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First Results from a Novel CMOS Detector Optimised for 100keV CryoEM

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Improvements in electron detection have had a significant positive impact on the quality of biological structures resolved by cryogenic electron microscopy (cryoEM). Using high detective quantum efficiency (DQE) direct electron detectors, researchers are now able to solve structures more quickly and more easily than was previously possible. To date, the majority of structures deposited in the Electron Microscopy Data Bank with resolution below 3Å were determined using 300keV electrons[1,2]. However, Transmission Electron Microscopes (TEMs) capable of operating at 300keV are expensive to purchase and maintain, putting them out of reach for many researchers and presenting a barrier to discovery[3]. 100keV TEMs offer the potential for a more democratic route to structure determination, though at the present time there is a paucity of suitable direct electron detectors optimized for 100keV operation[4]. It has been observed that for relatively thin samples (~300Å), typical of biological cryoEM specimens, the information coefficient is at its maximum at 100keV[5].

Here, we present initial results from a novel CMOS detector optimized for 100keV electrons. The sensor is of gapless, stitched CMOS construction with pixels at 50µm pitch and operates at a rate of 2000 frames per second. It is ready to be scaled to a large active area of 2048x2048 pixels.
We will show results from our experiments characterizing the sensor using 100keV electrons. Figures for DQE and MTF will be provided. A Landau distribution showing 100keV and 60keV electrons incident on the test sensor is seen in figure 1 [6].

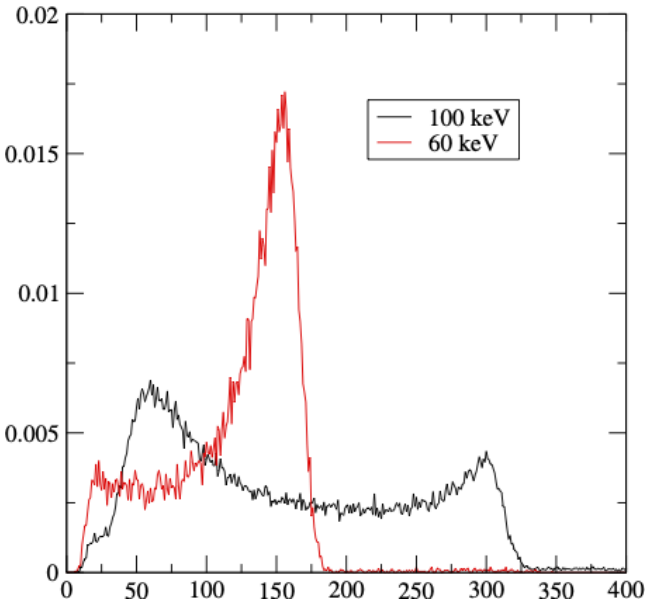

Figure 1. Landau distribution of test sensor

References:

[1] MA Herzik, M Wu, and GC Lander, Nat. Methods **14** (2017). doi: 10.1038/nmeth.4461
[2] EMDB, 'Electron Microscopy Data Bank', Electron Microscopy Data Bank. https://www.ebi.ac.uk/emdb/ (accessed Feb. 16, 2022).
[3] KR Vinothkumar and R Henderson, Q. Rev. Biophys. **49** (2016). doi: 10.1017/S0033583516000068.
[4] K Naydenova et al., IUCrJ 6 (2019). doi: 10.1107/S2052252519012612
[5] M Peet, R Henderson and CJ Russo, Ultramicroscopy **203** (2019). doi: 10.1016/j.ultramic.2019.02.007
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