Tuning of the Bio-Crystallography Beamline

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The Bio-Crystallography beamline was opened for public users from the last October. The purpose of our project is to tune the whole beamline for convenience of the users. The light source is a SPring-8 standard undulator with a magnetic periodicity 3.2 cm. The energy range of fundamental emission is from 6 keV to 18 keV, and that of third harmonics is from 18 keV to 54 keV. After commissioning of the undulator by the Insertion Device Group of JAERI-RIKEN Project Team, highly brilliant X-rays were available from 9 keV to 38 keV for the routine crystal structure analysis of biological macromolecules. The structure analysis with the multiple isomorphous replacement technique with optimized anomalous scattering (MIR-OAS) is the first priority target of our beamline commissioning.

Front end elements such as graphite filters, apertures, an absorber, X-Y slits and a Be window were tested together with the Front-End Group of the Project Team. The rotated-inclined double crystal monochromator (RIDCM) in the transfer channel was tuned by ourselves. The water cooling pin-post structure of the RIDCM removed high heat load up to 2 kW at the storage ring current of 20 mA. Although the RIDCM worked enough as a cooling device, its performance as an X-ray optics element was not so excellent. The distortion of Bragg net plane, introduced at the pin-post construction, diverged reflected X-rays in horizontal direction twice compared with the ideal value. The energy resolution of the RIDCM has not yet been tested.

Since the undulator is installed at a high-β section of the storage ring, the source profile has a spatial anisotropy. In order to achieve a quasi-isotropic beam profile at sample position, the Bio-Crystallography beamline utilizes two X-ray mirrors in the KB configuration. That is, the mirror bending parameters can independently be controlled. This was favorable to realize a focused beam smaller than 0.2 mm (FWHM) in vertical and horizontal directions. Using the KB mirror system, high brilliance beam at wavelength of 1.0 A was obtained over a flux of 10^{12} phs/sec at a beam size of 0.1 mm.