JAERI Beamline III (BL11XU)

1. Introduction

The third beamline of JAERI, BL11XU, is for material sciences using synchrotron radiation from an insertion device. BL11XU conforms to a standard undulator beamline at SPring-8. The insertion device is a standard in-vacuum type linear undulator with source characteristics of λ_u = 32 mm, N = 140 periods, tunable energy range about 5 ~ 70 keV using first, third and fifth harmonics X-ray, and linear polarization. The front end components are in accordance with other beamlines, but a novel X-ray beam position monitor is installed in front of the fast closing shutter (FCS) for one of the R&D projects.

The outside appearance of BL11XU is shown in Fig. 1. This beamline consists of one optics hutch and three experimental hutches. The length of the beamline at the experimental hall is 37 m, and the total length of the beamline (from the X-ray source point to the end of the experimental hutch 3) amounts to 70 m.

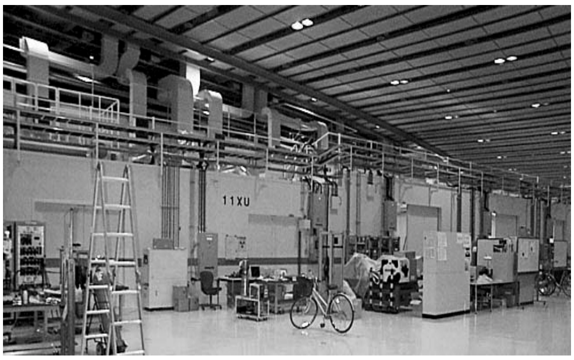

Fig. 1. Outside appearance of BL11XU.

We have mainly developed four experimental plans for this beamline. Details have been reported elsewhere [1,2].

2. Beamline Construction

Planing of BL11XU construction began in 1996. The front end was designed and produced in the same year. In 1997, the insertion device was designed and produced, and the front end was installed and adjusted. The next year the insertion device was installed and adjusted. At the same time, a transport channel, interlock system and beamline control system were designed, produced and installed. Then the beamline was constructed at the end of October in 1998.

This is the first case of beamline construction in user experimental time. Therefor, we took special care to guard against shock and vibration. Furthermore, we made other modifications to the beamline, for example, we made use of metallic materials instead of plastic and resinous materials to protect against radiation damage.

Figure 2 shows beamline components in the optics hutch. Characteristically, there are two “multipurpose spaces” for installing mirrors, differential pumping systems, and other experimental apparatuses for use in future developments.

3. Beamline Commissioning

The commissioning of BL11XU began in October 1998 and was finished by December of the same year.

Figure 3 shows the first SR beam at the 1st front end screen monitor in BL11XU. The SR beam irradiated a center of the screen. The figure shows good installation of the beamline components according to plan.

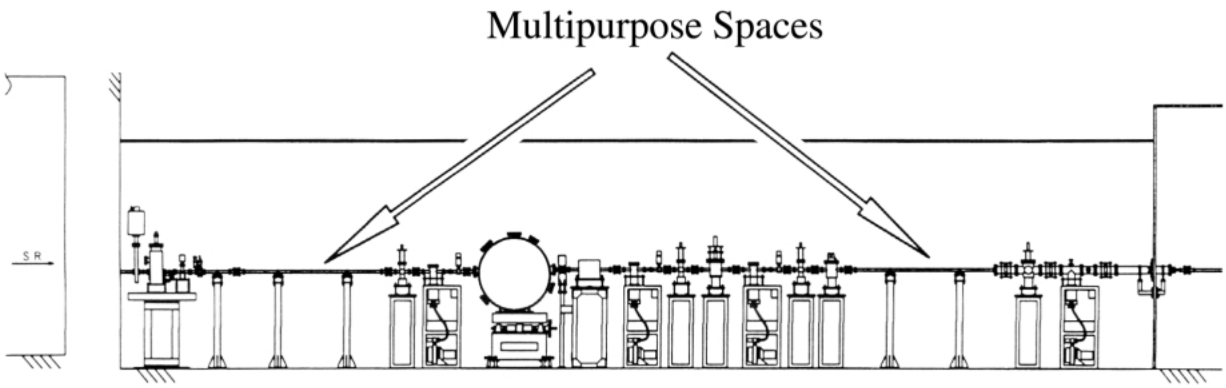

Fig. 2. Beamline components in optics hutch. There are two “multipurpose spaces” for installing mirrors, differential pumping systems, and other experimental apparatuses for use in future developments.

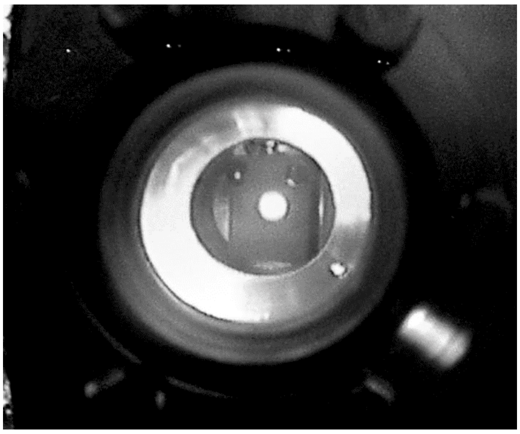

Fig. 3. First SR beam at the 1st front end screen monitor in BL11XU.

We performed the test running and the fine tuning of the inclined double crystal monochrometor. The optical alignments were accomplished by the same method as the preceding beamline commissioning group did. In the off-line alignment, the simple double-L-shaped tools [3] and only a few levels were used without X-ray. These tools were used to find the zero angle and to determine the origin or the center of each stage. Before the application experiments were started, the beamline was investigated for its performance. The flux, which was measured at a sample position by a PIN photo diode, was 1.6×10^{13} cps at Ib = 69 mA, ID gap = 20.1 mm, and E = 14.4 keV (first harmonics of the undulator). This value was the same order intensity as used with the other standard undulator beamlines of SPring-8. Table 1 shows FWHM (full width at half maximum) of rocking curves at the 1st Si crystal with respect to the photon energy. As shown in Table 1, FWHM of experimental results are 1.4 ~ 3.4 times larger than that of the theoretical value. In contrast to the theoretical values, FWHM values increased with an increase in photon energy. This might be the result of a distortion in the 1st Si crystal caused by the direct water cooling system.

4. Conclusions

This beamline is designed for the various kinds of studies on Mössbauer spectroscopy, high pressure science, inelastic X-ray spectroscopy, surface science, and other sciences. We are going to begin scientific programs from 1999.

References

[1] H. Shiwaku *et al.*, SPring-8 Annual Report 1997, 111 (1998)

[2] H. Shiwaku *et al.*, SPring-8 Information, **3**(6) (1998) 29. (in Japanese)

[3] M. Yabashi, SPring-8 Annual Report 1997, 70 (1998)

θ_B (degree)	E (keV)	ID-Gap (mm)	FWHM (arcsec)	Theoretical Value (arcsec)
7.689	14.789	20.6 (1st)	6.5	4.4
5.779	19.641	11.0 (3 rd)	7.5	3.1
4.130	27.460	13.9 (3 rd)	7.5	2.2

Table 1. FWHM monochromator rocking curves at the 1st Si crystal with respect to the photon energy