

## AbstractID: 4379 Title: Residual motion of lung tumors in end-of-inhale respiratory gating

**Purpose:** The intention of this study is to determine whether previously observed large external surrogate residual motion at end-of-inhale (EOI) translates into large tumor residual motion, and if improving the reproducibility at this phase can lessen the internal residual motion.

**Method and Materials:** We simulate gated treatment at the EOI phase, using a set of recently measured internal/external correlated patient data. The 3D locations of internal fiducial markers placed near the target are tracked in real-time with stereoscopic x-ray fluoroscopy. An external surrogate respiratory gating system is synchronized with the fluoroscopic unit so that the log files contain the three-dimensional marker position and the abdominal surface position at every time point. The internal and external measurements are taken even when the MV beam is gated off, throughout each treatment, so large amounts of internal/external-correlated data were collected.

**Results:** We found that under free-breathing conditions the residual motion of the tumors is much larger for EOI phase than for end-of-exhale (EOE) phase. The mean value of residual motion at EOI was found to be 2.2 mm and 2.7 mm for amplitude and phase-based gating, respectively; and, at EOE, 1.0 mm and 1.2 mm for the same quantities. However, the residual motion in the EOI gating window is correlated well with the reproducibility of the external surface position in the EOI phase. Using the results of a published breath-coaching study, we deduce that the tumor residual motion at EOI would approach that at EOE under breath-coaching conditions.

**Conclusion:** We conclude that the same reproducibility of tumor location can be achieved at EOI as at EOE if breath coaching is implemented. Based on these results, we believe that inhale gating is preferable to exhale gating as long as proper margins are employed and breath coaching is performed.