AbstractID: 12997 Title: Radiation treatment plans based on the 4D CT phased images generated by interpolation

Purpose: One of the drawbacks of the four dimensional (4D) CT scan is the larger scan dose to the patient than that of the conventional scan. We present the generation of the phased CT images from two inhale and exhale images via deformable registration, and compare the treatment plans made on both the maximum intensity projection (MIP) images from the original and interpolated phased images.

Method and Materials: Under free breathing, CT images for a lung cancer patient were obtained using the cine mode with the associated respiratory signals. The periodic whole images were sorted into 10 phased bins. For the artificial intermediate phased images, the end-inhale and end-exhale images were deformably registered. The resulting deformation vector field was modified for the appropriate deformation and applied to the inhale images, resulted in the target phased images. The same beam configurations were applied to both MIP images constructed from the original and generated phased images, respectively. Both plan results were compared based on the gamma index.

Results: When compared with the original CT scanned MIP images, generated MIP images were acceptable for the planning and gated treatment, such that 95% pixels passed the gamma evaluation (2%/2-mm in local).

Conclusions: The MIP images for the gated treatment can be obtained from two end phased images using the deformable registration. In application, patient training is necessary for the natural tidal volume maintenance when the patient stops breathing at end-inhale/exhale positions. Goggles displaying the respiratory signal of patient itself are helpful. CT scanners with multi-detectors are necessary for the short breath-hold period of the patient. This technique could reduce the additional radiation dose to the patient from the 4D CT scan aiming the gated treatment.