11A, 2C/2010G065

Blurred Image Correction in Soft X-ray Projection CT Microscopy - Comparison among radiation light sources -

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Introduction

Blur-correction of observed images on a soft X-ray projection CT microscope by iteration procedure has been continued [1]. Our study improves the precision of blur-correction and extends its application to biological specimens. In the recent study, our correction analysis was mainly carried out using a bending magnet line (BL11A), while more coherent beam would be more effective in the blur-correction of the observed images. Last year, we conducted the experiment at BL2C, which is an undulator beam line, in addition to BL11A. In this report, comparison of the blur-corrected images among several radiation light sources of soft and hard X-rays was discussed.

Results and Discussion

We used different radiation sources, BL11A, BL2C of Photon Factory, and BL20XU of SPring-8. BL11A is a bending magnet beam line ranging from 70 to 1900eV. BL2C is an undulator line covering photon energies of 250-1400eV. BL20XU is a hard X-ray undulator line at SPring-8. The observation of a biological sample such as chromosome is one of our targets. The projection microscope enlarges the image of the sample due to the layout of the zone plate, sample and CCD. The projection procedure easily magnifies the image, while it causes the blur image with Fresnel fringes.

The comparison of the blur-correction among the above three beams is conducted by using non-biological test samples. Figure 1 indicates the blur-correction of latex particles of 2.8μmϕ, which is observed at 700eV at BL11A. The adjacent particles were clearly reconstructed by the blur-correction. The particle size was matched with the nominal value. The spatial coherence of BL11A is not so high and the intensity distribution fluctuates temporally. The iteration procedure acted correctly to remove the fringes (blur). The undulator lines of BL2C and BL20XU are of high coherence and intensity. The Fresnel fringes were more clearly observed as shown in Fig.2 and 3. At BL2C with the energy of 500eV, a glass capillary of 5μmϕ could be reconstructed as its image contrast depended on the glass thickness. The edge of Au Mesh observed at 8 keV was clearly reconstructed at BL20XU. These blur-corrections were more rapidly converged than the BL11A data. It is because of the coherency of radiation source. Our study is focusing on the compensation of the missing fringe information.

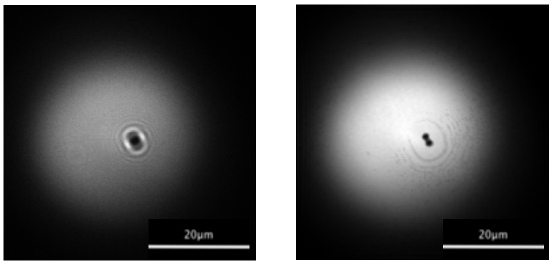

Fig.1 Blur and corrected images (latex particle of 2.8μmϕ) observed at the Photon Factory BL11A.

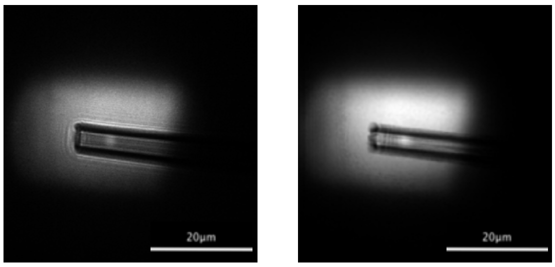

Fig.2 Blur and corrected images (glass capillary of 5μmϕ) observed at the Photon Factory BL2C (Undulator line).

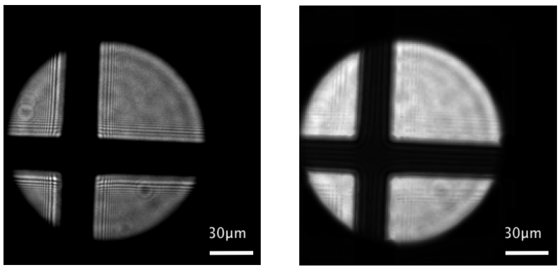

Fig.3 Blur and corrected images (Au Mesh) observed at the SPring-8 BL20XU.

References

[1] T. Shiina et al., Annual meeting of Japanese Society for Synchrotron Radiation Research, Proceedings, pp. 139, 2012.

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