen to minimize the difference between the broad beam dose as composition of pencil beams and accurately calculated dose using a more sophisticated algorithm. As a result, each pencil beam contributes to more voxels with nonzero dose. The depth attenuation of a pencil beam on those voxels not intersected by primary ray lines are interpolated. Our results show that the computational time is not substantially increased using modified pencil beam dose for optimization with a deterministic iterative least-squares algorithm, while the difference between recalculated deliverable dose after MLC segmentation and the pre-segmentation dose can be greatly reduced, especially in the region adjacent to the target volume. This eliminates the needs to over specify the constraints for dose prescription to compensate anticipated discrepancy with an oversimplified dose model. In addition, the resulting intensity profiles are smoother with a better-conditioned optimization problem after removal of discontinuities in the pencil beam penumbra.

This project was supported by AAPM Undergraduate Scholarship, 2003.