Appendix A
Summary of Experimental Stations
(May 31, 2008)

Table A.1. Public beamlines.

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
Public Beamlines						
BL01B1	XAFS	3.8 ~ 113	$3 \times 10^{-5} \sim 2 \times 10^{-4}$	$10^{9} \sim 10^{11}$	-	• XAFS in wide energy region (3.8 to 113 keV) • XAFS of dilute systems and thin films • Time resolved XAFS by quick scan
BL02B1	Single Crystal Structure Analysis	5 ~ 115	10^{-4}	$\sim 10^{10}$	0.3(H) × 0.3(V)	• Single crystal structure analysis in X-ray wide energy range • Precise X-ray diffraction analysis of the lattice or charge modulation originated from the phase transition at low temperatures
BL02B2	Powder Diffraction	12 ~ 35	$\sim 2 \times 10^{-4}$	$\sim 10^{11}$	3.0(H) × 0.5(V)	• Charge density studies closely related to properties of functional materials • Structural aspects of phase transition • Ab initio structure determination using powder diffraction data • Structural refinements by Rietveld method • Thin-film diffraction • In-situ difftaction experimnent under gas adsorption and/or photo irradiation
BL04B1	High Temperature and High Pressure	20 ~ 150	White radiation	-	0.05(H) × 0.05(V) ~ 10(H) × 10(V)	• Determination of phase relation • Equation of state of mantle • Viscosity of melts • Kinetics of mineral transformation • Rheology of mantle minerals • Structure of melts and glasses at high pressures
BL04B2	High Energy X-ray Diffraction	Si (111) : 37.8, 113.3 Si (220) : 61.7	10^{-3}	2.2×10^{10} (37.8 keV, Flat) 7.1×10^{11}(37.8 keV, Bent) 3.4×10^{9} (61.7 keV, Flat) 9.2×10^{10} (61.7 keV, Bent)	0.22(H) (37.8 keV) 0.38(H) (61.7 keV)	• Structural analysis of glass, liquid, and amorphous materials • X-ray diffraction under ultra high-pressure • Small angle scattering in supercritical fluid • Precise single crystal structure analysis
BL08W	High Energy Inelastic Scattering	Si (620) : 174 ~ 270 Si (771) : 270 ~ 300	$\sim 2 \times 10^{-3}$	5×10^{9} (300 keV)	1(H) × 3(V)	• Magnetic Compton scattering • High-resolution Compton scattering • High-energy Bragg scattering • High-energy fluorescent X-ray analysis
		Si (400) : 100 ~ 120	$< 1 \times 10^{-3}$	1×10^{13} (100 keV)	2(H) × 1(V)	
BL09XU	Nuclear Resonant Scattering	6.2 ~ 100	-	4×10^{13} (14.4 keV)	1.3(H) × 0.85(V)	• Lattice dynamics by using nuclear inelastic scattering • Time domain Mössbauer spectroscopy, especially under the extreme conditions • Coherent X-ray optics using nuclear resonant scattering • Nuclear excitation by electron transition (NEET) • Surface structures and residual strain analysis

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
BL10XU	High Pressure Research	20 ~ 58	10^{-4}	~ 1×10^{13}	0.01～1 diam.	• Structure analysis and phase transitions under ultra high pressure (DAC experiment) • Earth and planetary science
BL13XU	Surface and Interface Structures	7 ~ 32	10^{-4}	~ 10^{13} /mm ^{2} (for 12.4 keV)	H: 0.001-0.5, V: 0.001-0.5	• Atomic-scale structural analysis of a crystal surface, an ultra-thin film and a nanostructure • Surface structural analysis • Analysis of nanostructures grown at a vacuum/solid, liquid/solid, and solid/solid interface
BL14B2	Engineering Science Research II	3.8 ~ 72	10^{-4}	~10^{10}	-	• XAFS in wide energy region (3.8 to 72 keV) • XAFS of dilute systems and thin films • Time resolved XAFS by quick scan
BL19B2	Engineering Science Research I	5~72	10^{-4}	10^{9}	-	• Residual stress measurement, and structural analysis of thin film, surface and interface • Powder diffraction • X-ray imaging • Ultra-small angle X-ray scattering
BL20XU	Medical and Imaging II	Si (111): 7.62 ~ 37.7 Si (511): 23 ~ 113	~ 10^{-4}	10^{13}/mm^2 (@EH1) for Si (111)	1.4(H) × 0.7(V) (@EH1) 4(H) × 2(V) (@EH2)	• Micro-imaging : Hard X-ray microbeam/scanning microscopy, imaging microscopy, micro-tomography, phase-contrast microtomography with Bonse-Hart interferometer, X-ray holography, coherent X-ray optics, and other experiments on X-ray optics and developments of optical elements • Medical application : Micro-angiography, refraction-enhanced imaging, radiation therapy, phase-contrast CT using interferometer • Ultra-small angle scattering
BL20B2	Medical and Imaging I	Si (311) : 8.4 ~ 72.5 Si (111) : 5 ~ 37.5 Si (511) : 13.5 ~ 113.3	~ 10^{-4}	-	75(H) × 5(V) (Si (311), @Exp. Hall) 300(H) × 20(V) (Si (311), @Biomedical Imaging Center)	• The medical research mainly involves micro-radiography, micro-tomography and refraction-contrast imaging on biological specimens and small animals. • Imaging techniques involve the evaluation and development of various kinds of optical elements for novel imaging techniques.
BL25SU	Soft X-ray Spectroscopy of Solid	0.22 ~ 2	E/ΔE > 10^4	> 10^{11}	<0.4 diam.	• Observation of electronic structures by photoemission spectroscopy (PES) • Observation of electronic band structures by angle resolved photoemission spectroscopy (ARPES) • Magnetic state study by magnetic circular dichroism (MCD) of soft-x-ray absorption • Element-specific magnetization curve measurements by MCD • Analysis of atomic arrangements by photoelectron diffraction (PED) • Observation of Magnetic domains by photoelectron emission microscope (PEEM)

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
BL27SU	Soft X-ray Photochemistry	0.2 ~ 2 for A and B branches	10^{-2} for A- and B branches	> 10^{15}	4(H) × 2(V)	*Industrial research --- B branch* • Growth of thin film of functional material • Micro fabrication by functional material etching *Atomic and molecular spectroscopy --- C branch (C1, C2 station)* • Search of novel photochemical processes • High resolution atomic and molecular electron spectroscopy • Complete determination of electronic decay channel • Dissociation dynamics of inner-shell excited molecules • Site-specific dissociation processes of isolated molecules *Solid state physics --- C branch (C3 station)* • Study of electronic structures of solids by photoemission spectroscopy and soft x-ray emission spectroscopy
		0.3 ~ 2.8 at 1st (Horizontal Polarization) 0.17 ~ 2.8 at 0.5th (Vertical Polarization), for C branch	< 10^{-4} for C branch	> 10^{11} for <1000 eV	0.2(H) × 0.2(V) for C1 and C2 0.2(H) × 0.01(V) for C3	
BL28B2	White Beam X-ray Diffraction	> 5	White radiation	-	50(H) × 10(V) at 44 m from the light source	• White X-ray diffraction and topography • Time-resolved energy-dispersive XAFS (DXAFS) for studies of chemical and/or physical reaction process. • Biomedical imaging and radiation biology studies.
BL35XU	High Resolution Inelastic Scattering	8 ~ 50 (fundamental to 5th)	10^{-4}-10^{-8}	Optics Dependent		• Dynamics of materials on meV energy scales: Phonons, Excitations in Liquids and Glasses • Methods of investigation include inelastic X-ray scattering (IXS) and nuclear resonant scattering (NRS). • Focal spot size of ϕ20 microns possible with KB setup
BL37XU	Trace Element Analysis	A branch : 5 ~ 37 B branch : Si (111) : 75.5	Both: 2 × 10^{-4}	A branch : 10^{12} ~ 10^{13} B branch : 10^{10} ~ 10^{12}	A branch : 2(H) × 0.7(V) B branch : 3(H) × 0.5(V)	• X-ray microbeam spectrochemical analysis • Ultra trace element analysis • High energy X-ray fluorescence analysis
BL38B1	Structural Biology III	6.5 ~ 17.5	~ 2×10^{-4}	10^{10} ~ 10^{11}	-	• Routine data collection for macromolecular crystallography
BL39XU	Magnetic Materials	5 ~ 38	1 × 10^{-4}	2 × 10^{13}	0.6(H) × 0.6(V)	• X-ray magnetic circular dichroism (MCD) spectroscopy • Element-specific magnetometry • X-ray emission spectroscopy and its magnetic circular dichroism • Resonant or non-resonant magnetic scattering • XMCD microscopy, element-specific magnetometry in a micrometer region • XMCD experiment under high (~10 GPa) pressure • X-ray spectroscopy using variable light polarization
BL40XU	High Flux	8 ~ 17	0.02	10^{15} (12 keV)	0.25(H) × 0.04(V) (with focusing mirrors)	• Time-resolved diffraction and scattering experiments • X-ray speckle experiments • Microbeam X-ray diffraction experiments
BL40B2	Structural Biology II	6 ~ 17.5	10^{-4}	~ 10^{11} (12 keV)	0.25(H) × 0.2(V)	• Noncrystalline small and wide angle X-ray scattering

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
BL41XU	Structural Biology I	6.5 ~ 17.5 19 ~ 37 (optional)	$< 2 \times 10^{-4}$	$> 10^{13}$ (without slits) $> 5 \times 10^{11}$ (with slits)	0.07(H) × 0.05 (V) 0.025(H) × 0.025 (V) (minimum size)	• Structural biology • Macromolecular crystallography • Ultra-high resolution structure analysis • Microcrystallography
BL43IR	Infrared Materials Science	100 ~ 20000 cm^{-1}	~0.1 cm^{-1}	-	0.01	• Infrared microspectroscopy • Magneto-optical spectroscopy
BL46XU	Engineering Science Research III	6 ~ 35	$\sim 10^{-4}$	$\sim 10^{13}$	<0.5(H) × 0.5(V)	• Structural characterization of thin film by X-ray diffraction and X-ray reflectivity measurement • Residual stress measurement • Time resolved X-ray diffraction • Hard X-ray Photoemission Spectroscopy
BL47XU	HXPES, MCT	5.2 ~ 37.7	$\sim 2 \times 10^{-4}$	2×10^{13} (18 keV)	1.2(H) × 0.3(V) (18 keV, 40 m from source)	• Hard X-ray Photoelectron Spectroscopy • Projection type micro-tomography • Imaging type micro-tomography • Hard X-ray microbeam/scanning microscopy

Table A.2. RIKEN beamlines.

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
RIKEN Beamlines						
BL17SU	RIKEN Coherent Soft X-ray Spectroscopy	0.3~1.8	$E/\Delta E > 10^4$	$>10^{11}$	<0.1 (H) × 0.1 (V)	*Spectroscopic study on multiply charged ions --- A1a station* • Photoabsorption study on multiply charged ions • Fundamental research for X-ray astronomy using synchrotron radiation *High resolution photoemission spectroscopy --- A2 station* • Angle-resolved photoemission (ARPES) study using soft X-ray s to observe 'bulk' band structure • In situ ARPES measurement on strongly-correlated transition-metal oxide thin films fabricated by laser MBE method *Soft X-ray emission spectroscopy for solid and biological samples --- A3 station* • Study of the electronic structure of liquid and biological samples by soft X-ray emission spectroscopy *Soft X-ray diffraction spectroscopy --- B1 station* • Soft X-ray diffraction on the ordered materials to study the electronic structure *Surface science --- B2 station* • Soft X-ray spectroscopy to study the surface adsorbates and interfaces
BL19LXU	RIKEN SR Physics	7.2 ~ 18 (fundamental) 22 ~ 51 (3rd)	$\sim 10^{-4}$	2×10^{14} (14 keV)	1.5(H) × 0.8(V) (@EH2)	• This beamline is open for any research field requiring the highly brilliant X-ray beam

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
BL26B1&B2	RIKEN Structural Genomics I & II	6 ~ 17	~ 10^{-4}	~ 10^{11} (12 keV)	-	• Structural genomics research based on single crystal X-ray diffraction
BL29XU	RIKEN Coherent X-ray Optics	4.4 ~ 37.8	~ 1.3 × 10^{-4}	6 × 10^{13} (10keV)	1.6(H) × 0.7(V) (@EH1) 2.9(H) × 1.2(V) (@EH2) 28(H) × 12(V) (@EH3)	• X-ray optics, especially coherent X-ray optics
BL44B2	RIKEN Structural Biology II	6 ~ 18	~ 10^{-4}	1.1 × 10^{11} (12.4 keV)	0.20(H) × 0.22(V)	• Macromolecular crystallography
BL45XU	RIKEN Structural Biology I	6.8 ~ 14 (@SAXS Station) 7.5 ~ 14 (@SWAXS Station)	< 10^{-4} (@SAXS St.) < 10^{-4} (@SWAXS St.)	~ 1 ×10^{12} (@SAXS St.) ~ 2 × 10^{11} (@SWAXS St.)	0.4(H) × 0.2(V) (@SAXS St.) 0.3(H) × 0.2(V) (@SWAXS St.)	• SAXS-station: Time-resolved structures of non-crystalline biological materials such as protein, nucleic acid solutions, membrane, muscle, and micelle system under various conditions, are studied by using small-angle scattering and diffraction technique. • SWAXS-station: Wide-scale structural analysis for nano- and meso-strucure in soft-condensed matters such as polymer, lipid and complex fluid systems are investigated by using small- and wide-angle X-ray scattering/diffraction techniques.

Table A.3. Contract beamlines.

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
Contract Beamlines						
BL08B2	Hyogo BM (Hyogo Prefecture)	4.6~70	<10^{-4}	~10^{9}-10^{10}	-	• XAFS in a wide energy region • Small angle X-ray scattering for structural analyses of polymer and nano-composite materials • X-ray topography • Imaging • Powder diffraction with a high angular resolution
BL11XU	JAEA Quantum Dynamics (Japan Atomic Energy Agency)	6 ~ 70	10^{-4}	-	-	• Nuclear Resonant Scattering • Surface and interface structure with MBE • Inelastic scattering • XAFS

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
BL12XU	NSRRC ID (National Synchrotron Radiation Research Center, Taiwan)	4.5 ~ 35	1.4 × 10-4 for DCM 10^{-5} ~ 10^{-7} for HRM (optics dependent)	~10^{10} photons/s/meV below 26 keV after DCM Optics dependent at sample	0.12(H) × 0.08(V)	• Elementary electronic excitations, quasiparticle behaviors, and electron-correlation effects in correlated electron systems investigated using high resolution non-resonant or resonant inelastic X-ray scattering • Local electronic structure of molecular solids of low-Z elements (e.g., biomaterials) investigated by high resolution near-edge X-ray Raman scattering • Phase transitions under high-pressure, low and high temperatures • Materials science using high-resolution X-ray absorption and emission spectroscopy • X-ray physics and optics
BL12B2	NSRRC BM (National Synchrotron Radiation Research Center, Taiwan)	5 ~ 70 (monochromatic)	~ 10^{-4}	10^{10} ~ 10^{12}	0.25(H) × 0.25(V)	• X-ray absorption spectroscopy • Powder X-ray diffraction • High resolution X-ray scattering • Protein crystallography
		5 ~ 90 (white)	-	-	-	
BL14B1	JAEA Materials Science (Japan Atomic Energy Agency)	5 ~ 90 (monochromatic)	Si (111) : 10^{-4} Si (311) : 3 × 10^{-5} Si (511) : 7 × 10^{-6}	10^{10}	3(H) × 1(V) (with bender) 3(H) × 0.2(V) (with bender&mirror)	• Materials science at high pressure • Surface/interface analysis • XAFS • Pair-distribution function (PDF) analysis
		50 ~ 150 (white)	-	10^{13}	0.05(H) × 0.05(V) ~ 3(H) × 3(V)	
BL15XU	WEBRAM (National Institute for Materials Science)	1 ~ 60	10^{-4}	10^{12} ~ 10^{13}	~ 0.8 diam.	• Highly precise characterization of advanced materials • High energy excitation X-ray photoelectron spectroscopy • Highly precise X-ray powder diffraction
BL16XU	SUNBEAM ID (Industrial Consortium)	4.5 ~ 40	~ 10^{-4}	~ 10^{12} (normal)	< 1(H) × 1(V)	• Characterization of thin films for ULSI, optical and magnetic devices, secondary batteries, fuel cells, catalysts, functional materials, and structural materials.
				~ 10^{10} (focusing)	< 1 μm(H)×1 μm(V)	
BL16B2	SUNBEAM BM (Industrial Consortium)	4.5 ~ 113	~ 10^{-4}	~ 10^{10}	~ 0.1(H) × 0.1(V) (with mirror) ~ 40(H) × 2(V) (without mirror)	• Characterization of industrial materials, such as metal and oxide films, semiconductor crystals, etc., by XAFS, topography and other methods
BL22XU	JAEA Quantum Structural Science (Japan Atomic Energy Agency)	3 ~ 37 by DXM2 35 ~ 70 by DXM1	10^{-4}	2×10^{13}	2(V) × 3.2(H) (@EH3) 0.4(H) ×0.5(V) (focusing @EH3), at 14.4 keV	• Materials science at high pressure • Resonant X-ray scattering (activity at RI laboratory) • Residual Stress Distribution Measurement
BL23SU	JAEA Actinide Science (Japan Atomic Energy Agency)	0.35~ 1.8	<10^{-4}	10^{11}	< 0.2 diam.	• Surface chemistry with supersonic molecular beam • Biophysical spectroscopy • Photoelectron spectroscopy (activity at RI laboratory) • Magnetic circular dichroism (activity at RI facility)

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
BL24XU	Hyogo ID (Hyogo Prefecture)	4.5 ~ 35	$< 10^{-4}$	$\sim 10^{12}$	< 1(H) × 1(V)	• Structure analysis of small bio-crystals for industry • Crystallographic analysis of metallic materials for industry (surface analysis, strain measurements) • x-ray microscopic application for industry (micro- or nano-beam, high-resolution imaging)
BL32B2	Phamaceutical Industry (Phamaceutical Consortium for Protein Structure Analysis)	7 ~ 17.5	$\sim 10^{-4}$	$\sim 10^{11}$ (12 keV)	0.2(H) × 0.2(V) (12 keV)	• Protein structure analysis for structure-based drug design: It means design and optimization of new leading compounds based on pharmacodynamic action mechanism elucidated at the molecular level which obtained from a detailed interaction analysis of receptor-drug complexes, etc.
BL33LEP	Laser-Electron Photon (RCNP, Osaka University)	1.5 ~ 2.4 GeV (355-nm Solid-state laser) 1.5 ~ 3.0 GeV (257-nm Ar laser)	$\sim 5 \times 10^{-3}$	4×10^{6} 2×10^{5}	-	• Meson photoproduction from nucleon and nucleus • Photoexcitation of hyperons, nucleon resonances, and other exotic states • Photonuclear reactions • Beam diagnoses • Test and calibration of detectors with GeV photon beam
BL44XU	Macromolecular Assemblies (Institute for Protein Research, Osaka University)	7 ~ 17.5	2×10^{-4}	3×10^{11}	0.05(H) × 0.05(V)	• Crystal structure analysis of biological macromolecular assemblies (e.g. membrane protein complexes, protein complexes, protein-nucleic acid complexes, and viruses)

Table A.4. Accelerator beamlines.

	Name of Beamline	X-rays at Sample				Areas of Research
		Energy Range [keV]	Energy Resolution ΔE/E	Photon Flux [photon/s]	Beam Size [mm]	
Accelerator Beamlines						
BL05SS	Accelerator Beam Diagnosis	Visible light, White X-ray, Monochromatic X-ray (4~38keV), r -ray (10.2MeV)(planned)	-	-	-	• Accelerator science • Accelerator beam diagnostics • R&D of accelerator components • Production of MeV γ-ray photons
BL38B2	Accelerator Beam Diagnosis	Visible light, White X-ray, Monochromatic X-ray (4~14keV), r -ray (10.2 MeV)	-	-	-	• Accelerator science • Accelerator beam diagnostics • R&D of accelerator components • Production of MeV γ-ray photons