# AbstractID: 6631 Title: Optimizing the methodology for incorporating SPECT-guidance to reduce intensity modulated radiation therapy (IMRT) dose to functioning lung

**Purpose:** Single photon emission computed tomography (SPECT) provides a spatial distribution map of lung perfusion. Previously, an algorithmic methodology was developed using IMRT and SPECT guidance to deliberately divert dose away from higher functioning (perfused) lung, thereby potentially reducing lung toxicity. This work aims to refine this methodology by determining the optimal number and segmentation method for incorporating different levels of functionality.

**Method and Materials:** The lowest 15% of SPECT numbers were discarded as background noise. The remaining values were then divided equally so that each segment had the same range. IMRT treatment plans incorporating functional information were generated with the lung subdivided into varying numbers of SPECT segments. The segments ranged from 2 to the number beyond which there was no improvement in the Dose Functional Histogram (DFH) or function-weighted lung volume above 20/30 Gy ($F_{20}$ / $F_{30}$). The thresholds of 20/30 Gy were chosen for their significance in predicting radiation-induced pneumonitis. The plans generated using SPECT guidance were compared against "conventional" plans, generated with the assumption that lung function was spatially homogeneous.

**Results:** Of all the SPECT plans generated, those created with four segments produced the most favorable results overall. The results were variable, with the four segment SPECT-guided plans showing marginal to large improvement over conventional plans. One patient had a 42.9% and 61.7% reduction in $F_{20}$ and $F_{30}$ values, respectively, when compared to the conventional plan. For all patients, on average, the $F_{20}$ and $F_{30}$ values were reduced by 16.5% ± 18.3% and 21.1% ± 26.0%, respectively.

**Conclusion:** A standardized intensity-based segmentation procedure is crucial for routine use of SPECT-guidance in IMRT lung treatment planning. The simple procedure outlined here is valid for a range of patients. Segmenting lung SPECT into four intensity regions appears to provide the greatest benefit in reducing radiotherapy-induced functional lung damage.