# High-DQE Active Pixel Sensors for Electron Microscopy

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In this presentation we will discuss novel detectors for electron microscopy currently being developed at Lawrence Berkeley National Laboratory (LBNL). Monolithic Active Pixel Sensors (APS), first described in 1967 [1,2], have enjoyed a significant re-birth as cheap digital cameras and rivals to CCDs. This same technology is potentially interesting for electron microscopy, as APS offer excellent point-spread function, direct detection and high readout speed. An Active Pixel Sensor is a CMOS integrated circuit, with an imaging region divided into pixels, and a signal processing region. The pixels are "active" as they contain transistors used for buffering the charge collected and steering it.

Active Pixel Sensors for charged particle tracking are being explored by the high energy physics community as a next generation, low mass, tracking device. The feasibility of APS for electron microscopy has been explored by several authors[3,4] and in this presentation we will report on the first designs specifically targeted to electron microscopy. We have tested several circuits, with different pixel design and fabricated in different technologies. Results are consistent with simulations, demonstrating a very small point spread function and good single electron sensitivity.

Simulations and results will be presented, along with a discussion of the types of experiments enabled by these detectors.

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[2] P. Noble, ."Self-scanned image detector arrays"., IEEE Trans. Electron Devices,vol. **ED-15** (1968) 202.
[3] NH Xuong, et al. "First use of a high-sensitivity active pixel sensor array as a detector for electron microscopy", Proc. SPIE, **5301** (2004) 242.
[4] A.R. Faruqi, D. M. Cattermole and C. Raeburn, Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, **513** (2003) 317.