# AbstractID: 13073 Title: A computational method for estimating the dosimetric effect of intra-fraction motion on step-and-shoot IMRT and compensator plans

**Purpose:** Organ motion during intensity-modulated radiation therapy (IRMT) treatment can cause dose deviations. To investigate the extent of these dosimetric changes a computational model was developed and validated, allowing for estimations of the impact of motion.

**Method and Materials:** A Matlab program was written to simulate the effect of a motion track on the dose profile of both step-and-shoot IMRT and solid state compensator treatment plans. Static fluence maps for each segment were exported from the treatment planning system. These maps were shifted for each monitor unit delivered according to the motion track position at the time of delivery. These motion-encoded fluence maps were then recombined and used to calculate the motion-encoded dose. To validate the accuracy of the motion-encoded dose profile the treatment plan was delivered to a cylindrical 'cheese' phantom mounted on a four-dimensional motion phantom, programmed to create the motion track. EDR-2 film measured the planar dose, with the resultant dose distribution being compared to the code-predicted distribution using a gamma index analysis (3% dose difference, 3mm distance-to-agreement). A series of motion tracks incorporating both step-function shifts and sinusoidal motion were tested.

**Results:** The code was shown to accurately predict the film's dose distribution for all of the tested motion tracks, both for the step-and-shoot IMRT and compensator plans. The average gamma analysis pass rate for the motion-encoded dose profiles was 98.3±0.7. In the absence of motion, static delivery pass rates were 98.7±0.2.

**Conclusion:** A computational technique has been developed allowing for predictions of the dosimetric effect of intra-fraction motion. This technique has the potential to be used to evaluate a given plan's sensitivity to organ motion. This information could be used as a tool for selecting the optimal treatment modality or for plan optimization.

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