A fast-readout CCD system for configured-detector imaging in STXM

G R Morrison[1], A Gianoncelli[1], B Kaulich[2], D Bacescu[2], J Kovac[3]

1. *Dept of Physics, King's College London, Strand, London WC2R 2LS*
2. *ELETTRA - Sincrotrone Trieste, I-34012 Trieste-Basovizza, Italy*
3. *Jozef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia*

The use of a transmitted x-ray detector in scanning transmission x-ray microscopy that has a software configurable response function makes possible the use of a number of simultaneous imaging modes, allowing both absorption and phase contrast to be derived from a single scan of the specimen [1].

This paper describes a practical system based around an electron-multiplying CCD system (iXon DV860 from Andor Technology) that combines fast frame-transfer readout with very high sensitivity. The detector consists of a Peltier-cooled CCD array of 128 by 128 sensors, and makes use of visible light coupling to a phosphor screen, to make it easy to operate over a wide range of photon energies, from the oxygen K edge upwards. It has been tested successfully on the Twinmic end-station at the Elettra synchrotron.

In essence, such a detector system records, for every pixel in the STXM raster, a map of the intensity distribution in and around the brightfield cone of illumination produced by the focusing optic in the STXM, resulting in a large volume of data from a single raster scan.. Simple real-time processing of these data yields absorption and differential phase contrast image signals, but more elaborate processing can subsequently be applied to the full 3-D dataset generated by the STXM scan. In combination with through-focal series, and the acquisition of image data on either side of an x-ray absorption edge, a configured detector system can provide a wealth of information about the complex transmittance of the sample.

[1] G.R. Morrison, W.J. Eaton, R. Barrett, P.S. Charalambous, J. de Physique IV **104** 547-550 (2003)