Micro- and Nano-Imaging and Tomography at the Diamond Light Source (DLS) I13 Beamline

Shashidhara Marathe(shashidhara.marathe@diamond.ac.uk)[1], Malte Storm[1], Silvia Cipiccia[1]
Darren Batey[1], Marie-Christine Zdora[2], Andrew Bodey[1]
Xiaowen Shi[1], Christoph Rau[1]
[1]Diamond Light Source, Harwell Science and Innovation Campus, Didcot, OX11 0DE, UK, [2]Diamond Light Source, Harwell Science and Innovation Campus and Department of Physics & Astronomy, University College London, UK

Abstract

The I13 beamline of DLS is a 'long' beamline situated about 250 meters from the synchrotron insertion device undulator source and housed outside of the main synchrotron building. The beamline has two independent branch-lines called I13-Imaging and I13-Coherence, with two separate canted-undulator sources covering an X-ray energy range of 6-30 keV. I13-Imaging branch is funded in collaboration between Diamond and the University of Manchester and also called Diamond-Manchester branchline. Because of this long propagation distance from the source the X-rays have very high spatial coherence. Both branches are fully operational with user proposals being accepted twice a year for consideration [1].

In the I13-Imaging branch we routinely perform micro-tomography and propagation based phase contrast Imaging. The beamline is capable of running in monochromatic mode (using Si (111) Double Crystal Monochromator (DCM) and Multi-Layer Monochromator (MLM)) as well as the polychromatic mode called 'pink beam'. Element specific, high contrast imaging is done using the monochromatic mode whereas the fast and dynamic imaging is carried out using pink beam. A full-field X-ray microscopy with 50-100 nm resolution and relatively large field of views of 50-100 um is under development and will be soon available to users. X-ray Grating Talbot Interferometer (XGTI), a multi-modal quantitative phase contrast imaging technique can also be performed at both branches. The I13-Coherence branchline mainly focuses on reciprocal space imaging: 3D ptychography, Bragg-CDI, Bragg ptychography and in the energy range of 6-20 keV. The spatial resolution is tens of nanometers and field of view up to hundreds of microns in 2D [2]. Many present day soft materials and futuristic materials such as bio-composites or man-made composite materials contain structures at different length scales and I13 beamline is perfectly suited for imaging these samples with multi-mode and at multi- length scale.

Keywords: *micro-tomography, X-ray Microscopy, Coherent Diffraction Imaging (CDI), ptychography, tomography, X-ray Grating Talbot Interferometer (XGTI)*

References

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Biography

Dr. Shashi Marathe did his Ph.D degree in Gwangju Institute of Science and Technology (GIST), South Korea. His research topic was Coherent Diffraction Imaging (CDI). In 2011, he joined optics group of Advanced Photon Source (APS), USA as a postdoctoral fellow. In 2015, he joined Diamond Light Source (DLS) as Senior Scientist where he is presently working. His areas of interest are phase contrast imaging, dynamic X-ray imaging, diffraction imaging and X-ray optics & wave-front characterization.