

AbstractID: 5750 Title: Helical Tomotherapy Sinogram Deformation for Daily Adaptive Therapy

Purpose: To develop an algorithm for modifying a helical tomotherapy treatment delivery sequence based on a measured deformation and to test the algorithm by displacing artificially created test cases, and clinical test cases.

Method and Materials: A geometric test case was created consisting of an equilateral triangle with a 5.2-cm base located inside a circle with a 3.14-cm radius. The circle/triangle extended uniformly superior/inferior for 3-cm, and was centered at the machine isocenter. An inverse plan was created with the triangle irradiated to 2 cGy, and the circle irradiated to 1.5 cGy, yielding a 64 x 701 delivery sinogram. A clinical prostate treatment delivery was also used, where the Planning Target Volume (*PTV*) consisted of the prostate and seminal vesicles. The *PTV* was treated to 2 cGy per fraction, resulting in a 64 x 660 delivery sinogram. A program was developed to shift the MLC positions in each sinogram by a measured displacement of the target. A dose profile (*measured with an ionization chamber*) was incorporated into the algorithm to correct for off-axis factors. The dose distributions for displacement test cases were offset by known amounts, and then measured using Kodak EDR2 radiographic film and Computed Radiography (*CR*) plates placed axially on a tomotherapy treatment couch. The distance of the dose shifts from isocenter, and the absolute doses were measured and compared between the original film, and the film with the vertical shift with and without off-axis correction.

Results: The delivery sinograms for the test cases were offset by 2.5 cm in only the vertical direction, 2.5 cm in only the horizontal direction, and 2.5 cm diagonally using the deformation algorithm. The measured distances were within 5 mm of the desired position.

Conclusions: Presently, the deformation algorithm can correct for displacements up to 5 cm on a treatment slice.