I13-2

Diamond Manchester Imaging Branchline

I13 is dedicated to imaging and coherence related experiments and has been designed to support a broad range of scientific users from biomedicine, materials science, geophysics, astrophysics, archaeology and engineering applications.

It is housed in a building 250 metres away from the main ring building, and similar to other beamlines at Diamond, it exploits Diamond's brilliant X-rays and utilises them in two ways via X-ray Imaging (I13-2) and Coherence (I13-1) branch lines.

These branch lines provide different tools, which can run simultaneously and independently from each other, for non-destructive examination of internal features ranging from the micrometre to the nanometre length scale.

The Imaging branch performs in-line phase contrast imaging and tomography over a large field of view in the 6-30 keV energy range. The spatial resolution for this technique is in the micron range.

Micro-imaging

Images are recorded with resolutions up to circa 1 µm and a choice of magnifications.

Detector	pco.4000	pco.edge 5.5	pco.dimax S
Objective lens	2x 4x 10x	2x 4x 10x	2x 4x 10x
Total magnification	4x 8x 20x	4x 8x 20x	4x 10x 20x
Effective pixel size / µm	2.3 1.1 0.45	1.6 0.81 0.33	2.8 1.1 0.55
Field of view / mm	9.0 x 6.0 4.5 x 3.0 1.8 x 1.2	4.2 x 3.5 2.1 x 1.8 0.83 x 0.70	5.5 x 5.5 2.2 x 2.2 1.1 x 1.1

High image quality

pco.4000

Scintillator-coupled detector
4008 x 2672 pixels
Pixel sixe: 9 µm x 9 µm
Dynamic range: 5,455:1
Maximum frame rate at full resolution: 5 Hz
Exposure time: 5 µs – 49 days
Low noise

High image quality

pco.edge 5.5

Scintillator-coupled detector
2560 x 2160 pixels
Pixel sixe: 6.5 µm x 6.5 µm
Dynamic range: 27,000:1
Maximum frame rate at full resolution: 100 Hz
Exposure time: 500 µs – 2s
Very low noise

High speed

pco.dimax S

Scintillator-coupled detector
2160 x 2160 pixels
Pixel sixe: 11 µm x 11 µm
Dynamic range: 1,600:1
Maximum frame rate at full resolution: 1,279 Hz
Exposure time: 1.5 µs – 40 ms

I13-2 APPLICATIONS

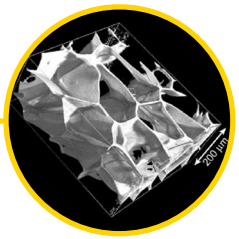
Bio-Medical Research

- Characterise the performance of injectable bone substitutes in promoting bone growth;
- Investigate cochlea structure to understanding hearing;
- Imaging of soft tissues including muscles.

Energy

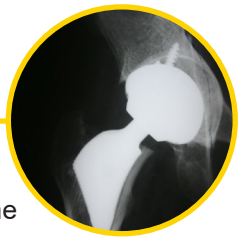
- Probe of lithium ion batteries;
- Image structures in nuclear storage materials.

Novel Imaging Techniques



- Study the effect of drugs on living cells;
- Follow the effects of biological processes on the cell e.g. starvation;
- Monitor cell regulation processes;
- Investigate impact of nanoparticles on cells.

Materials



- Study the size distribution of aluminium grains in polycrystalline materials;
- Follow crack propagation in engineering materials;
- Image pharmaceutical samples in their manufactured form;
- Dendritic growth of aluminium-tin alloys.

For further information

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