Performance of the macromolecular crystallography short-gap undulator beam line BL-17A at the Photon Factory

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Four new short straight sections were created as part of the "Straight-Section Upgrade Project" of the Photon Factory during a six-month shutdown in the first half of FY2005. A new short-gap undulator, SGU#17, was designed for one of the short straight sections. With the high brilliance beam derived from SGU#17, we have proposed two advances in the field of structural biology: micro-crystal structure analysis and structure determination using softer X-rays.

After the completion of BL-17A, we successfully delivered the first beam on Oct 7, 2005. Then, we started alignment and commissioning of the beam line. The preliminary performance is as follows. The focused beam size (FWHM) with the K-B mirror system is about 32.9 μm (V) x 234 μm (H). The photon flux at 12.4 keV after the collimation slit of 100, 40 and 20 μm^2 are $7.7x10^{10}$, $2.2x10^{10}$ and $6.7x10^{9}$ photons/sec, respectively. This preliminary result is about 60 % of the expected performance and it could be improved by optimizing the setting of the undulator and beam line optics.

A single-axis diffractometer was designed with the final goal of 100 to 200 nm rotation error for micron-size crystals. We started test experiments in April of 2006. We will describe the optical design and preliminary performance of the beam line, and the results of the test experiments using small crystals and softer X-rays.

The BL-17A is still under improvement although very promising results have already been obtained. Further optimization of the optics, stabilization of the beam position by feedback system and tuning of the diffractometer will be integrated into the user friendly experimental environment, and micron-crystal structure analysis and structure determination using softer X-ray will become routine at the BL-17A.