Abstract ID: 16348 Title: Investigation of the Reproducibility of Probability Distribution Function (PDF) of Tumor Motion in Lung Stereotactic Body Radiation Therapy (SBRT)

Purpose: To investigate the reproducibility of probability distribution function (PDF) of lung tumor motion using cine-MV images from lung SBRT treatments. Findings of the study will provide valuable information for probability-based treatment planning.

Methods:Ten lung cancer patients who underwent SBRT treatment were included in this study. All treatment plans were created using 3D-conformal technique with 8 to 11 beams and wedges. Cine-MV images were acquired during treatment for each beam at a rate of 1 frame/sec. Tumor motion tracking was achieved using an cross-correlation algorithm. Tumor motion trajectories were extracted for all beams in all fractions of all patients. Inaccurate tracking results (based on visual inspection) were removed from further study. Only 3 beams with the best tracking results from each fraction were used to calculate the tumor motion PDF, which is defined as the probability of finding the tumor at different positions. For each patient the tumor motion PDF was generated for each fraction (PDFn) using the 3 selected beams and a mean PDF (PDFm) was generated as the mean of all fractional PDFs. Inter-fractional PDF reproducibility (Rn) was calculated by comparing PDFn to PDFm. Mean tumor motion range (Dm) was determined for each patient and correlated to the mean PDF reproducibility (Rm).

Results: Inter-fractional PDF reproducibility of lung tumor motion ranged from 0.750 to 0.986 among all patients. Mean PDF reproducibility of the patient (Rm) ranged from 0.840 to 0.954, with an average of 0.89±0.05. Mean PDF reproducibility decreased exponentially as a function of the mean tumor motion range: $Rm=0.15\exp(-0.45Dm)+0.85$.

Conclusions:Tumor motion PDF for lung SBRT patients can be determined using cine-MV images. PDF reproducibility varied between patients and decreased exponentially as tumor motion range increased.