Contribution ID: **64** Type: **Posters**

ACTIVE PIXEL SENSOR AS DOSIMETRIC DEVICE FOR INTERVENTIONAL RADIOLOGY

Tuesday, 29 November 2011 14:30 (1 minute)

Interventional Radiology (IR) is a subspecialty of radiology comprehensive of all minimally invasive diagnostic and therapeutic procedures performed using radiological devices to obtain image guidance. The interventional procedures are potentially harmful for interventional radiologists and medical staff due to the X-ray diffusion by the patient's body. The characteristic energy range of the diffused photons spans few tens of keV. Individual operators safety is very important and is performed via effective dose (whole body) and equivalent dose (hands, arms, legs, lens and thyroid) monitoring.
In this work we will present a study of CMOS Active Pixel Sensors as sensor elements for an X-ray dosimeter prototype, capable of real-time measurements, packaged in a small form-factor, with wireless communication and no external power supply to be used for individual operators dosimetry for IR procedures.

The performance of several sensors, both research prototypes and standard CMOS imagers have been studied in realistic Interventional Radiology conditions.
Two dosimetric quantities have been studied, the number of detected photons and the measured energy deposition. Both show a linear dependence with the dose measured by commercial dosimeters. The uncertainties in the measurement are dominated by statistic effects and can be pushed below 5%.

The acquisition frequency can be kept at 1 Hz thus allowing a fast enough dose rate measurement. The high sensor segmentation permits to measure high photon fluxes (tens of thousands of photons in each frame) without signal saturation.

Another desirable characteristic of Active Pixel Sensors is the sensitivity to low energy photons (down to few keV) considerably lower than the commercially available dosimeters, allowing to measure this radiation component, important for the evaluation of epidermis damages.

We conclude that CMOS Active Pixel Sensors could be used as sensitive element for X-ray dosimeter in the energy range characteristic of IR procedures.

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Session Classification: Poster Session: presentation of posters