AbstractID: 1896 Title: Application of Mathematical Phantom to Model Motion in Radiation Therapy of Lung Tumor

Motion is a serious problem in conformal radiation therapy for lung tumors as it forces the clinician to prescribe an extra margin around the whole target volume. This limits the maximum dose that can be delivered to the target volume since a significant volume of normal lung tissues is being irradiated at the same time. A better approach would be to assign a patient-specific margin around the tumor according to the extent of its motion. This requires understanding of the nature of lung tumor motion in 3D, and the dose delivery outcome must be predicted as a function of the margin design. For these purposes, we have adapted a mathematical phantom with the capability of modelling different breathing patterns for use in radiation therapy planning. This 'virtual patient' is based on the NCAT[1] phantom designed originally for nuclear medicine applications. Cine fluoroscopy images of a real lung patient were evaluated to determine the motion characteristics of tumor in relation to diaphragm and chest wall. It is possible to mimic the motion of the diaphragm by creating artificial CT data sets from the phantom and sorting them to follow the patient's breathing pattern. The phantom CT data were successfully imported into a commercial treatment planning system (Theraplan Plus), demonstrating its potential for radiation therapy simulation. The resulting planning exercises will help establish guidelines for individualized target contouring and combining acceptable lung dose with the potential for dose escalation.

Segars, et al. IEEE Trans Nuc Sci, 48(1): 89-97 (2001).