AbstractID: 5329 Title: A dynamic Motion Simulation with Heterogeneous motion Constraints

Purpose: Accurate radiation treatment of moving tumors is important for lung and low abdomen cancer patients. In this work, we have designed a tumor motion simulation system which provides a realistic simulation environment for advanced radiation treatment. The simulation can be used as a test bed for control algorithms of radiation dose delivery, motion prediction algorithms, and mechanical operation algorithms. It also provides us a better understanding of complicated tumor motion with incorporating different statistical analytical results.

Method and Materials: We have defined motion rotation and translation in 2D space. The base motion is periodic patterns. Various constraints, such as amplitude fluctuation, velocity variation, frequency change, mechanical limitation, and system errors, have been considered in motion generation. The different variable can be predefined distribution, such as Gaussian distribution, or a probability distribution function from statistical analysis of real patient data. Motion prediction will be included in the simulation when only limited data is available.

Results: We have designed the simulation based on statistical results of tumor motion from real patients and various constraints. A user friendly GUI interface with interactive control and nice visualization has been implemented. Several simulation algorithms have been implemented with different constraints. Intensive performance evaluation has been tested. The results show that our simulation system have produced simulated motion very similar to real tumor motion.

Conclusion: Our simulation system provides a user friendly, interactive GUI interface for tumor respiratory motion simulation. The simulation algorithms considered various constrains in real treatment conditions. The simulation is valuable to understand tumor motion and is a good test bed for improved effectiveness in image guided radiation treatment. We will integrate our simulation in to a 2D phantom design.

Conflict of Interest (only if applicable):