

Monolithic Detectors for Modern Microscopies

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The scientific capabilities of new sources can only be fully realized with new detectors. Higher brightness, coherence, and improved energy, spatial and temporal resolution make new measurements possible, but only if the measurements can actually be made. Just as we use a variety of probe particles at different energies due to their diverse interactions with matter, numerous types of detectors are needed for the same reason. For X-ray energies below ~ 8 keV, the use of silicon sensors for direct detection has made dramatic improvements. Although a technicality, the manner in which the readout electronics are attached to the sensor enables or limits the detector performance. In the simplest approach, the sensor and the electronics are the same piece of silicon. Such monolithic detectors have pixels with comparatively little electronics per pixel, but with pixels which can be smaller and lower noise. This presentation will discuss monolithic detectors being developed at Berkeley Lab for use in storage rings, FELs and electron microscopes. Both CCD (Charge-Coupled Devices) and CIS (CMOS Image Sensors) technologies are used. Readout speed is often – but not always – the motivation, as small pixels have other advantages.