AbstractID: 4930 Title: A phantom study to compare 2D electronic portal imaging with 3D kV cone-beam imaging.

Purpose: To compare patient positioning using a 2D Electronic Portal Imaging Device (EPID) with a 3D registration technique that uses a kV Cone Beam (CB) device.

Introduction: The Elekta kV CB device represents a significant advancement in on-line imaging for patient positioning and structure delineation. There exists an obvious interest in studying the robustness of this new technology. The phantom-based study reported here compares the cone-beam imaging capability with conventional EPID 2D imaging and registration. Additionally, a technique was developed to generate digitally reconstructed portal images (DRPIs) from the CBCT and compare them to EPID images.

Materials and Methods: A Rando anthropomorphic phantom had surgical screws placed in the pelvic region. A treatment isocenter was selected in the pelvic region of the CT dataset of the phantom. The phantom was initially positioned using the CB volume imaging capability. Known shifts of the phantom were introduced and the phantom was repositioned using the CB. The CB corrections were compared to the corrections obtained using the internal fiducials and EPID imaging. Additionally, the EPID-based positioning was mimicked by simulating the 2D imaging using the 3D CB data set. The digitally reconstructed images (DRR) were generated from the CBCT set and used as DRPIs. They were compared to both the diagnostic CT DRR's and the EPID images.

Results and Conclusion: The CB and EPID shifts were well correlated as determined by linear regression analysis. The correlation between the DRPIs and the EPIDs was even higher using the same analysis. However, on the shift-by-shift basis the CB was more accurate than the EPID: it gave more accurate shift determination than the EPID for approximately 90% test shifts. The DRPIs had the advantage over the CB 2Dimages because they included the treatment isocenter, field edges and distance scale.