

AbstractID: 3602 Title: Detective quantum efficiency analysis of an electronic portal imaging device

Purpose: To evaluate the portal image quality of an Elekta iViewGT system based on detective quantum efficiency (DQE) measurements.

Method and Materials: An amorphous silicon based imager was irradiated with 6MV and 18MV beams of an Elekta Precise linear accelerator. The detector panel size is 1024 x 1024 with 0.4 mm pixel size. The source to panel distance is 150 cm. The presampling modulation transfer function (MTF) was computed from angulated slit images. Flat field images were acquired at 2 MUs and 10 MUs for the noise power spectra (NPS) measurements. For the calculation of the DQE, published dose-to-fluence conversion factors were used, namely 1.19×10^7 photons/mm² per cGy for 6MV and 3.23×10^6 photons/mm² per cGy for 18 MV. [Med. Phys. 25, 689–702 (1998)]

Results: 1. The resolution (MTF) for the 6MV beam ($f_{1/2}=0.25$ lp/mm) is comparable to a proto-type flat-panel array [Med. Phys. 31, 985-996 (2004)]. The MTF declines for the 18 MV beam ($f_{1/2}=0.16$ lp/mm); 2. The NPS are nearly flat up to the Nyquist frequency for both energies. Fixed pattern noises are present at several frequencies and become less apparent for high MUs due to frame-averaging effect; 3. The DQEs are approximately 1-2% at lower frequencies for both beams. The DQE values are similar for low and high MUs, and fall off rapidly due to decreased MTF at higher frequencies.

Conclusion: The performance of a clinical portal imaging system has been characterized in terms of MTF, NPS and DQE. Our data demonstrate that this imager is X-ray quantum-limited. The DQE evaluation procedures are being further tested for accuracy, efficiency and robustness. The clinical impact of the MTF, DQE and fixed pattern noise will be investigated further.