Structural Biology II (BL40B2)

1. Introduction

We have started to construct on a new beamline BL40B2 in the D zone of the SPring-8 storage ring for structure biology. Professor Yoji Inoko of Osaka University and his Macromolecular Small Angle X-ray Scattering group basically proposed the idea for the beamline. The Public Beamline Committee of JASRI approved the construction while mentioning the importance of supplying protein crystallography capabilities. Especially Dr. Shunji Goto and Dr. Kunikazu Takeshita of JASRI [1] made strong efforts in drawing the blue prints for the beamline optics and X-ray protection hutches. This paper presents the current status of the experimental station for BL40B2.

2. Basic Concepts for Experiments

The purpose of the beamline in the area of small angle scattering is to record the monochromatic scattering from non-crystalline biological materials by using a tunable beam with wide ranges for resolution and X-ray energy. For protein crystallography, the purpose of the beamline is to collect monochromatic data for routine macromolecular structure analysis. To facilitate energy changes, beam alignment, and sample setup, all R & D issues have been removed.

Areas of Research: small angle scattering, recording the monochromatic scattering from non-crystalline biological materials, protein crystallography, collecting the monochromatic data for routine macromolecular crystallography.

3. Beam Supplied to the Experimental Station

The location of BL40B2 is in the D2 zone of the SPring-8 storage ring. The light source is a B2 type bending magnet that has its magnetic field at 0.679 T and critical energy at 28.9 keV. The white X-ray generated by the bending magnet is introduced into the optical system composed of a fixed-exit double crystal monochromator and a bent cylinder mirror.

According to the calculations by Dr. Goto, the optimal glancing angle is 3.2 mrad at a distance between the light source and miller of 38,015 mm and in the energy range from 5 keV to 20 keV. The expected photon flux is approximately 10^{12} ph/s in 0.1 % b.w. at 20 keV. The expected energy resolution is 10^{-4} ($\Delta E/E$). Lead sealed hutches has made the optics and experimental facilities X-ray proof.

4. Experimental Station

The experimental station has two experiment modes: the SX mode and PX mode. Both modes use an imaging plate area detector, Rigaku R-AXIS IV. In the SX mode, the X-ray beam is orthopediated by an extra quadrant slit in the beamline optics, and excess scattering is removed by the quadrant slit in the experimental station. Two fixed length vacuum paths allow camera lengths of 400 mm and 1,000 mm. In the PX mode, an inverted geometry goniometer is installed to allow some free space around the crystal.

The facilities in the experimental station are as follows. (A) Measurement: quadrant slit, shutter attenuation, gas-flow type ion, beam path with down stream shutter, on-line imaging plate detector (detector area 300 × 300 mm^2), scintillation counter for measurement of absorption edge, high speed X-ray shutters. (B) Sample: sample stage, cryostat, temperature control range 80 ~ 375 K. (C) Control: workstation for control and data collection. (D) Other: automated crystal centering and axis-set, microscope.

References

[1] S. Goto, *et al.*, J. Synchrotron Rad. **5** (1998) 1202-1205.