

AbstractID: 1459 Title: Investigation of a passive infra-red tracking system for mapping internal anatomy deformation due to breathing

The accuracy of dose delivery in radiotherapy is affected by the uncertainty in tumour localization. Motion of internal anatomy due to physiological processes such as respiration may lead to significant displacements which compromise tumour coverage and generate irradiation of healthy tissue. The goal of this work was to develop a technique for mapping motion of internal anatomy due to respiration using a passive infra-red tracking system. Chest motion is tracked using multiple reflective markers fixed to the patient's skin. The distribution of these markers on the patient surface was optimized to avoid the appearance of 'ghost markers' as well as partial occlusion of one marker by another. Ghost markers occur when one or more markers are coplanar with each other and the two sensors of the tracking system. Measurement of breathing motion was performed with the tracking system following reflective markers on the chest of patients during acquisition of CT scans. A pre-study of marker positions was performed and a maximum of seven to eight markers lead to ghost marker-free nominal configurations. Given this ghost marker-free initial configuration, software was developed to remove ghost markers which occasionally appear due to CT couch translation or due to breathing motion. Multiple ($n \geq 3$) CT scans were acquired while tracking breathing motion to allow sorting CT slices according to the corresponding breathing level. The ability to image internal anatomy at various stages throughout the breathing cycle provides the opportunity to assess the impact of breathing induced motion on the delivered dose distribution.