Poster

The micro/nanofocus crystallography beamline VMXm at Diamond Light Source

A. J. Warren1, J. Trincao1, A. D. Crawshaw1, G. Duller1, G. Evans1

[1]Diamond Light Source, Diamond House, Harwell Campus, Didcot, OX11 0DE. UK anna.warren@diamond.ac.uk

The Versatile Macromolecular Crystallography Microfocus (VMXm) beamline is a new micro/nanofocus beamline joining the suite of macromolecular crystallography beamlines at Diamond Light Source. The beamline is now accepting users and has been designed to enable rotation data collection from microcrystals down to 0.5 microns in size and took its first users in Autumn 2018. The beamline optics deliver a beamsize of 0.4 - 10 μm vertically and horizontally between 1.5 - 5 μm to the sample position. The beamline operates at energies between 6-28 keV, delivering ~10^{12} ph/s to the sample (at 12.5 keV). The beamline is equipped with two detectors, a Pilatus3 6M (Si sensor) and Eiger2 X 9M (CdTe sensor) which are fully interchangeable. With the CdTe detector the quantum efficiency of the detector is improved at higher energies compared to the Si detector. With this in mind, photoelectron escape can be exploited in microcrystals using higher energy data collections, and this in turn can prolong the lifetime of the crystals in the beam.

In combination with the development of the beamline, an important aspect of successful data collection is to ensure that crystals have been mounted in the most optimal manner. Microcrystals are prepared on electron microscopy grids using techniques borrowed from cryo-EM. Samples are prepared in advance using the VMXm support laboratory, with grid preparation being validated through image visualization in an offline Scanning Electron Microscope (SEM). Once grids are introduced to the beamline, crystals are visualized and aligned to the X-ray beam using either an on-axis optical microscope or a built-in SEM. Signal to noise of the diffracted X-rays is greatly improved due to the mounting technique of the crystals, and the samples being held under vacuum for diffraction measurements, reducing background scatter to a minimum.

Due to the prolonged lifetime of the crystals in the beam owing to photoelectron escape, and the mounting of the crystals in vacuum, the beamline can push the limits of what is traditionally possible for macromolecular crystallography at a synchrotron source, moving towards what might be expected from serial XFEL experiments.

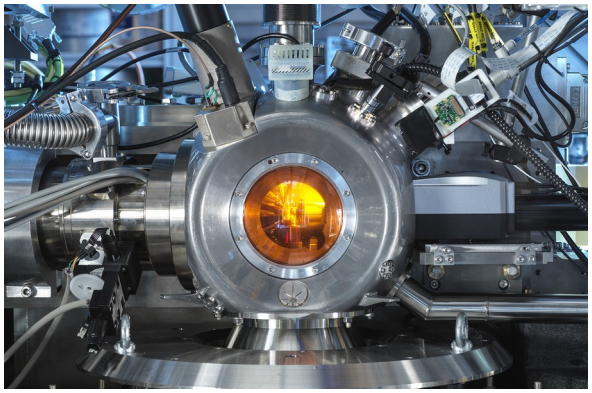

Figure 1. The VMXm sample vessel where data collections are carried out under vacuum