AbstractID: 5671 Title: Exploiting the full potential of MLC based aperture optimization through collimator rotation

Purpose: To investigate the benefits of MLC rotation in Direct Aperture Optimization (DAO) inverse treatment planning.

Method and Materials: An alternative to fluence based inverse planning is to optimize directly the leaf positions and field weights of MLC apertures. Here we introduce a new technique called Rotating Aperture Optimization (RAO) which is based on an extension of DAO. Our technique differs from existing aperture based IMRT techniques in that the MLC is rotated in between each aperture. Treatment plans are generated for 10 nasopharynx recurrence patients with and without MLC rotation for 5 mm and 1cm leaf width MLCs. A comparison study is performed between RAO and DAO in order to assess the benefits of RAO over and above those available with fixed collimator angle DAO. Film verification is also performed to evaluate the accuracy of fixed and rotated collimator aperture delivery.

Results: An analysis of the final cost values and DVHs indicate that plans generated with RAO are as good as or better than DAO while maintaining a smaller number of apertures and MU than conventional IMRT. In particular, RAO with the 1cm leaf width MLC is able to produce better plans than DAO with the 1 cm leaf width MLC and plans that are equivalent to DAO with the higher resolution 5mm leaf width MLC. Film verification results show that RAO is less sensitive to tongue and groove effects than DAO. Although delivery time is increased due to the collimator rotation speed this is a mechanical limit that could be easily overcome.

Conclusion: Our results indicate that RAO is able to provide superior dose distributions, particularly with larger (1 cm) leaf width MLCs, while maintaining the lower MU and number of apertures afforded by the direct aperture approach.

Conflict of Interest: Supported in part by Varian Medical Systems.