Commercialization of an Ultra-Wide Dynamic Range Direct X-ray Detection System

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Synchrotron x-ray light source capabilities have outpaced current commercially available x-ray detectors. This detector deficiency is especially apparent in modern x-ray scattering experiments which require very large dynamic ranges or where the instantaneous count-rate exceeds 10^7 x-rays/pixel/s. This capability gap in the detector market leaves scientists unable to answer fundamental questions.

Sydor Technologies, in collaboration with Professor Sol Gruner's group at Cornell University, is commercializing an ultra-wide dynamic range x-ray detector based on Cornell's proven technology [1]. This detector has demonstrated single x-ray sensitivity with a dynamic range of greater than 10^8 10 keV photons/pixel/s with a read noise of 0.13 10 keV photons. The Sydor version is made from eight submodules that are tileable on all four sides to yield a 512 x 512-pixel imaging area. Each submodule consists of two custom application specific integrated circuits bump-bonded to a single diode with an integrated cooling system. The system generates on the order of 10 Gb/s of data and is capable of continuous operation at a 1 kHz frame rate. The electronics and mechanicals are engineered to readily allow the design to be scaled-up, enabling larger active areas and increased data bandwidth for faster framing future systems.

Preliminary data will be presented on the systems performance, and an overview of the design will be discussed.

[1] M.W. Tate, D. Chamberlain, K.S. Green, H.T. Philipp, P. Purohit, C. Strohman, and S.M. Gruner, "A medium-format, mixed-mode pixel array detector for kilohertz x-ray imaging," J. Phys.: Conf. Ser. **425** 062009 (2013).