AbstractID: 13586 Title: Dosimetric Effect of Residual Tumor Motion in Phase and Amplitude-Based Gated Lung Stereotactic Body Radiotherapy

Purpose
To evaluate dosimetric effect of residual tumor motion in lung Stereotactic Body Radiotherapy(SBRT) with two gating methods using external markers: amplitude-(AG) and phase-based(PG).

Methods and Materials
The 3D tumor motion data were obtained from the treatment logs of 6 lung patients with various target size, each treated with 3 fractions of SBRT using Cyberknife Robotic Radiosurgical System and Synchrony™(Accuray, Sunnyvale CA). Amplitude and phase-based gating treatments were simulated with a gating window of 5 mm. Planning target volume(PTV) was defined as physician-contoured clinical target volume(CTV) surrounded by isotropic 5 mm margin. Each patient was prescribed with 60Gy/3fractions prescribed to 80% isodose line which covered at least 95% of the PTV. In order to reconstruct the dose with motion, the multileaf collimator(MLC) leave positions at each segment were resorted according to the residual tumor motion. The newly created MLC file was imported back to treatment planning system(Eclipse™; Varian Medical Systems, Palo Alto, CA) for dose recalculation.

Results
In either AG or PG, with a 5-mm margin, CTV coverage is not affected as much as PTV. With residual tumor motion constrained within gating window(5 mm), both gating methods result in an insignificant decrease(<1%) in dose coverage on PTVs and CTVs. With baseline shift(2-10 mm), the residual motion during PG has higher probability of excursion outside gating window. The PTV D95 decreases by 9-14% with PG and 5-9% with AG. Overall, AG appears to offer greater target dose coverage compared to PG, however at the expense of reduction of the duty cycle. Compared with PG, AG increases the fractional treatment time by up to 46%, which may be undesirable in gated lung SBRT treatments.

Conclusion
The ideal gating method for lung SBRT requires further investigation and optimization but may be individualized dependent on the empirical pattern of motion observed in each case.