# AbstractID: 11022 Title: Inferring Nodal Volume and Primary Tumor Positions from Multiple Anatomical Surrogates Using 4D CT in Stage III Lung Cancer

**Purpose:**
To investigate the feasibility of modeling primary tumor and nodal volume positions from anatomical surrogates in order to reduce the contouring burden of planning from 4D CTs in Stage III lung cancer.

**Method and Materials:**
To localize their centroid positions at each respiratory phase, we contoured nodal volumes and primary tumors in 16 Stage III lung cancer planning 10-equal-phase 4D CTs. We also localized a series of anatomical respiratory surrogates (carina, xyphoid, nipples, midsternal external marker) in each image. To explore the feasibility of our proposed method, we 1) characterized the correlations between target and surrogate 3D motion, 2) applied Ordinary Least-Squares (OLS) and Partial Least-Squares (PLS) to a random subset (3-8) of images to predict the target positions in the remaining images, 3) determined the best set of three respiratory phase bins to contour, and 4) used them to create 3-phase models using either all anatomical surrogates or carina alone.

**Results:**
The surrogate best-correlated to target motion was most often the carina but varied widely. Depending on the number of phases used to build the models, mean errors ranged from 1.0mm to 1.4mm and from 0.8mm to 1.0mm for OLS and PLS, respectively. When the 0%, 40%, and 70% respiration phases were used, 3-phase models had mean(±standard deviation) errors of 0.8±0.5mm and 2.4±9.0mm for models based on all surrogates and carina alone, respectively. For target coordinates with motion>5mm, the mean 3-phase error was 1.3mm.

**Conclusion:**
Using only three contoured respiratory phases to train the models, the mean model error was on the order of CT resolution. Inferential modeling of the primary tumor and nodal volume positions may have the potential to decrease the time required to process 4D CT scans, thereby improving therapy by allowing for incorporation of patient-specific margins in the planning process.