

III. Beamlines

The SPring-8 storage ring can accommodate up to 62 beamlines: 34 insertion devices, 4 long undulators, and 24 bending magnets. At the time of writing, 56 beamlines are in operation, and cover a wide variety of research fields related to synchrotron radiation science and technology. The beamlines are classified into the following four types.

- (1) Public Beamlines
- (2) Contract Beamlines
- (3) RIKEN Beamlines
- (4) Accelerator Diagnostics Beamlines

There are now 26 fully operational public beamlines. Beamlines, that are proposed and constructed by external organizations, such as universities, research institutes, and private companies, are called contract beamlines, and are exclusively used by contractors for their own research purposes. Currently, 19 contract beamlines are in operation. The contract

beamlines include NSRRC BM (BL12B2) and NSRRC ID (BL12XU) beamlines, which were constructed by the National Synchrotron Radiation Research Center in Taiwan. The Catalytic Reaction Dynamics for Fuel Cells beamline (BL36XU) constructed by the University of Electro-Communications and the Laser-Electron Photon II beamline (BL31LEP) constructed by Research Center for Nuclear Physics, Osaka University, began operations in January and October 2013, respectively. The beamlines constructed by RIKEN are called RIKEN beamlines, and are used for RIKEN's own research activities. RIKEN currently has 9 operating RIKEN beamlines and is reconstructing one. In addition, two accelerator diagnostics beamlines are in operation.

To display the beamline portfolio of SPring-8, Fig. 2 shows the beamline map and beamline classification, while Table III presents the research field of each beamline.

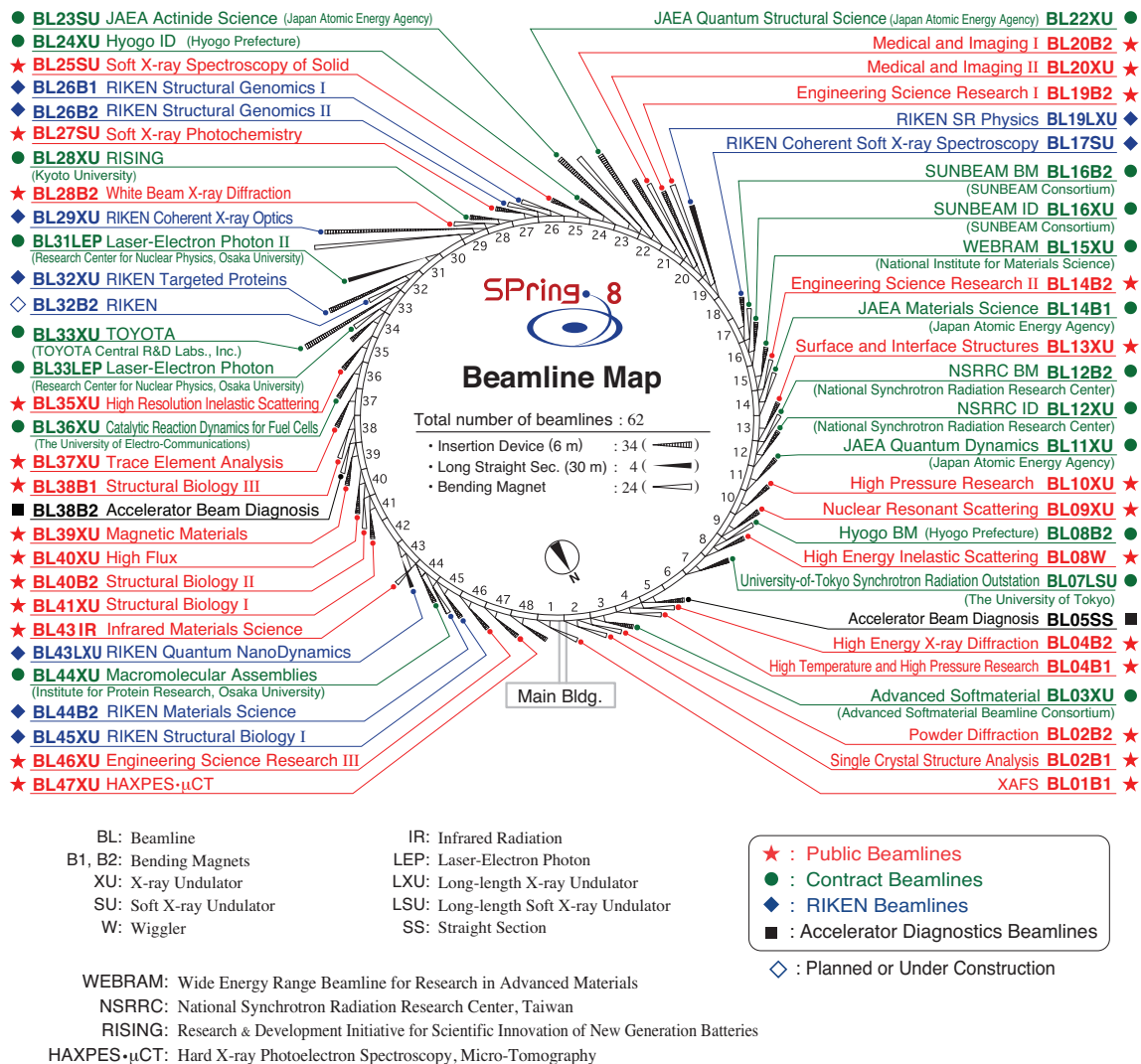


Fig. 2. Beamline map.

Table III. List of beamlines

BL #	Beamline Name	(Public Use) or (First Beam)	Areas of Research
★ Public Beamlines			
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 as tenth seconds.
BL02B1	Single Crystal Structure Analysis	(Oct. 1997)	Precise crystal structure analysis using high resolution data of single crystal (X-ray energy: 8–115 keV).
BL02B2	Powder Diffraction	(Sept. 1999)	Accurate structure analysis of crystalline materials using powder diffraction data by Rietveld refinements and maximum entropy method (MEM).
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)	Structural analysis of glass, liquid, and amorphous materials. X-ray diffraction under ultra high-pressure.
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	Nuclear Resonant Scattering	(Oct. 1997)	Lattice dynamics using nuclear inelastic scattering. Mössbauer spectroscopy, especially for the surface/interface study and under the extreme conditions.
BL10XU	High Pressure Research	(Oct. 1997)	Structure analysis and phase transitions under ultra high 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, ultra-thin films, and nanostructures. Surface X-ray diffraction (SXRD). Microbeam diffraction.
BL14B2	Engineering Science Research II	(Sept. 2007)	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 imaging, X-ray topography. Ultra-small angle X-ray scattering.
BL20XU	Medical and Imaging II	(Sept. 2001)	Microimaging. Hard X-ray microbeam/scanning microscopy, imaging microscopy, microtomography, 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. Microangiography, refraction-enhanced imaging, radiation therapy, phase-contrast CT using interferometer. Ultra-small angle scattering.
BL20B2	Medical and Imaging I	(Sept. 1999)	Microimaging: microtomography, phase-contrast microtomography with Bonse-Hart interferometer and 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)	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).
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). High resolution atomic and molecular electron spectroscopy. Dissociation dynamics of inner-shell excited molecules. (Molecular science) Photoemission and soft-X-ray emission spectroscopy for solids. (Solid state and surface physics)
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.
BL35XU	High Resolution Inelastic Scattering	(Sept. 2001)	Material dynamics on ~meV energy scales using inelastic X-ray scattering (IXS) and, sometimes, nuclear resonant scattering (NRS).
BL37XU	Trace Element Analysis	(Nov. 2002)	X-ray microbeam spectrochemical analysis. Ultra trace element analysis. High energy X-ray fluorescence analysis.
BL38B1	Structural Biology III	(Oct. 2000)	Structural biology. Macromolecular crystallography. Automatic data collection.
BL39XU	Magnetic Materials	(Oct. 1997)	X-ray magnetic circular dichroism (XMCD) spectroscopy and element-specific magnetometry under multiple-extreme conditions. XMCD/XAS using a sub-micron X-ray beam. X-ray emission spectroscopy. Resonant X-ray magnetic scattering.
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.
BL40B2	Structural Biology II	(Sept. 1999)	Noncrystalline small and wide angle X-ray scattering.
BL41XU	Structural Biology I	(Oct. 1997)	Structural biology. Macromolecular crystallography. Data collection from small crystals and large unicell crystals. Ultra-high resolution data collection.
BL43IR	Infrared Materials Science	(Apr. 2000)	Infrared microspectroscopy.
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.
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
● Contract Beamlines			
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. X-ray diffraction and reflectivity measurements for softmaterials.
BL07LSU	University-of-Tokyo Synchrotron Radiation Outstation (The University of Tokyo)	(Oct. 2009)	Time-resolved soft X-ray spectroscopy, nano-beam photoemission spectroscopy, ultra 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 for structural analyses of polymer and nanocomposite materials. X-ray topography. Imaging. Powder diffraction with a high angular-resolution.
BL11XU	JAEA Quantum Dynamics	(Oct. 1998)	Nuclear scattering. Surface and interface structure analysis with MBE. Inelastic X-ray scattering. XAFS.
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, Taiwan)	(Dec. 2001)	High resolution non-resonant or resonant inelastic X-ray scattering. High resolution near-edge X-ray Raman scattering. Phase transitions under high-pressure, low and high temperatures. High-resolution X-ray absorption and emission spectroscopy. X-ray physics and optics.
BL14B1	JAEA Materials Science	(Dec. 1997)	Materials science under high-temperature and high-pressure. <i>In situ</i> study on catalysis using dispersive XAFS. X-ray diffraction for structure physics.
BL15XU	WEBRAM (National Institute for Materials Science)	(Jan. 2000)	Hard X-ray photoelectron spectroscopy. High-precision X-ray powder diffraction.
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) and X-ray topography.
BL16XU	SUNBEAM ID (SUNBEAM Consortium)	(Oct. 1998)	Characterization of semiconductor materials, secondary batteries, fuel cells, catalysts, electrical display related materials, and structural materials with using X-ray diffraction, X-ray microbeam based evaluation technique (including X-ray magnetic circular dichroism), and fluorescence X-ray analysis.
BL22XU	JAEA Quantum Structural Science	(May 2002)	Materials science under high-pressure. Resonant X-ray scattering. Speckle scattering. Residual stress/strain distribution analysis.
BL23SU	JAEA Actinide Science	(Feb. 1998)	Surface chemistry with supersonic molecular beam. Biophysical spectroscopy. Photoelectron spectroscopy. Magnetic circular dichroism.
BL24XU	Hyogo ID (Hyogo Prefecture)	(May. 1998)	Surface/interface analysis for industry by fluorescent X-ray analysis, strain measurements and grazing incidence X-ray diffraction. Microbeam formation studies for materials and life sciences. Micro-SAXS for local long-range structure analysis.
BL28XU	RISING (Kyoto University) RISING: Research & Development Initiative for Scientific Innovation of New Generation Batteries	(Apr. 2012)	Analysis of rechargeable batteries. Time-resolved X-ray diffraction and XAFS with microbeam. XAFS of dilute systems and thin films. Dispersive XAFS. Hard X-ray photoelectron spectroscopy.
BL31LEP	Laser-Electron Photon II (RCNP, Osaka University)	(Apr. 2013)	Production of high intensity GeV photon beam by laser-backward Compton scattering. Hadron physics via photo-nucleon and photo-nuclear reactions. Test and calibration of detectors with GeV gamma-ray and converted electrons/positrons.
BL33LEP	Laser-Electron Photon (RCNP, Osaka University)	(Jun. 1999)	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.
BL33XU	TOYOTA (TOYOTA Central R&D Labs., Inc.)	(Apr. 2009)	Time-resolved XAFS. Characterization of industrial materials, such as catalysts, secondary batteries, fuel cells.
BL36XU	Catalytic Reaction Dynamics for Fuel Cells (The University of Electro-Communications)	(Jan.2013)	Real time analysis of catalytic reaction dynamics for fuel cells: time resolved XAFS, 2D spatial resolved XAFS, depth resolved XAFS, 3D laminography XAFS, ambient pressure hard X-ray photoelectron spectroscopy.
BL44XU	Macromolecular Assemblies (IPR, Osaka University)	(May 1999)	Crystal structure analysis of biological macromolecular assemblies (e.g. membrane complexes, protein complexes, protein-nucleic acid complexes, and viruses).
◆ RIKEN Beamlines			
BL17SU	RIKEN Coherent Soft X-ray Spectroscopy	(Sept. 2003)	High resolution photoemission spectroscopy. Soft X-ray emission spectroscopy for liquid and biological samples. Soft X-ray diffraction spectroscopy. Surface science.
BL19LXU	RIKEN SR Physics	(Oct. 2000)	SR science with highly brilliant X-ray beam.
BL26B1	RIKEN Structural Genomics I	(Apr. 2002)	Structural genomics research based on single crystal X-ray diffraction.
BL26B2	RIKEN Structural Genomics II	(Apr. 2002)	Structural genomics 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 micro-crystallography.
BL43LXU	RIKEN Quantum NanoDynamics	(Oct. 2011)	High resolution inelastic X-ray scattering for investigating atomic and electronic dynamics.
BL44B2	RIKEN Materials Science	(Feb. 1998)	Structural materials science research using powder X-ray diffraction.
BL45XU	RIKEN Structural Biology I	(Jul. 1997)	Time-resolved and static structures of non-crystalline biological materials using small-angle scattering and diffraction techniques.
■ Accelerator Diagnostics Beamlines			
BL05SS	Accelerator Beam Diagnosis	(Mar. 2004)	Accelerator beam diagnostics. R&D of accelerator components. Nano forensic science.
BL38B2	Accelerator Beam Diagnosis	(Sept. 1999)	Accelerator beam diagnostics. R&D of accelerator components.