Powder Diffraction (BL02B2)

1. Introduction

This beamline is designed for research on accurate structure analysis by powder specimens in the area of materials science. This beamline makes it possible to collect high angular and high energy resolution powder data, which will increase the accuracy of structure analysis of crystalline material from powder data [1-6].

2. X-ray Optics

A schematic drawing of the beamline is shown in Fig. 1. The main optics is the standard SPring-8 bending magnet system, which contains a fixed-exit double crystal monochromator and a platinum coated mirror. The photon flux is expected to reach 10^{10} - 10^{12} photons/sec at the sample position. The wavelength will be tunable in the range of 5 – 30 keV with high energy resolution close to $\Delta E/E = 10^{-4}$ of up to 30 keV.

3. Large Debye-Scherrer Camera

The Debye-Scherrer Camera with a radius of 286.5 mm is available for a wide range of temperatures (10-1,000 K). Schematic drawings of the large Debye-Scherrer camera are shown in Fig. 2. A displex cryostat (~10 K) is installed within the ω-stage of this camera. A high temperature gas flow system can also be installed for high temperature experiments. As a detector, it has an Imaging Plate (IP) on the 2θ arm. The pixel size of IP can be varied from 50×50 μm to 100×100 μm. It is also possible to record several powder patterns (max. 10) on the same IP using a long vertical slit attached before the IP. The high energy beam with high flux allows us to collect much more Bragg reflections (high resolution data) with good counting statistics. The diffraction experiments are performed by transmission geometry. By using the high energy X-ray photons of SPring-8, the effects of absorption become insignificant even for heavy materials, such as those involving rare-earth metals. These advantages will make it possible to measure high quality powder data of crystalline materials even at low temperature. Figure 3 shows a photograph of the Debye-Scherrer camera equipped with cryostat and radial slits. The areas of research for which this beamline has been designed include:

- Accurate structure analysis of novel materials by powder specimens (Fullerene related materials, High temperature superconductors, CMR materials, Zeolite, *etc.*),
- Structural aspects of phase transition
- *Ab initio* structure analysis by powder diffraction
- Rietveld refinements.

References

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[3] M. Takata, *et al.*, Phys. Rev. Lett. **78** (1997) 3330.
[4] M. Takata, *et al.*, J. Phys. Soc. Jpn Lett. (1999) *in press.*
[5] M. Fujimori, *et al.*, Phys. Rev. Lett. **82** (1999) 4452
[6] M. Takata, *et al.*, Phys. Rev. Lett. (1999) *in press.*

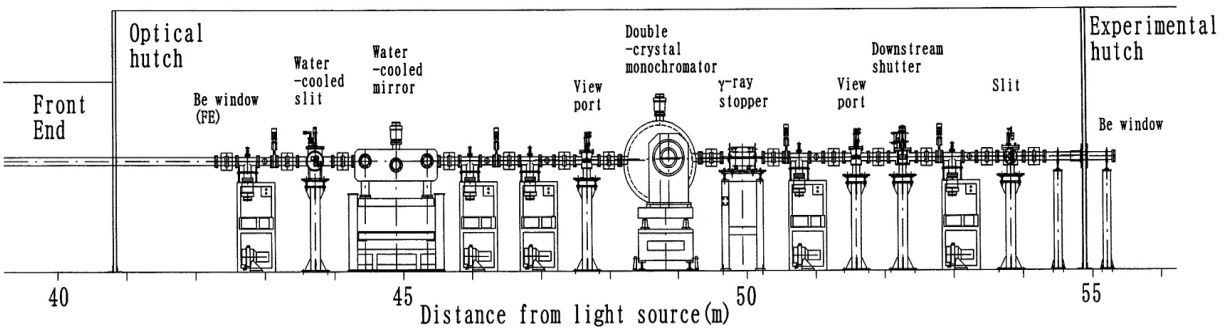

Fig. 1. Beamline optics of BL02B2.

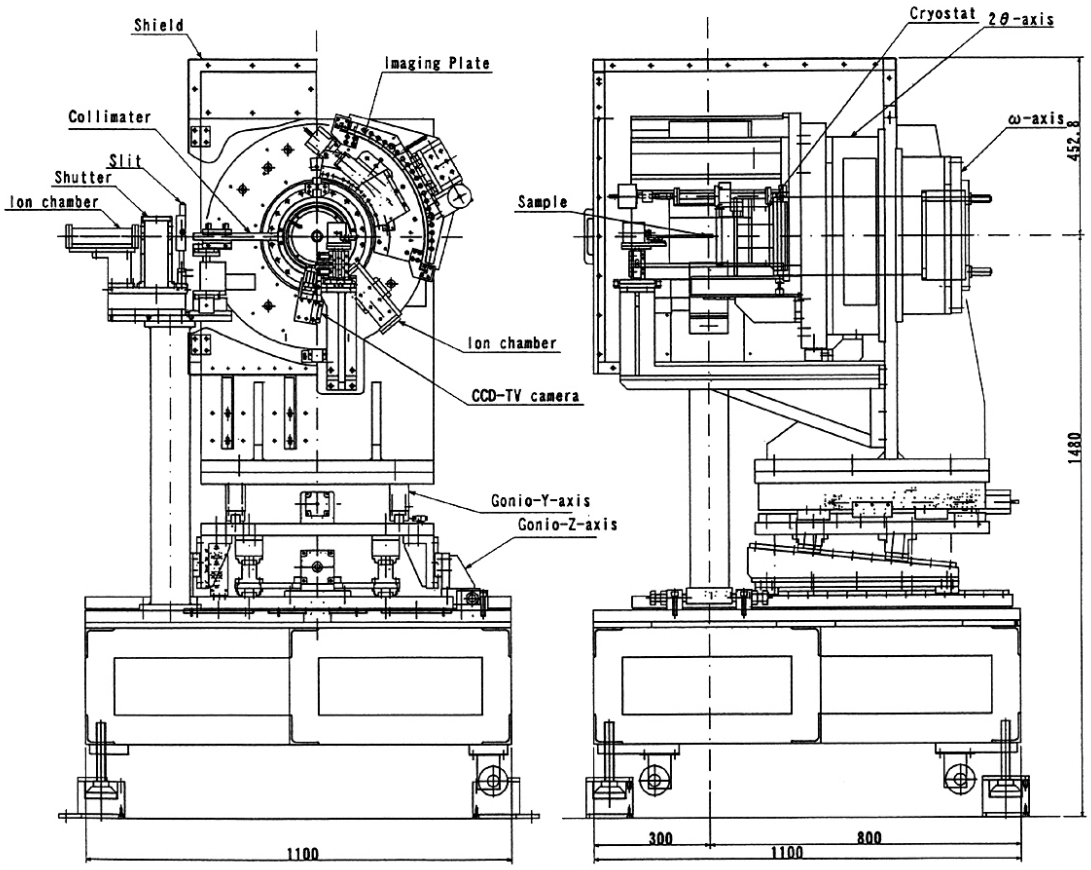

Fig.2. Schematic drawings of Large Debye-Scherrer camera.

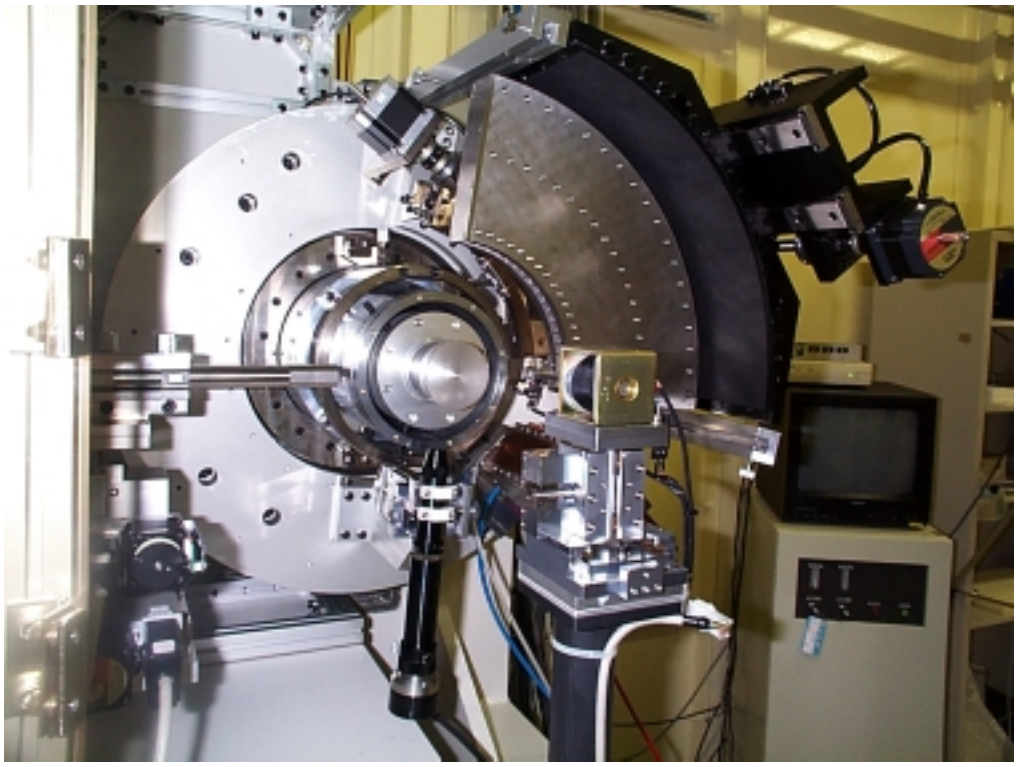

Fig.3. Large Debye-Scherrer camera in the experimental hutch of BL02B2.