AbstractID: 3652 Title: A Computational Algorithm for Independent Planar Dose Verification of IMRT

Purpose: The purpose of this work is to develop a computational algorithm for independent planar dose verification of IMRT plans delivered with an MLC as part of the IMRT quality assurance procedure.

Methods and Materials: A pencil beam convolution method was adopted for the algorithm. The general scheme of the calculation consists of three parts. The first part calculates the delivered fluence in air based on the positions of the leaves and jaws specified in the RTP file. We employed a modified three-source model to obtain the planar fluence at the detector plane based on the projected source integration on the source plane shaped by the combined positions of the jaws and MLC. In the second part, dose kernel in phantom was determined by fitting the convolution results with a series of square-field profiles. Thirdly, the mid-leaf and interleaf transmissions, rounded leaf end, and tongue-and-groove effects were considered to improve the accuracy of the algorithm. All of these effects were taken into account by semi-empirical methodology and the parameters were obtained by fits to measured data. To verify the accuracy of the algorithm, we compared the calculation results with the MapCHECK measurements.

Results: The accuracy of the algorithm was verified by comparing the calculations with the MapCHECK measurements for several head-and-neck cases. The passing rate for most of the cases is above 95% with the 2% in absolute dose or 2-mm distance-to-agreement criteria. The agreement was better than the agreement between the results from a commercial planning system (Pinnacle^3, version 7.0g) and MapCHECK measurements for all the cases tested.

Conclusions: An algorithm has been developed for independent planar dose verification of IMRT plans as part of the IMRT quality assurance procedure. Our methods could be implemented on other kinds of machines with minor modifications.