AbstractID: 5622 Title: Automatic Determination of Required Adjustment in Patient Setup for Radiation Therapy

Purpose: To automatically determine the required adjustment for radiotherapy patient setup from two electronic portal images and rapidly calculated digitally reconstructed radiographs (DRR's) from the CT dataset acquired during CT-simulation.

Method and Materials: An amorphous silicon EPID (OPTIVUE, Siemens) was used to obtain setup portal images on patients receiving radiotherapy treatment at various anatomical sites. Two orthogonal portal images or a pair of portals with minimum of 12 degree parallax were acquired. A CT dataset obtained during CT-simulation was used in an algorithm that calculated DRR's in approximately 80 ms. An iterative procedure compared the generated DRR with the acquired portal image using as the initial position the treatment plan isocenter and gantry angles. The minimum deviation between the generated DRR's and the acquired portal images was obtained using various similarity measures. The output from the registration algorithm gave the required patient setup adjustment with 6 degrees of freedom (3 couch translation shifts, and 3 rotational shifts)

Results: The alignment of the acquired portals images with the generated DRR's were evaluated by a radiation oncologist for 37 patients (74 portal images). The agreement between generated DRR's and acquired portal images were within 2 mm in 73 of the 74 images analyzed. The largest deviation was approximately 5mm. The calculated translational shift from planned isocenter was between 1 mm and 7 mm. Rotational shifts were usually less than 2 degrees.

Conclusion: A robust and intensity-based software was evaluated for automatic patient positioning based on DRRs and portal images. The software shows agreement to within 2 mm as compared to evaluations performed by a human observer for various anatomical sites. The software also provides rotational shifts which are difficult to be determined by a human observer in cases where the magnitude is small.