AbstractID: 11725 Title: Time analysis of image-based dynamic MLC tracking

Purpose:
To develop a method for detailed temporal analysis of image-based dynamic multileaf collimator (DMLC) tracking.

Method and Materials:
A prototype DMLC tracking system integrated with a linear accelerator was used for tracking of a cyclically moving phantom with a marker during delivery of a treatment beam. The real-time target localization was based on x-ray images acquired with a portal imager and an orthogonal kV imager. As soon as an image was stored on the imaging computer a computer program determined the marker position and transferred it to the DMLC tracking program. This program first estimated the three-dimensional target position either by a single-imager method or by triangulation (when both imagers were used) and then adjusted the MLC aperture to the target. Imaging intervals from 150ms to 1000ms were investigated for kV imaging alone, MV imaging alone, and combined kV/MV imaging. In an off-line analysis, the recorded kV and MV images were synchronized with Dynalog files of the MLC positions and log files of the tracking process. It allowed temporal analysis of the information flow for each individual image from acquisition to MLC adjustment.

Results:
For 150ms imaging intervals the total time from image acquisition to completed MLC adjustment was 300ms for MV and 450ms for kV images. The main part of this time was from image acquisition to completed image file writing (220ms±10ms for MV,350ms±19ms for kV). Image file opening (38ms±8ms), marker segmentation (4ms±7ms), MLC position calculation (16ms±5ms), and MLC adjustment (26ms±5ms) were much faster. Increase of the imaging interval to 1000ms linearly increased the total time to 1010ms (MV) and 1190ms (kV), because of largely delayed image file writing.

Conclusion:
A method for detailed temporal analysis of each individual real-time position signal for DMLC tracking has been developed.

Conflict of Interest:
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