AbstractID: 13957 Title: A Quantitative Evaluation of Velocity AI Deformable Image Registration

Purpose: We designed an experiment to quantitatively evaluate the feasibility of the VelocityAI version 2.0 deformable image registration algorithm (DIRA), rigid scale (RS) and rigid only (RO) for adaptive radiotherapy. **Method and Materials**: A phantom made of a Lucite box, bolus material, solid water and a Radiadyne balloon was developed to simulate a prostate patient. A deformable prostate was simulated using a balloon filled with 65 cc water and eighty Visicoil derived golden markers spaced on a 10 mm grid were attached to the balloon's surface. A native computer tomography (CT) scan was taken with 1.5 mm slice thickness. Subsequently the balloon was deformed and the corresponding CT data set was collected using the same acquisition protocol and registered to the native image. The resampled data sets were created using the DIRA, RS and RO algorithms. The position of the makers in the resampled image was compared to that of native image by three independent observers. The accuracy of DIRA was studied when different ROIs were employed. **Results**: When applying DIRA, the range of markers' shifts was reduced from 0-3.0 mm to 0-2.5 mm laterally (x), 3.6-10.45 mm to 0-3.6 mm anterior-posteriorly (z) and increased from 0.1-2.0 mm to 0-3.4 mm superior-inferiorly (y) while the range of markers' 3D position decreased from 3.6-10.45 mm to 0.37-3.94 mm. Results from all three algorithms were within 1 mm and their accuracy ranged from 3.94 to 4.75 mm. When the ROI was decreased (15 mm to 3mm) from the balloon the accuracy of DIRA was improved by ~ 2mm (5.55 to 3.21 mm). **Conclusion**: The DIRA technique had the best accuracy (≤4 mm) and can be improved within 1mm by decreasing the ROI and it may have the potential to be used in adaptive radiation therapy.