

AbstractID: 1415 Title: A Simple Technique To Implement Target Shift Corrections in Image-Guided Radiotherapy

A common positioning error in radiotherapy is due to the movement of a mobile target as a rigid object, relative to external setup marks on a patient. These setup errors often introduce temporal variations in the position of the target relative to the planned external radiation beams as radiotherapy treatments last several weeks and the treatment plan is usually calculated once before the onset of radiotherapy. These variations can cause dose deviations from the planned doses and result in suboptimal treatments. Recent advances in image guided radiotherapy (IGRT) are able to detect real time variations of target position quantitatively. In this work, we present a simple technique to utilize this knowledge and to restore the original beam geometries relative to the moved target. The technique involves three matrix transformations for beams: 1) from the machine coordinate system to the patient coordinate system as in the dosimetric plan; 2) from the patient coordinate system in the radiotherapy plan to the patient coordinate system that is identified at the time of treatment using the information from the on-line imaging system utilized by IGRT; 3) from the patient coordinate system at the time of treatment to the machine coordinate system. By using these matrix transformations, the new isocenter coordinates, the gantry, couch and collimator angles of the beams for the treatment, can be derived in order to account for the target shift so that the newly derived beams will possess the same positions and orientations relative to the target as in the plan.