Hyogo BL (BL24XU)

1. Introduction

The Hyogo beamline BL24XU has been constructed for protein crystal structure analysis, surface/interface analysis of inorganic materials, X-ray microbeam analysis, and the development of X-ray imaging. To perform these studies, this beamline includes the following characteristics. 1) Employing a figure-8 undulator [1], horizontal and vertical polarized X-rays can be obtained in a wide energy range. 2）Two monochromators with diamond crystals adopt so-called troika conception to simultaneously perform three experiments for different purposes. 3) Monochromatized or white X-rays can be utilized in experiment hutch C.

The construction of this beamline has been completed in May 1998, and commissioning has been finished in September 1998.

2. Beamline

The in-vacuum type figure-8 undulator, which provides both horizontally and vertically polarized X-rays, has been chosen as the light source. The horizontally/vertically polarized X-rays are obtained with integer/half-odd-integer harmonics.

Since some of the front end standard components are unable to endure a high heat load by the intense beam from the undulator, new components developed by the SPring-8 front end team have been installed last winter.

All of the transport components and three double crystal monochromators (A, B, and C in Fig. 1) are placed in the optics hutch. To simultaneously carry out three experiments for different purposes, the first crystal also functions as a beam splitter. Monochromator C with Si crystals has a mechanism with which the first crystal can be put on or off the beam axis, so that either the monochromatic or white experimental mode can be operated. Water cooled slits and view ports are installed upstream and downstream of each monochromator. To restrain high energy gamma rays, a white shutter is put downstream of monochromator C (in detail, see [2]).

3. Commissioning

The commissioning of the undulator, front end components, optics hutch, and experimental hutch C have been carried out during May and June in 1998. The radiation power of the figure-8 undulator is too complicated to determine the beam axis only from the power distribution. In general, the harmonics spectra of the undulator are hardest at the on-axis position. Accordingly, the beam axis has been determined by measuring such spectra as a function of the front end xy slit position. Figure 2 shows spectra obtained for different vertical positions of the xy slit. Few spectral differences have been observed in the horizontal direction owing to the large beam emittance in this direction. Therefore, the beam axis in the horizontal direction has been decided at the maximum flux position. Successively, the optical adjustment of monochromator C has been done and rocking curves almost identical to theoretical ones have been observed as shown in Fig. 3.

The commissioning of the monochromators A and B have been carried out and radiation surveys around the experimental hutches A and B have been completed in September 1998. An observed rocking

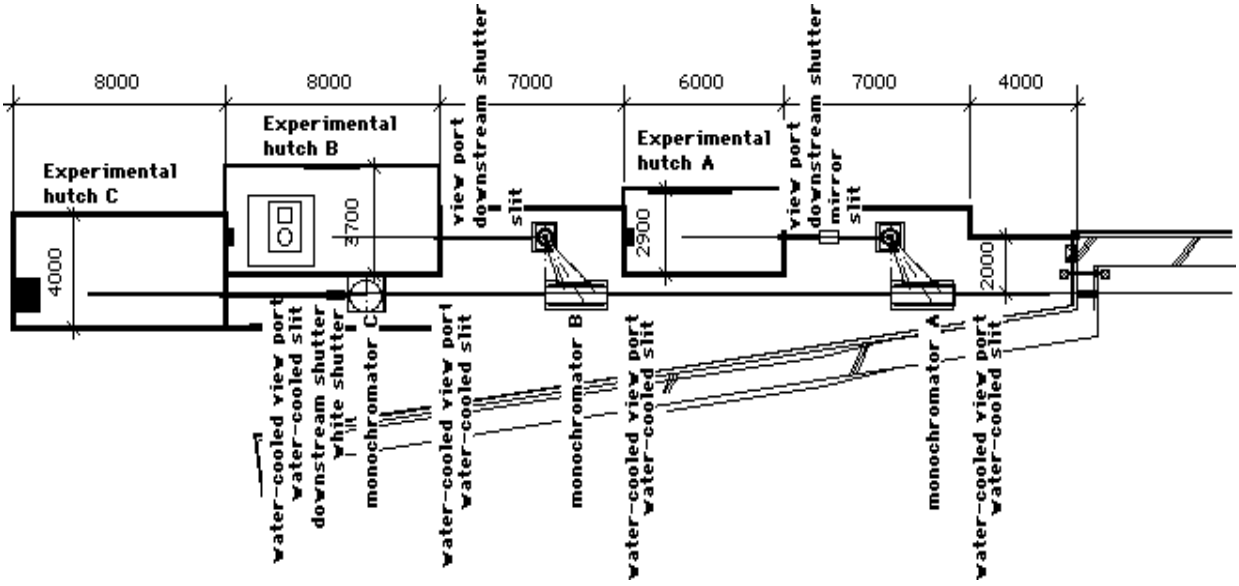

Fig. 1. Plan view of the Hyogo beamline.

curve is shown in Fig. 4. The FWHM of the rocking curve is almost the same as the theoretical one.

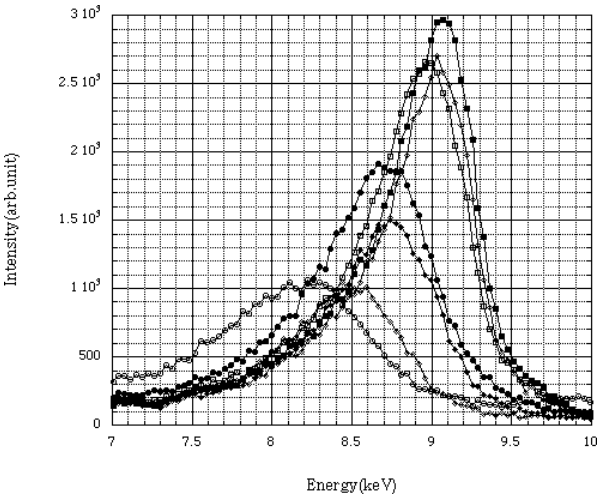

Fig. 2 First harmonic spectra measured by an SSD. The undulator gap is 10.5mm.

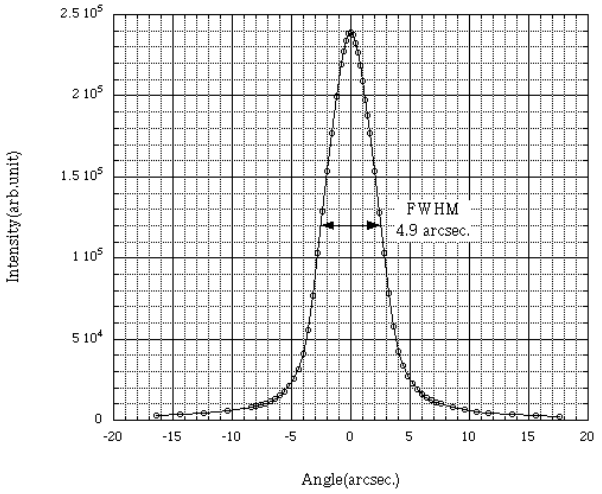

Fig. 3. An observed rocking curve of monochromator C for Si 111 Bragg reflection. The X-ray energy is 16 .2 keV.

In the present operation mode, the undulator gap is fixed at 11.3 mm, and X-rays with an energy of 15/10 keV (1.5/1 harmonics) are provided to experimental

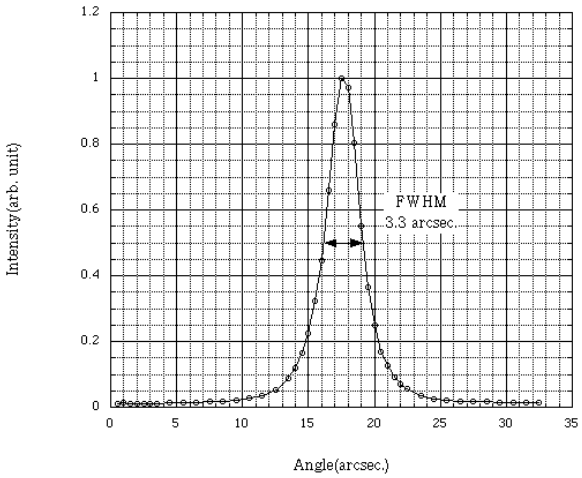

Fig. 4 An observed rocking curve of monochromator B for diamond 220 Bragg reflection. The X-ray energy is 9.4 keV.

hutches A/B. In hutch A, the adjustment of the diffractometer has been completed and various protein crystals have been analyzed. In hutch B, the commissioning of the surface/interface analysis apparatuses has been almost finished. Refraction contrast X-ray imaging, microbeam analysis, and other experiments are now being carried out in hutch C.

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References

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[2] J. Matsui *et. al.*, SPring-8 Annual Report 1997, 125 (1997)