# 2006 AAPM Abstract

Abstract ID: 4639

**Title: The use of a new dynamic motion phantom for patient specific QA in tracking therapy**

C Chuang*, L Verhey, L MA, UC San Francisco, San Francisco, CA, UCSF, San Francisco, CA

**Purpose:** Respiratory gated/tracked radiation delivery with high tumor dose conformity is now a reality. This study aims to develop a patient-specific quality assurance procedure for 4D tracking delivery using patient-specific motion probability distribution functions and a dynamic motion phantom.

**Method and Materials:** A commercial 4D motion phantom (CIRS, Norfolk, VA) was used in the study. A CT scan of the phantom was taken at a specific phase of motion. Patient motion trajectories during treatment were extracted using chest-wall LED markers and fiducials implanted inside target. To produce the patient-specific motion, a probability distribution function was generated from the extracted target motion trajectory. Sampled points from the probability function were input into the phantom motor controller, and patient treatment plan was delivered to the moving phantom with and without motion tracking. Dose distributions can then be compared with the original static plan calculations.

**Results:** The tumor motion probability function for a 36-minute delivery showed significant differences from a 5-minute snapshot of tumor motion, with a median of 0.64 mm vs.1.98 mm in the S/I direction, 0.56 mm vs. 1.22 mm, and 0.28 mm vs. 0.83 mm for A/P and R/L, respectively. The variances for the S/I direction were 5.58 mm vs. 7.24 mm, 0.98 mm vs. 0.84 mm, and 4.82 mm vs. 5.66 mm for A/P and R/L, respectively. A study of target motion compared with center of mass motion also showed significant differences, particularly in the S/I and R/L directions. Results of dose comparison with/without 4D tracking will be presented.

**Conclusion:** A tumor probability distribution function is a more accurate representation of tumor motion than the center of mass method. To conduct patient-specific QA for 4D tracked dose delivery, it is more accurate to use the probability distribution and a programmable motion phantom is an excellent tool for this.