

AbstractID: 7605 Title: Optically Guided High Resolution Dosimetry for Small Volume Stereotactic Treatments

Purpose: To attain sub-millimeter dosimetric precision necessary for the film verification of small volume radiation treatment plans with steep dose gradients.

Methodology: An infrared-detectable, stereo-optical frame was fitted on a dosimetry phantom in order to accurately localize and orient the phantom at the linear accelerator (linac) isocenter under optical guidance by an infrared stereo-optical camera system. For subsequent creation of a verification phantom plan on a treatment planning system, we obtained high resolution CT scans of the phantom loaded with film spacers using a CT-simulator. Scanning parameters for the 512 x 512 pixel images were 1.5 mm spacing, 1.5 mm thickness, 0.38 pitch and 350 mm field of view. This scanning protocol provided adequate resolution for determination of the physical geometry and localization of the phantom. The stereo-optical frame, film plane positions were clearly observable in the resultant images. Once loaded with GAFChromic film, the phantom assembly was aligned on the linac and irradiated according to patient's treatment plans, however the dose was scaled to be within the dosimetric range of the film. A film from the same batch was dose-calibrated to obtain the optical density to dose relationship using a step wedge.

Results: If placed on a linac couch mount that allowed small adjustments with 6 degrees of freedom, the phantom was easily positioned to sub-millimeter and one-tenth-degree precision under optical guidance. This arrangement allowed high precision positioning for film irradiation with small-volume stereotactic radiosurgery and radiotherapy treatments with steep dose gradients for 3-D conformal or MLC-based intensity modulated radiotherapy.

Conclusion: The method provides highly accurate phantom positioning in all six degrees of freedom. Precision alignment was most critical at the periphery of the target, where dose gradients are the sharpest.

Conflict of Interest : Research sponsored by Varian Medical Systems Inc.