6 Summary of Experimental Stations

About 54 experimental stations are operated at the PF Storage Ring and the PF-AR, as shown in Figs. 1 and 2. Two thirds of the stations are dedicated to research using hard X-rays, with the remaining one third used for studies in the VUV and soft X-ray energy regions. Tables 1 and 2 summarize the areas of the research carried out at experimental stations at the PF storage ring and PF-AR. The specifications in terms of optics and performance of each experimental station differ according to experimental requirements and methodology. Tables 3 and 4 list the details of the optics of the hard X-ray stations and the soft X-ray / VUV stations. The principal performance parameters, including energy range, energy resolution, beam-spot size, and photon flux at the sample position are shown.

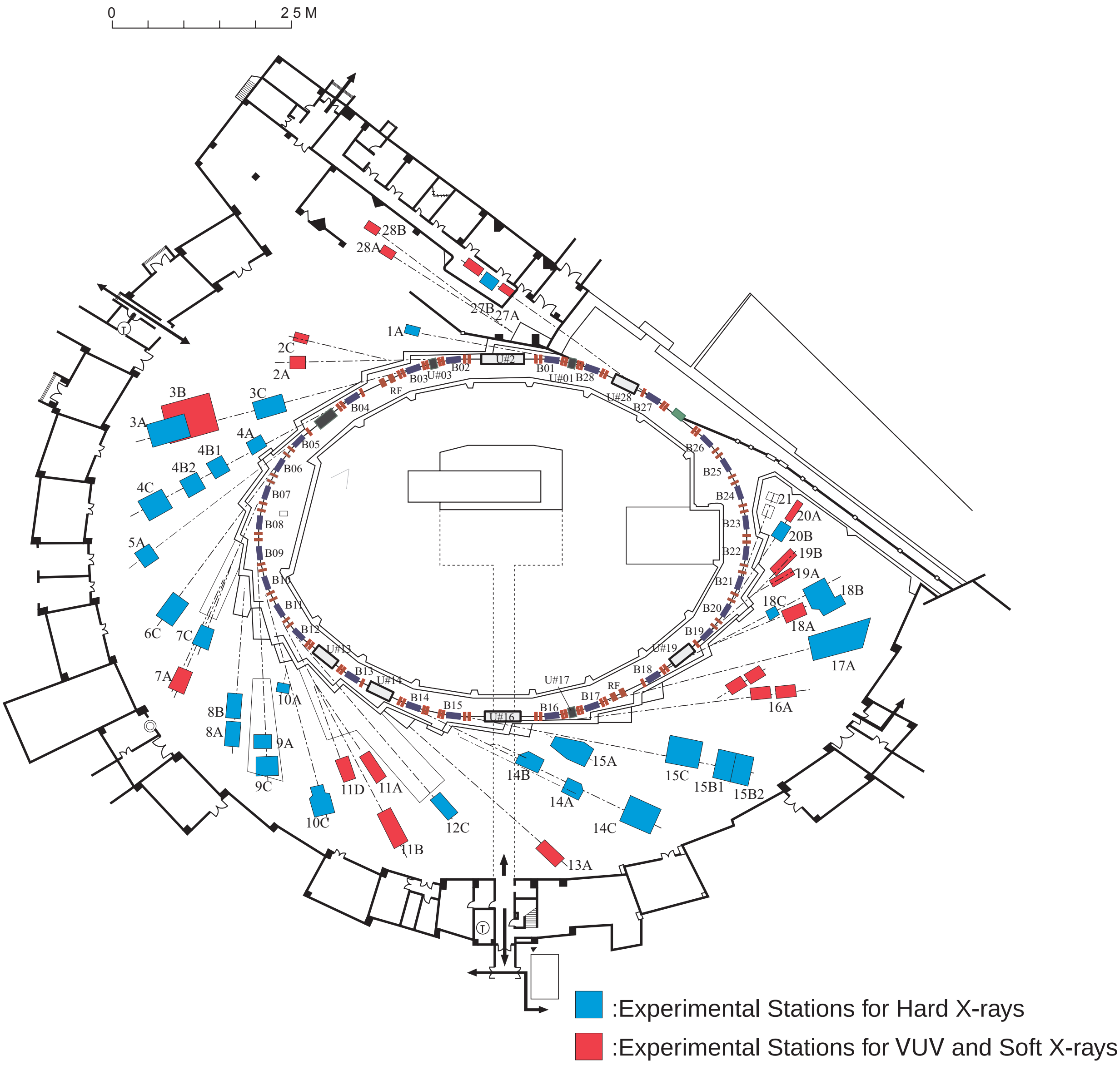

Figure 1
Plan view of the PF experimental hall, showing hard X-ray experimental stations (blue), and VUV and soft X-ray experimental stations (red).

Table 1 Complete list of experimental stations at the PF Storage Ring.

Experimental Station		Person in Charge
BL-1	(Short gap Undulator)	
A	Macromolecular crystallography	N. Matsugaki
BL-2	(Undulator)	
A	Soft X-ray spectroscopy	Y. Kitajima
C	Soft X-ray spectroscopy	J. Adachi
BL-3	(A: Short Gap Undulator)	
A	X-ray diffraction and scattering station for materials science	H. Nakao
B	VUV and soft X-ray spectroscopy	A. Yagishita
C	Characterization of X-ray optical elements/White X-ray maganetic diffraction	K. Hirano
BL-4		
A	Trace element analysis, X-ray microprobe	A. Iida
B1	Micro-crystal and Micro-area structure analysis	Y. Yamasaki
B2	Powder diffraction	H. Nakao
C	X-ray diffraction and scattering	H. Nakao, Y. Yamasaki
BL-5	(Multipole Wiggler)	
A	Macromolecular crystallography	Y. Yamada
BL-6		
C	X-ray diffraction and scattering	H. Kawata
BL-7		
A	[RCS] Soft X-ray spectroscopy	J. Okabayashi [RCS], K. Amemiya
C	X-ray spectroscopy and diffraction	H. Sugiyama
BL-8		
A	Weissenberg Camera for Powder/Single-crystal measurements under Extreme Conditions	H. Nakao
B	Weissenberg Camera for Powder/Single-crystal measurements under Extreme Conditions	Y. Yamasaki
BL-9		
A	XAFS	H. Abe
C	X-ray versatile station	M. Nomura
BL-10		
A	X-ray diffraction/scattering	Y. Yamasaki
C	Small-angle X-ray scattering of solution sample	N. Igarashi
BL-11		
A	Soft X-ray spectroscopy	Y. Kitajima
B	Surface EXAFS, soft X-ray spectroscopy	Y. Kitajima
D	Characterization of optical elements used in the VSX region	K. Ito
BL-12		
A*	Characterization of VUV-SX optical elements, soft X-ray spectroscopy	A. Yagishita
C	XAFS	H. Nitani

Experimental Station		Person in Charge
BL-13	(Undulator)	
A	Soft X-ray photoemission spectroscopy and XAFS	K. Mase
BL-14	(Vertical Wiggler)	
A	Crystal structure analysis and detector development	S. Kishimoto
B	High-precision X-ray optics	K. Hirano
C	Medical applications and General purpose (X-ray)	K. Hyodo
BL-15		
A	Small-angle X-ray scattering of muscle and alloys	N. Igarashi
B1	White X-ray topography and X-ray experiments for general purpose	H. Sugiyama
B2	Surface and interface X-ray diffraction	H. Sugiyama
C	High-resolution X-ray diffraction	K. Hirano
BL-16	(Variable Polarization Undulator)	
A	Soft X-ray spectroscopies with circular and linear polarization	K. Amemiya
BL-17	(Short Gap Undulator)	
A	Macromolecular crystallogarphy	N. Igarashi
BL-18		
A	[ISSP] Angle-resolved photoelectron spectroscopy of surfaces and interfaces	A. Kakizaki [ISSP], A. Yagishita
B	[India, DST] Multipurpose monochromatic hard X-ray station	N. Igarashi
C	High pressure X-ray powder diffraction (DAC)	T. Kikegawa
BL-19	(Revolver Undulator)	
A	[ISSP] Spin-resolved photoelectron spectroscopy (Mott detector)	A. Kakizaki [ISSP], A. Yagishita
B	[ISSP] Soft X-ray emission spectroscopy	A. Kakizaki [ISSP], A. Yagishita
BL-20		
A	VUV spectroscopy	K. Ito
B	[ASCo.] White and monochromatic beam general-purpose X-ray station	H. Kawata
BL-21	[Light Source Division]Beam position monitoring	K. Haga [Light Source]
BL-27	(Beamline for experiments using radioisotopes)	
A	Radiation biology, soft X-ray photoelectron spectroscopy	N. Usami
B	Radiation biology, XAFS, X-ray diffuse scattering	N. Usami
BL-28	(Elliptical / Helical Undulator)	
A	High-resolution VUV-SX beamline for angle-resolved photoemission	K. Ono
B	High-resolution VUV-SX spectroscopy	K. Ono

RCS Research Center for Spectrochemistry, the University of Tokyo
ISSP Institute for Solid State Physics, the University of Tokyo
ASCo. Australian Synchorotron Co-operation

* shutdown at the end of 2010.

Table 2 List of experimental stations at the PF-AR.

Experimental Station		Person in Charge
AR-NE1 (Multipole Wiggler)		
A	Laser-heating high pressure X-ray diffraction and nuclear resonant scattering (DAC)	T. Kikegawa
AR-NE3 (Undulator)		
A	Macromolecular crystallography	Y. Yamada
AR-NE5		
C	High pressure and high temperature X-ray diffraction (MAX-80)	T. Kikegawa
AR-NE7		
A	High pressure and high temperature X-ray diffracition (MAX-III), X-ray Imaging	K. Hyodo
AR-NW2 (Undulator)		
A	XAFS/Dispersive XAFS /Time-resolved-X-ray diffraction	H. Abe
AR-NW10		
A	XAFS	H. Nitani
AR-NW12 (Undulator)		
A	Macromolecular crystallography	L. Chavas
AR-NW14 (Undulator)		
A	Time-resolved X-ray diffraction, scattering and absorption	S. Adachi

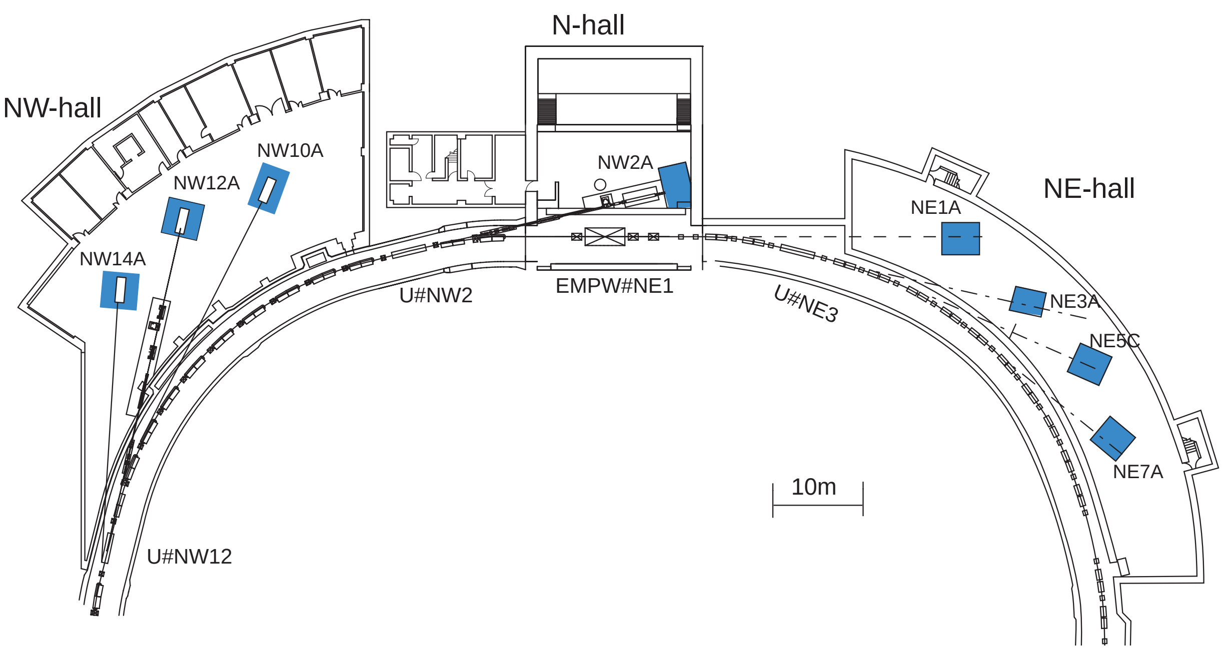

Figure 2
Plan view of beamlines in the PF-AR north-east, north, and north-west experimental halls.

Table 3 Specifications of X-ray beamline optics.

Branch Beamline	Horizontal Acceptance (mrad)	Type of Monochromator	Mirror	Photon Energy (keV)	Beam Size (H×V) (mm)	Photon Flux at Sample Position (/s)	Energy Resolution $(\Delta E/E)\times10^{-4}$	Reference
BL-1A	0.2	Channel-cut Si(111) Liquid N_2 Cooling	Bimorph Si Rh-Coated Si Rh-Coated	4.5 11 ~ 13	0.07×0.02	2×10^{10}	~ 2	
BL-3A	1	Flat Double Crystal Si(111)	Bent Cylinder	4 ~ 14	0.7×0.2	6×10^{12}	~ 5	
BL-3C	1.75	Double Crystal Si(111)	None	4 ~ 20 or whitle	20×6(mono) 0.1×0.1(white			
BL-4A	6	Double Crystal Sagittal Focusing	Vertical Focusing Mirror	4 ~ 20	50×4 4×1		~ 2	1
BL-4B1	4.5	Double Crystal Si(111)	None	4 ~ 35	50×5		~ 2	2
BL-4B2	4.5	Double Crystal Si(111)	Bent Cylinder	6 ~ 20	13×2		~2	3, 4
BL-4C	2	Flat Double Crystal Si(111)	Bent Cylinder	5 ~ 19	0.7×0.5		~5	5, 6
BL-5A	0.5	Micro-Channel Double Crystal Si(111)	Bent Plane Si Rh-Coated Bent Cylinder Si Rh-Coated	6.5 ~ 17	1.2×0.4	3×10^{11} (0.2×0.2 mm^2)	~2	
BL-6C	2	Flat Double Crystal Si(111)	Bent Cylinder	5 ~ 12 (~25 non- Focus)	1.2×1.2			
BL-7C	4	Double Crystal Si(111) Sagittal Focusing	Double Mirror Fused Quartz Focusing	4 ~ 20 (4 ~ 13)	5×1	$1\times10^{10}/6mm^2$ (8 keV, 300 mA) (1×10^{11} when focused)	~ 2	7 - 9
BL-8A	2.22	Flat Double Crystal Si(111)	Bent Cylinder	5 ~ 19	0.82×0.52	3.2×10^{11} (12.4keV, 400mA)	~ 5	10
BL-8B	2.21	Flat Double Crystal Si(111)	Bent Cylinder	5 ~ 19	0.75×0.45	2.2×10^{11} (12.4keV, 400mA)	~ 5	10

Branch Beamline	Horizontal Acceptance (mrad)	Type of Monochromator	Mirror	Photon Energy (keV)	Beam Size (H×V) (mm)	Photon Flux at Sample Position (/s)	Energy Resolution $(\Delta E/E)\times10^{-4}$	Reference
BL-9A	3	Double Crystal Si (111)	Collimating and Focusing Bent Conical Mirrors (Rh-Coated) Double Flat Mirror (Rh/Ni-Coated)	2.2 ~ 15	1×0.3	4×10^{11}(9 keV, 300 mA)	2	11, 12
BL-9C	3.5	Double Crystal Si(111)	Bent Cylinder Rh-Coated Si	4 ~ 23 or white	1×1	5×10^{10}(9 keV, 300 mA)	~ 2	
BL-10A	1	Si(111), Si(311) Quartz(100), PG(002) Curved Si(111) (α~ 4°, 8°)	Plane Pt coated Fuzed Quartz	5 ~ 25	10×3		10 ~ 5	13
BL-10C	4	Double Crystal Si(111)	Bent Cylinder	4 ~ 10	1.2×0.2	~10^{11}/1.5mm^2 (8 keV, 400 mA)	2	
BL-12C	2	Double Crystal Si(111) Si(311)	Bent Cylinder	6 ~ 23	0.65×0.4	5×10^{10}/1mm^2 (8 keV, 300mA) w.Si(111)	~ 2	14
BL-14A	1.28 (Vertical)	Double Crystal Si (111) Si (311) Si (553)	Bent Cylinder Rh-coated Fused Quartz	5.1 ~ 19.1 9.9 ~ 35.6 22.7 ~ 84.5	2×1 at focus 5×38		2	15
BL-14B	2.2 (Vertical)	Double Crystal Si(111),	None	10 ~ 57	5×14		2	
BL-14C	1.96 (Vertical)	Double Crystal Si(111), Si(220)	None	5 ~ 100 or white	6×70		2	16, 17
BL-15A	2	Bent Crystal Ge(111) (α = 8.0°)	Bent Plane, Fused Quartz Pt-coated	8.0 (fixed)	0.5×0.25	9×10^{10}/mm^2 (8.0 keV, 350 mA)	~ 10	18
BL-15B1 B2	2	Double Crystal Si (111)	Bent Cylinder	5 ~ 20 or white	0.6×0.4	10^{11}/1mm^2 (8.0keV, 350mA)	~ 2	
BL-15C	2	Double Crystal Si (111)	None	4 ~ 30	60×6			

Branch Beamline	Horizontal Acceptance (mrad)	Type of Monochromator	Mirror	Photon Energy (keV)	Beam Size (H×V) (mm)	Photon Flux at Sample Position (/s)	Energy Resolution $(\Delta E/E)\times 10^{-4}$	Reference
BL-17A	0.1 ~ 0.2	Double Crystal Si(111) Liquid N_2 cooling	Bent Plane Si Rh-Coated Bent Plane Si Rh-Coated	6 ~ 9 11 ~ 13	0.25×0.04	10^{10} (12.4 keV, 450mA, 0.02×0.02mm^2)	~2	19, 20
BL-18B	2	Double Crystal Si(111)	Plane and Bent Cylinder	6 ~ 30			~2	
BL-18C	1	Double Crystal Si(111)	Cylinder Fused Quartz, Pt-coated	6 ~ 25	0.07×0.04		~2	
BL-20B [ASCo.]	2	Channel Cut Si(111) Channel Cut Si(311) Sagittal Focusing Si(111) Double Crystal	None	4.5 ~ 21 10 ~ 36 4.5 ~ 25	25×2 25×1.5 0.6×1		~ 2 ~ 1 ~ 2	21
BL-27B	4	Double Crystal Si(111)	None	4 ~ 20	100×6		~ 2	22
AR-NE1A	0.28	Micro-Channel Double Crystal Si(111), High-resolution Channel Cut Si(4,2,2,)&(12,2,2)	Bent Plane W/C Mutilayer Coated Si	6 ~ 50	0.1×0.1	6×10^{11} (14.4keV)	~ 2	
AR-NE3A	H:0.2 V:0.1	Double Crystal Si(111) Liquid N2 Cooling	Pre-Mirror Bent Flat Si Rh-Coated Post-Mirror Bent Cylinder Fused Quartz Rh-Coated	6.5 ~ 17	0.8×0.2	8×10^{11} (0.2×0.2mm^2)	~ 2	23 24
AR-NE5C	3	Double Crystal Si(111)	None	30 ~ 100 or white	60×5		5	25
AR-NE7A	4	Double Crystal Si(111)		25 ~ 50 or white	80×3		5	
AR-NW2A	H:1.0 V:0.2	Double Crystal Si(111) Liquid N_2 Cooling	Bent Cylinder Si Rh-Coated Bent Flat Si Rh-Coated	5 ~ 25	0.6×0.2 ~10×0.06	6×10^{12}	~2	26-28
AR-NW10A	1.2	Si(311)	Pt-Coated Bent Cylinder	8 ~ 42	2.2×0.5	1×10^{10}	~1	29

Branch Beamline	Horizontal Acceptance (mrad)	Type of Monochromator	Mirror	Photon Energy (keV)	Beam Size (H×V) (mm)	Photon Flux at Sample Position (/s)	Energy Resolution (ΔE/E)×10^{-4}	Reference
AR-NW12A	H:0.3 V:0.1	Double Crystal Si(111) Liquid N_2 cooling	Pre-Mirror Bent Flat Si Rh-Coated Post-Mirror Bent Cylinder Si Rh-Coated	6.5-17	1.3×0.3	2×10^{11} (0.2×0.2 mm^2)	~2	
AR-NW14A	H:0.3 V:0.1	Double Crystal Si(111) Liquid N_2 Cooling	Bent Cylinder Rh-Coated Bent Flat Rh-Coated	4.9 ~ 25	0.45×0.25	5×10^{12}	~2	30

ASCo. Australian Synchrotron Co-operation

REFERENCES

[1] A. Iida *et al.*, *Rev. Sci. Instrum.*, **66** (1995) 1373.
[2] K. Ohsumi *et al.*, *Rev. Sci. Instrum.*, **66** (1995) 1448.
[3] Powder Diffraction User Group, *KEK Report,* **94-11** (1995).
[4] H. Toraya, H. Hibino and K. Ohsumi, *J. Synchrotron Rad.*, **3** (1996) 75.
[5] H. Iwasaki *et al.*, *Rev. Sci. Instum.*, **60** (1989) 2406.
[6] *Photon Factory Activity Report* 1995, #**13** (1996) E-1.
[7] M. Nomura and A.Koyama, *KEK Internal,* **93-1** (1993).
[8] M. Nomura et al., *KEK Report,* **91-1** (1991).
[9] M. Nomura and A. Koyama, in *"X-ray Absorption Fine Structure"*, ed. by S. S. Hasnain, Ellis Horwood, Chichester, 1991, p.667.
[10] A. Nakao et al., *AIP Conf. Proc.,* **1234** (2010) 367.
[11] M. Nomura and A. Koyama, *J. Synchrotron Rad.*, **6** (1999) 182.
[12] M. Nomura and A. Koyama, *Nucl. Insrtum. Meth.*, **A467-468** (2001) 733.
[13] S. Sasaki, *Rev. Sci. Instrum.*, **60** (1989) 2417.
[14] M. Nomura and A. Koyama, *KEK Report,* **95-15** (1996).
[15] Y. Satow and Y. Iitaka, *Rev. Sci. Instrum.*, **60** (1989) 2390.
[16] *Photon Factory Activity Report* 1999, #**17** (2000) A 92.
[17] *Photon Factory Activity Report* 1999, #**17** (2000) A 103.
[18] Y. Amemiya *et al.*, *Nucl. Instrum. Meth.*, **208** (1983) 471.
[19] N. Igarashi et al., *AIP Conf. Proc.,* **879** (2007) 812.
[20] N. Igarashi et al., *J. Synshrotron Rad.,* **15** (2008) 292.
[21] R.F. Garret *et al.*, *Rev. Sci. Instrum.*, **66** (1995) 1351.
[22] H. Konishi *et al.*, *Nucl. Insrtum. Meth.*, **A372** (1996) 322.
[23] Y. Yamada et al., *AIP Conf. Proc.,* **1234** (2010) 415.
[24] M. Hiraki et al., *AIP Conf. Proc.,* **1234** (2010) 673.
[25] T. Kikegawa *et al.*, *Rev. Sci. Instrum.*, **66** (1995) 1335.
[26] T. Mori *et al.*, *AIP Conf. Proc.,* **705** (2004) 255.
[27] H. Kawata *et al.*, *AIP Conf. Proc.,* **705** (2004) 663.
[28] Y. Inada et al. *AIP Conf. Proc.,* **879** (2007) 1230.
[29] M. Nomura et al., *AIP Conf. Proc.,* **882** (2007) 896.
[30] S. Nozawa et al., *J. Synchrotron Rad.,* **14** (2007) 313.

Table 4 Specifications of VUV and soft X-ray beamline optics.

Beamline	Acceptance H × V (mrad) or Undulator Parameters	Type of Monochromator	Groove Density (ℓ/mm)	Energy Range (eV)	Beam Size H × V (mm)	Resolving Power (E/ΔE) Photon Flux (photons/s)	Reference
BL-2A Undulator	K = 0.5 ~ 2.2 λ_u = 6 cm	Double Crystal InSb (111), Si (111)	____	1740 ~ 5000	< 1ϕ	2000, 8000 10^{11}	1 - 4
BL-2C Undulator	K = 0.55 ~ 2.2 λ_u = 6 cm	Varied-Line-Space Plane Grating	1000 2200	250 ~ 1400	0.9 × 0.1	5000 ~ 10000 10^{11} ~ 10^{10}	5 - 7
BL-3B	10 × 2	Grazing Incidence R = 24 m α+β = 165°	200 600 1800	10 ~ 280	< 2ϕ	200 ~ 3000 10^{12} ~ 10^{9}	8, 9
BL-7A [RCS]	6 × 1	Varied-Line-Space Plane Grating	300 650	50 ~ 1300	2.5 × 0.5	1000 ~ 9000 10^{12} ~ 10^{9}	10
BL-11A	5 × 1	Varied-Line-Space Plane Grating	300 800 1200	70 ~ 1900	2 × 1	500 ~ 5000 10^{12} ~ 10^{9}	11 - 14
BL-11B	4 × 0.6	Double Crystal InSb (111), Si (111)	____	1724 ~ 5000	5 × 2	2000 10^{10}	3, 15, 16, 17
BL-11D	4 × 2	Grazing Incidence Varied Deviation-angle On-Blaze Mount R_1 = 52.5 m R_3 = 22.5 m	2400	60 ~ 245 200 ~ 900	1 × 0.1	2000 10^{11}	18
BL-12A*	2.2 × 0.34	Grazing Incidence R = 2 m α = 88°	1200	30 ~ 1000	2 × 3	1000 10^{9}	19
BL-13A Undulator		Variable-included-angle Varied-line-spacing plane grating	300 1000	30 ~ 330 100 ~ 1200	~0.2 × 0.04	4000 ~ 10000 10^{11} ~ 10^{9}	20
BL-16A Undulator	K_{max} = 2.37 (Circular Polarization) K_{max} = 3.12 (Horizontal Linear Polarization) K_{max} = 1.98 (Vertical Linear Polarization) K_{max} = 1.73 (45-deg Linear Polarization) λ_u = 5.6 cm	Variable-included-angle varied-line-spacing plane grating	500 1000	250 ~ 1500	~0.2 × 0.1	4000 ~ 8000 10^{12} ~ 10^{11}	21
BL-18A (ISSP)	2 × 2	Grazing Incidence R = 3 m α+β = 160° R = 6.65 m α+β = 167.5°	300 600 1200	15 ~ 150	< 1ϕ β	1000~2000 10^{11} ~10^{9}	22

Beamline	Acceptance or H × V (mrad) Undulator Parameters	Type of Monochromator	Groove Density (ℓ/mm)	Energy Range (eV)	Beam Size H × V (mm)	Resolving Power (E/ΔE) Photon Flux (photons/s)	Reference
BL-19A Revolver Undulator (ISSP)	K = 1.0 ~ 9.0 λ_u = 16.4 cm K = 0.5 ~ 1.25 λ_u = 5 cm K = 0.5 ~ 2.5 λ_u = 7.2 cm	Grazing Incidence R = 2 m α+β = 160° R = 4 m α+β = 170°	600 1200 600 1200	12 ~ 250	< 0.7ϕ	1000 10^{12}	23, 24
BL-19B Revolver Undulator (ISSP)	K = 1.0 ~ 5.0 λ_u = 10 cm	Varied-Line-Space Plane Grating	800 2400	10 ~ 1200	< 0.5ϕ	400~4000 10^{12} ~10^{11}	24 - 26
BL-20A	28 × 5	3m Normal Incidence	1200 2400	5 ~ 40	2 × 1	300 ~ 30000 10^{12} ~ 10^{8}	27
BL-27A	5 × 0.5	Double Crystal InSb (111)	____	1800 ~ 4000		2000	28
BL-28A/B Helical Undulator	K_x = 0.23 ~ 3 K_y = 0.23 ~ 6 λ_u = 16 cm	Varied-Line-Space Plane Grating	400	30 ~ 300	0.15 × 0.05	30000 10^{12}	29

RCS Research Center for Spectrochemistry, the University of Tokyo
ISSP Institute for Solid State Physics, the University of Tokyo

* shutdown at tthe end of 2010.

REFERENCES

[1] H. Maezawa *et al.*, *Nucl. Instrum. Meth.*, **A246** (1986) 310.
[2] Y. Kitajima *et al.*, *Rev. Sci. Instrum.*, **63** (1992) 886.
[3] Y. Kitajima, *J. Elec. Spec. Relat. Phenom.*, **80** (1996) 405.
[4] Y. Kitajima, *J. Synchrotron Rad.*, **6** (1999) 167.
[5] Y. Yan and A. Yagishita, *KEK Report,* **95-9** (1995).
[6] M. Watanabe *et al.*, *Proc. SPIE*, **3150** (1997) 58.
[7] M. Watanabe *et al.*, *Nucl. Instrum. Meth.*, **A467-468** (2001) 512.
[8] A. Yagishita *et al.*, *Nucl. Instrum. Meth.*, **A306** (1991) 578.
[9] S. Masui *et al.*, *Rev. Sci. Instrum.*, **63** (1992) 1330.
[10] K. Amemiya *et al.*, *J. Elec. Spectrosc. Relat. Phenom.*, **124** (2002) 151.
[11] K. Amemiya *et al.*, *J. Synchrotron Rad.*, **3** (1996) 282.
[12] K. Amemiya *et al.*, *Proc. SPIE Proceedings,* **3150** (1997) 171.
[13] Y. Kitajima *et al.*, *J. Syncrotron Rad.*, **5** (1998) 729.
[14] Y. Kitajima *et al.*, *J. Elec. Spectrosc. Relat. Phenom.*, **101-103** (1999) 927.
[15] T. Ohta *et al.*, *Nucl. Instrum. Meth.*, **A246** (1986) 373.
[16] M. Funabashi *et al.*, *Rev. Sci. Instrum.*, **60** (1989) 1983.
[17] T. Iwazumi et al., *Rev. Sci. Instrum.*, **66** (1995) 1691.
[18] *Photon Factory Activity Report* 1997, **#15** (1998) A 101.
[19] *Photon Factory Activity Report* 1992, **#10** (1993) I-2.
[20] K. Mase et al., *AIP Conf. Proc.,* **1234** (2010) 703.
[21] K. Amemiya et al., *AIP Conf. Proc.*, **1234** (2010) 295.
[22] S. Suzuki *et al.*, *Activity Report of SRL-ISSP,* **60** (1989).
[23] A. Kakizaki *et al.*, *Rev. Sci. Instrum.*, **60** (1989) 1893.
[24] A. Kakizaki *et al.*, *Rev. Sci. Instrum.*, **63** (1992) 367.
[25] M. Fujisawa *et al.*, *Nucl. Instrum. Meth.*, **A467-468** (2001) 309.
[26] M. Fujisawa *et al.*, *Nucl. Instrum. Meth.*, **A467-468** (2001) 313.
[27] K. Ito *et al.*, *Rev. Sci. Instrum.*, **66** (1995) 2119.
[28] H. Konishi *et al.*, *Nucl. Instrum. Meth.*, **A372** (1996) 322.
[29] K. Amemiya and T. Ohta, *J. Synchrotron Rad.*, **11** (2004) 171.