AbstractID: 5204 Title: High performance dual kV & MV imaging with one detector

Purpose: Recent developments in Adaptive Radiation Therapy (ART) leverage MV and kV X-ray imaging to acquire patient images in treatment position. We have developed a kV X-ray imaging system, in line with the MV treatment beam, which enables us to acquire: (i) 2D kV X-ray images (single acquisitions and fluoroscopy) simultaneously with the MV treatment, (ii) 3D tomographic kV X-ray images, and (iii) MV beam pattern and profile (for entrance dosimetry). Our imaging system utilizes a detector with wide dynamic range allowing us to achieve these technically challenging objectives.

Methods and Materials: In the in-line imaging system, the kV source is opposite to the linear accelerator target with its focal point 100cm from the isocenter. During kV imaging, the kV detector is deployed close to the exit window of the MV beam, which adds to the intensity of the MV beam seen by the detector. Providing all the possible modes of imaging requires a large dynamic range for the flat panel imager. Two multiple gain detectors from Perkin Elmer Optoelectronics were evaluated (XRD1640AN & XRD1621AN), their acquisition and interface parameters were defined.

Results: kV CBCT imaging allows for 1% contrast in 4mm object to be visible with a dose of 3.4cGy (120kV) using 1mm slice thickness. Cross sectional images of a bar resolution phantom with a 512^3 reconstruction allow for 0.9 lp/mm bars to be resolvable. Both detectors were evaluated for saturation at multiple MV energies.

Conclusion: We have developed an imaging system that provides a challenging combination of high quality 2D KV imaging simultaneous with the MV treatment beam, 3D kV CBCT volumetric images, and the acquisition of the MV beam shape and profile (for entrance dosimetry).

Conflict of Interest: Sponsored by Siemens