

Coherent Hard X-ray Bio-imaging at Diamond & Diamond II.

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The key advantage of using hard X-rays (>4keV) for imaging biological material is that it enables the study of thick specimens (>10 microns) at resolutions approaching 20 nm. This is especially important when examining features which extend over long distances such as nerve fibres in the brain. The use of coherent x-rays for such studies is a key part of the case for upgrading existing machines and constructing new brighter synchrotron sources. Due to the complexity of biological cells and tissue, it is expected that 3D images will be essential for the reliable interpretation of structures in thick specimens.

A description of the status of coherent hard x-ray bio-imaging at Diamond will be given together with plans for exploiting the increased coherent flux which will be available within the Diamond II project. This will provide a new machine lattice, up to 5 flagship beamlines and upgrades and enhancements across all instruments.

Issues to be covered will include:

- Recent developments at the coherent imaging beamline I13-1
- A dedicated coherent hard x-ray bio-imaging beamline on Diamond II
- The need for cryo-cooling for both frozen hydrated and fixed, stained material
- The use of the term resolution for studying material which includes features with a wide range of different contrast.
- Examining thick specimens beyond the depth of focus limit.
- Whether the very high time averaged coherent flux on XFEL sources could be used for coherent imaging.

The aim is to stimulate discussion about these issues.

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