SPring-8

I. Introduction

SPring-8 was stably operated throughout FY2018 with the total operation time of the accelerator complex and the total user beam time of 5316.7 h and 4559.6 h, respectively, and a total downtime of 43.1 h. SPring-8 completed all its operations by the middle of February 2019.

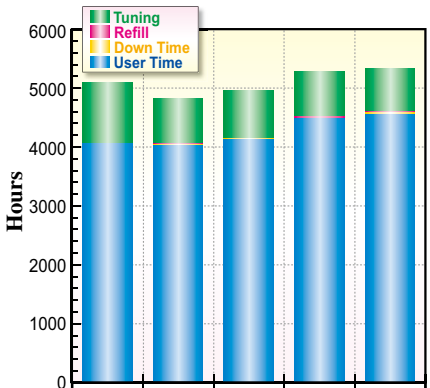
Regarding its research proposal system, SPring-8 designated Industrial Application Using Advanced Technology as a field of the priority research program on 19 September 2018. Concerning the contract beamlines, there were five interim reviews conducted for JAEA Actinide Science (BL22XU), JAEA Actinide Science II (BL23SU), QST Quantum Dynamics I (BL11XU), QST Quantum Dynamics II (BL14B1), and Catalytic Reaction Dynamics for Fuel Cells (BL36XU, The University of Electro-Communications), and all projects were authorized to continue.

At present, the number of SPring-8 users is as many as 15,000, all of whom are members of the SPring-8 User Community (SPRUC). It is important for SPring-8 to jointly organize scientific events with SPRUC, such as the SPring-8 Symposium, to facilitate dialogue between users and the facility staff. In 2018, the SPring-8 Symposium was held at Himeji City Civic Center on August 25–26, with 345 participants. SPring-8 also promotes communication between users and industry. The Joint Conference on Industrial Applications of SPring-8 was held in Kobe on September 6–7, 2018, with 240 participants. As part of its continuous effort towards fostering of human resources in synchrotron sciences, SPring-8 organized the 18th SPring-8 Summer School with 60 students of graduate schools nationwide, in cooperation with Hyogo University, Kwansei Gakuin University, The University of Tokyo, Okayama University, Osaka University, Japan Atomic Energy Agency, National Institutes for Quantum and Radiological Science and Technology, and RIKEN. Furthermore, SPring-8 and SPRUC organized the 2nd SPring-8 Autumn School with 45 participants, which included 3rd year university students and researchers from companies.

II. Machine Operation

The operation statistics for the last five fiscal years are shown in Fig. 1. In FY2018, the total operation time of the accelerator complex was 5329.8 h. The operation time of the storage ring was 5316.7 h, 85.8% of which (4559.6 h) was for SR experiments. This excellent figure for the user time represents a storage ring availability of 98.9%. The downtime resulting from failure accounted for 43.1 h (0.95% of the total user time), which was 50% greater than the figure for last year owing to problems with the magnet system. The intensity of the light source, i.e., the stored current, was kept extremely stable within 0.1% owing to the top-up operation, in which the current is filled up at any time on demand. For 99.9% of the user time in FY2018, the stored current was kept at 100 mA by the top-up operation.

The variety of operation modes for SR experiments is one of the characteristics of SPring-8. The operation modes are grouped into several-bunch and hybrid filling modes. The several-bunch mode consists of equally spaced bunches or bunch trains, i.e., 203 bunches, or 29 trains of 11 bunches, and the hybrid filling mode is composed of a long bunch train and isolated single bunches as shown in Table 1, where the share of each operation mode is also shown. The isolated bunch impurity is routinely maintained better than 10^{-8} in the top-up operation by bunch cleaning in the booster. The bunch current is also kept constant within 1% by the top-up operation. Table 2 summarizes the beam parameters of the storage ring.



	FY2014	FY2015	FY2016	FY2017	FY2018
Accelerator Operation Time	5099.3	4817.9	4951.7	5281.6	5329.8
Storage Ring Operation Time	5080.7	4804.8	4941.1	5270.4	5316.7
Tuning & Study (Acc. & BL)	1019.3	767.2	803.1	769.6	721.8
Refill	5.1	5.3	3.4	4.6	5.3
Down Time	17.1	16.8	23.1	28.7	43.1
Mean Time Between Failures	163.2	202.8	229.2	194.7	168.9
Achieved User Time	4057.8	4033.9	4125.5	4478.7	4559.6
Planning User Time	4080.0	4056.0	4152.0	4512.0	4608.0
Availability (%)	99.5	99.5	99.4	99.3	98.9

Fig. 1. Operation statistics for last five fiscal years.

Table 1. Operation modes in FY2018

	Single bunch current (mA)	Share of operation time (%)
203 bunches		29.2
4 bunch-train × 84		3.7
11 bunch-train × 29		22.9
1/7-filling + 5 single bunches	3	6.8
2/29-filling + 26 single bunches	1.4	3.1
1/14-filling + 12 single bunches	1.6	13.5
11/29-filling + 1 single bunch	5	20.8

Table 2. Beam parameters of SPring-8 storage ring

Energy [GeV]	8
Number of buckets	2436
Tunes (ν_x / ν_y)	41.14 / 19.34
Current [mA]:	
single bunch	12
multi bunch	100
Bunch length (σ) [psec]	13
Horizontal emittance [nm·rad]	2.4*
Vertical emittance [pm·rad]	4.8*
Coupling [%]	0.2
RF Voltage [MV]	14.4** ~ 16
Momentum acceptance [%]	3.2 (~256 MeV)
Beam size (σ_x / σ_y)* [μm]	
Long ID section	333 / 7
ID section	316 / 5
BM1 section	94 / 12
BM2 section	100 / 12
Beam divergence (σ_x' / σ_y')* [μrad]	
Long ID section	8 / 0.7
ID section	9 / 1.0
BM1 section	58 / 0.5
BM2 section	68 / 0.5
Operational chromaticities (ξ_x / ξ_y)	+2 / +2***
Lifetime [hr]:	
100 mA (multi bunch)	~ 250
1 mA (single bunch)	~ 30
Horizontal dispersion [m]:	
Long ID section	0.153
ID section	0.146
BM1 section	0.039
BM2 section	0.059
Fast orbit stability (0.1 – 200 Hz) [μm]	
horizontal (rms)	~ 4
vertical (rms)	~ 1

* Assuming 0.2% coupling
** Power saving mode
*** With bunch-by-bunch feedback

III. Beamlines

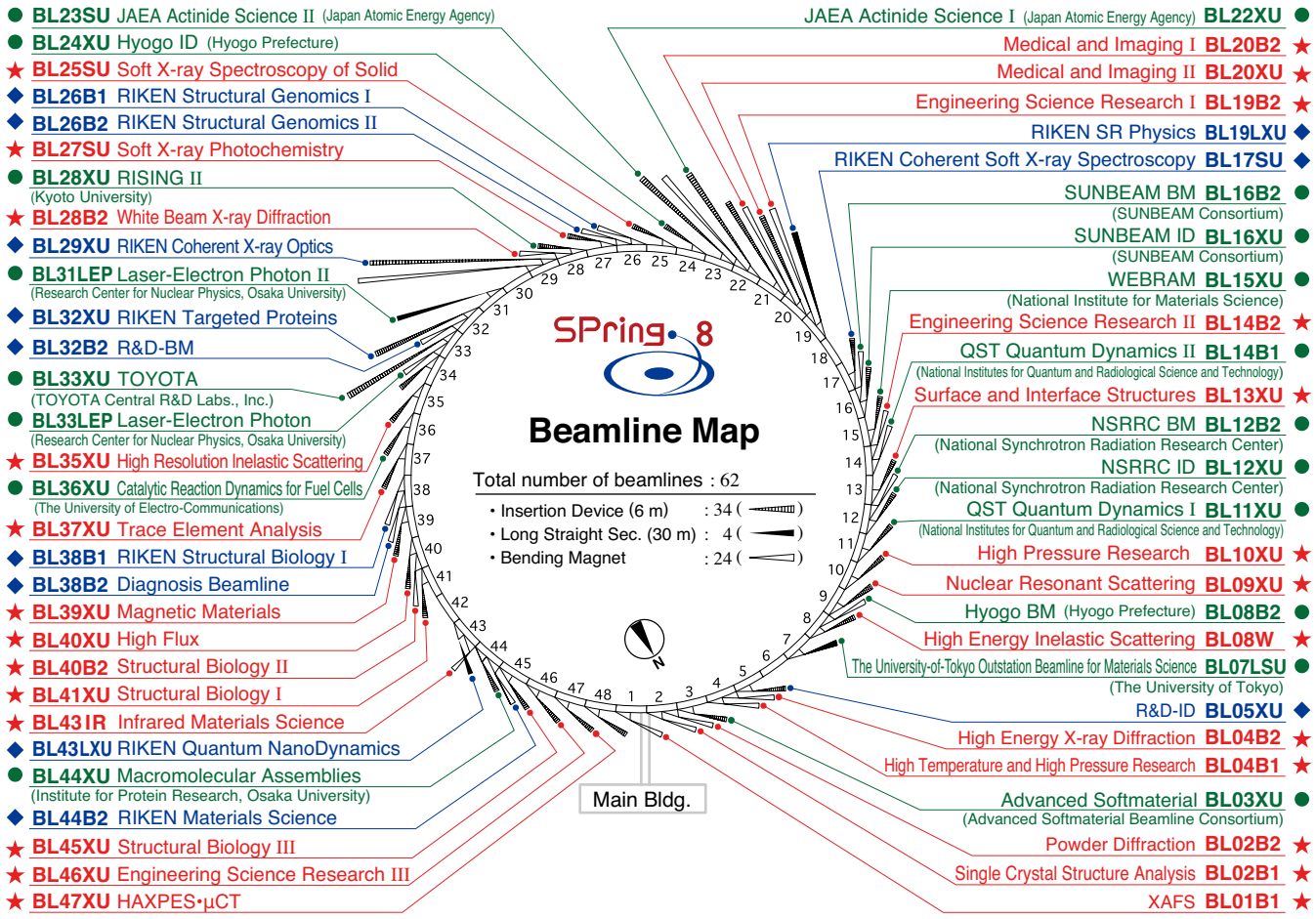
The SPring-8 storage ring can accommodate up to 62 beamlines: 34 insertion devices, 4 long undulators, and 24 bending magnets. At present, 57 beamlines are in operation, covering a wide variety of research fields involving synchrotron radiation science and technology. The beamlines are classified into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

(1) Public Beamlines (26 beamlines operating),
(2) Contract Beamlines (19 beamlines operating), and
(3) RIKEN Beamlines (12 beamlines operating).

There are now 26 public beamlines in full operation. The beamlines that are proposed and constructed by external organizations, such as universities, research institutes, private companies, and consortiums, are called contract beamlines and are exclusively used by contractors for their own research purposes. At present, 19 contract beamlines are in operation. The beamlines constructed by RIKEN that are not 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 12 beamlines.

From 2019A, BL45XU is newly available as a public beamline and added to Macromolecular Crystallography Beamlines (PX-BLs), while BL38B1 becomes RIKEN Beamline and no longer available as a PX-BL.

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.



BL: Beamline
B1, B2: Bending Magnets
XU: X-ray Undulator
SU: Soft X-ray Undulator
W: Wiggler

IR: Infrared Radiation
LEP: Laser-Electron Photon
LXU: Long-length X-ray Undulator
LSU: Long-length Soft X-ray Undulator

★ : Public Beamlines
● : Contract Beamlines
◆ : RIKEN Beamlines

WEBRAM: Wide Energy Range Beamline for Research in Advanced Materials
NSRRC: National Synchrotron Radiation Research Center, Taiwan
RISING: Research & Development Initiative for Scientific Innovation of New Generation Batteries

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			
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)	Charge density study and phase identification of crystalline materials from accurate powder diffraction measurements. (X-ray energy range: 12.4 – 35 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	Nuclear Resonant Scattering	(Oct. 1997)	Lattice dynamics using nuclear inelastic scattering. Mössbauer spectroscopy, especially for the surface/interface study and under the extreme conditions. Hard X-ray photoelectron spectroscopy (HAXPES). Depth analysis of HAXPES with high flux and energy resolution.
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)	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. Ultra-small 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. Ultra-small 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	High Resolution Inelastic Scattering	(Sept. 2001)	Materials dynamics on ~meV energy scales using inelastic X-ray scattering (IXS).
BL37XU	Trace Element Analysis	(Nov. 2002)	X-ray microbeam spectrochemical analysis. 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		
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	**The University-of-Tokyo Outstation Beamline for Materials Science** (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. X-ray topography. Imaging. X-ray diffraction for multipurpose.
BL11XU	**QST Quantum Dynamics I** (National Institutes for Quantum & Radiological Science & Technology)	(Oct. 1998)	Synchrotron radiation Mössbauer spectroscopy. XAFS. Resonant inelastic X-ray scattering spectroscopy. *In situ* X-ray diffraction during molecular-beam epitaxial growth.
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 under high-temperature and high-pressure, Energy-dispersive XAFS. X-ray diffraction for surface structure analyses.
BL15XU	**WEBRAM** (National Institute for Materials Science)	(Jan. 2000)	Hard X-ray photoelectron spectroscopy. High-precision X-ray powder diffraction. Structural analysis of thin film, surface and interface.
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. Resonant X-ray scattering. Speckle scattering.
BL23SU	**JAEA Actinide Science II** (Japan Atomic Energy Agency)	(Feb. 1998)	Surface chemistry with supersonic molecular beam. Biophysical spectroscopy. Photoelectron spectroscopy. Magnetic circular dichroism.
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	**RISING II** (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 photonucleon 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)	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 and X-ray diffraction, 2D scanning microscopic XAFS, 3D computed tomography/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 protein complexes, protein complexes, protein-nucleic acid complexes, and viruses).
	◆ RIKEN Beamlines		
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 diffraction, X-ray absorption fine structure, R&D of SR instruments.
BL38B1	**RIKEN Structural Biology I**	(Oct. 2000)	Time-resolved and static structures 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**	(Feb. 1998)	Structural materials science research using powder X-ray diffraction.

IV. User Program and Statistics

SPring-8 calls for public use proposals twice a year, in principle. The submitted proposals are reviewed by the SPring-8 Proposal Review Committee (SPring-8 PRC). Since 1997, SPring-8 has accepted a variety of proposals. For the promotion of research on industrial applications at SPring-8, the Industrial Application Division was established in 2005. With consultation support for industrial users provided by the division's coordinators, Industrial Application Proposals currently account for approximately 16%-20% of the total number of proposals conducted at the public beamlines. In addition, the Measurement Services were introduced in 2007B, wherein personnel of the Industrial Application Division carry out XAFS measurements on behalf of users at BL14B2. SPring-8 also launched a Protein Crystallography Data Collection Service at BL38B1 and a Powder X-ray Diffraction Measurement Service at BL19B2 in 2009B, a Hard X-ray Photoemission Spectroscopy (HAXPES) Measurement Service and a Thin Film Analysis (GIXD/XRR) Measurement Service at BL46XU in 2012B, and a Small Angle Scattering (SAXS) Measurement Service at BL19B2 in 2014B.

In FY2018, JASRI started to call for Cross-SR Facility Use Proposals for Industrial Application. These are intended to produce outstanding results through the research results from other domestic synchrotron radiation facilities.

SPring-8 has consistently provided ~4,500 h of user beamtime per year. Since the start of its operation in 1997, SPring-8 has succeeded in providing users with a total beamtime of 83,961 h. The beamtime available to users, the number of experiments conducted, and the number of user visits at the public and contract beamlines are summarized in Fig. 3. Some of the proposals are for proprietary use, for which refereed reports are not required. Figures 4 to 13 show the information on user programs.

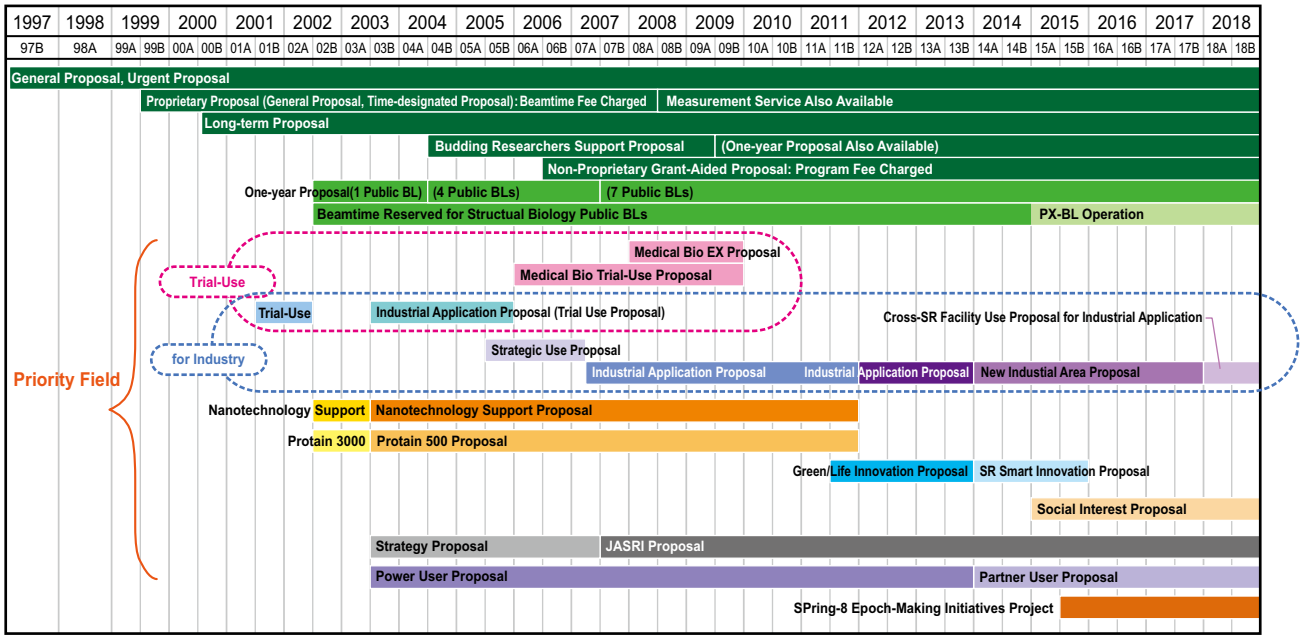


Fig. 3. Categories of proposals for the public beamlines.

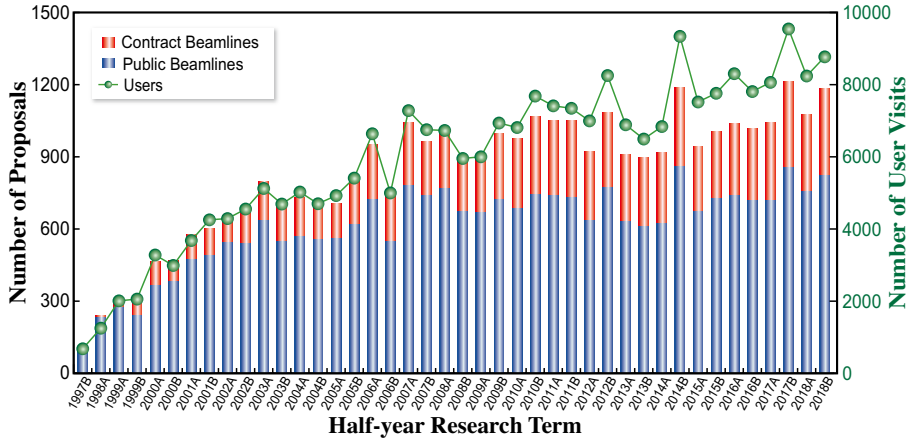


Fig. 4. Numbers of conducted experiments.

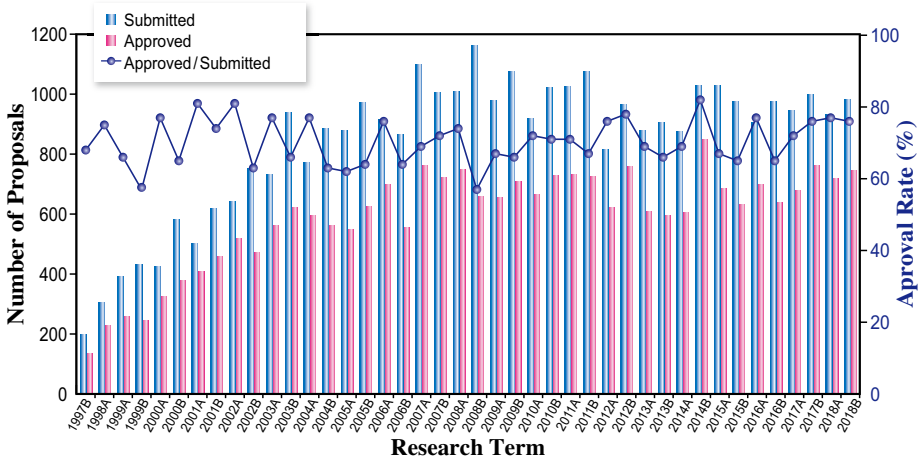


Fig. 5. Numbers of submitted proposals and approved proposals by research term (public beamlines).

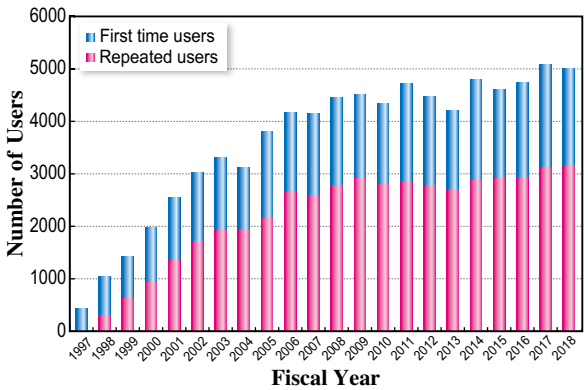


Fig. 6. Numbers of users by fical year.

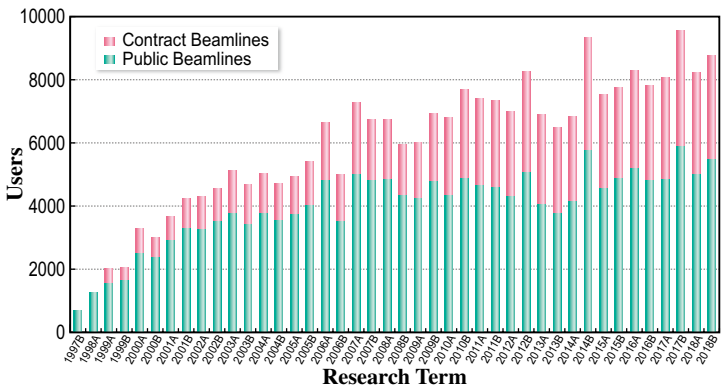


Fig. 7. Numbers of users visits by research term.

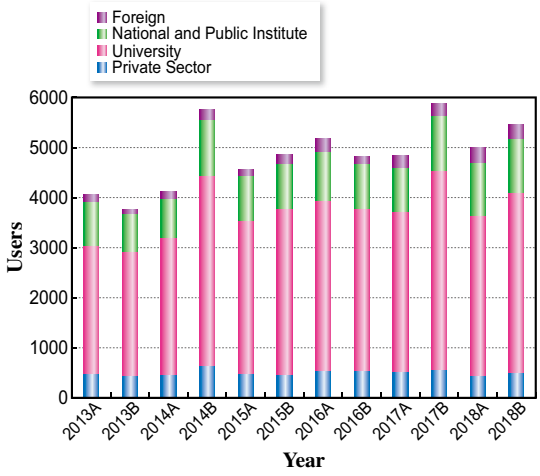


Fig. 8. Numbers of users by affiliation categories (public beamlines).

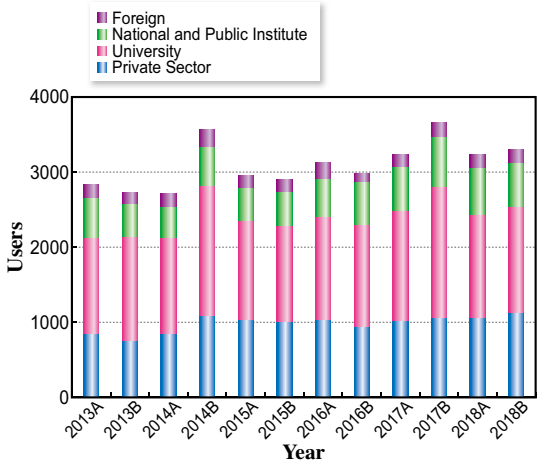


Fig. 9. Numbers of users by affiliation categories (contract beamlines).

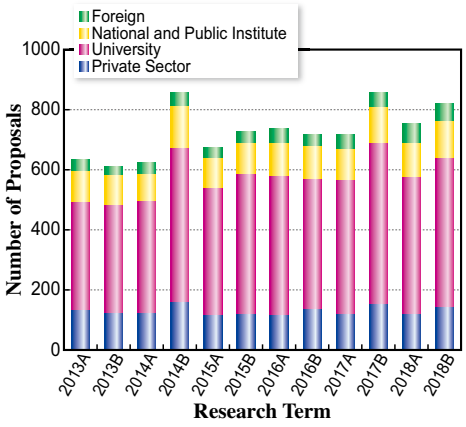


Fig. 10. Numbers of conducted proposals by affiliation (public beamlines).

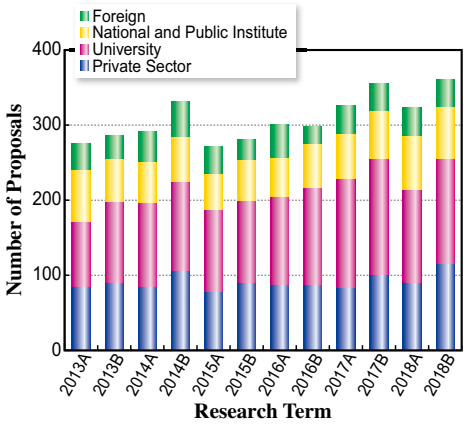


Fig. 11. Numbers of conducted proposals by affiliation categories (contract beamlines).

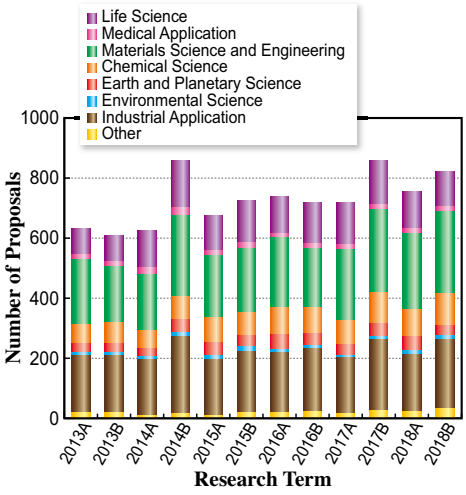


Fig. 12. Numbers of conducted proposals by research area (public beamlines).

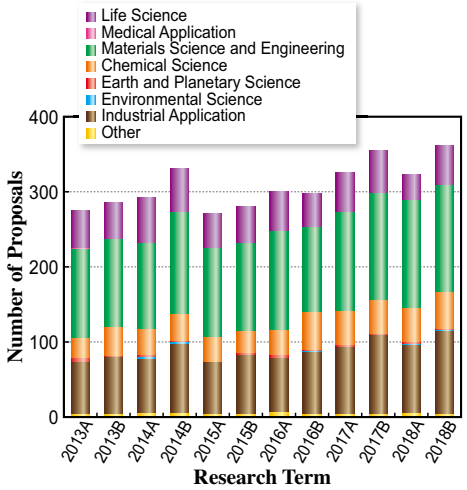


Fig. 13. Numbers of conducted proposals by research area (contract beamlines).

V. Research Outcome

As of March 2019, the total number of registered refereed papers from SPring-8 was 14,874. Figure 14 shows the annual statistics of refereed papers.

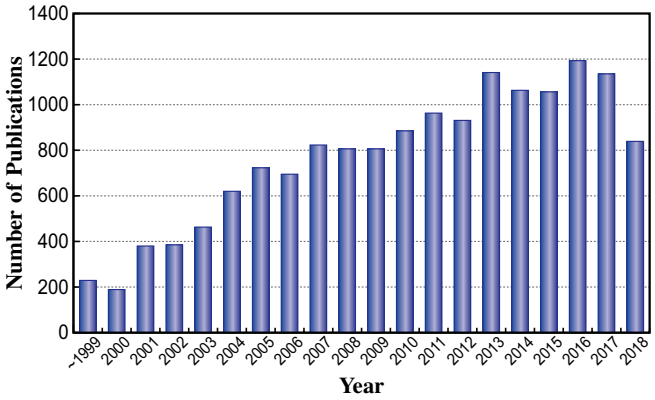


Fig. 14. Number of refereed publications.

VI. Budget and Personnel

When SPring-8 started operation in 1997, it was jointly managed by RIKEN, JAERI (now JAEA), and JASRI. However, JAERI withdrew from the management of SPring-8 on September 30, 2005. SPring-8 is currently administered by RIKEN and JASRI collaboratively.

The total budget for the operation of SPring-8 in FY2018 was about 9.5 billion yen. As of October 2018, RIKEN and JASRI have a total of 427 staff members. Figure 15 shows the annual budget allocated to operations, maintenance, and promotion of SPring-8. Figure 16 shows the manpower of RIKEN and JASRI.

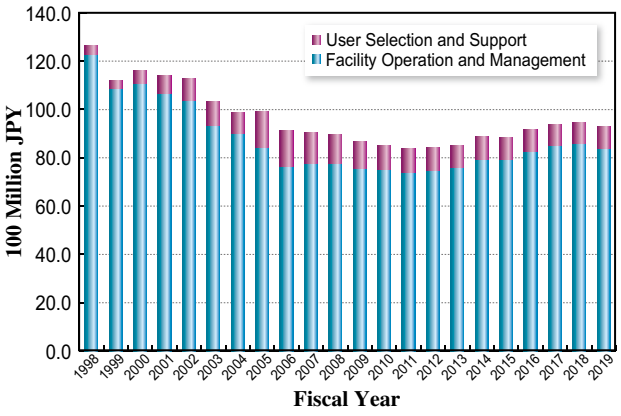


Fig. 15. SPring-8 budget.

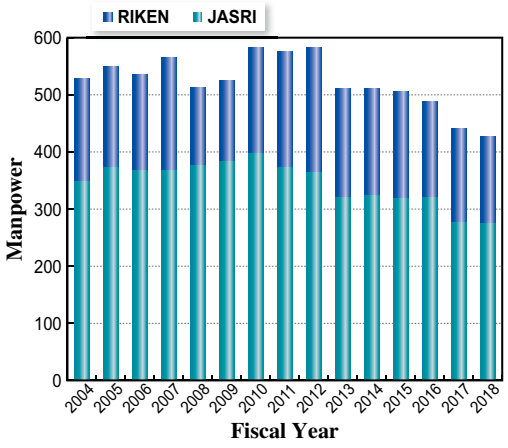


Fig. 16. Personnel at SPring-8: JASRI and RIKEN.

VII. Research Complex

The facilities of SPring-8, SACLA, and NewSUBARU form the Center of Excellence (COE) at the SPring-8 campus where JASRI, public beamline users, the contractors of contract beamlines, RIKEN, and the University of Hyogo work in close cooperation, forming a research complex where each member has their own role in delivering high-quality results to the field of synchrotron radiation science and technology. The organizational charts of RIKEN and JASRI, which are at the center of this research complex, are shown in Fig. 17 and Fig. 18, respectively.

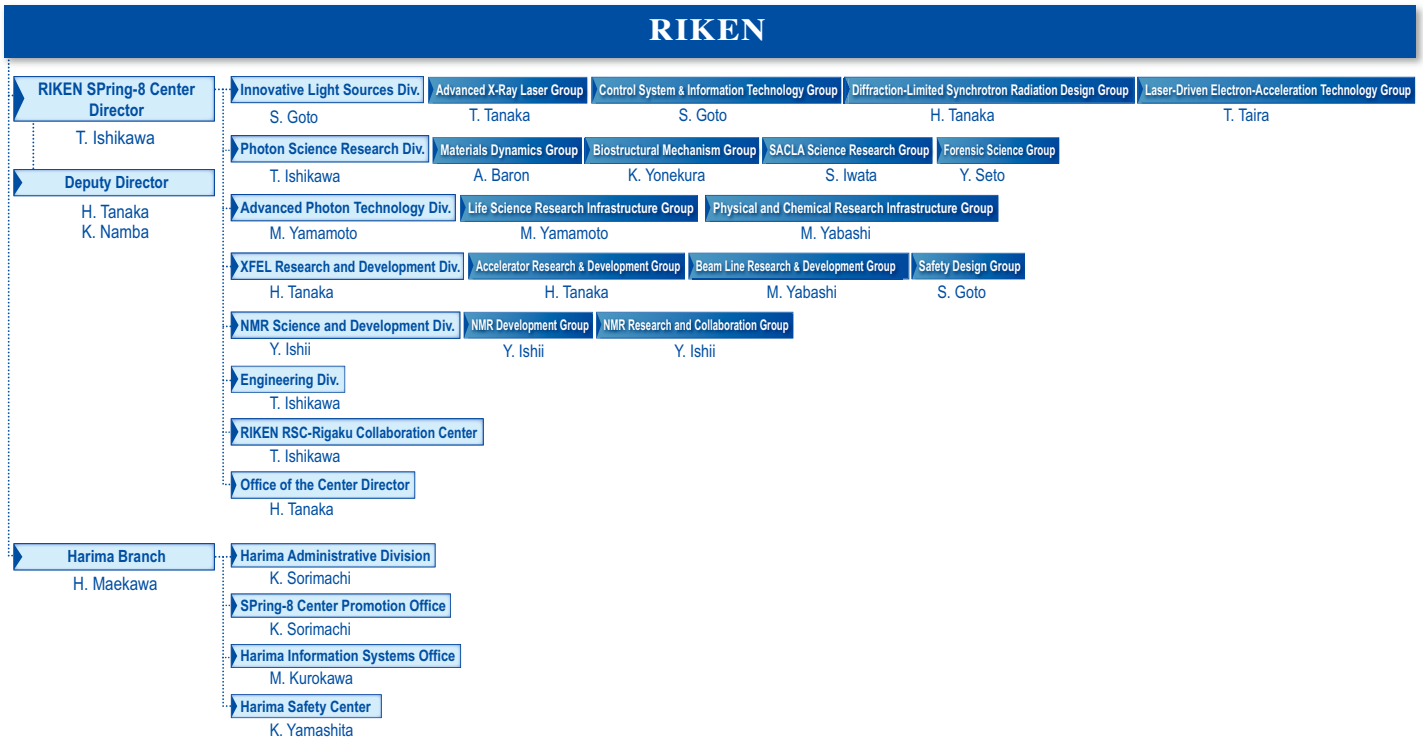


Fig. 17. RIKEN Harima Branch chart as of July 2019.

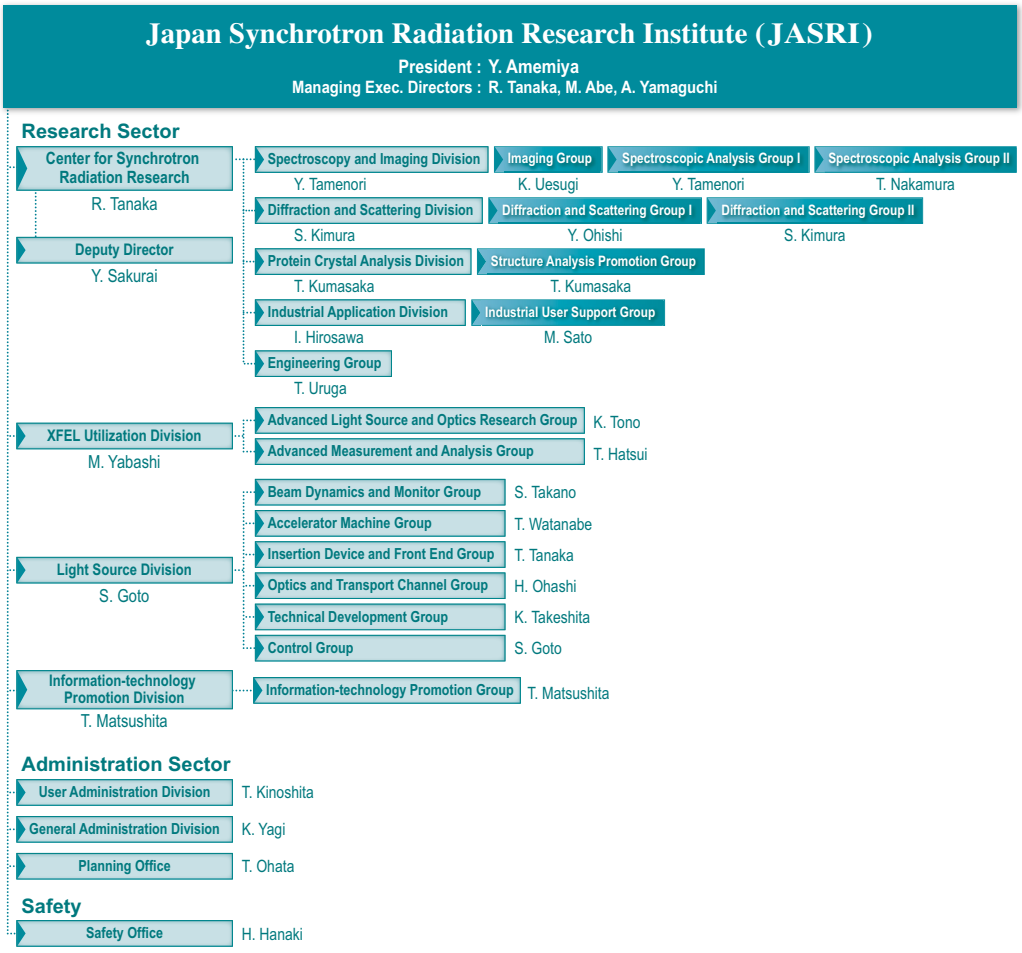


Fig. 18. JASRI chart as of July 2019.

VIII. SPring-8 Users Community (SPRUC)

The SPring-8 Users Community (SPRUC) is a user society that includes not only all users but also potential users who are interested in using SPring-8. In addition to these individuals, representative organizations comprising 26 institutes (principal universities, national/international research institutes, industries, and beamline consortiums) participate in SPRUC to discuss further promotion of the utilization of SPring-8 from strategic and perspective viewpoints.

As one of the key activities of SPRUC, the SPring-8 Symposium is held annually at the site of one of the representing organizations jointly with RIKEN and JASRI. SPring-8 Symposium 2018 with the theme "Starting movements toward the innovative leap of SPring-8" was held at Himeji Civic Auditorium on August 25 and 26. A panel discussion was held to debate this theme. This debate led to a workshop on the upgrade of beamlines toward the SPring-8 upgrade, which was co-hosted by RIKEN, JASRI, and SPRUC in March 2019. The award ceremony of the SPRUC 2018 Young Scientist Award, which was conferred on Dr. Makina Saito, Kyoto University and Dr. Keitaro Yamashita, Tokyo University, was also held. SPring-8 Symposium 2019 is scheduled to be held on August 30 and 31 at 50th Anniversary Hall, Okayama University, jointly hosted by Okayama University.

SPRUC has continued to promote the activities of SPRUC Multidisciplinary Research Groups in order to develop the use of SPring-8 in new research areas that will be important for future science and technology. Two research groups, one for nanodevice science and the other for practical application, have operated actively since their launching in 2015. The nanodevice science research group led by Dr. Teruo Ono, Kyoto University, which is at the end of the midterm of the research period, held a special session to discuss advanced results and future perspectives of spintronics research in JSR2019 (annual meeting of the Japanese Society for Synchrotron Radiation Research, held in January). The practical application research group successfully finished the first term led by Dr. Masatoshi Takao, project officer, and received an ex-post evaluation. The second term of the research project with a two-year research period, led by Dr. Masatoshi Takao as the program officer and Dr. Akihiko Fujiwara as the executive officer, started in the period 2018B.

The 4th-term SPRUC research groups were voluntarily organized in more than 30 research fields, and each research group actively conducted research meetings. For the research meetings, SPRUC supported the travel expenses of lecturers who contributed to promoting intercommunication between research fields. SPRUC supported the SPring-8 Summer School for enhancing users' research competency and also hosted the SPring-8 Autumn School with JASRI to acquire new users. In the latter school, the SPRUC research groups contributed to planning the lectures.

There were three modifications in the SPRUC organizational structure and related rules. One was the founding of SACLA Utilization Committee and its subsidiary organization XFEL Utilization Research Group. This will enhance the collaboration between SPRUC and the SACLA user community, and lead

SPRUC 2018 Young Scientist Award
Prof. Y. Amemiya, Dr. M. Saito, Dr. K. Yamashita, and Prof. J. Mizuki

to the creation of new research fields. The second was the changing of the advisers for the utilization committee to those for the SPRUC chair. This is to strengthen the planning ability in SPRUC steering. The third was the modification of the election rules of the SPRUC chair.

Prof. J. Mizuki
Kwansei Gakuin University
SPRUC Chairman FY2018

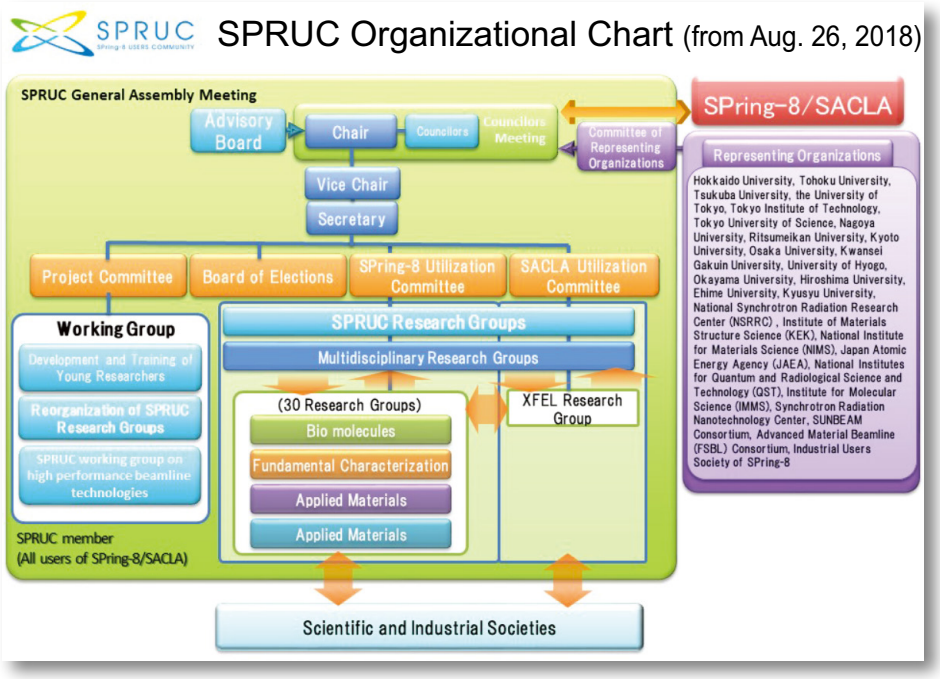


Chart of SPRUC organizational structure reorganized.

IX. Outreach Activities

To find new users in unexplored fields of application, SPring-8 holds various serialized seminars named Workshop on Advanced Techniques and Applications at SPring-8. Here are some representatives.

- 26th SPring-8 as a research tool for the drug delivery system (DDS)
  June 22, 2018 • Nagasaki Brick Hall (Nagasaki)

- 27th Cultural property analysis with SPring-8
  July 7, 2018 • Nara Women's University (Nara)

- 30th Current status and future prospects of protein structural biology research at SPring-8
  August 9-10, 2018 • Osaka University (Osaka)