AbstractID: 10349 Title: A 3-step methodology-cum-algorithm for fast optimization of beam weights and shapes in aperture-based IMRT

Purpose: We presented a 3-step methodology-cum-algorithm that can perform a fast optimization of beam weights and shapes in aperture-based IMRT.

Method and Materials: In the presented work, we propose a "3-step methodology-cum-algorithm" that can optimize beam weights & shapes at a fast pace in Aperture-based IMRT. Step 1: the initial aperture angles & shapes are customized by the planner based on the patient anatomy. Step 2: the weights for these apertures are optimized by using Gaussian-Elimination code along with few additional codes to avoid negative weights. Step 3: the optimum/final aperture shapes are derived by a *feed back* sub-routine incorporated in the Gaussian-Elimination code. The *feed back* sub-routine fine-tunes the MLC positions in each aperture to improve the dose distribution further. During fine-tuning of the aperture shape, the aperture weight is automatically updated with respect to the current shape of the aperture. The objective for steps 2 & 3 is to minimize the cost function below a pre-set value. Moreover, step 3 is kept as an optional to save time in many patient cases. The principal feature of this algorithm is that the time taken for the optimization is very less, approximately of the order of few seconds, regardless of the complexity of the given case.

Results: We tested this algorithm on a variety of patient cases using CMS XiO (4.3.1) planning system for beam placement & dose calculation. Also few cases have been treated using the algorithm in our department. The results obtained using the algorithm show that the number of segments and MUs are significantly reduced (upto 60% and 50% respectively), while providing dose distribution that is comparable to that of beamlet-based IMRT plan obtained using KonRad® (2.2.23) inverse planning system.

Conclusion: The results demonstrate that the proposed 3-step methodology-cum-algorithm can be effectively used for clinical applications.