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Developing Bragg Coherent Diffractive Imaging for Biological crystals at the Advanced Photon Source

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Bragg Coherent Diffractive Imaging (BCDI) of radiation hard crystals (e.g. lead, gold) is now a relatively mature technique for characterising elastic strain fields at the nanoscale. The technique relies upon the fact that coherent diffraction from a crystal produces a continuous intensity distribution around every Bragg peak; if sampled correctly, this information can be used to reconstruct the crystals three-dimensional complex density. The corresponding phase of the density is related to the elastic strain which provides information on the atomic displacements within the crystal lattice (Pfeifer et al, 2006).

For protein crystals the presence of strain and disorder within the crystal can have a critical influence on the size of crystal that can be grown and the quality of diffraction data that can be collected. Hence, our group has recently been applying BCDI to the high-resolution characterisation of elastic strains in micron-sized protein crystals. One of the major experimental challenges with such samples is that they are highly radiation sensitive; however the combination of cryogenic temperatures and photon counting detectors offers a possible solution.

Here we present the first BCDI results collected from protein crystals of Lysozyme measuring ~3.5 microns in diameter using the newly developed cryo-BCDI setup at beamline 34-ID-C at the Advanced Photon Source. Our preliminary reconstructions from the BCDI data are promising, and pave the way for strain analysis of crystals composed of more complex proteins in future experiments.

Pfeifer, M. et al(2006).Nature,442(7098),63–6.

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