AbstractID: 8963 Title: A "Slicing" Approach for IMRT Optimization Using Linear Programming

Purpose: To present a two-stage optimization approach that explicitly considers aperture-specific dose distributions prior to dose optimization.

Methods: Approximate and fast non-Monte Carlo dose calculation models have typically been utilized for pencil beam weight optimization. Such approximate dose calculations do not take into account aperture specific collimator effects. This leads to potentially significant differences between the dose distribution corresponding to the optimization and a final more accurate dose calculation is typically used to evaluate the treatment plan (conventional planning). We propose a 2-stage approach in which the aperture specific dose distributions were calculated using Monte Carlo and then optimized using sequential linear programming techniques. Our approach was compared with the “conventional” IMRT planning approach and a single-stage process known as “direct aperture optimization”.

Results: We have tested our approach on a head and neck case in the which, the target involved the primary tumor plus the nodal volume. The dose prescription was a simultaneous integrated boost. The *conventional* plan used 159 apertures, the *2-stage* plan used 123 apertures (36 of the original apertures yielded weights of zero) and the *DMPO* plan used 89 apertures. The 2-stage plan outperformed both the conventional IMRT plan and the DMPO plans. The 2-stage optimization approach resulted in an improvement of almost 10-14% for the RP compared with the other optimization approaches and in the lowest maximum cord and brainstem doses. The 2-stage approach also resulted in the least volume of the CTV (both primary and nodal volumes) receiving “hot spots”. These improvements were achieved with greater delivery efficiency relative to the conventional plan.

Conclusions: Our results demonstrate that the 2-stage optimization process in which an initial set of apertures is obtained and then re-optimized using linear programming yields superior results relative to the conventional approach and to the DMPO direct aperture-based approach.