

III. Beamlines

The SPring-8 storage ring can accommodate up to 62 beamlines: 34 insertion devices, 4 long undulators, and 24 bending magnets. At present, 57 beamlines are in operation, covering a wide variety of research fields involving synchrotron radiation science and technology. The beamlines are classified into the following three types.

- (1) Public Beamlines (26 beamlines operating),
- (2) Contract Beamlines (17 beamlines operating), and
- (3) RIKEN Beamlines (14 beamlines operating).

There are now 26 public beamlines in full operation. The beamlines that have been proposed and constructed

by external organizations, such as universities, research institutes, private companies and consortiums, are called contract beamlines, which are used exclusively by the contractors for their own research purposes. At present, 17 contract beamlines are in operation. The beamlines constructed by RIKEN or transferred to RIKEN, except for public beamlines, are called RIKEN beamlines, which are mainly used for RIKEN's own research activities, with partial availability for public use. RIKEN is now operating 14 beamlines. To illustrate the beamline portfolio of SPring-8, a beamline map is shown in Fig. 2 together with the beamline classification. The research fields of each beamline are presented in Table 3.

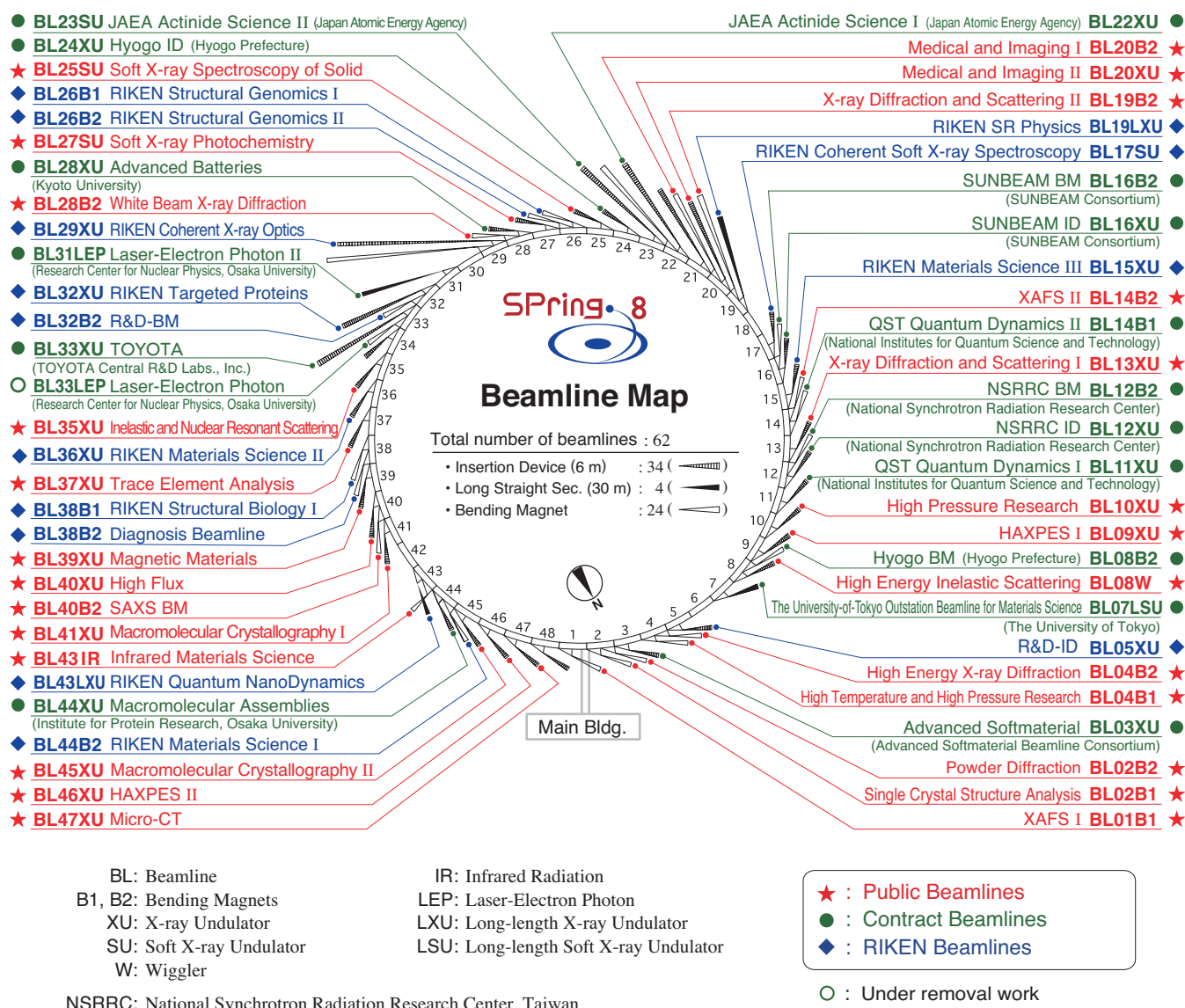


Fig. 2. Beamline map.

Table 3. List of beamlines

BL #	Beamline Name	(Public Use) or (First Beam)	Areas of Research and Available Techniques
★ Public Beamlines			as of April 2022
BL01B1	XAFS	(Oct. 1997)	Wide energy range (3.8–113 keV), XAFS of dilute systems and thin films, time-resolved XAFS by quick scan (time-resolved QXAFS), depth-resolved XAFS. XAFS at low and high temperatures. Simultaneous XAFS and XRD measurements. Simultaneous XAFS and IR measurements.
BL02B1	Single Crystal Structure Analysis	(Oct. 1997)	Charge density study using high energy X-ray. <i>In situ</i> single crystal experiments. Microcrystal structure analysis.
BL02B2	Powder Diffraction	(Sept. 1999)	Charge density study from powder diffraction. Structural phase transition. <i>Ab initio</i> structure determination from powder diffraction. Crystal structure refinement by Rietveld method. <i>In situ</i> powder diffraction experiment under gas and vapor adsorption/desorption.
BL04B1	High Temperature and High Pressure Research	(Oct. 1997)	X-ray diffraction measurements and radiography under extreme conditions using large-volume press.
BL04B2	High Energy X-ray Diffraction	(Sept. 1999)	Structural analysis of glass, liquid, and amorphous materials.
BL08W	High Energy Inelastic Scattering	(Oct. 1997)	Magnetic Compton scattering. High-resolution Compton scattering. Compton scattering imaging. High-energy X-ray scattering. High-energy X-ray fluorescence analysis (XRF). Time-resolved pair distribution function analysis (PDF).
BL09XU	HAXPES	(Oct. 1997)	Resonant hard X-ray photoelectron spectroscopy (HAXPES). Polarization-dependent HAXPES using diamond phase retarder. Depth analysis of electron state. Materials science and applied materials science.
BL10XU	High Pressure Research	(Oct. 1997)	Crystal structure analysis under high pressure using diamond-anvil cells, <i>in situ/operando</i> observation of phase transition and compression behavior under extreme conditions. Material sciences under extreme conditions. High pressure Earth and Planetary science.
BL13XU	Surface and Interface Structures	(Sept. 2001)	X-ray diffraction and reflectivity measurements. Atomic-scale structural analysis of crystal surfaces and interfaces, ultrathin films, and nanostructures. Residual stress measurement. Time-resolved X-ray diffraction. <i>In situ</i> process observation using X-ray diffraction. <i>Operando</i> X-ray diffraction. High-resolution powder X-ray diffraction and X-ray total scattering. Structural refinement using Rietveld analysis. <i>In situ/operando</i> powder X-ray diffraction. Time-resolved powder X-ray diffraction. Analysis of local structures using micro/nano beam.
BL14B2	Engineering Science Research II	(Sept. 2007)	X-ray imaging. XAFS in a wide energy range (5–72 keV). XAFS of dilute systems and thin films. Time-resolved XAFS by quick scan (Time-resolved QXAFS).
BL19B2	Engineering Science Research I	(Nov. 2001)	Residual stress measurement. Structural analysis of thin film, surface and interface. Powder X-ray diffraction. X-ray topography. Ultrasmall-angle X-ray scattering.
BL20XU	Medical and Imaging II	(Sept. 2001)	X-ray micro-/nano-imaging: micro-CT, nano-CT (15–37.7 keV), refraction/phase contrast imaging. X-ray diffraction tomography (XRD-CT), microbeam/scanning X-ray microscope. Research and development of X-ray optics and optical elements, coherent X-ray optics. Ultra small-angle X-ray scattering (USAXS, 23 keV).
BL20B2	Medical and Imaging I	(Sept. 1999)	Micro-radiography, micro-angiography, micro-tomography, and refraction-contrast imaging are the mainly used techniques. BL20B2 is also applicable to small-animal experiments for medical research. Research and development of basic techniques for evaluation of optical devices and X-ray imaging.
BL25SU	Soft X-ray Spectroscopy of Solid	(Apr. 1998)	Research on electron states by photoemission spectroscopy (PES). Research on electronic band structures by angle-resolved photoemission spectroscopy (ARPES). Study of magnetic states by magnetic circular dichroism (MCD) of soft X-ray absorption. Analysis of surface atomic arrangement by photoelectron diffraction (PED). Nano-spectroscopic analysis using low-energy/photoemission electron microscope (SPELEEM).
BL27SU	Soft X-ray Photochemistry	(May 1998)	Soft X-ray photoabsorption spectroscopy of dilute samples in partial fluorescence yield mode. Surface and interface analysis using depth-resolved soft X-ray photoabsorption spectroscopy. Soft X-ray photoabsorption spectroscopy under ambient atmospheric pressure. Spectroscopy using soft X-ray microbeam. Observation of electron state in solids by soft X-ray emission spectroscopy.
BL28B2	White Beam X-ray Diffraction	(Sept. 1999)	White X-ray diffraction: X-ray topography. Energy-dispersive strain measurement. Time-resolved energy-dispersive XAFS (DXAFS) for studies of chemical and/or physical reaction process. Radiation therapy. High energy (~200 keV) X-ray microtomography.
BL35XU	Inelastic and Nuclear Resonant Scattering	(Sept. 2001)	Phonons in solids and atomic dynamics in disordered materials by inelastic X-ray scattering. Atomic and molecular dynamics by nuclear resonant inelastic scattering and quasi-elastic scattering. Synchrotron-radiation-based Mössbauer spectroscopy. Nuclear excitation.
BL37XU	Trace Element Analysis	(Nov. 2002)	X-ray microbeam/nano-beam spectrochemical analysis. X-ray spectroscopic imaging. Ultratrace-element analysis. High-energy X-ray fluorescence analysis. Projection/scanning/imaging XAFS microscopy. High brightness XAFS. Coherent diffraction imaging XAFS microscopy.
BL39XU	Magnetic Materials	(Oct. 1997)	X-ray magnetic circular dichroism (XMCD) spectroscopy and element-specific magnetometry (ESM). X-ray emission spectroscopy (XES) and its magnetic circular dichroism. XMCD magnetic imaging and local ESM using micro/nano-beam, XAFS microscopy and local ESM, XAFS and XMCD at high pressure. X-ray spectroscopy using variable X-ray polarization (horizontally/perpendicularly linear or circular).
BL40XU	High Flux	(Apr. 2000)	Fast time-resolved X-ray diffraction and scattering experiments. X-ray photon correlation spectroscopy, X-ray fluorescence analysis. Microbeam X-ray diffraction and scattering experiments. Micro-crystallography.
BL40B2	Structural Biology II	(Sept. 1999)	Small-angle X-ray scattering (SAXS).
BL41XU	Structural Biology I	(Oct. 1997)	Macromolecular crystallography. Micro-crystallography. Ultra-high resolution structural analysis.
BL43IR	Infrared Materials Science	(Apr. 2000)	Infrared microspectroscopy.
BL45XU	Structural Biology III	(Apr. 2019)	Macromolecular crystallography. Micro-crystallography. Automation and high throughput data collection for protein crystallography.
BL46XU	Engineering Science Research III	(Nov. 2000)	Hard X-ray photoemission spectroscopy.
BL47XU	HAXPES · μCT	(Oct. 1997)	X-ray optics. Planetary science. Materials science. Applied materials science.

BL #	Beamline Name (Public Use or First Beam)	Areas of Research and Available Techniques
● Contract Beamlines		
as of April 2022		
BL03XU	Advanced Softmaterial (Advanced Softmaterial Beamline Consortium) (Nov. 2009)	Structural characterization of softmaterials using small- and wide-angle X-ray scattering. Grazing-incidence small- and wide-angle X-ray scattering for thin films.
BL07LSU	The University-of-Tokyo Outstation Beamline for Materials Science (The University of Tokyo) (Oct. 2009)	Ambient pressure photoemission spectroscopy, nano-beam photoemission spectroscopy, high-resolution soft X-ray emission spectroscopy, and any methods requiring the highly brilliant soft X-ray beam.
BL08B2	Hyogo BM (Hyogo Prefecture) (Jun. 2005)	XAFS in a wide energy region. Small angle X-ray scattering. X-ray topography. Imaging. X-ray diffraction for multipurpose.
BL11XU	QST Quantum Dynamics I (National Institutes for Quantum Science and Technology) (Oct. 1998)	Nuclear resonant scattering. Surface and interface structure with MBE. Resonant inelastic X-ray scattering. X-ray emission spectroscopy.
BL12B2	NSRRC BM (National Synchrotron Rad. Res. Center) (Oct. 2000)	X-ray absorption spectroscopy. Powder X-ray diffraction. High resolution X-ray scattering. Protein crystallography.
BL12XU	NSRRC ID (National Synchrotron Rad. Res. Center) (Dec. 2001)	Non-resonant or resonant inelastic X-ray scattering. Hard X-ray photoemission spectroscopy.
BL14B1	QST Quantum Dynamics II (National Institutes for Quantum Science and Technology) (Dec. 1997)	Materials science at high pressure. XAFS. Time-resolved energy-dispersive XAFS (DXAFS).
BL16B2	SUNBEAM BM (SUNBEAM Consortium) (Oct. 1998)	Characterization of secondary battery related materials, semiconductors, fuel cells, catalysts, and several industrial materials with using X-ray absorption fine structure measurements, X-ray diffraction (including X-ray reflectivity technique), X-ray topography and computed tomography/laminography.
BL16XU	SUNBEAM ID (SUNBEAM Consortium) (Oct. 1998)	Characterization of secondary battery related materials, semiconductors, fuel cells, catalysts, and structural materials using X-ray diffraction. X-ray microbeam based evaluation techniques (including X-ray magnetic circular dichroism), hard X-ray photoelectron spectroscopy and fluorescence X-ray analysis.
BL22XU	JAEA Actinide Science I (Japan Atomic Energy Agency) (May 2002)	HAXPES. XAFS. Residual stress/strain distribution analysis. High-pressure science. Coherent X-ray diffraction. Surface X-ray diffraction. High-energy X-ray diffraction. Time-resolved X-ray diffraction.
BL23SU	JAEA Actinide Science II (Japan Atomic Energy Agency) (Feb. 1998)	Surface chemistry with supersonic molecular beam. Photoelectron spectroscopy. Magnetic circular dichroism. STXM.
BL24XU	Hyogo ID (Hyogo Prefecture) (May. 1998)	Microbeam small- and wide-angle X-ray scattering for local structure analysis. Scanning and imaging microscope, micro-tomography, coherent diffraction. Microbeam X-ray diffraction and bright field X-ray topography for electronic device materials. Near-ambient pressure hard X-ray photoelectron spectroscopy.
BL28XU	Advanced Batteries (Kyoto University) (Apr. 2012)	Characterization of rechargeable battery reactions and battery related materials by resonant X-ray diffraction, X-ray absorption spectroscopy (XAS), X-ray diffraction spectroscopy (XDS), and hard X-ray photoemission spectroscopy (HAXPES).
BL31LEP	Laser-Electron Photon II (RCNP, Osaka University) (Oct. 2013)	Production of high intensity GeV photon beam by laser-backward Compton scattering. Hadron physics via photonuclear and photonuclear reactions. Test and calibration of detectors with GeV gamma-ray and converted electrons/positrons.
BL33LEP	Laser-Electron Photon (RCNP, Osaka University) (Jun. 1999)	Under removal work.
BL33XU	TOYOTA (TOYOTA Central R&D Labs., Inc.) (Apr. 2009)	Time-resolved XAFS. 3DXRD. Characterization of industrial materials and devices (e.g. catalysts, lightweight bodies, secondary batteries, fuel cells, and power modules).
BL44XU	Macromolecular Assemblies (IPR, Osaka University) (May 1999)	Crystal structure analysis of biological macromolecular assemblies (e.g., membrane protein complexes, protein complexes, protein-nucleic acid complexes, and viruses).
◆ RIKEN Beamlines		
as of April 2022		
BL05XU	R&D-ID (Mar. 2004)	R&D of high-energy X-ray optics, instruments, and applications; structural and dynamical research using small and wide angle scattering.
BL15XU	RIKEN Materials Science III (Oct. 2021)	Advanced diffraction and scattering with high-energy X-rays.
BL17SU	RIKEN Coherent Soft X-ray Spectroscopy (Sept. 2003)	High resolution photoemission spectroscopy; soft X-ray emission spectroscopy; soft X-ray diffraction spectroscopy; soft X-ray microspectroscopy.
BL19LXU	RIKEN SR Physics (Oct. 2000)	SR science with highly brilliant X-ray beam.
BL26B1	RIKEN Structural Genomics I (Apr. 2002)	Structural biology research based on single crystal X-ray diffraction.
BL26B2	RIKEN Structural Genomics II (Apr. 2002)	Structural biology research based on single crystal X-ray diffraction.
BL29XU	RIKEN Coherent X-ray Optics (Dec. 1998)	X-ray optics, especially coherent X-ray optics.
BL32XU	RIKEN Targeted Proteins (Oct. 2009)	Protein microcrystallography.
BL32B2	R&D-BM (May 2002)	X-ray computed tomography; X-ray diffraction; X-ray absorption fine structure; R&D of SR instruments.
BL36XU	RIKEN Materials Science II (Apr. 2020)	Time resolved XAFS and X-ray diffraction; 2D/3D scanning XAFS imaging; 3D computed tomography/laminography XAFS imaging; X-ray emission spectroscopy; ambient pressure hard X-ray photoelectron spectroscopy; pink beam experiments.
BL38B1	RIKEN Structural Biology I (Oct. 2000)	Structure study of non-crystalline biological materials using small-angle scattering and diffraction techniques.
BL38B2	Diagnosis Beamline (Sept. 1999)	Accelerator beam diagnostics.
BL43LXU	RIKEN Quantum NanoDynamics (Oct. 2011)	High resolution inelastic X-ray scattering for investigating atomic and electronic dynamics.
BL44B2	RIKEN Materials Science I (Feb. 1998)	Structural materials science research using powder X-ray diffraction.