INITIAL COMPARISON OF THREE AM-SI EPIDS USING THE QC-3V PHANTOM.

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Introduction

A number of new flat panel detectors are becoming available for electronic portal imaging. We have made a preliminary comparision of three EPIDs based on amorphous silicon detector arrays: the Varian AS500®, the Elekta *i*ViewGT® and a new flat panel system by Siemens which we refer to as the FP detector. We used the QC-3V phantom to obtain objective, quantitative parameters for the spatial and contrast resolution of each EPID at 6MV. While these results are only preliminary in nature, they provide the first quantitative comparision between the new flat panel detectors.

Materials and Methods

We used three QC-3V test phantoms to determine the spatial resolution and contrast-to-noise ratio (CNR) for three different flat panel EPIDs: a Varian AS500® located at Vancouver Cancer Centre, an Elekta *i*ViewGT® at Clatterbridge Centre for Oncology in the UK, and two prototype Siemens FP detectors at UCSF. Siemens FP-B employs a thinner phosphor screen than FP-A. The QC-3V phantom has been described by *Rajapakshe et al.*[1] and is manufactured to high tolerances and calibrated so that results from different phantoms are fully interchangeable. The phantom was placed on the surface of the EPID in each case, to minimise image blurring due to the finite focal spot size. Portal images were acquired at 6MV and analysed by the PIPSpro* software to yield CNR and spatial resolution. Initially we used f_{50} as the measure of spatial resolution, this being the frequency at 50% RMTF in lp/mm. However it became apparent that greater sensitivity can be achieved at higher spatial frequencies, and so PIPSpro was modified to calculate f_{40} and f_{30} as well. Since the Siemens FP detectors were still being used for physics testing and were not yet in routine clinical operation, our results must be considered to be only preliminary in nature.

Results

Fig. 1 shows how the software detects the edge of the phantom, outlines the external contour, and places ROIs over each region to be analysed. Fig. 2 shows a computed RMTF curve and quantitative results.

Figure 1

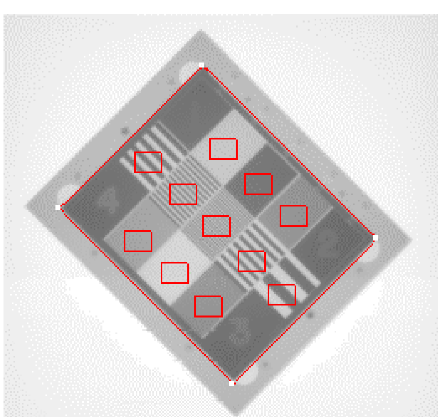
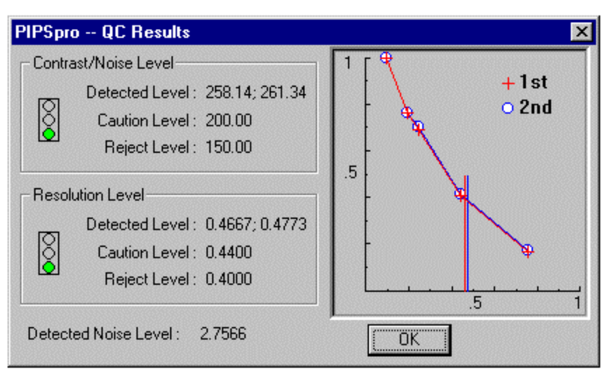


Figure 2

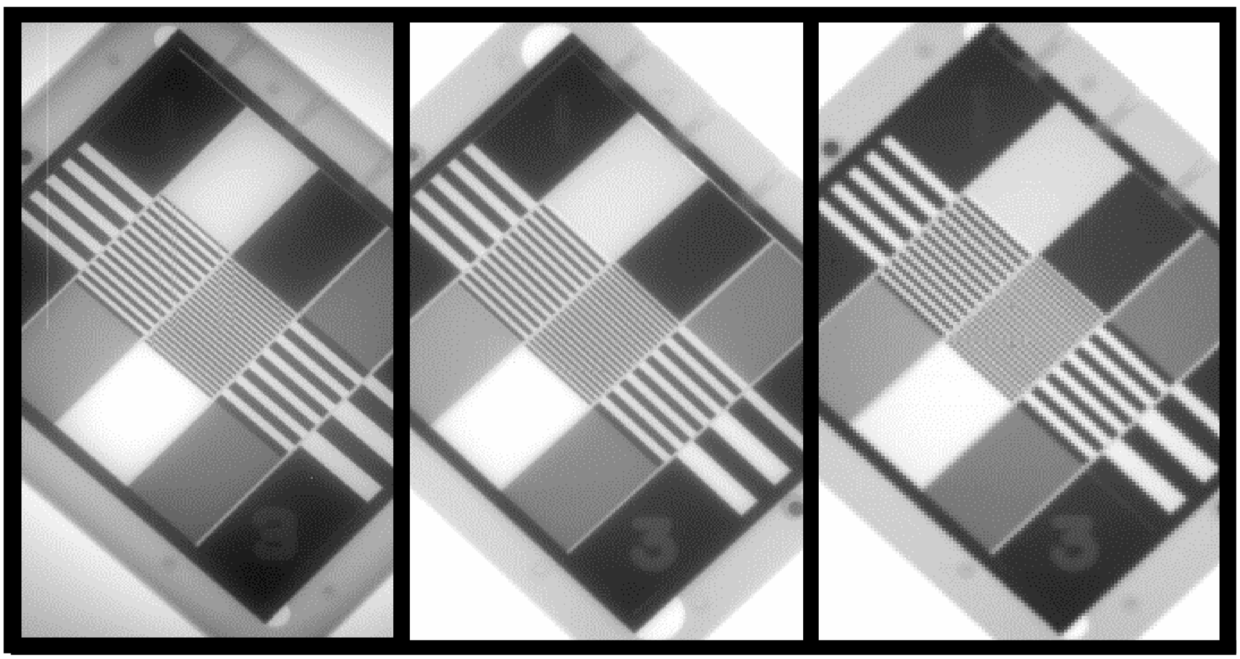


The results for CNR, f_{50}, f_{40} and f_{30} are shown in the table.

EPID	Pixel matrix	Pixel size mm	Dose mu	CNR	f_{50} lp/mm	f_{40} lp/mm	f_{30} lp/mm
Varian AS500	512 x 384	0.78	5	260	0.392	0.472	0.600
Elekta *i*ViewGT	1024 x 1024	0.4	100	448	0.461	0.618	0.767
Siemens FP-A	1024 x 1024	0.4	100	611	0.454	0.575	0.696
Siemens FP-B	1024 x 1024	0.4	142	635	0.621	0.758	0.819

Spatial resolution is independent of dose, but CNR should depend on the square root of dose if quantum noise is dominant. Fig. 3 shows an enlarged view of the central portion of the QC-3V phantom, as imaged by each detector. The AS500 image was enlarged to the same scale as the other images. The bars in the central section have a spatial frequency of 0.76 lp/mm.

Figure 3. Left: Siemens FP-B. Center: *i*ViewGT. Right: Varian AS500 (enlarged).



Discussion

Visual observation supports the conclusion from the table that the Siemens and Elekta detectors provide superior spatial resolution compared to the Varian AS500 flat panel, as could be expected from the difference in pixel sizes. The results for the two Siemens FP test systems demonstrate that the phosphor thickness has a significant impact on spatial resolution, although the effect on CNR requires further study.

1. R. Rajapakshe, K. Luchka and S. Shalev, A quality control test for electronic portal imaging devices. *Med. Phys.* 23 (7) 1237-1244, 1996.

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