Purpose: The purpose of the present work is to assess the changes in size and respiration-induced motion of lung tumors resulting from radiation treatment.

Methods and Materials: Six to ten four-dimensional computed tomography (4-DCT) image datasets were acquired for each of 5 stage-III non-small-cell lung cancer patients who received chemo-radiotherapy treatment over six weeks. Serial 4-D datasets were obtained each week. Gross tumor volumes (GTV) were outlined on each data set. Software tools in the radiation treatment planning system were used to calculate the volumes and centroids of the GTVs on the 0% (end-inspiration) and 50% (end-expiration) phase for each dataset. Interfractional changes in GTV location was assessed by registering corresponding phases of the datasets based on vertebral body landmarks and determining variations in the position of the GTV centroids relative to the landmarks. Forty-six scans including six primary tumors (involved nodal stations were not included) were analyzed.

Results: The initial mean tumor volume was 53 cm^3 (range: 1 to 137cm^3). The interfractional changes in GTV position were predominantly in the superior-inferior direction with a mean magnitude of 3.4mm (range: 0.1 to 9.3mm). Overall tumor regression ranged from 20-71% (0% phase) and 15-70% (50% phase). As tumors shrunk, the magnitude of intrafractional GTV motion increased in the anterior-posterior and superior-inferior directions while remaining constant in the right-left direction. Reproducibility of the GTV-centroid position at the 50% phase, based on same-day repeat CT scans, was within 2 mm in each direction.

Conclusions: Because of changes in tumor size and intrafractional tumor motion, care must be taken when reducing treatment portals based on explicit

determination of the internal target volume (ITV). Repeat 4-DCT scans might be warranted during treatment.