AbstractID: 8804 Title: Prospective displacement and velocity based cine 4D CT

Purpose: Existing 4D CT scans show artifacts in a large percentage of cases. Additional dose is also given to ensure redundancy in data to minimize artifacts. To solve this a Prospective Displacement and Velocity based (PDV CT) cine method for acquisition of 4D CT images was developed. It is compared against retrospective methods for efficiency, dose, and accuracy. Effects of different model parameters are also illustrated. **Method and Materials:** With the PDV CT method, image acquisition is only performed if both displacement and velocity of the respiratory signal are within predetermined tolerances. Respiratory signals from a Varian Real Time Position Management (RPM) system for 24 patients (103 sessions) under free breathing conditions were used. To surmount system latency and enhance efficiency, a linear adaptive prediction algorithm was used. The root-mean-square of differences between displacements and velocities of the respiratory signal corresponding to subsequent images, were calculated in order to evaluate the accuracy of each method. **Results:** A reduction in patient dose during image acquisition between 22 - 50% was achieved depending on the parameters chosen. The mean root-mean-square difference show PDV CT produces similar results than retrospective displacement sorting in general, although differences ~20% smaller was achieved for some parameters. Velocity RMS differences improved between 30% - 45% when compared to retrospective phase sorting. The efficiency in acquisition time compared to retrospective phase sorting varied from ~10% for displacement and velocity tolerances of 1mm and 4mm/s, respectively, to 80% - 93% for 4mm and 4mm/s. **Conclusion:** The reduced variation in the displacement and velocity of the respiratory signal indicates that the PDV CT method described here, could be a valuable tool for reducing artifacts in 4D CT images, and more importantly, substantial dose reduction to the patient, although the price may be acquisition time. **Conflict-of-Interest:** Research supported by 1P01CA116602.