

### 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, covering a wide variety of research fields involving 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 public beamlines in full operation. The 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 the contractors for their own research purposes. At present, 19 contract beamlines are in operation. The contract beamlines include the NSRRC BM (BL12B2) and NSRRC ID (BL12XU) beamlines, which were constructed by the National Synchrotron Radiation Research Center of Taiwan. The beamlines constructed by RIKEN are called RIKEN beamlines, which are mainly used for RIKEN's own research activities and are partly available for public use. RIKEN is now operating 9 beamlines and is reconstructing one beamline. In addition, two accelerator diagnostics beamlines are in operation.

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.

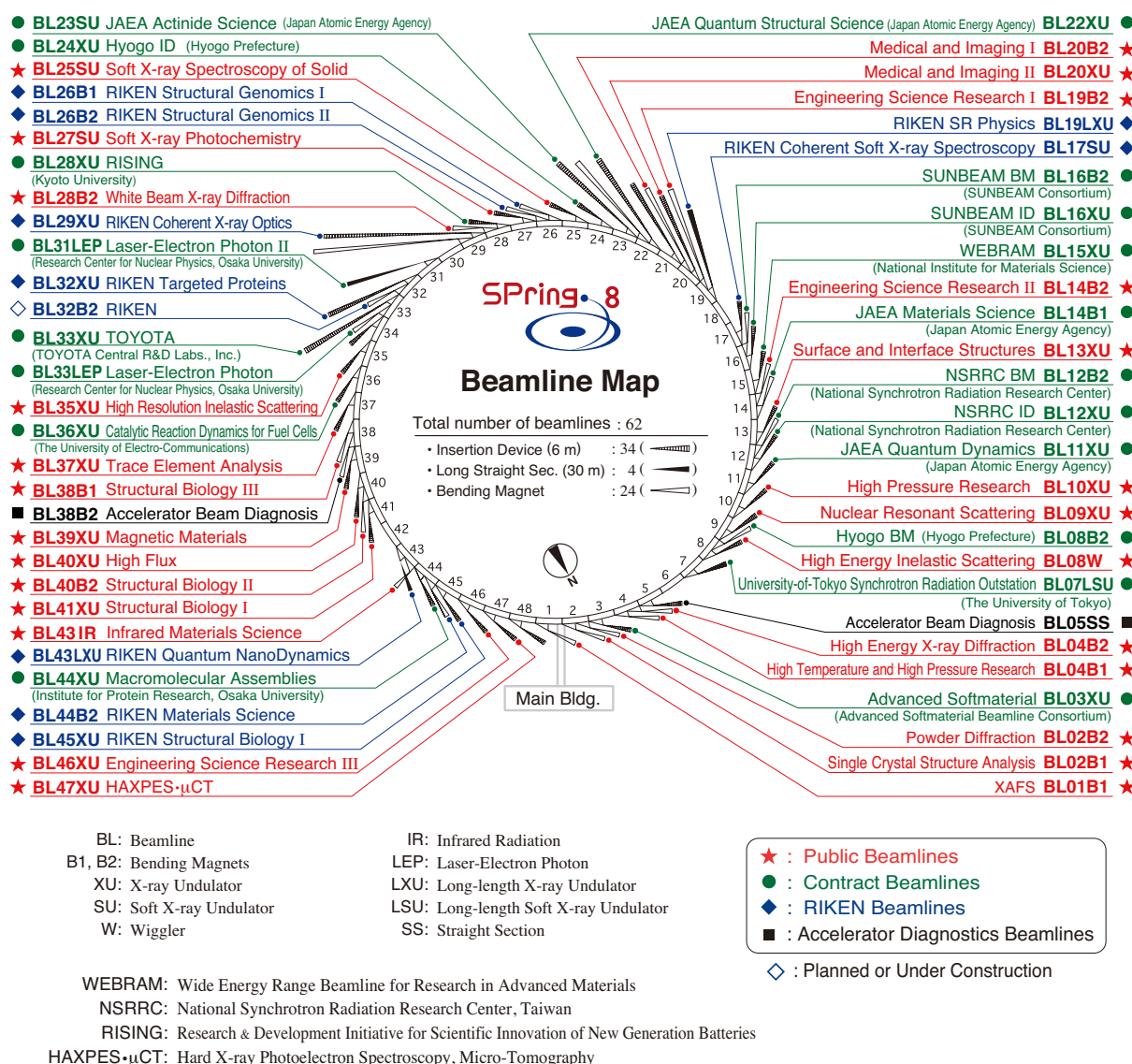


Fig. 2. Beamline map.

Table 3. List of beamlines

BL #	Beamline Name	(Public Use) or (First Beam)	Areas of Research
<b>★ Public Beamlines</b>			
BL01B1	<b>XAFS</b>	(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	<b>Single Crystal Structure Analysis</b>	(Oct. 1997)	Charge density study and crystal structure analysis from accurate single crystal diffraction measurements. (X-ray energy range: 8 – 115 keV)
BL02B2	<b>Powder Diffraction</b>	(Sept. 1999)	Charge density study and phase identification of crystalline materials from accurate powder diffraction measurements. (X-ray energy range: 12.4 – 35 keV)
BL04B1	<b>High Temperature and High Pressure Research</b>	(Oct. 1997)	High temperature and high pressure research with the multi-anvil press by powder X-ray diffraction, radiography and ultrasonic measurement.
BL04B2	<b>High Energy X-ray Diffraction</b>	(Sept. 1999)	Structural biology. Macromolecular crystallography. Microcrystallography. High resolution data collection.
BL08W	<b>High Energy Inelastic Scattering</b>	(Oct. 1997)	Magnetic Compton scattering. High-resolution Compton scattering. High-energy Bragg scattering. High-energy fluorescent X-ray analysis.
BL09XU	<b>Nuclear Resonant Scattering</b>	(Oct. 1997)	Lattice dynamics using nuclear inelastic scattering. Mössbauer spectroscopy, especially for the surface/interface study and under the extreme conditions.
BL10XU	<b>High Pressure Research</b>	(Oct. 1997)	Structure analysis and phase transitions under ultra high pressure (DAC experiment). Earth and planetary science.
BL13XU	<b>Surface and Interface Structures</b>	(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	<b>Engineering Science Research II</b>	(Sept. 2007)	XAFS in wide energy region (3.8 to 72 keV). XAFS of dilute systems and thin films.
BL19B2	<b>Engineering Science Research I</b>	(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	<b>Medical and Imaging II</b>	(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	<b>Medical and Imaging I</b>	(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	<b>Soft X-ray Spectroscopy of Solid</b>	(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. Chemical and magnetic imaging by soft X-ray scanning microscopy and photoelectron emission microscopy (PEEM).
BL27SU	<b>Soft X-ray Photochemistry</b>	(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	<b>White Beam X-ray Diffraction</b>	(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	<b>High Resolution Inelastic Scattering</b>	(Sept. 2001)	Materials dynamics on ~meV energy scales using inelastic X-ray scattering (IXS).
BL37XU	<b>Trace Element Analysis</b>	(Nov. 2002)	X-ray microbeam spectrochemical analysis. Ultra trace element analysis. High energy X-ray fluorescence analysis.
BL38B1	<b>Structural Biology III</b>	(Oct. 2000)	Structural biology. Macromolecular crystallography. Automatic data collection.
BL39XU	<b>Magnetic Materials</b>	(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	<b>High Flux</b>	(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	<b>Structural Biology II</b>	(Sept. 1999)	Noncrystalline small and wide angle X-ray scattering.
BL41XU	<b>Structural Biology I</b>	(Oct. 1997)	Structural biology. Macromolecular crystallography. Microcrystallography. High resolution data collection.
BL43IR	<b>Infrared Materials Science</b>	(Apr. 2000)	Infrared microspectroscopy.
BL46XU	<b>Engineering Science Research III</b>	(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	<b>HAXPES · μCT</b>	(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
<b>● Contract Beamlines</b>			
BL03XU	<b>Advanced Softmaterial</b> (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	<b>University-of-Tokyo Synchrotron Radiation Outstation</b> (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	<b>Hyogo BM</b> (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	<b>JAEA Quantum Dynamics</b>	(Oct. 1998)	Nuclear scattering. Surface and interface structure analysis with MBE. Inelastic X-ray scattering. XAFS.
BL12B2	<b>NSRRC BM</b> (National Synchrotron Rad. Res. Center)	(Oct. 2000)	X-ray absorption spectroscopy. Powder X-ray diffraction. High resolution X-ray scattering. Protein crystallography.
BL12XU	<b>NSRRC ID</b> (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	<b>JAEA Materials Science</b>	(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	<b>WEBRAM</b> (National Institute for Materials Science)	(Jan. 2000)	Hard X-ray photoelectron spectroscopy. High-precision X-ray powder diffraction.
BL16B2	<b>SUNBEAM BM</b> (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	<b>SUNBEAM ID</b> (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	<b>JAEA Quantum Structural Science</b>	(May 2002)	Materials science under high-pressure. Resonant X-ray scattering. Speckle scattering. Residual stress/strain distribution analysis.
BL23SU	<b>JAEA Actinide Science</b>	(Feb. 1998)	Surface chemistry with supersonic molecular beam. Biophysical spectroscopy. Photoelectron spectroscopy. Magnetic circular dichroism.
BL24XU	<b>Hyogo ID</b> (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	<b>RISING</b> (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	<b>Laser-Electron Photon II</b> (RCNP, Osaka University)	(Oct. 2013)	Production of high intensity GeV photon beam by laser-backward Compton scattering. Hadron physics via photonuclear and photoneuclear reactions. Test and calibration of detectors with GeV gamma-ray and converted electrons/positrons.
BL33LEP	<b>Laser-Electron Photon</b> (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	<b>TOYOTA</b> (TOYOTA Central R&D Labs., Inc.)	(Apr. 2009)	Time-resolved XAFS. Characterization of industrial materials, such as catalysts, secondary batteries, fuel cells.
BL36XU	<b>Catalytic Reaction Dynamics for Fuel Cells</b> (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	<b>Macromolecular Assemblies</b> (IPR, Osaka University)	(May 1999)	Crystal structure analysis of biological macromolecular assemblies (e.g., membrane complexes, protein complexes, protein-nucleic acid complexes, and viruses).
<b>◆ RIKEN Beamlines</b>			
BL17SU	<b>RIKEN Coherent Soft X-ray Spectroscopy</b>	(Sept. 2003)	High resolution photoemission spectroscopy. Soft X-ray emission spectroscopy for liquid and biological samples. Soft X-ray diffraction spectroscopy. Surface science.
BL19LXU	<b>RIKEN SR Physics</b>	(Oct. 2000)	SR science with highly brilliant X-ray beam.
BL26B1	<b>RIKEN Structural Genomics I</b>	(Apr. 2002)	Structural genomics research based on single crystal X-ray diffraction.
BL26B2	<b>RIKEN Structural Genomics II</b>	(Apr. 2002)	Structural genomics research based on single crystal X-ray diffraction.
BL29XU	<b>RIKEN Coherent X-ray Optics</b>	(Dec. 1998)	X-ray optics, especially coherent X-ray optics.
BL32XU	<b>RIKEN Targeted Proteins</b>	(Oct. 2009)	Protein microcrystallography.
BL43LXU	<b>RIKEN Quantum NanoDynamics</b>	(Oct. 2011)	High resolution inelastic X-ray scattering for investigating atomic and electronic dynamics.
BL44B2	<b>RIKEN Materials Science</b>	(Feb. 1998)	Structural materials science research using powder X-ray diffraction.
BL45XU	<b>RIKEN Structural Biology I</b>	(Jul. 1997)	Time-resolved and static structures of non-crystalline biological materials using small-angle scattering and diffraction techniques.
<b>■ Accelerator Diagnostics Beamlines</b>			
BL05SS	<b>Accelerator Beam Diagnosis</b>	(Mar. 2004)	Accelerator beam diagnostics. R&D of accelerator components. Nano-forensic science.
BL38B2	<b>Accelerator Beam Diagnosis</b>	(Sept. 1999)	Accelerator beam diagnostics.