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The Development of the LPD Pixel Detector at RAL

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The UK Science and Technology Facilities Council (STFC) delivers detector systems to large scale scientific facilities both in the UK and world-wide. It achieves this through a combination of central laboratory and university led projects and wider generic research and development programmes.

As part of this programme RAL recently delivered the Large Pixel Detector[1] (LPD) to the European XFEL project in Hamburg. The LPD is one of several large area megapixel scale x-ray detectors that have been designed for the first XFEL beamlines. The LPD has been developed in close collaboration with scientific instrument FXE [2] to meet their demanding pump-probe experiments on ultrafast timescales. The complete system has been assembled from custom silicon sensors and ASICs as well as programmable data acquisition cards, other supporting electronics, mechanics and cooling. The required large detector area was then achieved by tiling multiple units that operate in parallel. The LPD system features a large in pixel memory depth of 512 multiple gain images that can be stored and accessed with a flexible readout system. Data is then transferred off the detector head in between x-ray pulses with an accompanying high rate data acquisition system >10 GB/s.

The delivered detector has been demonstrated to be capable of operating with a frame rate of 4.5MHz and record images with a dynamic range of 1:100,000 photons whilst maintaining low noise. The performance of the complete system will be presented along with first images from LPD at the FXE beamline. The presentation will include lessons learned in the development process as well as upgrade ideas for the future.

References:

[1] A. Koch et al. "Performance of an LPD prototype detector at MHz frame rates under Synchrotron and FEL radiation", JINST , vol. 8, pp. C11001-10, (2013).

[2] <http://www.xfel.eu/research/instruments/fxe>

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