

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, 55 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 (13 beamlines operating), and
- (3) RIKEN Beamlines (16 beamlines operating).

Currently, 26 public beamlines are fully operational. Beamlines that have been proposed and constructed by external organizations, such as universities, research

institutes, private companies and consortiums, are referred to as contract beamlines and these are used exclusively by contractors for their own research purposes. At present, 13 contract beamlines are in operation. Beamlines constructed by RIKEN or transferred to RIKEN, except for public beamlines, are referred to as RIKEN beamlines and are primarily used for RIKEN's own research activities, with partial availability for public use. RIKEN is now operating 16 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.

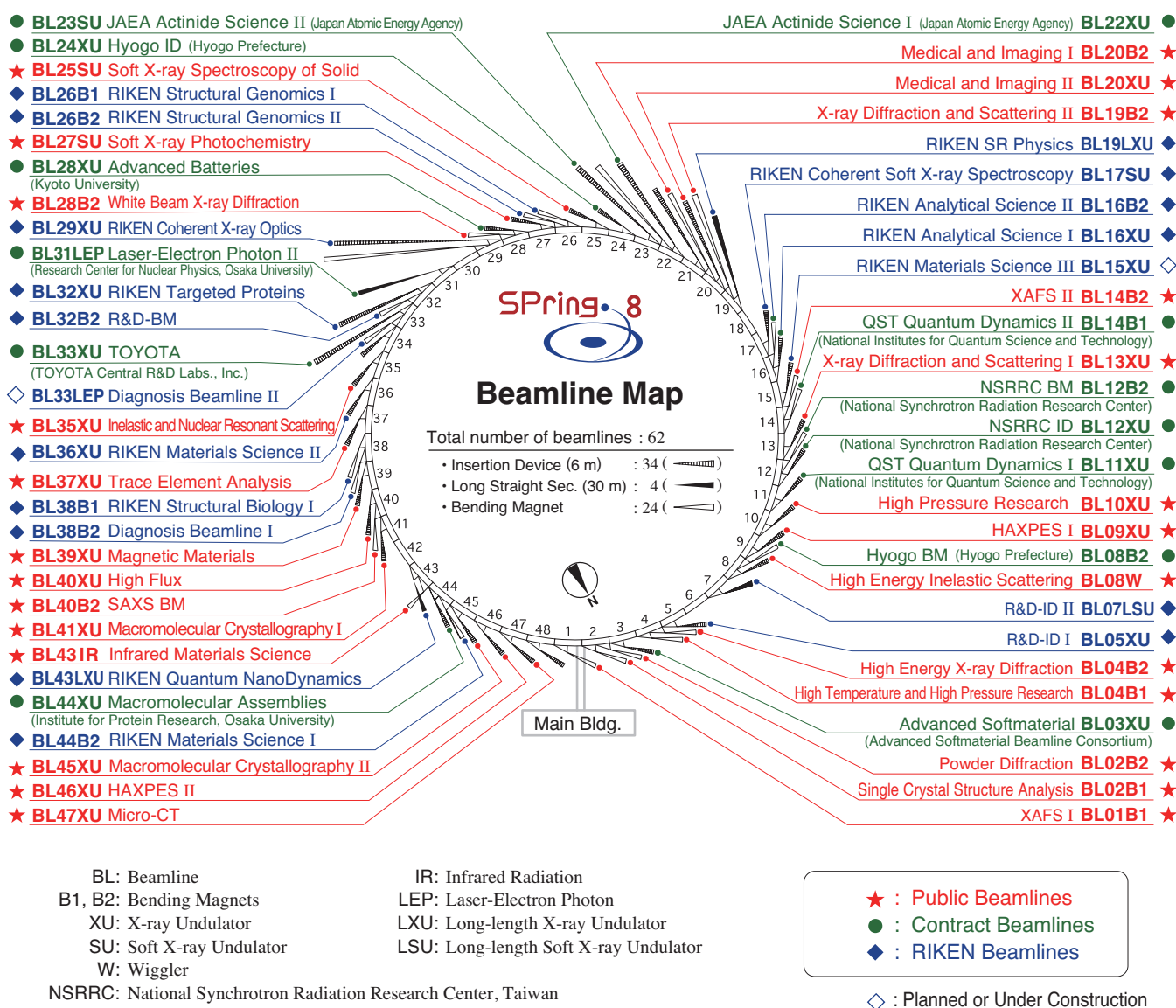


Fig. 2. Beamline map.

Table 3. List of beamlines

BL #	Beamline Name	(Public Use) or (First Beam)	Areas of Research and Available Techniques
★ Public Beamlines			as of April 2024
BL01B1	XAFS I	(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 Structural Analysis	(Oct. 1997)	Charge density study using high energy X-ray, <i>in situ</i> single crystal experiments, microcrystal structure analysis.
BL02B2	Powder Diffraction	(Sep. 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	(Sep. 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 I	(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	X-ray Diffraction and Scattering I	(Sep. 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 nanodiffraction.
BL14B2	XAFS II	(Sep. 2007)	X-ray imaging, XAFS in a wide energy range (3.8–72 keV), XAFS of dilute systems and thin films, time-resolved XAFS by quick scan (time-resolved QXAFS), XAFS at low and high temperatures.
BL19B2	X-ray Diffraction and Scattering II	(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.
BL20B2	Medical and Imaging I	(Sep. 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.
BL20XU	Medical and Imaging II	(Sep. 2001)	X-ray micro-/nano-imaging: micro-tomography (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, ultrasmall-angle X-ray scattering (USAXS, 23 keV).
BL25SU	Soft X-ray Spectroscopy of Solid	(Apr. 1998)	Research on electronic 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 absorption spectroscopy of dilute samples in partial fluorescence yield mode, surface and interface analysis using depth-resolved soft X-ray absorption spectroscopy, soft X-ray absorption 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	(Sep. 1999)	White X-ray diffraction: X-ray topography, energy-dispersive strain measurement, high energy (~200 keV) X-ray microtomography, high-speed X-ray imaging.
BL35XU	Inelastic and Nuclear Resonant Scattering	(Sep. 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), XAFS and XMCD spectroscopy under extreme conditions (high pressure, high magnetic field, and low/high temperature), XAFS and XMCD spectroscopy using micro/nanobeam and variable X-ray polarization (horizontally/perpendicularly linear or circular), scanning XAFS and XMCD microscopy using micro/nanobeam, X-ray emission spectroscopy (XES) and high-energy resolution fluorescence detected (HERFD) XAFS spectroscopy.
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	SAXS BM	(Sep. 1999)	Small-angle X-ray scattering (SAXS).
BL41XU	Macromolecular Crystallography I	(Oct. 1997)	Macromolecular crystallography, micro-crystallography, ultrahigh resolution structural analysis.
BL43IR	Infrared Materials Science	(Apr. 2000)	Infrared microspectroscopy.
BL45XU	Macromolecular Crystallography II	(Apr. 2019)	Macromolecular crystallography, micro-crystallography, automation and high throughput data collection for protein crystallography.
BL46XU	HAXPES II	(Nov. 2000)	Hard X-ray photoemission spectroscopy, ambient pressure hard X-ray photoemission spectroscopy.
BL47XU	Micro-CT	(Oct. 1997)	X-ray micro-/nano-imaging including CT (7–15 keV), refraction/phase contrast imaging, high speed X-ray imaging, microbeam/scanning X-ray microscope.

BL #	Beamline Name	(Public Use) or (First Beam)	Areas of Research and Available Techniques
● Contract Beamlines			
as of April 2024			
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.
BL08B2	Hyogo BM (Hyogo Prefecture)	(Jun. 2005)	Small angle X-ray scattering, X-ray imaging, X-ray computed tomography, X-ray topography.
BL11XU	QST Quantum Dynamics I (National Institutes for Quantum Science and Technology)	(Oct. 1998)	Mössbauer spectroscopy, resonant inelastic X-ray scattering, X-ray emission spectroscopy, surface X-ray diffraction (<i>in situ</i> studies on crystal growth of III-V group semiconductor).
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)	High-temperature and high-pressure X-ray diffraction measurements mainly on hydrogen materials, XAFS for dilute samples, time-resolved energy-dispersive XAFS, irradiation research on biomaterials.
BL22XU	JAEA Actinide Science I (Japan Atomic Energy Agency)	(May 2002)	HAXPES, microbeam XAFS, residual stress/strain distribution analysis, X-ray imaging, time-resolved X-ray diffraction, surface X-ray diffraction, high-energy X-ray diffraction, high-pressure science, coherent 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 resonance 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)	Quark nuclear physics (hadron physics) studied in photon-nucleon and photon-nucleus reactions using high-intensity linearly polarized GeV photon beams from laser-induced Compton scattering; testing detectors using electrons or positrons converted from GeV photons.
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			
BL05XU	R&D-ID I	(Mar. 2004)	R&D of high-energy X-ray optics, instruments, and applications; structural and dynamical research using small and wide angle scattering.
BL07LSU	R&D-ID II	(Oct. 2009)	R&D of soft X-ray optics, instruments, and applications.
BL15XU	RIKEN Materials Science III	(Oct. 2021)	Advanced diffraction and scattering with high-energy X-rays.
BL16XU	Analytical Science I	(Oct. 1998)	Characterization of materials and products using multiple analytical techniques. (e.g., multi-axis diffractometer)
BL16B2	Analytical Science II	(Oct. 1998)	Characterization of materials and products using multiple analytical techniques. (e.g., X-ray digital topography)
BL17SU	RIKEN Coherent Soft X-ray Spectroscopy	(Sep. 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	(Mar. 2020)	Time resolved XAFS and X-ray diffraction; 2D/3D scanning XAFS imaging; 3D computed tomography/laminography XAFS imaging; X-ray emission 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	(Sep. 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.