

AbstractID: 9337 Title: Experimental investigation of a monoscopic real-time tumor tracking method combining occasional x-ray imaging and continuous external respiratory monitoring

Purpose:

To demonstrate the feasibility of a monoscopic method for real-time tumour tracking, combining occasional x-ray imaging and continuous external respiratory monitoring, which incorporates two correlations; (1) the correlation between the two projected components of 3D tumour positions on the imager plane (x_p, y_p) and the external respiratory signal (R), (2) the correlation between (x_p, y_p) and the unresolved component ($z_{||}$) along the monoscopic view direction using a prior 3D tumour trajectory that can be obtained by either MV/kV imaging or 4DCBCT.

Method and Materials:

A lung tumor trajectory acquired by a CyberKnife system was fed into 3D motion platform with a marker-embedded phantom. The associated external respiratory signal was also fed into a separate 1D motion platform. The moving phantom was imaged by MV and kV imagers simultaneously. The 1D motion was also monitored by RPM system. The marker positions from images were extracted by Varian RPM-Fluoro application. The performance of the proposed method was compared with stereoscopic estimation under various imaging frequencies.

Results:

The overall estimation error for continuous kV/MV imaging was 0.1 ± 0.3 mm, which reflects the mechanical uncertainty of imaging systems and the marker extraction uncertainty. The error was 0.2 ± 0.7 mm for stereoscopic estimation with 10-s interval imaging and 0.6 ± 0.7 mm for monoscopic estimation with the same update interval.

Conclusion:

The proposed method can effectively estimate target position and thus be used for tumor tracking with gantry-mounted single x-ray imagers that major linac manufacturers offer.

Conflict of Interest:

Research supported by Varian Medical Systems.