

## DESIGN AND MEASUREMENT WITH A NEW PORTABLE X-RAY CAMERA

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We present a new color X-ray camera (Figure 1) for full field fluorescence imaging capable of time-, energy-, and space-resolved fluorescence measurements. This new device includes a high-speed pnCCD as energy-dispersive detector, driving electronic boards and a single-stage TEC for cooling the detector. A poly-capillary optics can be attached in front of a beryllium entrance window to enhance imaging capability. The type of the window can be adapted to the specific applications, e.g. for the detection of light elements. The housing is reasonably vacuum-sealed and can be operated as a standalone system or conditioned at regular intervals. The CCD operating temperature is around -25 °C, with the warm side of the TEC foreseen to be coupled to a water-cooled copper heat exchanger.

The pnCCD has an active area of 12.7 x 12.7 mm<sup>2</sup>, 264 x 264 pixels with 48 µm square pixel size. The column-parallel and split-frame readout enable frame rates up to 1000 Hz (equivalent to 70 Mpixel/s) and a maximum count rate of 1.5 Mcps. The spectroscopic performance at this count rate is 150 eV @ 400 Hz and 160 eV @ 1.000 Hz for Mn-K $\alpha$ . As the pnCCD is built on 450 µm thick fully-depleted silicon the quantum efficiency is high – it approaches 100 % in the 1 keV-10 keV range and still amounts to 35 % for 270 eV or 20 keV photons.

The camera is capable of fast acquisition of spatially and energy resolved fluorescence images. A dedicated software enables the acquisition and the online processing of the spectral data for all 69696 pixels, leading to a real-time visualization of the elements distribution in a sample. Measurements showing the capability of spatial oversampling leading to sub-pixel resolution (Figure 2), diverse results obtained with magnifying optics and spectroscopic (color) images are presented. The design and the performance characteristics of this novel X-ray camera are suitable for Full-Field XRF, fast TXRF imaging or XRD either as a standalone instrument or as a detector module to be integrated into a larger system. The newest version of the compact detector module will be introduced.



Figure 1: A color X-ray camera has been developed comprising a 48 µm pnCCD for fast X-ray imaging with good spectroscopic performance and subpixel spatial resolution.

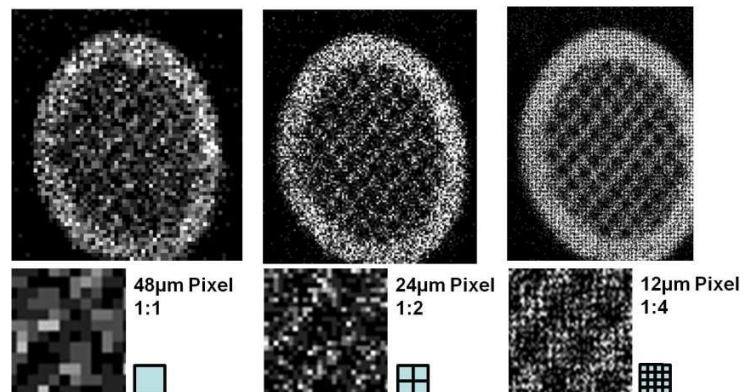


Figure 2: Measurement with the X-ray camera of a fine gold mesh showing the capability of subpixel resolution by means of pixel oversampling. A resolution of 17 µm is reached in accordance with the width of the poly-capillary optics.