

AbstractID: 9476 Title: Marker-based strategies for predictive, on-line monitoring of dynamic treatments with MV projection images

Purpose:

Given the need to dose escalate under high precision, hypo-fractionated RT for certain anatomic targets, especially those where respiratory motion is important, requires better capabilities for real-time treatment monitoring. At present, CBCT-based systems, such as Synergy (Elekta) and Trilogy (Varian) tend to rely on a single daily, pre-treatment volumetric snapshot. Here, we describe a general system of real-time treatment verification using radiographic markers and kV and MV cine/flouro that can be applied to both static and dynamic (IMRT; arc-based) therapies on CBCT IGRT systems.

Method and Materials:

A set of mock-treatment datasets were recorded from simultaneous MV and kV cine/flouro imaging under varied treatment scenarios using an experimental Synergy system (Elekta Inc., Crawley, UK). We employ a commercially available programmable motion phantom (Modus Medical Devices, Inc.) modified to accommodate an arbitrary arrangement of metallic markers and to simulate patient respiration. The radiographic markers are identified on a baseline CT dataset (simulation or pre-treatment CBCT) and a 3D tolerance ROI is constructed for each marker. This ROI is then projected onto the MV imaging plane and is superimposed on the current MV image. This mask is also used to refine the automated marker tracking algorithm.

Results:

Development work is ongoing, supported by the aforementioned phantom measurements. Patient treatment data will be used to refine the software tools and demonstrate the clinical feasibility of this method.

Dynamic-MLC fields pose an interesting challenge. A “predictive” technique is employed whereby the tracking algorithm has a priori knowledge of field shapes and “expected” marker positions at given segments or gantry angles.

Conclusions:

This marker-tracking technique can be applied to any static beam or arc-based intensity-modulated delivery and can be employed with the standard equipment available on most modern linear accelerators.