# SPring-8

## I. Introduction

It was the last year that SPring-8 celebrated the 20th anniversary since its start of operation in 1997. SPring-8 was stably operated throughout 2017 with the total operation time of the accelerator complex and the total user beam time of 5281.6 h and 4478.7 h, respectively, with the total down time of 29 h. SPring-8 had to complete all its operations by the middle of February 2018.

Regarding its research proposal system, SPring-8 designated the Cross-SR Facility Use Proposals for Industrial Application as a priority field of the priority research program on 25 September 2017. Concerning the contract beamlines, there were five interim reviews conducted for Research Center for Nuclear Physics, Osaka University (BL33LEP I), and the project was authorized to continue. Upon the expiration of their contract terms, reviews were also conducted for SUNBEAM Consortium (BL16B2, BL16XU), Hyogo ID (BL24XU, Hyogo Prefecture), and their proposals for the next term were approved.

At present, SPring-8 users number is as many as 13,000, all of whom are members of the SPring-8 User Community (SPRUC).

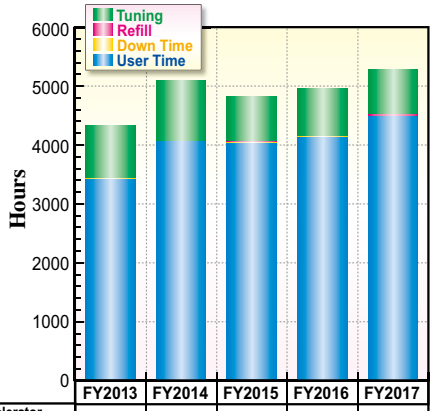
It is important for SPring-8 to jointly organize scientific events with SPRUC, such as the SPring-8 Symposium, to facilitate dialogue between users and the facility staff. In 2017, the SPring-8 Symposium was held at Hiroshima University on September 4–5, with a participant number of 267. SPring-8 also accelerates communication between users and the industry. The Joint Conference on Industrial Applications of SPring-8 was held in Kawasaki on August 31 to September 1, 2017, with 258 participants. As part of its continuous effort towards fostering of human resources in synchrotron sciences, SPring-8 organized the 17th SPring-8 Summer School with 90 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 1st SPring-8 Autumn School with 43 participants which included 3rd year university students and researcher of companies.

## II. Machine Operation

The operation statistics for the last five fiscal years are shown in Fig. 1. In FY2017, the total operation time of the accelerator complex was 5281.6 h. The operation time of the storage ring was 5270.4 h, 85.0% of which (4478.7 h) was for SR experiments. This excellent figure of the user time represents a storage ring availability of 99.3%, and a remarkable availability higher than 99% has been accomplished throughout the last five fiscal years. The downtime resulting from failure accounted for 0.64% (28.7 h) of the total user time. The intensity of the light source, i.e., the stored current is kept extremely stable within 0.1% thanks to the top-up operation, in which the current is filled up at any time on demand. In 93.4% of the user time in FY2017 the stored current stayed at 100 mA by the top-up operation, but in 5.8% at 70 mA as a result of failure of the RF system.

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. Several-bunch mode consists of equally spaced bunches or bunch-trains, i.e., 203 bunches, or 29 trains of 11 bunches, and hybrid-filling mode is composed of long bunch train and isolated single bunches as shown in Table 1, where a share of each operation mode is also shown. An isolated bunch impurity is routinely maintained better than $10^{-8}$ in the top-up operation by the bunch cleaning in the booster. The bunch current is also kept constant within 1% by means of the top-up operation. In the operation of the “11/29-filling+1single bunch” mode in the 8th cycle, failure of the timing system incurred a shift of the injection timing signal by one RF bucket, and it disabled us from maintaining the 5 mA single bunch for about 40h.

Table 2 summarizes the beam parameters of the storage ring.




| | FY2013 | FY2014 | FY2015 | FY2016 | FY2017 |
|---|---|---|---|---|---|
| Accelerator Operation Time | 4330.0 | 5099.3 | 4817.9 | 4951.7 | 5281.6 |
| Storage Ring Operation Time | 4265.4 | 5080.7 | 4804.8 | 4941.1 | 5270.4 |
| Tuning & Study (Acc. & BL) | 898.0 | 1019.3 | 767.2 | 803.1 | 769.6 |
| Refill | 3.5 | 5.1 | 5.3 | 3.4 | 4.6 |
| Down Time | 20.0 | 17.1 | 16.8 | 23.1 | 28.7 |
| Mean Time Between Failures | 213.0 | 163.2 | 202.8 | 229.2 | 194.7 |
| Achieved User Time | 3408.5 | 4057.8 | 4033.9 | 4125.5 | 4478.7 |
| Planning User Time | 3432.0 | 4080.0 | 4056.0 | 4152.0 | 4512.0 |
| Availability (%) | 99.3 | 99.5 | 99.5 | 99.4 | 99.3 |

Fig. 1. Operation statistics for most recent five fiscal years.

Table 1. Operation modes in FY2017

| | Single bunch current (mA) | Share of operation time (%) |
|---|---|---|
| 203 bunches | | 18.1 |
| 4 bunch-train × 84 | | 7.4 |
| 11 bunch-train × 29 | | 20.7 |
| 1/7-filling + 5 single bunches | 3 | 8.0 |
| 2/29-filling + 26 single bunches | 1.4 | 3.2 |
| 1/14-filling + 12 single bunches | 1.6 | 14.4 |
| 4/58-filling + 53 single bunches | 1 | 6.4 |
| 11/29-filling + 1 single bunch | 5 | 21.8 |

Table 2. Beam parameters of SPring-8 storage ring

| | |
|---|---|
| Energy [GeV] | 8 |
| Number of buckets | 2436 |
| Tunes ($\nu_x$ / $\nu_y$) | 41.14 / 19.34 |
| Current [mA]: | |
| single bunch | 12 |
| multi bunch | 100 |
| Bunch length ($\sigma$) [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 ($\sigma_x$ / $\sigma_y$)* [μm] | |
| Long ID section | 333 / 7 |
| ID section | 316 / 5 |
| BM1 section | 94 / 12 |
| BM2 section | 100 / 12 |
| Beam divergence ($\sigma_x'$ / $\sigma_y'$)* [μrad] | |
| Long ID section | 8 / 0.7 |
| ID section | 9 / 1.0 |
| BM1 section | 58 / 0.5 |
| BM2 section | 68 / 0.5 |
| Operational chromaticities ($\xi_x$ / $\xi_y$) | +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

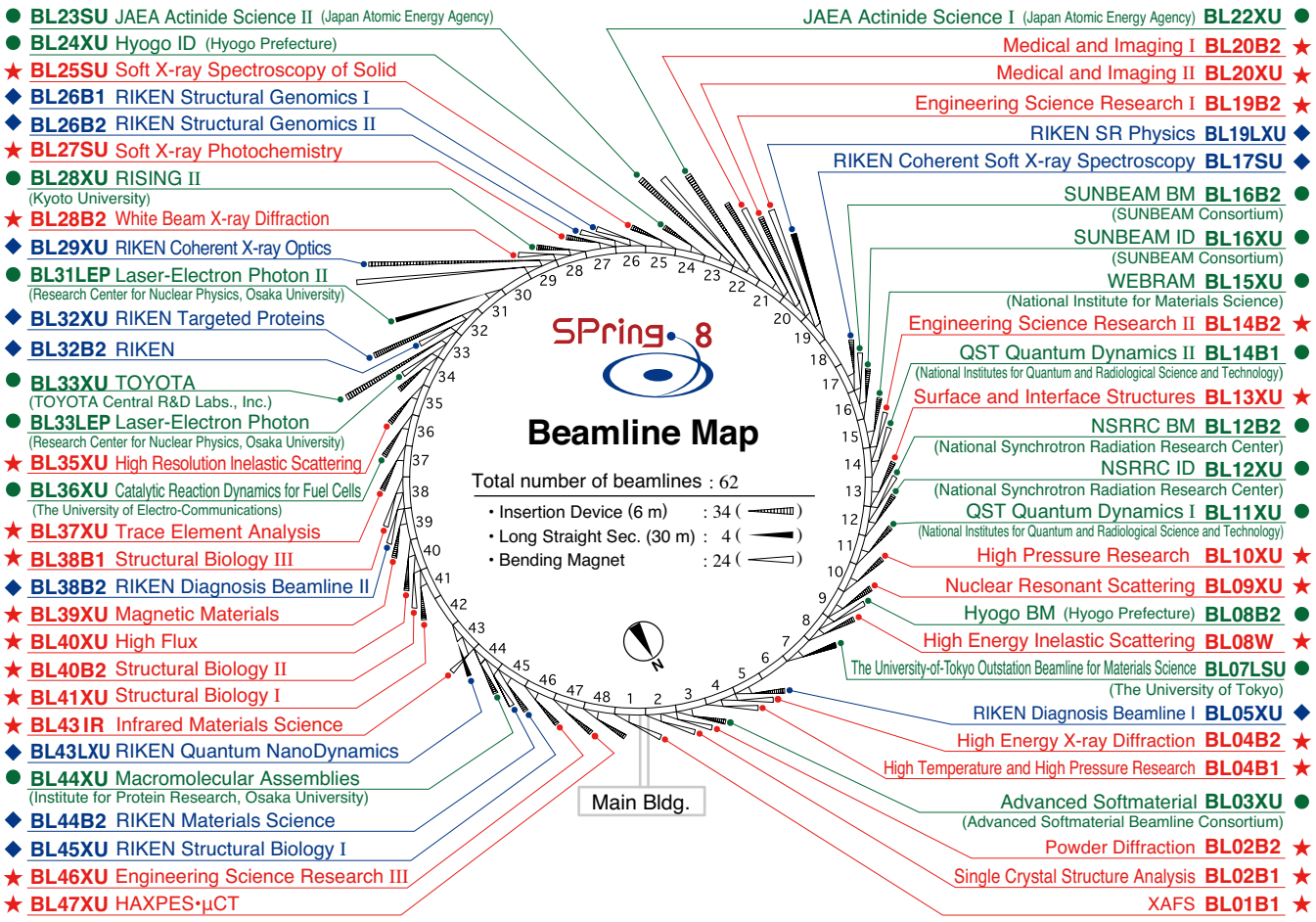
# III. Beamlines

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)
(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 the contractors for their own research purposes. At present, 19 contract beamlines are in operation. The beamlines constructed by 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 12 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.




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 accurate 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 imaging, 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, microtomography, phase-contrast microtomography X-ray diffraction tomography (XRD-CT), X-ray holography, coherent X-ray optics, and other experiments on X-ray optics and developments of optical elements. Refraction-enhanced imaging, phase-contrast CT. 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. Chemical and magnetic imaging by soft X-ray scanning microscopy and photoelectron emission microscopy (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). Elemental and chemical mapping using micro soft X-ray beam. Soft X-ray emission spectroscopy for solids. |
| 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. |
| 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 100 nm focussed 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. 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. |
| 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 and Available Techniques |
|---|---|---|---|
| | **● Contract Beamlines** | | |
| BL03XU | **Advanced Softmaterial**<br>(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**<br>(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**<br>(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 | **QST Quantum Dynamics I**<br>(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**<br>(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**<br>(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**<br>(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**<br>(National Institute for Materials Science) | (Jan. 2000) | Hard X-ray photoelectron spectroscopy. High-precision X-ray powder diffraction. |
| BL16B2 | **SUNBEAM BM**<br>(SUNBEAM Consortium) | (Oct. 1998) | Characterization of secondary battery related materials, semiconductors, fuel cells, catalysts, and several industrial materials using X-ray absorption fine structure measurements, X-ray diffraction (including X-ray reflectivity technique) and X-ray topography. |
| BL16XU | **SUNBEAM ID**<br>(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 photoemission spectroscopy and fluorescence X-ray analysis. |
| BL22XU | **JAEA Actinide Science I**<br>(Japan Atomic Energy Agency) | (May 2002) | Materials science under high-pressure. Resonant X-ray scattering. Speckle scattering. Residual stress/strain distribution analysis. |
| BL23SU | **JAEA Actinide Science II**<br>(Japan Atomic Energy Agency) | (Feb. 1998) | Surface chemistry with supersonic molecular beam. Biophysical spectroscopy. Photoelectron spectroscopy. Magnetic circular dichroism. |
| BL24XU | **Hyogo ID**<br>(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 material and life sciences. Scanning and imaging microscope. Micro-tomography. Micro-XAFS. Microbeam small- and wide-angle X-ray scattering for local structure analysis. Bright field X-ray topography. Near-ambient pressure hard X-ray photoelectron spectroscopy. 2016 Bright-field X-ray topography under multiple-beam diffraction condition. |
| BL28XU | **RISING II**<br>(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**<br>(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**<br>(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**<br>(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**<br>(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**<br>(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 | **RIKEN Diagnosis Beamline I** | (Mar. 2004) | Accelerator beam diagnostics. R&D of accelerator components. |
| 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. |
| BL38B2 | **RIKEN Diagnosis Beamline II** | (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. |
| BL45XU | **RIKEN Structural Biology I** | (Jul. 1997) | Time-resolved and static structures of non-crystalline biological materials using small-angle scattering and diffraction techniques. |

# 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, currently, Industrial Application Proposals account for approximately 16%–20% of the total number of proposals conducted at the public beamlines. In addition, the Measurement Service was introduced in 2007B, wherein the personnel of the Industrial Application Division carries out XAFS measurements on behalf of users at BL14B2. SPring-8 also launched a Protein Crystallography Data Collection Service at BL38B1 and 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.

SPring-8 has consistently provided ~4,500h 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 79,401h. 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. Part of the proposals are for proprietary use, for which refereed reports are not required. Figures 4 to 13 show the information on user programs.

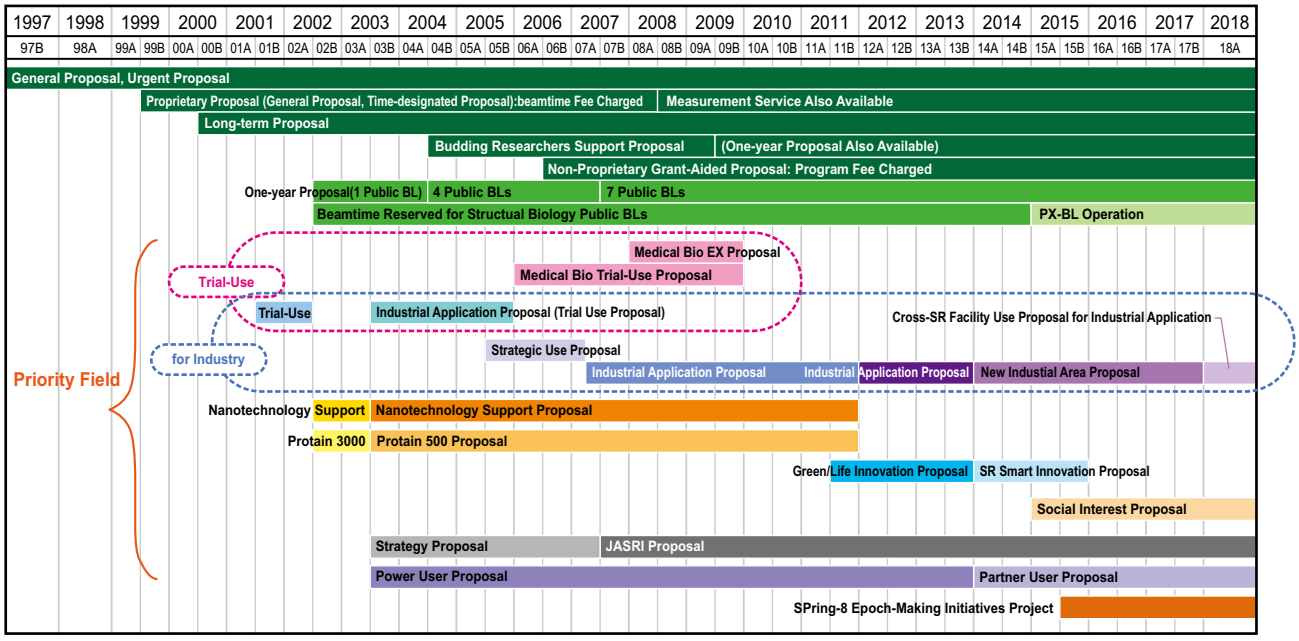



Fig. 3. Categories of proposals for the public beamlines.

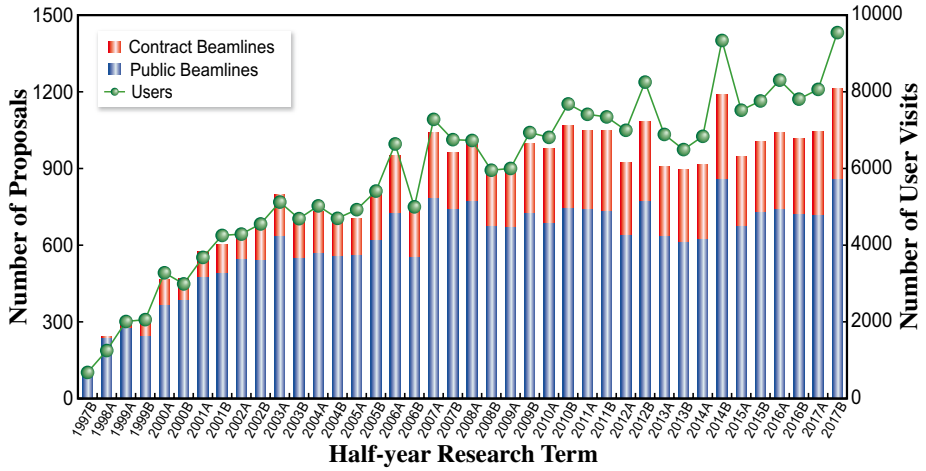



Fig. 4. Numbers of conducted experiments.

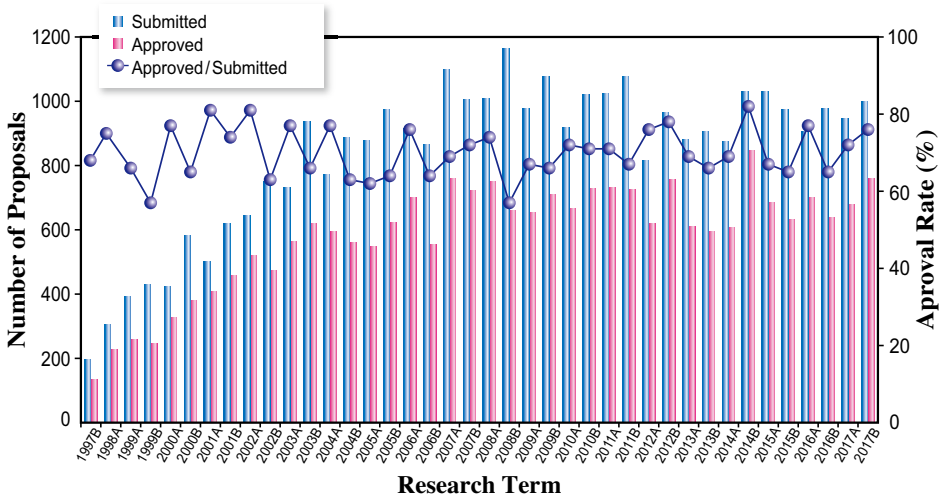



Fig. 5. Numbers of submitted proposals and approved proposals by research term (public beamlines).

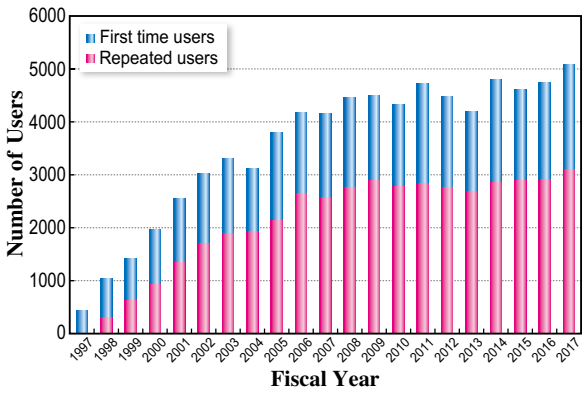



Fig. 6. Numbers of users by fical year.

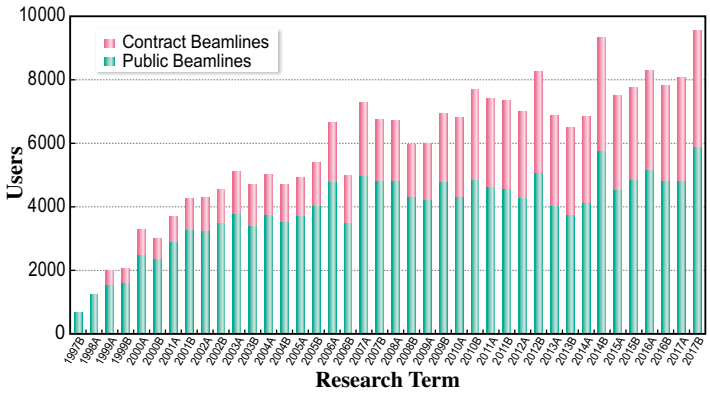



Fig. 7. Numbers of users visits by research term.

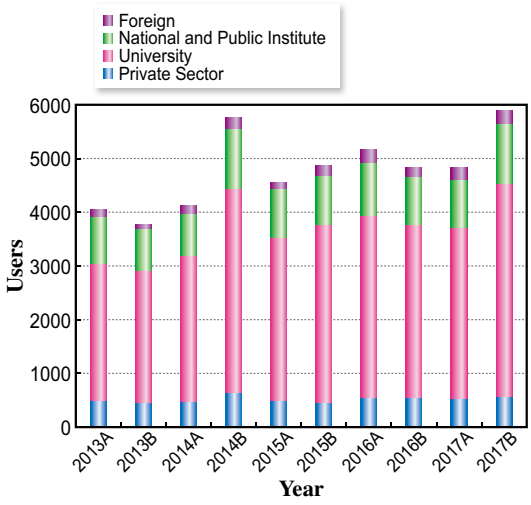



Fig. 8. Numbers of users by affiliation categories (public beamlines).


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

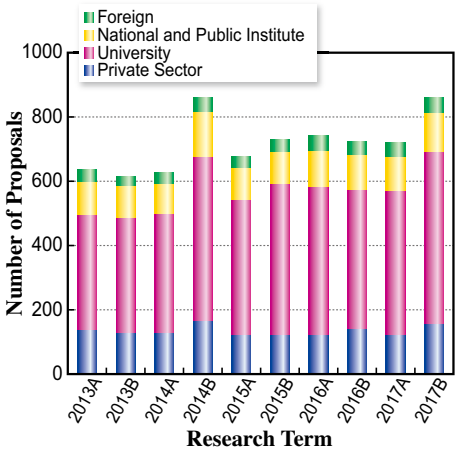



Fig. 10. Numbers of conducted proposals by affiliation (public beamlines).

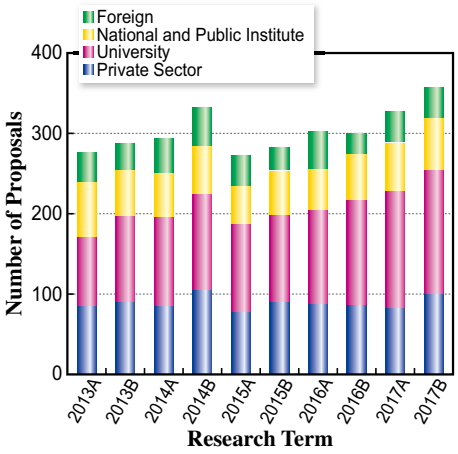



Fig. 11. Numbers of conducted proposals by affiliation categories (contract beamlines).

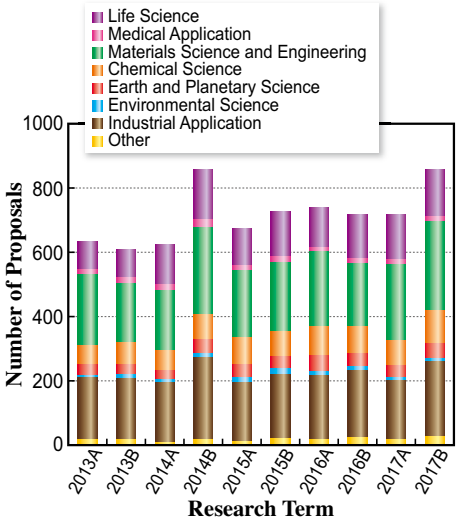



Fig. 12. Numbers of conducted proposals by research area (public beamlines).

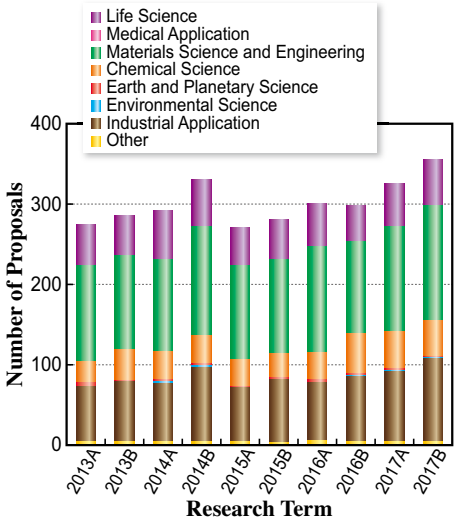



Fig. 13. Numbers of conducted proposals by research area (contract beamlines).

# V. Research Outcome

As of March 2018, the total number of registered refereed papers from SPring-8 was 14,069. Figure14 shows the annual statistics of refereed papers.

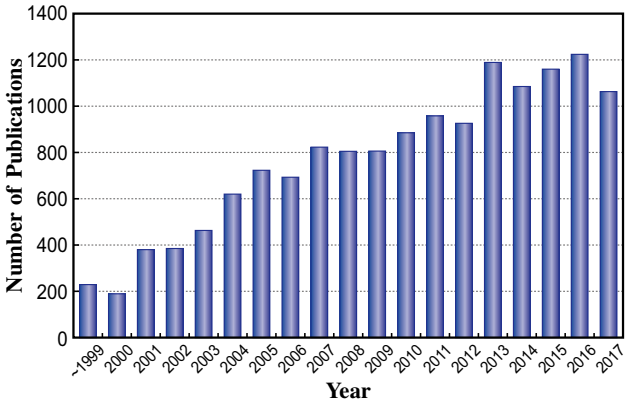



Fig. 14. Number of refereed publications.

# 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 FY2017 was about 9.4 billion yen. As of October 2016, RIKEN and JASRI have a total of 441 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.

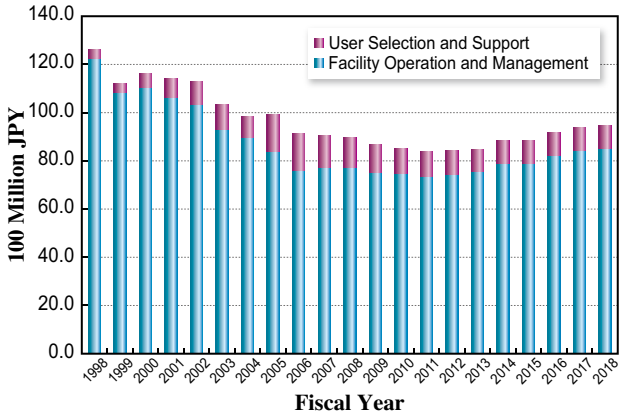



Fig. 15. SPring-8 budget.

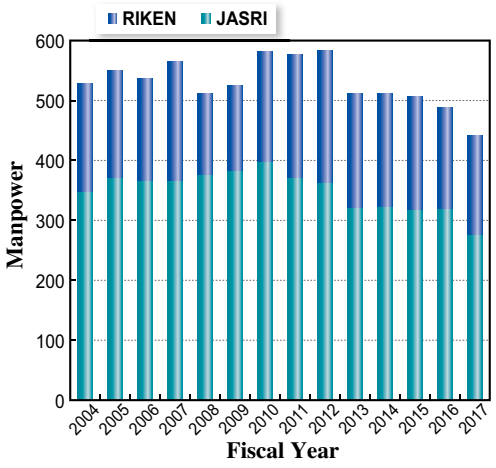



Fig. 16. Personnel at SPring-8: JASRI and RIKEN.

# 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.

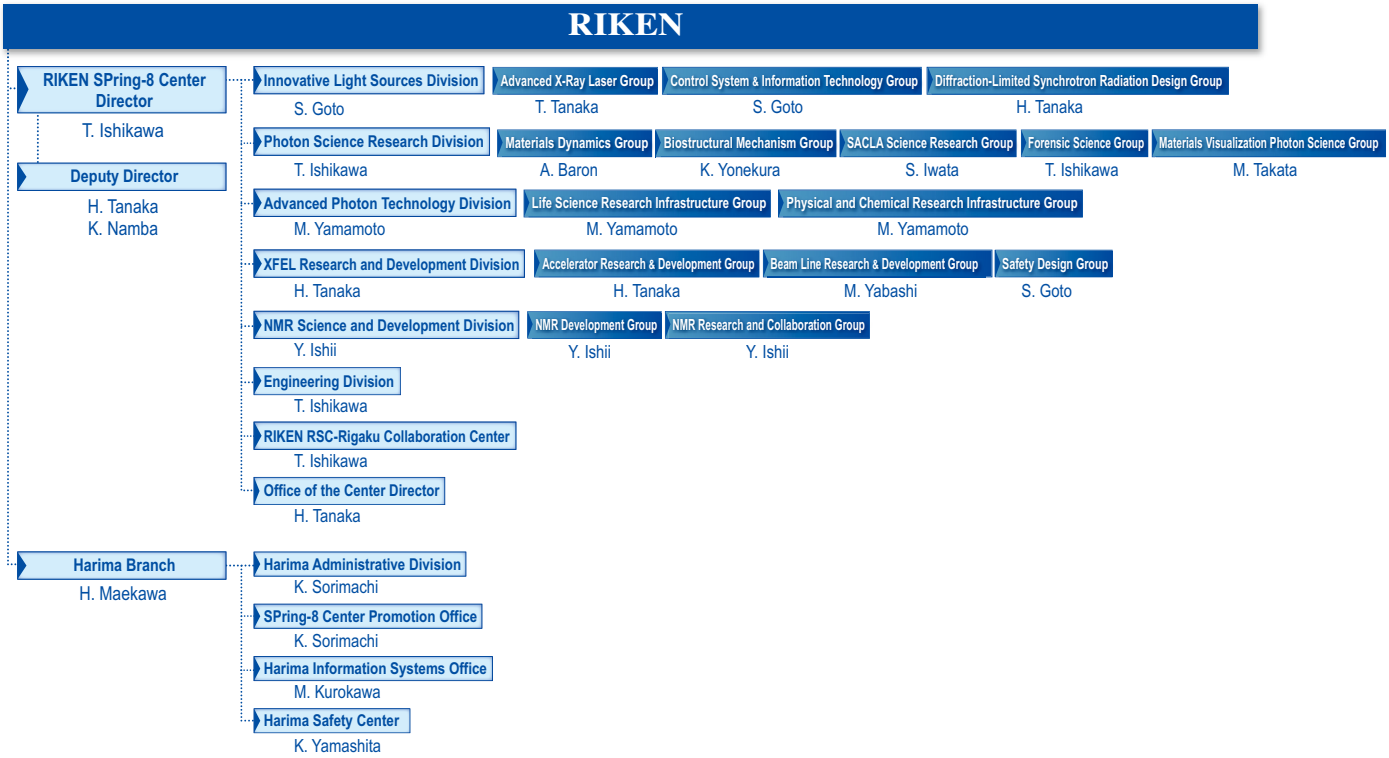



Fig. 17. RIKEN Harima Branch chart as of April 2018.

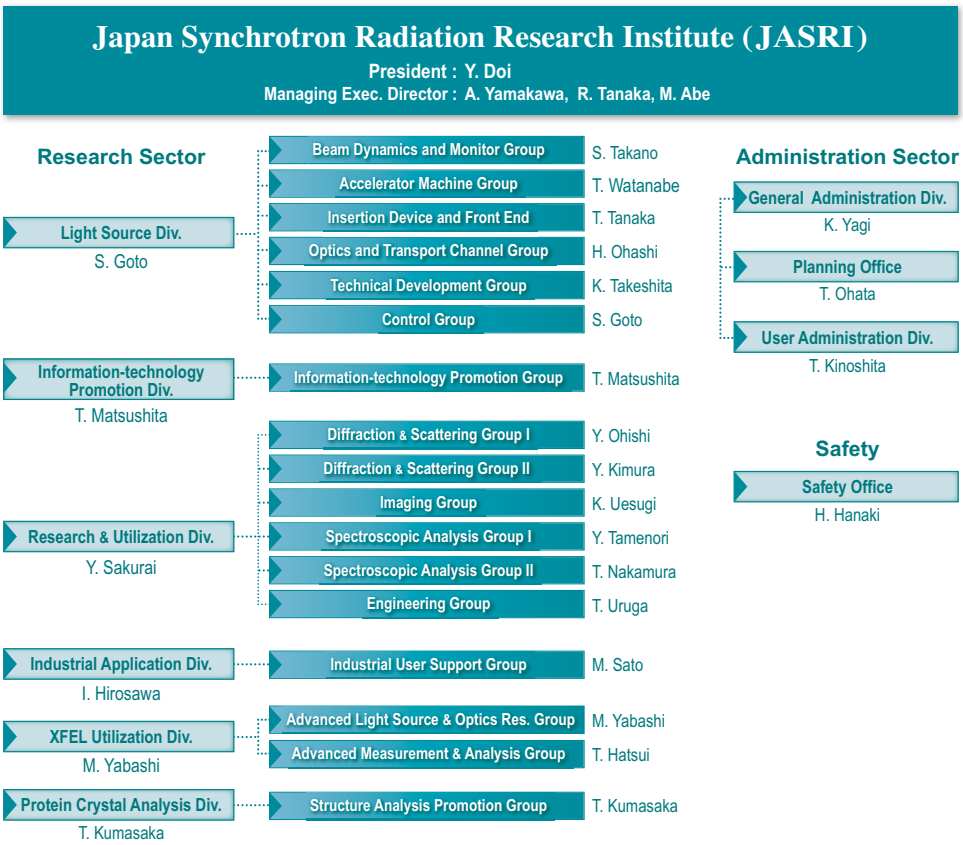



Fig. 18. JASRI chart as of April 2018.

# 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, 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 2017, with the theme "Future vision of SPring-8", was held at Hiroshima University on September 4 and 5, 2017. In the symposium, a panel discussion was performed at the special session to debate on the theme. The award ceremony of SPRUC 2017 Young Scientist award which was conferred to two researchers (Dr. Shinji Miwa, Osaka University and Dr. Tatsuya Sakamaki, Tohoku University) was also held at the symposium. SPring-8 Symposium 2018 is scheduled to be held on August 25 and 26 at Himeji City Hall, jointly hosted by University of Hyogo.

SPRUC has continued to promote the activities of "SPRUC multidisciplinary research groups" in order to develop the use of SPring-8 in the new areas that will be important to future science and technology. Four multidisciplinary research fields were designated in 2014, and two multidisciplinary research groups for nanodevice science and application were launched in 2015. The groups actively performed an innovative use of SPring-8, and the nanodevice science research group is now preparing to launch the SPRUC Research Group at the next term. In addition, 3rd Term Research Groups each actively organized a workshop in FY2017.

In order to discuss medium- and long-term plans for the future performance of detectors and measurement systems, a SPRUC working group on high-performance beamline technologies was launched in December 2016. The working group sent out questionnaire about the comments to the plan for the high performance technologies to the SPRUC user group, and summarized the results. The result was submitted to the chair of SPRUC, Prof. Nakagawa, as "the Midterm report", and is now open on the SPRUC website.

At last, the two projects which started in FY2017 are described: First, the "SPring-8 Autumn School" was held on September 18–21, 2017, in order to open for beginners such as younger students and researchers who have never used SPring-8 beamlines. The school was a great success and will be held also in FY2018. The second is "SPRUC-RIKEN-JASRI 3-way meeting", which was organized in order to discuss the future issues and to feedback the opinions from SPRUC to the SPring-8 facility. At the meeting, the four representatives from each organizations come together at a pace of every two months.

Prof. A. Nakagawa
Osaka University
SPRUC Chairman FY2017

*SPRUC 2017 Young Scientist Award*
*Prof. Y. Amemiya, Dr. T. Sakamaki, Dr. S. Miwa and Prof. A. Nakagawa*

*SPring-8 Symposium 2017*

# 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.

- 15th: Novel functional materials using biological systems and the origins
  August 24, 2017 • Campus Plaza Kyoto (Kyoto)

- 16th Cultural property analysis with SPring-8
  June 10, 2017 • Tohoku University of Art and Design (Yamagata)

- 17th Current status and future prospects of protein structural biology at SPring-8
  August 3-4, 2017 • Osaka University (Osaka)

- 18th Frontiers of metal nanoparticle catalyst development – Controlling with the structure and the function – (Co-hosted by Industrial Users Society of SPring-8)
  December 1, 2017 • AP Shinagawa (Tokyo)

- 15th Novel functional materials using biological systems and the origins
  August 24, 2017 • Campus Plaza Kyoto (Kyoto)

- 23rd and 24th Acceleration of drug discovery with SPring-8 - the utilization and the usage system -
  (23rd) February 26, 2018 - Knowledge Capital Osaka (Osaka)
  (24th) March 5, 2018 - Fukurashia Tokyo Station (Tokyo)

SPring-8 Summer School