Precession electron diffraction using a direct electron detector

Ian MacLaren[1], Damien McGrouther[1], Sam McFadzean[1], Enrique Frutos-Myro[1], JK Weiss[2], Doug Cosart[2], Jing Lu[2], Joaquim Portillo[3,4], Alan Robins[3], Stavros Nicolopoulos[3], Eduardo Nebot del Busto[5] and Richard Skogeby[5]

[1]University of Glasgow, UK, [2]NanoMEGAS USA, USA, [3]NanoMEGAS SPRL, Belgium, [4]Universitat de Barcelona, Spain, [5]Quantum Detectors Ltd., UK

Small fast direct electron detectors have revolutionised STEM imaging and scanned diffraction in recent years, enabling the rapid acquisition of high quality diffraction patterns in a scan, and thereby allowing applications like phase contrast imaging via ptychography, differential phase contrast imaging, lattice strain mapping, imaging of 3D periodicity in crystals, and many more applications. Scanning precession electron diffraction (SPED) has meanwhile emerged as a critical tool for mapping crystal phase and orientation distributions, and for strain mapping up to length scales measured in microns. However, SPED has hitherto been limited by the noise on the detector system used – a fast video camera imaging the phosphor screen of the microscope. Thus, upgrading to a direct electron counting detector as the recording device is the obvious logical next step for the technique and would improve both acquisition speed and reduce the number of electrons needed for an acceptable quality set of diffraction patterns for quantitative evaluation. In this talk, I will cover recent developments in integrating an electron counting detector into a scanning precession electron diffraction system, give an overview of results and benchmark tests of the system performed to date, and give an outlook of the prospects for the use of this system in nanoscale characterisation of crystalline materials.