AbstractID: 3932 Title: Digital tomosynthesis for verification of radiation therapy positioning: Preliminary results from a kilovoltage on-board imaging system.

Purpose:
This study introduces a new radiation therapy target localization technique using online digital tomosynthesis (DTS), a method for reconstructing 3-D slices from 2-D projection data acquired with limited source motion. By separating the visualization of overlapping structure, DTS is expected to improve the visualization of anatomy compared with 2-D planar radiographic imaging techniques, and may therefore yield more accurate target localization during radiation therapy set-up.

Method and Materials:
We simulated treatment planning and setup of an anthropomorphic chest phantom. A treatment isocenter was marked in CT images. The phantom was then aligned for treatment on a Varian 21EX equipped with an on-board-imager (OBI), attached to the gantry orthogonal to the megavoltage treatment axis. Once aligned, 2-D image projections were acquired over 200 degrees and coronal and sagittal DTS planes were reconstructed through the treatment isocenter from projection sub-sets spanning 40^{o}. Comparison of DTS images with corresponding planes from the CT data, as well as lateral and postero-anterior (PA) planar radiographs, yielded estimations of set-up error.

Results:
Sagittal and coronal DTS slices improved the visibility of anatomy when compared with planar radiograph equivalents, improving estimation of the set-up error. Registration of sagittal and coronal DTS reconstructions with corresponding planes through the isocenter in the CT data was found to be feasible for estimating set-up error. Preliminary determination of the set-up accuracy of our clinical procedure was determined to be within 1mm for the phantom study presented here.

Conclusion:
Tomosynthesis has been demonstrated on a commercially available medical accelerator, and may be practical for improving patient set-up when full cone-beam-CT is not required. DTS significantly improves the visibility of soft-tissue detail that is obscured by overlying anatomy in radiographs and portal images. Additional benefits include a reduction in dose, acquisition and reconstruction time, and easier data handling compared with full cone-beam-CT.