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Detector Development at ELETTRA

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This work reports on the recent activities carried out by the Detector and Instrumentation Laboratory of Elettra Sincrotrone Trieste. Since both the Elettra synchrotron and the Fermi free electron laser are generating photons in the low to medium x-ray energy range from some eV to tenths of keV the activities of the detector and instrumentation laboratory focuses on spectroscopic and imaging photon detectors, which feature high quantum efficiency from below the carbon edge and are operated also in UHV environments.
Regarding low energy imaging detectors the PERCIVAL CMOS ('Pixelated Energy Resolving CMOS Imager, Versatile and Large'), currently under development by a collaboration of DESY, RAL, Elettra, PAL, DLS and Soleil, aims to address the need for such detectors for synchrotrons and free electron lasers in the soft X-ray regime. Its application to soft X-ray ptychography at the Twinmic beamline will be discussed.
Using the Twinmic beamline instrumentation, future possibilities in complementary imaging modalities, including in-situ atomic force microscopy and spectral imaging with custom-made monolithic and multi-element silicon drift detectors, will be discussed. It's noteworthy that a 64-channel detector utilizing the latter has been successfully commissioned at Elettra's XRF beamline.
Element-specific spectral imaging in the medium to hard X-ray energy range has garnered significant interest from the community. Examples of detector and optics based spectral X-ray phase contrast imaging and its translation to compact sources will be discussed briefly. Moreover, first results of a pixelated spectral THz imaging detector based on MEMs resonators will be presented as well.
The majorities of Elettra's soft x-ray beam lines are employing fast (4 M counts / sec, time resolution of some 10th of ps) and spatially resolving (< 60 µm) electron detectors and their associated readout electronics, which have been developed in-house and have been tailored to the specific needs of the respective beam line. In addition, devices for in situ beam diagnostics and dose monitoring for synchrotron radiation and FEL beams have been developed and are operated on a daily basis. Moreover, some recent results in basic research on room temperature semiconductors will be discussed.
In this presentation an overview of these devices and their application to specific scientific applications will be given and, in view of upgrade programs future directions, will be discussed.

I plan to submit also conference proceedings

No

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