AbstractID: 3317 Title: Evaluation of lung tumor dose coverage in free-breathing treatment plans using respiration-correlated CT

Purpose: We quantify the effect of respiration on 3D conformal radiotherapy of lung tumors in terms of dosimetric end-points using respiration-correlated CT scans (RCCT).

Method and Materials: Six patients received RCCT scans (GE Advantage4D CT). Repeat slices were obtained at each couch position and retrospectively sorted according to respiratory phase using an external respiratory monitor. We generated simulated free-breathing (FB) CT sets by assembling slices at different respiratory phases from the RCCT study. FB treatment plans similar to the clinical plan were created based on a 1.5 cm expansion of the gross tumor volume (GTV) in one patient and 1.0 cm in two other patients. Superposition-convolution dose calculations (ADAC/Pinnacle system) were used. We applied the FB plan to the RCCT data sets at various respiratory phases and evaluated dose coverage of the GTV and clinical target volume (CTV=GTV+6mm).

Results: Initial results are presented for an extreme situation: the patient with the largest tumor motion (2.3 cm, inferior/superior direction) and the start phase of the simulated FB scan chosen to have the tumor at its most superior position. The D99% values are: 1) FB plan: GTV 5833 cGy, CTV 5706 cGy. 2) FB plan applied to end-inspiration: GTV 5828 cGy, CTV 5433 cGy. The GTV and CTV are only modestly underdosed at end-inspiration (tumor most inferior), in this worst case scenario (FB plan based on a tumor at a superior position). Dosimetric indices at end-expiration show less change. Preliminary studies on two other patients with smaller tumor excursions show similarly small dosimetric changes.

Conclusion: Tumor coverage by free-breathing based plans with standard margins changes only slightly with breathing phase in an extreme case. This study examines only respiratory motion and not interfractional tumor motion or setup error which also affect tumor dose coverage.