

Standard Components for Transport Channel of SPring-8 Beamlines

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1. Introduction

We have reported a basic concept of standardization of beamline transport channel components [1]. We have finalized the specifications of the standard components such as down stream shutters, slits, view ports, gamma-ray stoppers, pumping units, beryllium windows, bellows, vacuum tubes, posts and other components. Main components for preceding beamlines have been fabricated and have partially been installed in optics hutches.

In this report, we show the basic functions, specifications, and configurations of main components.

2. Standard components

Basic specifications of main components are shown in Table 1. All vacuum components are high-vacuum compatible and pressure down to 10^{-4} Pa are attained using a turbo molecular pump. For following components we show codes in parentheses.

Bellows (BL-TC-BELS-)

Bellows are used to connect the components adjusting the fabrication errors and alignment errors of the components.

Beryllium window (BL-TC-BEWN-)

A vacuum tight Beryllium windows are used at the end of the transport channel. For white bending magnet beamline we prepare the water-cooled windows.

Down stream shutter (BL-TC-DSST-)

Basically, we put the down stream shutter downstream from a set of monochromator and gamma stopper. A Pb block sealed in stainless steel box is used for shutter and it is pneumatically driven (Fig. 1).

Gamma stopper (BL-TC-GSTP-)

For a monochromatic X-ray beamline, a gamma stopper is placed downstream the monochromator to stop the gamma rays with direct SR beam. The monochromatic beam is 30 mm higher than the direct beam and it passes through a rectangular tube surrounded by the Pb block (Fig. 2).

Helium chamber (BL-TC-HECH-)

A helium chamber is attached to the beryllium window at white beamline to prevent the oxidation of

beryllium. The helium chamber is sealed by a kapton foil window.

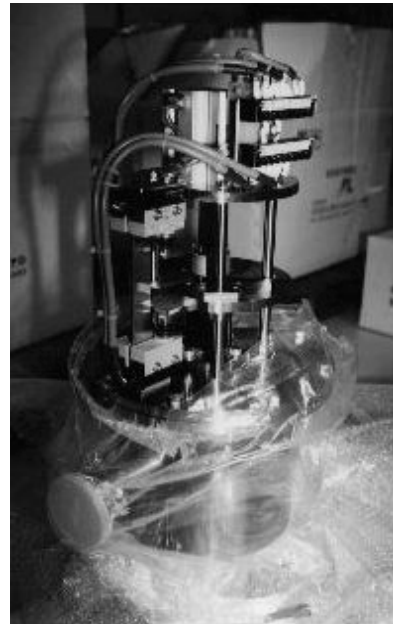


Figure 1. Down stream shutter



Figure 2. Gamma stopper

Water-cooled mask (BL-TC-MASK-)

A water-cooled copper rod with a rectangular hole is used at white bending magnet beamline to confine the horizontally diverging beam. Typical aperture size is 10 mm.

Post (BL-TC-POST)

We prepared two kind of posts. "BL-TC-PST1" supports standard components such as down stream shutter, slit, view port. This post has adjustment bolts in the xyz-direction. "BL-TC-PST2" supports vacuum tubes.

Pumping unit (BL-TC-PUMP-)

A set of 300-L/s turbo molecular pump with oil-free scroll pump is used for the standard pumping system (Fig. 3). A Pirani gauge and a cold cathode gauge are used to measure the pressure down to 10^{-7} Pa for each evacuating section.

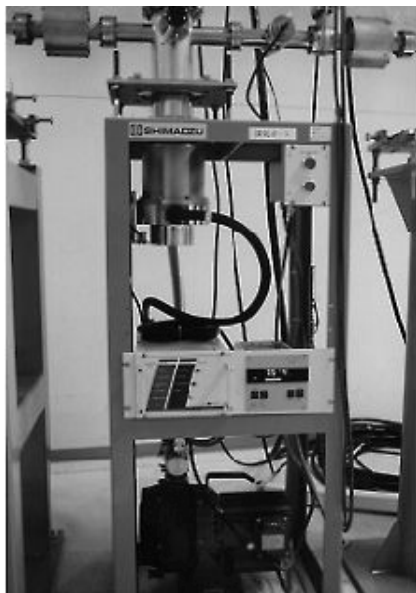


Figure 3. Pumping unit

Slit for monochromatic x-rays (BL-TC-SLIT- -MN)

A 2-mm-thick tantalum blade is used for slit blade. Each blade is driven by a stepping motor with resolution of $1\ \mu\text{m}/\text{step}$. Rotary feedthroughs are used to introduce the rotary motion of the stepping motor and linear motion is produced by screws inside the vacuum chamber. A slit mechanism inside the chamber is shown in Fig. 4.

Water-cooled slit for white x-rays (BL-TC-SLIT- -WC)

A pair of water cooled 10-mm-thick copper blade and 5-mm-thick tantalum blade is used for slit blade. Each blade is driven by a stepping motor with resolution of $0.5\ \mu\text{m}/\text{step}$. Linear feedthroughs are used to introduce the motion from the outside of the vacuum chamber.

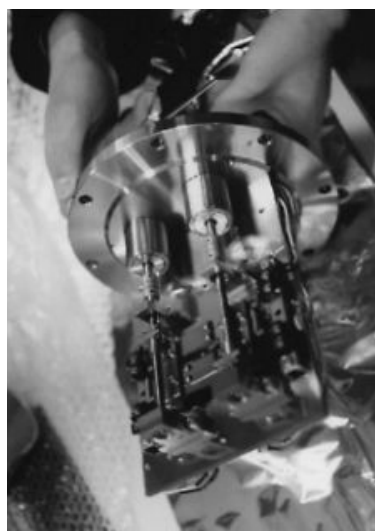


Figure 4. Slit for monochromatic x-rays

View port (BL-TC-VPRT-)

View ports (Fig. 5) are installed downstream from the main optical components to check the SR beam position. A fluorescent screen is pneumatically driven and inserted in the SR beam.

Vacuum tube (BL-TC-VTUB-)

Vacuum tubes are used to connect the components and to adjust the beamline length.

X-ray stopper (BL-TC-XSTP)

A X-ray stopper is placed at the end of experimental hutch to stop the monochromatic SR beam (Fig. 6). Pb block of 300-mm-wide, 300-mm-high, and 100-mm-thick is used for X-ray stopper. For the beamline with tandem experimental hutches, a movable X-ray stopper is installed at the end of the upstream hatch.



Figure 5. View port



Figure 6. X-ray stopper

3. Deflection stage and elevation stage for standard bending magnet beamline

For bending magnet beamlines, we adopted collimator mirror-monochromator-refocusing mirror optics to improve energy resolution and to obtain the higher flux density at the sample position.

To simplify an adjustment of this optics we designed mechanically linked deflection and elevation stages. The deflection stage supports the monochromator, gamma

stopper, and other components placed between two mirrors, and the elevation stage lifts the refocusing mirror and downstream components. The deflection stage has a capability to lift the components up to 3000 kg totally.

Reference

[1] T. Ishikawa, SPring-8 annual report 1995, 38, (1995).

Table 1. Basic specification of main components

Components	Flange type : ICF70 for undulator	ICF114 for BM	ICF152 for BM
Bellows (BL-TC-BELS-)			
Flange-flange distance	200 ± 10 mm	300 ± 10 mm	300 ± 10 mm
Beryllium window (BL-TC-BEWN-)			
Be thickness	0.2 mm	0.2 mm	0.2 mm
Aperture size	10 mm φ	15 mm × 40 mm	15 mm × 60 mm
Down stream shutter (BL-TC-DSST-)			
Flange-flange distance	400 mm	400 mm	400 mm
Pb thickness	94 mm	94 mm	94 mm
Gamma stopper (BL-TC-GSTP-)			
Flange-flange distance	600 mm	600 mm	600 mm
Pb thickness	350 mm	350 mm	350 mm
Pb area (H × W)	325 mm × 300 mm	325 mm × 300 mm	325 mm × 300 mm
Slit for monochromatic x-rays (BL-TC-SLIT- -MN)			
Flange-flange distance	280 mm	360 mm	380 mm
Resolution	1 μm/step	1 μm/step	1 μm/step
Range (Horizontal)	-5 ~ +5 mm	-5 ~ +35 mm	-5 ~ +35 mm
Range (Vertical)	-5 ~ +5 mm	-5 ~ +5 mm	-5 ~ +5 mm
Ta blade thickness	2 mm	2 mm	2 mm
Water-cooled slit (BL-TC-SLIT- -WC)			
Flange-flange distance	-----	500 mm	500 mm
Resolution	-----	0.5 μm/step	0.5 μm/step
Range (Horizontal)	-----	-5 ~ +35 mm	-5 ~ +35 mm
Range (Vertical)	-----	-20 ~ +20 mm	-20 ~ +20 mm
Cu/Ta blade thickness	-----	10 mm / 5 mm	10 mm / 5 mm
View port (BL-TC-VPRT-)			
Flange-flange distance	200 mm	350 mm	350 mm
Screen size	20 mm × 20 mm	20 mm × 100 mm	20 mm × 100 mm

