III-01

Pixel array detectors

Brian Rodricks
Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL 60439

Sandor L. Barna, Sol M. Gruner, John A. Shepherd, Mark W. Tate, and Robert L. Wixted
Department of Physics, Princeton University, Princeton, NJ 08544

This paper describes the development of a large area hybrid pixel detector designed for time-resolved synchrotron x-ray scattering experiments where limited frames, with a high framing rate, is required. The final design parameters call for a 1024 x 1024 pixel array device with 150 micron pixels, 100% quantum efficiency for x-rays with energy upto 20 keV, with a framing rate in the microsecond range. The device will consist of a fully depleted diode array bump bonded to a CMOS electronic storage capacitor array with eight frames per pixel. The two devices are separated by a x-ray blocking layer that protects the radiation sensitive electronics layer from damage. The signal is integrated in the electronics layer and stored in one of eight CMOS capacitors. After eight frames are taken, the data are then read out, using clocking electronics external to the detector, and stored in a RAM disk.

Results will be presented on the development of a prototype 4 x 4 pixel electronics layer that is capable of storing at least 10,000 20-keV x-ray photons for a capacity of over 50 million electrons with a noise corresponding to 2 x-ray photons per pixel. The diode detective layer, x-ray blocking layer, and electronics storage layer will be discussed.