AbstractID: 6906 Title: Real time 4D dose calculations with treatment couch compensation including tumor deformation and couch dynamics

**Purpose**: To perform 4D dose calculations using a feedback-controlled treatment couch in 15 lung and abdominal patients

**Methods**: Fifteen patients undergoing 4D CT were considered in this work. The GTV was delineated on ten 3D CT data sets by independent experts, with a planning margin added corresponding to the 2σ deviation from the mean center-of-mass. Tumor trajectories were derived from 4D CT data and fitted to a Fourier series expansion. Intra- and inter-fraction statistical variations in amplitude and period were applied by considering literature estimates of the standard deviations.. The couch feedback control system was simulated using second-order couch dynamics and a first-order controller. The residual tumor trajectory was calculated by inputting the tumor trajectory to the control system. A 7-beam IMRT plan was generated on the end-exhale CT with a prescription dose of 66 Gy. . The resulting 4D dose distribution was calculated by sampling the isocenter position along the continuous tumor trajectory before and after motion compensation using a previously published Monte Carlo algorithm.

**Results**: The mean tumor motion amplitude was **11.4±3.4 (SD) mm**. After compensation the amplitude was **0.42±0.23 mm.** Degradation of the tumor dose up to 35% was observed. After compensation, an average of **18.8 ± 4.7%** improvement in the 100% dose coverage was seen for end inhale, and **13.4 ± 4.7%** for the 90% coverage. For the combined 4D dose, GTV dose coverage was **94.7±4.7%** (for 100% coverage) after compensation, but degraded to **87.3±4.5%** without compensation.

**Conclusion**: We have developed a framework for performing 4D dose calculations using real-time tumor trajectories. For IMRT plans, the average improvement in the dose coverage to the PTV for mobile tumors with a feedback-controlled couch was X%

**Conflict of Interest:** Supported by 3DLine Medical Systems.