

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 (13 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 and 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 and are mainly used for RIKEN's own research activities, with partial availability for public use. RIKEN is now operating 13 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.

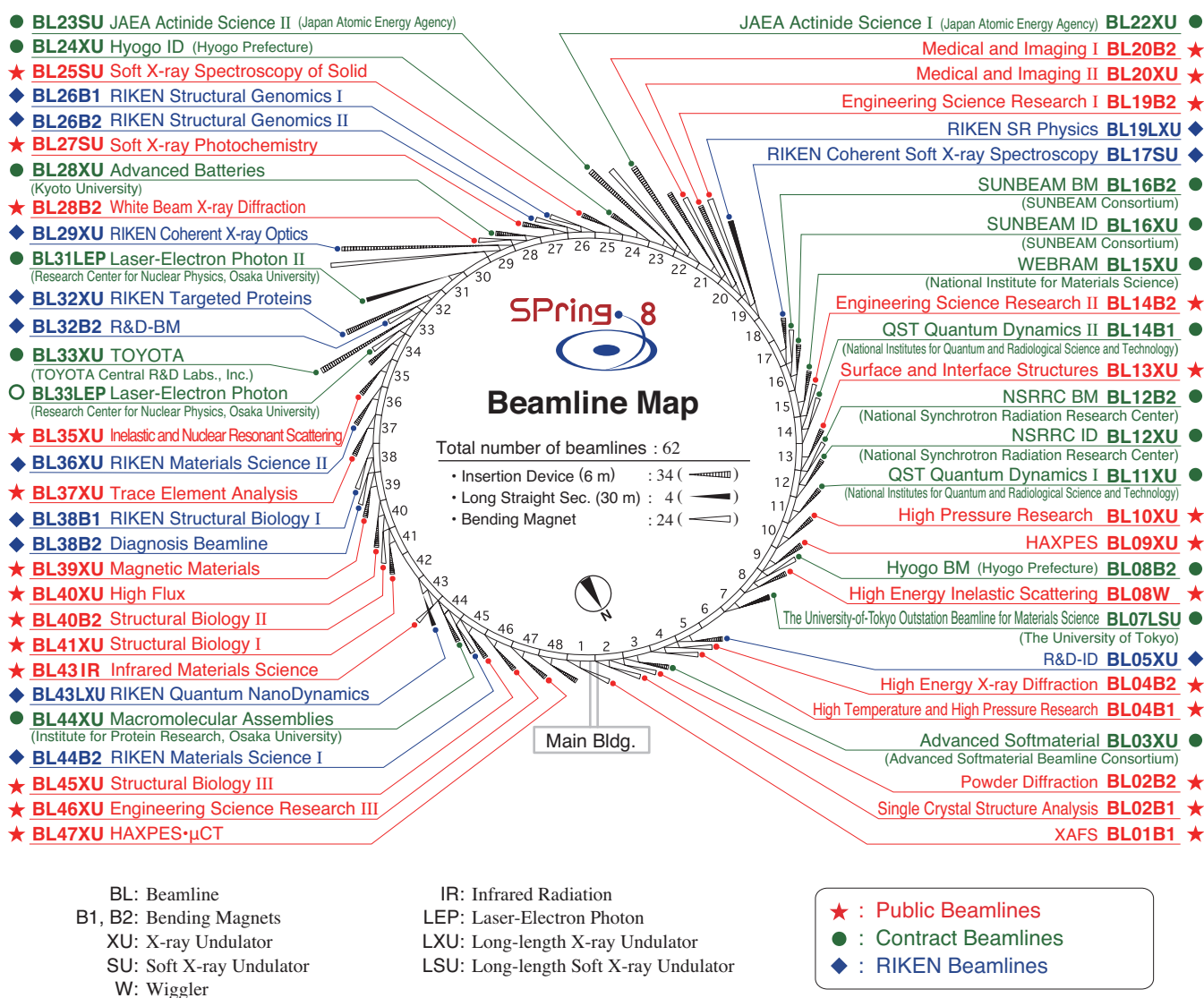


Fig. 2. Beamline map.

Table 3. List of beamlines

BL #	Beamline Name	(Public Use or First Beam)	Areas of Research and Available Techniques
★ Public Beamlines			as of April 2021
BL01B1	XAFS	(Oct. 1997)	XAFS in wide energy region (3.8 to 113 keV). XAFS of dilute systems and thin films. Quick XAFS with a time resolution of seconds to tens of seconds.
BL02B1	Single Crystal Structure Analysis	(Oct. 1997)	Charge density study and crystal structure analysis from single crystal X-ray diffraction. (X-ray energy range: 8 – 115 keV)
BL02B2	Powder Diffraction	(Sept. 1999)	Crystal structure study by Rietveld method, and <i>in situ</i> powder diffraction experiment under various conditions. (X-ray energy range: 12 – 37 keV)
BL04B1	High Temperature and High Pressure Research	(Oct. 1997)	High temperature and high pressure research with the multi-anvil press by powder X-ray diffraction, radiography and ultrasonic measurement.
BL04B2	High Energy X-ray Diffraction	(Sept. 1999)	Pair distribution function analysis for glass, liquid, and amorphous materials. High-energy X-ray total scattering. Containerless levitation.
BL08W	High Energy Inelastic Scattering	(Oct. 1997)	Magnetic Compton scattering. High-resolution Compton scattering. High-energy Bragg scattering. High-energy fluorescent X-ray analysis.
BL09XU	HAXPES	(Oct. 1997)	Hard X-ray photoelectron spectroscopy (HAXPES). Electronic state analysis with tunable energy (resonant HAXPES) and high energy resolution. Depth analysis of angle resolved HAXPES with wide acceptance lens.
BL10XU	High Pressure Research	(Oct. 1997)	Structure analysis and phase transitions under ultrahigh pressure (DAC experiment). Earth and planetary science.
BL13XU	Surface and Interface Structures	(Sept. 2001)	Atomic-scale structural analysis of surfaces and interfaces of crystalline materials, ultrathin films, and nanostructures. Surface X-ray diffraction (SXRD). Microbeam diffraction.
BL14B2	Engineering Science Research II	(Sept. 2007)	X-ray Imaging. XAFS in wide energy region (3.8 to 72 keV). XAFS of dilute systems and thin films.
BL19B2	Engineering Science Research I	(Nov. 2001)	Residual stress measurement. Structural analysis of thin film, surface, interface. Powder diffraction. X-ray topography. Ultrasmall angle X-ray scattering.
BL20XU	Medical and Imaging II	(Sept. 2001)	Microimaging. Micro-/nano-tomography, phase-contrast microtomography, X-ray diffraction tomography (XRD-CT), hard X-ray microbeam/scanning microscopy, imaging microscopy, coherent X-ray optics, and other experiments on X-ray optics and developments of optical elements. Refraction-enhanced imaging. Ultrasmall angle scattering.
BL20B2	Medical and Imaging I	(Sept. 1999)	Microimaging: microtomography, phase-contrast microtomography with grating interferometer for biological specimen and other kinds of specimen. Evaluation and development of various kinds of optical elements for novel imaging techniques. Large field X-ray topography.
BL25SU	Soft X-ray Spectroscopy of Solid	(Apr. 1998)	Study of electronic state of solids by soft X-ray photoemission spectroscopy (PES) including angle-resolved PES (ARPES). Atomic arrangement analysis of surfaces by photoelectron diffraction (PED) technique using two-dimensional photoemission analyzer. Magnetic state analysis by magnetic circular dichroism (MCD) of soft X-ray absorption and its element-specific magnetization curve measurements.
BL27SU	Soft X-ray Photochemistry	(May 1998)	Ambient atmospheric pressure soft X-ray photoabsorption spectroscopy. Chemical state analysis of light elements in dilute samples (NEXAFS). Elemental and chemical mapping using micro soft X-ray beam. Soft-X-ray emission spectroscopy.
BL28B2	White Beam X-ray Diffraction	(Sept. 1999)	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. High energy 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 spectrochemical analysis using micro/nano beam: Scanning X-ray microspectroscopy. X-ray spectroscopic imaging: Projection type spectroscopic tomography and imaging type spectroscopic tomography. Ultra trace element analysis. High energy X-ray fluorescence analysis.
BL39XU	Magnetic Materials	(Oct. 1997)	X-ray magnetic circular dichroism (XMCD) spectroscopy and element-specific magnetometry under multiple-extreme conditions. XMCD/XAS using a 100 nm focused X-ray beam. X-ray emission spectroscopy.
BL40XU	High Flux	(Apr. 2000)	Time-resolved diffraction and scattering experiments. Microbeam X-ray diffraction and scattering experiments. X-ray photon correlation spectroscopy. Fluorescence analysis. Quick XAFS. Submicrometer-scale single crystal structure analysis with high flux and zone plate focused X-ray beam. Single shot imaging with X-ray choppers. Laser pump-X-ray probe experiment.
BL40B2	Structural Biology II	(Sept. 1999)	Noncrystalline small and wide angle X-ray scattering.
BL41XU	Structural Biology I	(Oct. 1997)	Structural biology. Macromolecular crystallography. Microcrystallography. High resolution data collection.
BL43IR	Infrared Materials Science	(Apr. 2000)	Infrared microspectroscopy.
BL45XU	Structural Biology III	(Apr. 2019)	Structural biology. Macromolecular crystallography. Automation & High throughput data collection. Microcrystallography.
BL46XU	Engineering Science Research III	(Nov. 2000)	Structural characterization of thin films by X-ray diffraction and X-ray reflectivity measurement. Residual stress measurement. Time resolved X-ray diffraction measurement. Hard X-ray Photoemission Spectroscopy. X-ray Imaging.
BL47XU	HAXPES · μCT	(Oct. 1997)	Hard X-ray photoelectron spectroscopy (HAXPES). Depth analysis of angle resolved HAXPES with wide acceptance lens. Projection type microtomography. Imaging type microtomography. Hard X-ray microbeam/scanning microscopy.

BL #	Beamline Name	(Public Use) or (First Beam)	Areas of Research and Available Techniques
◆ Contract Beamlines			as of April 2021
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 & Radiological Science & 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 & Radiological Science & Technology)	(Dec. 1997)	Materials science at high pressure. XAFS. Time-resolved energy-dispersive XAFS (DXAFS).
BL15XU	WEBRAM (National Institute for Materials Science)	(Jan. 2000)	Under preparations
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. Materials science under high-pressure. Coherent X-ray diffraction. Surface X-ray diffraction. High-energy 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)	Production of high intensity GeV photon beam by laser-backward Compton scattering. Hadron physics via photoneutron and photoneuclear 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 2021
BL05XU	R&D-ID	(Mar. 2004)	Structural and dynamical research using small and wide angle scattering, R&D of SR instruments.
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	(Jan. 2013)	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 experiment.
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.