

AbstractID: 3402 Title: A Novel 4-D CT Acquisition Protocol to Validate Respiratory Gating with the RPM System

Purpose: To introduce a method in acquiring a 4-D CT data set without the use of external markers, to validate the use of the RPM Gating System, and to present the results from the first lung cancer patient treated with this method.

Method and Materials: Patients were scanned on a GE Multi-Slice CT Scanner. Registration of the images was based on internal correlation at tissue interfaces between successive respiratory phases. This resulted in a 4-D CT data set acquired without the use of external markers. Regions of interest (ROI) were also constructed on an axial CT slice containing the chest wall, the tumor, and any other critical structure that was affected by respiratory motion. The mean CT number in each ROI was plotted as a function of mid-scan time. The RPM signal was also plotted over the same mid-scan time interval and the sample correlation coefficient, r , of each ROI and RPM curve was determined.

Results: 4-D CT improved the quality of images affected by respiratory motion. For our first patient treated, the sample correlation coefficient was calculated for all combinations of the tumor, chest wall, liver, and the signal acquired by the RPM and the magnitude ranged between 0.897 and 0.982. This suggested that the RPM could predict tumor/internal organ motion determined by the 4-D CT data set. Electronic portal images were taken at the treatment phase and matched well with digitally reconstructed radiographs taken at the same phase. Portal images of the posterior field used in treatment were also taken in cine loop format during three different treatment fractions throughout treatment and showed no changes in anatomy at the treatment phase over the treatment period.

Conclusion: The RPM system is an effective tool for respiratory gating if treatment planning and verification is based on 4-D CT.