AbstractID: 9179 Title: Accounting for Variable Anatomy in Radiation Therapy Dose Distributions

In radiation therapy of cancer, uncertainties due to changes in patient anatomy during the course of treatment may lead to differences between the planned dose distribution and the actual dose distribution delivered to the patient. This could potentially have an adverse impact on the treatment outcome. The goal of this research is to calculate the daily and cumulative dose distribution received by the patient while accounting for variable anatomy. The result is a best estimate of the actual dose delivered to individual tissue volumes within the patient. We define "variable anatomy" as organ motion and deformation as well as changes in tissue density and external contour. We use the thin-plate spline warping algorithm along with a conventional treatment planning system to combine the dose distributions computed for a series of 3-D computed tomography studies taken during radiotherapy. The dose distribution is calculated on each treatment study and mapped back to the coordinate system of the planning study via the warping process, thus providing a means of tracking the dose delivered to each tissue voxel. Using this methodology for one clinical prostate case, we demonstrate that there are significant localized dose differences (>10%) in a single fraction as well as in 15 cumulative fractions. Also, after 15-20 fractions the dose distribution converges to within 2-3% of the expectation value of the dose delivered but does *not* converge to the planned dose distribution. This methodology has the potential to provide quantitative information to guide decisions for adaptive radiotherapy.