AbstractID: 1776 Title: Development of a 3D dynamic verification phantom for 4DCT and IMRT

A major challenge with 4D computed tomography (4DCT) and intensity modulated radiation therapy (IMRT) is the verification of the methods used to acquire 4DCT datasets or to produce the 4D treatment plan. We are developing a hardware-based system that is capable of verifying the various methods being currently developed for 4D imaging and treatment. The goal behind our method is to produce a robust system that will precisely and accurately move a phantom (currently a traditional cubic dosimetry phantom) in three dimensions along a preselected trajectory. Motion is provided by a system of stepping motor-controlled screws, controlled using a commercial Labview-programmed motor controller. A 4DCT dataset will be acquired using the phantom, embedded with high-contrast objects, and the trajectories measured using our 4DCT analysis software. The trajectories will be compared against the programmed phantom motion to determine the accuracy of the 4DCT process. The phantom will allow the implantation of dosimeters for the verification of a 4D treatment plan (e.g., an IMRT plan that has explicit consideration of breathing motion) or of the determination of dose-delivery errors due to breathing motion. The phantom is capable of accurately reproducing trajectories, input as a series of equally spaced temporal samples, in three dimensions with accurate timing. The trajectories for the phantom are defined using a series of coordinates in three-dimensional space that are equally spaced in time. The phantom will be equipped with an independent spatial position validation system, consisting of digital linear encoders tracking screw positions at all times.