

AbstractID: 7976 Title: Intra-fraction target-beam positioning

The problem of intrafraction tumor-target positioning can be divided into two separate processes: (1) estimating the real-time target position and (2) repositioning the beam to account for intrafraction target motion. Several solutions exist for both target position estimation and beam repositioning, however in principal any method of position estimation could be integrated with any method of beam repositioning. Note that beam repositioning can include moving the target to align with the beam (e.g. couch motion), which in the target reference is the same as moving the beam to align with the target.

There are several common features in target position estimation systems. First, that in the absence of a real-time volumetric imaging system, the target position is estimated from surrogates and thus there is uncertainty in the position of the target with respect to the surrogates. Second, for all but EPID-based methods target position estimation is independent of the treatment beam and therefore careful quality assurance is required to ensure the accurate position estimation with respect to the treatment beam.

There are also several common features of the beam repositioning systems. First, control systems with secondary feedback are required to ensure accurate and precise real time mechanical motion. Second, that there is a delay between the target motion and the beam repositioning. This delay causes delay-time dependent errors which can be reduced with prediction algorithms.

The various target position estimation and beam repositioning processes either in development or available for clinical use will be described and contrasted.

Educational objectives:

1. Understand the separation of the target position estimation and beam repositioning processes.
2. Understand the advantages and disadvantages of several real-time target position estimation systems.
3. Understand the advantages and disadvantages of several beam repositioning systems.

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