AbstractID: 11756 Title: 4D prone vs. supine scanning: modifications in the breathing motion characteristics and image data quality

Purpose: To propose a method to reduce tumor motion excursion by applying natural abdominal compression in prone position. The goal is twofold: evaluate changes in tumor motion amplitude and investigate changes in 4D image quality in prone vs. supine positioning.
Method: Patients underwent supine and prone 4D scanning; ten image datasets were reconstructed in each case using *time-based* ("phase") sorting. Breathing patterns from supine and prone scans were compared in terms of overall pattern and amplitude. Tumor volumes were calculated and the coordinates of their centroids were used to estimate changes in motion amplitude. Breathing files were further processed to compute the probabilities of finding the target at ten *equally spaced locations* between the extreme locations of the respiratory pattern; the most probable location was identified. The *time sorted* dataset that best matched this *most probable location* was identified.
Results: In prone positioning the breathing pattern was more consistent over time and the tumor motion amplitude decreased considerably. Tumor volumes were more consistent in the prone scan, owing to reduced artifacts (a consequence of reduced motion amplitude). In addition, changes in the respiratory p.d.f. have been observed. The visual inspection of the images confirmed residual artifacts in the 4D image datasets. The most accurate dataset was the one corresponding to the most probable location.
Conclusions: Tumor motion amplitude is reduced in prone position and the respiratory pattern is more regular over time, thus providing potential for more accurate image datasets. However, the amount of time spent at a given excursion also plays an important role in image dataset accuracy and the most probable location should be identified to determine which dataset acquired in a 4D scan provides the most accurate representation of the anatomy of interest (which can deviate significantly from the "full-exhale" dataset, especially for irregular breathing patterns).