

AbstractID: 6949 Title: Experimental evaluation of motion effects by integration of the 4DCT/4DPET hybrid GE Discovery VCT scanner with the CIRS dynamic lung phantom

Purpose: The integrated 4DPET/CT scanner has the advantage of accurate body position correspondence between the PET and CT scans as well as 4D acquisition capabilities for both modalities. The former reduces possible errors from misalignment when fusing PET and CT scans taken on different machines, while the latter improves our capability to account for anatomical changes due to respiratory motion. However, owing to the fundamental differences between the scanning techniques, artifacts may differ between the modalities.

Materials and Methods: In our investigation we have expanded the advantage of the integrated scanner single reference frame by the improvement of a lung dynamic phantom that can be monitored by both the PET and CT 4D scanning procedures. This was achieved by the development of custom made inserts for the dynamic phantom that can accommodate different sized FDG-filled spheres. The motion of the dynamic phantom was preprogrammed for trajectories of sine, sine⁶ and prerecorded traces of lung implanted fiducials from a previous study. In the case of the analytical curves, periods between 3.5 and 8.5 seconds were used along with amplitudes varying from 0.5 to 3cm. Spheres of various sizes filled with FDG of various activities were used.

Results: Gated PET and CT images of the same moving target were obtained within the same frame of reference for various amplitudes and periods of motion and for various sizes and activities of FDG-filled spheres. Comparison of the images from the two modalities shows differences in the motion artifacts, which should be taken into account in radiotherapy planning.

Conclusion: We have successfully developed a phantom system for obtaining highly correlated data sets for PET and CT with and without gated (4D) acquisition. Our preliminary results suggest that motions do have significant impact on the images. Further studies will investigate the clinical implications of this work.