

# **Performance of solid-state image sensors in medical X-ray applications**

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## **Abstract**

During the last decade the conventional film screen in medical X-ray equipment is being replaced by digital detectors. These digital detectors consist of an energy converter, x-ray to photons or x-ray to electric charge, a gain element and a read-out device, e.g. CCD or CMOS detector.

In this tutorial the focus will be on indirect X-ray detection using a phosphorous applied on a fiber optic plate coupled to a CCD or CMOS detector. The influence of each separate element on the final image quality will be discussed.

In medical X-ray imaging the detective quantum efficiency (DQE) is an important parameter for defining the image quality and system performance. It is a measure of how well a detector is able to extract information from a beam of radiation. For high doses – in the quantum-noise limited regime – the DQE is independent of dose, but at low doses the DQE starts to decrease and hence it is a good indicator of the system performance at low radiation levels. The method to measure DQE will be explained. The effect of the performance of a solid-state image sensor on the DQE will be presented. The main items to discuss are the noise, quantum efficiency, charge capacity, pixel size and the binning feature. The presentation will end with a summary of the strengths and weaknesses of solid-state image sensors for medical X-ray applications.