

# A direct electron detector for electron microscopy based on EMPIX2 ASIC

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EMPIX2 is a novel hybrid pixel detector readout ASIC for electron microscopy with a maximum frame rate of 100 kfps and a very large dynamic range[1]. It features 128 x 128 square pixels at a pitch of 150  $\mu\text{m}$ . The ASIC was bump bonded to 500  $\mu\text{m}$  thick silicon pixel sensor and tested.

Based on the EMPIX2 detector testing system, we designed and assembled a prototype camera for electron microscope. it is mounted on a TECNAI F20 electron microscope (see Fig.1) and we did lots of experiments to evaluate the performance of the camera. Currently, limited by the data acquisition system, this camera can operate stably at half the highest frame rate, that is 50 kfps. In TEM mode, a flat field beam is used to vertically illuminate the camera, and the gain and offset of the detector are corrected pixel by pixel through scanning the exposure time to compensate the inconsistency of each pixel.

After completing the calibration of the gain, we test the detector response to low-dose electrons, and the results showed that it has good single electron resolution. Through edge imaging, we obtain the MTF and DQE of the detector. Fig.2 shows flat-field images of a pin, the edge of the pin is clear. We are conducting more experiments and expect to display more electron microscopy images of some typical materials or samples.



Fig.1 The Experimental environment.

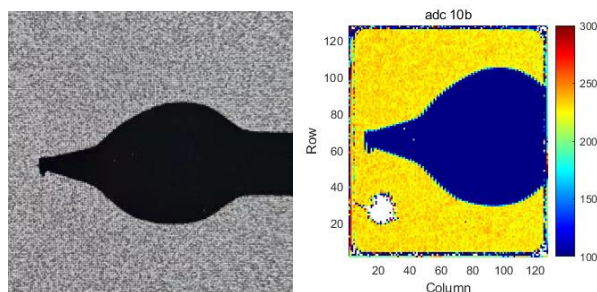


Fig.2 Flat-field images of a pin, left is pattern on a CCD-based camera and right is pattern recorded by EMPIX2 detector (The defect around and at the lower left corner are some obstructions above the sensor).

[1] <https://doi.org/10.1088/1748-0221/18/12/C12007>.