AbstractID: 8452 Title: A concept of pseudo-4D IMRT optimization using phase-dependent apertures

Purpose: To present a concept of pseudo-4D IMRT optimization based on 3D optimization of all the respiratory phases.

Method and Materials: A digital phantom with an embedded target was created. A 10-phase cyclic respiratory motion was designed. Five equally spaced beams encompassing the target were used. Individual 3D optimization was performed for each phase. After the optimization, a phase was chosen as a reference to which all doses were mapped through the use of a registration model. A new phase-dependent leaf sequence (*pd*-LS) file for each field was re-constituted by selecting the first aperture from the first phase, the second aperture from the second phase, and so on until all the corresponding apertures were selected. For each field, the apertures in the *pd*-LS file were then served as inputs for a re-optimization of their shapes and dose weights to achieve the result of the same intensity map of the field in the reference phase. The resultant 4D dose from all the fields was calculated by mapping the dose deposited for each phase by the respective apertures onto the reference phase. The 4D plan and DVH were studied and compared with those of the 3D plan optimized for the same reference phase.

Results: Phase-dependent leaf sequence file has been reconstituted that 'follows' the target motion; the pseudo-4D plan could be delivered more efficiently by utilizing the full respiratory cycle. The pseudo-4D plan yielded a similar coverage for the target and a lower dose to the surrounding normal tissues when compared to the 3D plan.

Conclusion: To a first approximation, a pseudo-4D dose optimization can be accomplished with 3D optimization tool by (1) combining the apertures selectively according to the respiratory phases and order of the apertures they are executed and (2) re-optimizing the shape and dose weight of the aperture.