AbstractID: 14322 Title: A generic respiratory motion model to describe tumor and normal tissues motion for radiotherapy applications.

Purpose: Modeling of respiratory motion is very important for the efficacy of radiation therapy. Having such a model is a key point to deliver, under breathing induced motion, less dose to the healthy tissues and higher dose to the tumor. The objective of this work is the use of a generic respiratory motion model to predict in real-time the motion of the tumor and the adjacent anatomy.

Method and Materials: The generic model used is based on principal component analysis. The fitting of the model to a given patient's anatomy requires only two static CT images (end-inspiration, end-expiration) in combination with respiratory synchronized images of the patient's body surface. Our model computes a relation between the surface acquired by an external camera and the internal motion described by the deformation fields. The resulting patient adapted model is subsequently used to generate, in real-time, the motion of the tumor and the adjacent anatomy. In this study 6 patients were used to create and validate the model. The intrinsic model efficiency was tested by generating 4D-CT series comparing them to the corresponding acquired 4D-CT. The model based motion information is subsequently used to improve planning and delivery of 4D-IMRT by accounting for 3D tumor (Suh et al 2009) as well as normal tissue motion.

Results: Good correlation (r=0.93±0.4) and expert validation (1.9mm±0.6mm: based on anatomical landmarks identification) was found between the acquired 4D-CT series and the model generated images. Preliminary results indicate that including the normal tissue motion based on the motion model improve the delivery efficiency of the 4D-IMRT compared to simply accounting for tumor motion.

Conclusion: The use of a motion model for radiotherapy applications avoids unnecessary 4D-CT acquisitions. Better results in 4D-IMRT can be obtained by accounting for normal tissue motion than simply using the 3D tumor motion.