5th Italy-Australia Workshop:

"Synchrotron Radiation X-Ray Imaging for Life Sciences & Cultural Heritage"

Detector developments for Elettra and Fermi

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Mostly, the final data quality in X-ray imaging is limited by the performance of the X-ray detection devices utilized in this application. Basically two different classes of detectors are needed to retrieve quantitative data: firstly it requires devices that are able to monitor not only the incident photon intensity or radiation dose on the sample on a ppm level but also the beam position with submicron resolution- all this without altering the X-ray beam. Secondly it requires appropriate imaging detectors able to detect spatially resolved all those photons emerging from the sample preferable with single photon resolution and with a precision better than 1 %. In many cases high frame rates are needed.

Regarding the first class of detectors the performance of mono-crystalline chemical vapour deposit diamond detectors will be presented. Owing to the ultra fast response these solid-state detectors possesses the ability of beam position monitoring on the single bunch level at synchrotrons and FELs. Moreover, preliminary results obtained with a segmented InGaAs / InAlAs quantum well detector fabricated by the IOM CNR Laboratorio Tasc will be discussed. The quantum well detector allows monitoring simultaneously the intensity and the position of pulsed or continuous photon beams over an extended spectral range. In both cases two versions of the read-out electronics have been applied: charge integration with 1 ms frame rate and 20 bit dynamics and a system based on wide bandwidth (8GHz) radiofrequency amplifiers, able to analyze fast photon pulses.

With respect to imaging detectors a concept based on a large area low energy CMOS imagers at high frame rates for FEL based coherent scatter imaging and a large line scan CCD in time delay integration mode for medical imaging will be discussed.