

AbstractID: 9208 Title: From a Phase-based to displacement-based gate using a custom designed software application

Purpose: The Varian Real-Time Position Management (RPM) system allows respiratory gating based on either phase or amplitude of the breathing waveform. RPM-based phase gating during treatment is not robust in some patients because of unusual or mildly irregular breathing. We developed a robust method to convert a phase-based breathing gate determined from physician's inspection of target motion imaged during 4D-CT simulation to an equivalent displacement-based gate for gated external beam treatment using the RPM respiratory system.

Method and Materials: The application parses respiratory data from the simulation RPM breathing trace, extracts displacement, time and phase information and calculates a suggested displacement gate based on the physician-specified phase gate. The displacement versus phase information is fitted; values of this function at the lower and upper bounds of the phase thresholds, and the average of these two values are extracted. We also calculate the mean and standard deviation of the displacements, and the duty cycles for each of the three displacement values and the original phase gate. The similarity of the average value displacement gate to the phase gate is evaluated by comparing their respective duty cycles and the mean displacement and standard deviation within each gate, which are measures of baseline drift and residual in-gate motion.

Results: An equivalent displacement gate can be derived from a physician-specified phase gate. The mean of the mean of displacements for 5 patients is 0.160 cm for the phase gate and 0.108 cm for the displacement gate, the mean of residuals is 0.094 cm and 0.177 cm, and 39.1% and 37.6% for the mean duty cycles respectively.

Conclusion: Displacement gates can be consistently derived from phase based gates, thus facilitating migration from a phase-based simulation session to displacement-based treatment sessions.