OPERATION and PROPOSALS

1. Outline of the Accelerators

Two electron storage rings, the PF ring and the PF-AR, have been operated as dedicated light sources at the Photon Factory. The annual user experiment times, 3,800 hours for the PF ring and 2,400 hours for the PF-AR, were achieved in FY2024.

The PF ring is operated at a constant energy of 2.5 GeV and a current of 450 mA with two operation modes: the normal filling mode and the hybrid filling mode. In the hybrid filling mode, the isolated bunch current has been limited to 30 mA because of the beam instability and radiation around ID#02. We have investigated appropriate operation-parameters for the beam stability condition in the hybrid filling mode for the user experiment time.

At the PF-AR, about half of the operation time was conducted at a lower energy mode of 5 GeV, which was introduced in FY2019.

The machine parameters of the rings and the calculated spectral performances are listed in **Tables 1-1** and **1-2**. The spectral distributions of synchrotron radiation (SR) from the bending magnets and the insertion devices are shown in **Fig. 1-1**.

Table 1-1: Principal beam parameters of the PF ring and PF-AR.

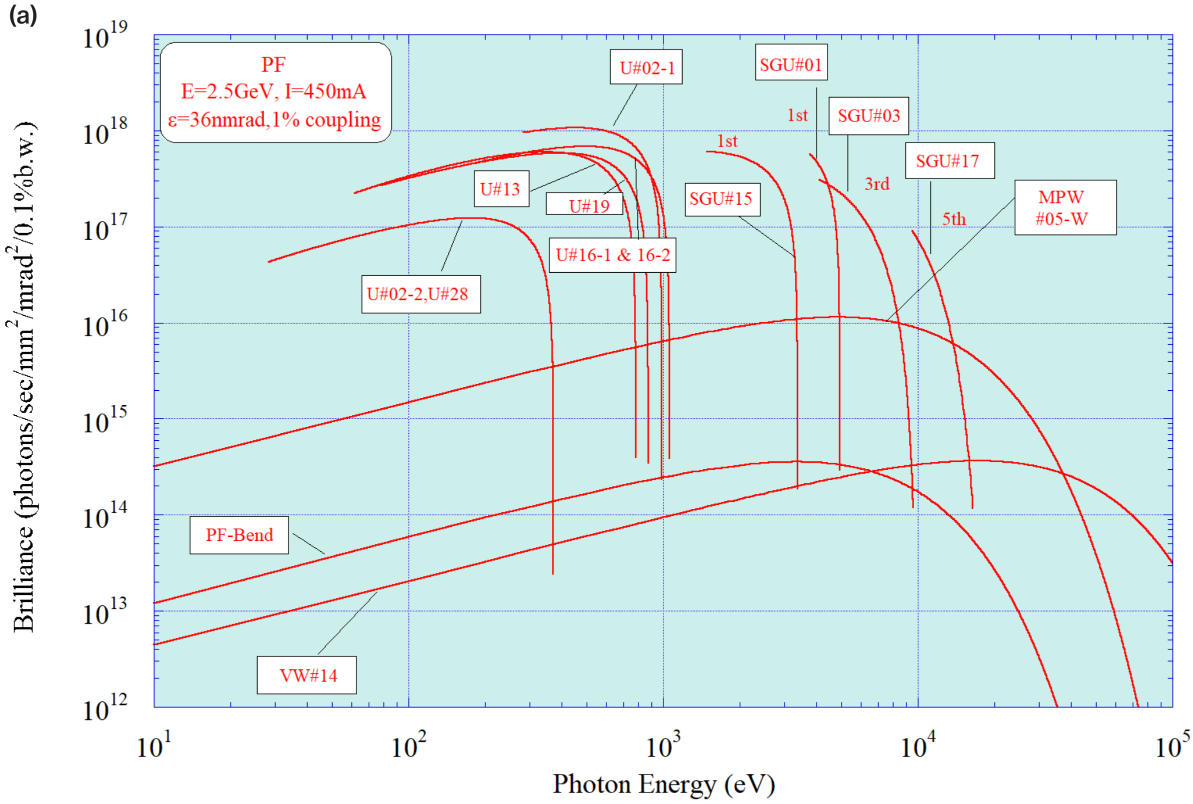
	PF ring	PF-AR	
Energy	2.5 GeV	6.5 GeV	5 GeV
Natural emittance	35.4 nm rad	246 nm rad	144 nm rad
Circumference	187 m	377 m	←
RF frequency	500.01 MHz	508.6 MHz	←
Bending radius	8.66 m	23.7 m	←
Energy loss per turn	0.4 MeV	6.66 MeV	2.33 MeV
Damping time			
Vertical	7.8 ms	2.5 ms	5.4 ms
Longitudinal	3.9 ms	1.2 ms	2.7 ms
Natural bunch length	9.7 mm	15 mm	12 mm
Momentum compaction factor	0.00656	0.0116	←
Natural chromaticity			
Horizontal	-13.3	-14.3	←
Vertical	-17.2	-13.9	←
Stored current	450 mA	50 mA	←
Normal filling	250 bunches	Single	←
Beam lifetime	20 h (at 450 mA)	14 h (at 50 mA)	5 h (at 50 mA)
Hybrid filling	Single (30 mA)		
	131 bunches (420 mA)		
Beam lifetime	8 h (at 450 mA)		

Table 1-2: Calculated spectral performances of the bending source and all the insertion devices at the PF ring (2.5 GeV, 450 mA) and PF-AR (6.5 GeV, 50 mA).

Name	E/I GeV/mA	λ_u cm	N	L m	$G_y(G_x)$ cm	$B_y(B_x)$ T	Type of magnet	σ_x mm	σ_y mm	$\sigma_{x'}$ mrad	$\sigma_{y'}$ mrad	$K_y(K_x)$	$\varepsilon_1/\varepsilon_c$ keV	D	B	P_T kW
PF	2.5/450															
Bend						0.963		0.41	0.059	0.178	0.012		4	5.41E+13	3.53E+14	
SGU#01		1.2	39	0.5	0.4	0.7	P(NdFeB)	0.6	0.012	0.088	0.029	0.78		2.64E+16	9.90E+17	0.4
U#02-1		6	60	3.6	2.8	0.4	H(NdFeB)	0.65	0.042	0.054	0.008	2.3		1.74E+17	9.53E+17	1.07
U#02-2		16	17	2.72	2.6	0.33(0.33)	P(NdFeB)	0.65	0.042	0.054	0.008	4.93(4.93)		8.83E+15	3.74E+16	0.53
SGU#03		1.8	26	0.5	0.4	1	P(NdFeB)	0.6	0.012	0.088	0.029	1.68		2.72E+16	5.82E+17	0.83
MPW#05-W		12	21	2.5	2.64	1.4	H(NdFeB)	0.71	0.045	0.078	0.009	16	5.9	2.27E+15	1.13E+16	8.79
U#13		7.6	47	3.6	2.3	0.68(0.34)	P(NdFeB)	0.74	0.02	0.094	0.019	4.84(2.42)		3.78E+16	2.24E+17	2.96
VW#14					5	5	S.C.	0.53	0.045	0.127	0.008		20.8	5.41E+13	3.62E+14	
SGU#15		1.76	27	0.5	0.4	0.97	P(NdFeB)	0.6	0.012	0.088	0.029	1.37		2.83E+16	6.07E+17	0.8
U#16-1 & 16-2		5.6	44	2.5	2.1	0.6(0.38)	P(NdFeB)	0.654	0.042	0.055	0.008	3(2)		8.31E+16	4.52E+17	1.58
SGU#17		1.6	29	0.5	0.4	0.92	P(NdFeB)	0.6	0.012	0.088	0.029	1.37		2.97E+16	6.40E+17	0.7
U#19		6.8	55	3.74	2.4	0.71(0.46)	P(NdFeB)	0.71	0.045	0.078	0.009	4.5(2.92)		6.31E+16	2.69E+17	3.35
U#28		16	22	3.52	2.7	0.33(0.33)	P(NdFeB)	0.53	0.045	0.127	0.008	4.93(4.93)		9.10E+15	4.29E+16	0.68
PF-AR	6.5/50															
Bend						0.915		1.05	0.17	0.36	0.038		26	3.83E+13	3.42E+13	
EMPW#NE01-W		16	21	3.36	3(11)	1(0.2)	P(NdFeB)	1.07	1.13	0.23	0.019	15(3)	28(90%)	1.58E+15	1.82E+15	4.49
U#NE03		4	90	3.6	1	0.8	P(NdFeB)	1.75	0.16	0.355	0.026	3		4.90E+15	2.84E+15	3.708
U#NW02		4	90	3.6	1	0.8	P(NdFeB)	1.75	0.16	0.355	0.026	3		4.90E+15	2.84E+15	3.708
U#NW12		4	95	3.8	1	0.8	P(NdFeB)	1.91	0.13	0.365	0.033	3		4.07E+15	2.60E+15	3.25
U#NW14-36		3.6	79	2.8	1	0.8	P(NdFeB)	1.61	0.15	0.214	0.027	2.8		6.76E+15	4.39E+15	2.43
U#NW14-20		2	75	1.5	0.8	0.63	P(NdFeB)	1.86	0.15	0.285	0.027	1.17		3.53E+15	1.97E+15	0.936

λ_u: period length, N: number of periods, L: length of undulator or wiggler, $G_y(G_x)$: minimum vertical (horizontal) gap height, $B_y(B_x)$: maximum vertical (horizontal) magnetic field, H: hybrid configuration, S.C.: super-conducting magnet, σ_x, σ_y: horizontal or vertical beam size, $\sigma_{x'}$, $\sigma_{y'}$: horizontal or vertical beam divergence, $K_y(K_x)$: vertical (horizontal) deflection parameter, D: photon flux density (photons/sec/mrad^2/0.1%b.w.), B: brilliance (photons/sec/mm^2/mrad^2/0.1%b.w.), P_T:total radiated power. MPW#05 and EMPW#NE01 are operated in wiggler mode denoted by -W.

(a)



(b)

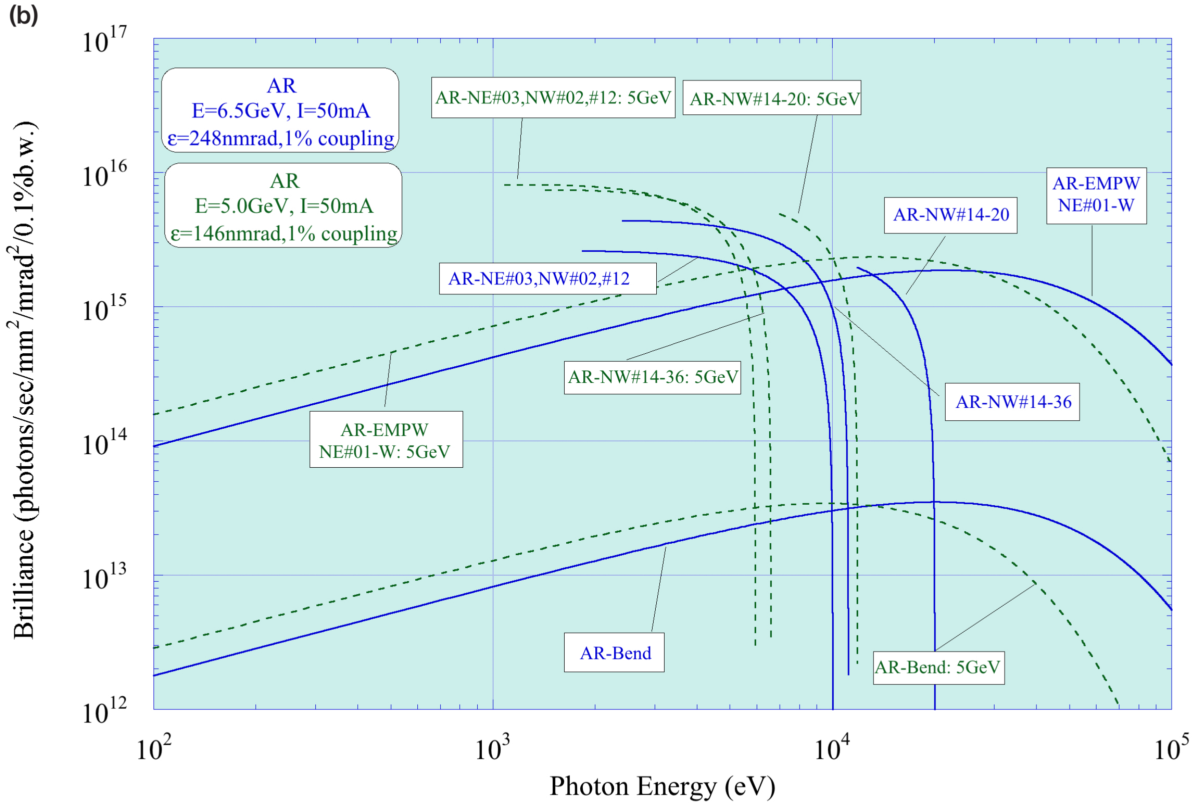


Figure 1-1: Synchrotron radiation spectra available at the Photon Factory. **(a)** PF ring, and **(b)** PF-AR, blue curves for 6.5 GeV and green dashed curves for 5 GeV. The name of each source is listed in **Table 1-2.** The spectral curve of each undulator is the locus of the peak of the first harmonic within the allowance range of parameter K. For SGU#01 and SGU#15, the first harmonic regions are shown. For SGU#03, the third harmonic region is shown. For SGU#17, the fifth harmonic region is shown.

2. Operation Summary

The annual operation schedule of the PF ring and the PF-AR in FY2024 is shown in **Fig. 2-1**.

The operation statistics of both rings for the past decade are shown in **Fig. 2-2**. Since FY2021, the targets for the annual user experiment time have been set at 3,600 hours for the PF ring and 2,400 hours for the PF-AR. And these for the PF ring and the PF-AR were both achieved in FY2024.

Table 2-1 shows the operation statistics of the PF ring for the past 10 years. **Figure 2-3** is a pie chart showing the breakdown of failure causes of interruptions for the user time that occurred at the PF ring in FY2024. The total failure time in FY2024 was 27.5 hours, almost the same as the previous fiscal year, with a failure rate of 0.7% and a mean time between failures (MTBF) of 192.4 hours. Thus, we think that good levels have been maintained for these indicators at the PF ring. The pie chart shows that failures related to the magnet system accounted for a high percentage of 34.3% in FY2024. This is due to the aging of the magnet power supply. The second most common problem was RF- related failure at 27.6%. This is due to the aging of klystron equipment.

In the hybrid filling mode in February and March 2025, longitudinal beam instability often occurred. We established the RF modulation method automatically to decrease the longitudinal beam instability. To supply the stable orbit electron beam, other methods such as change of filling pattern will be tested.

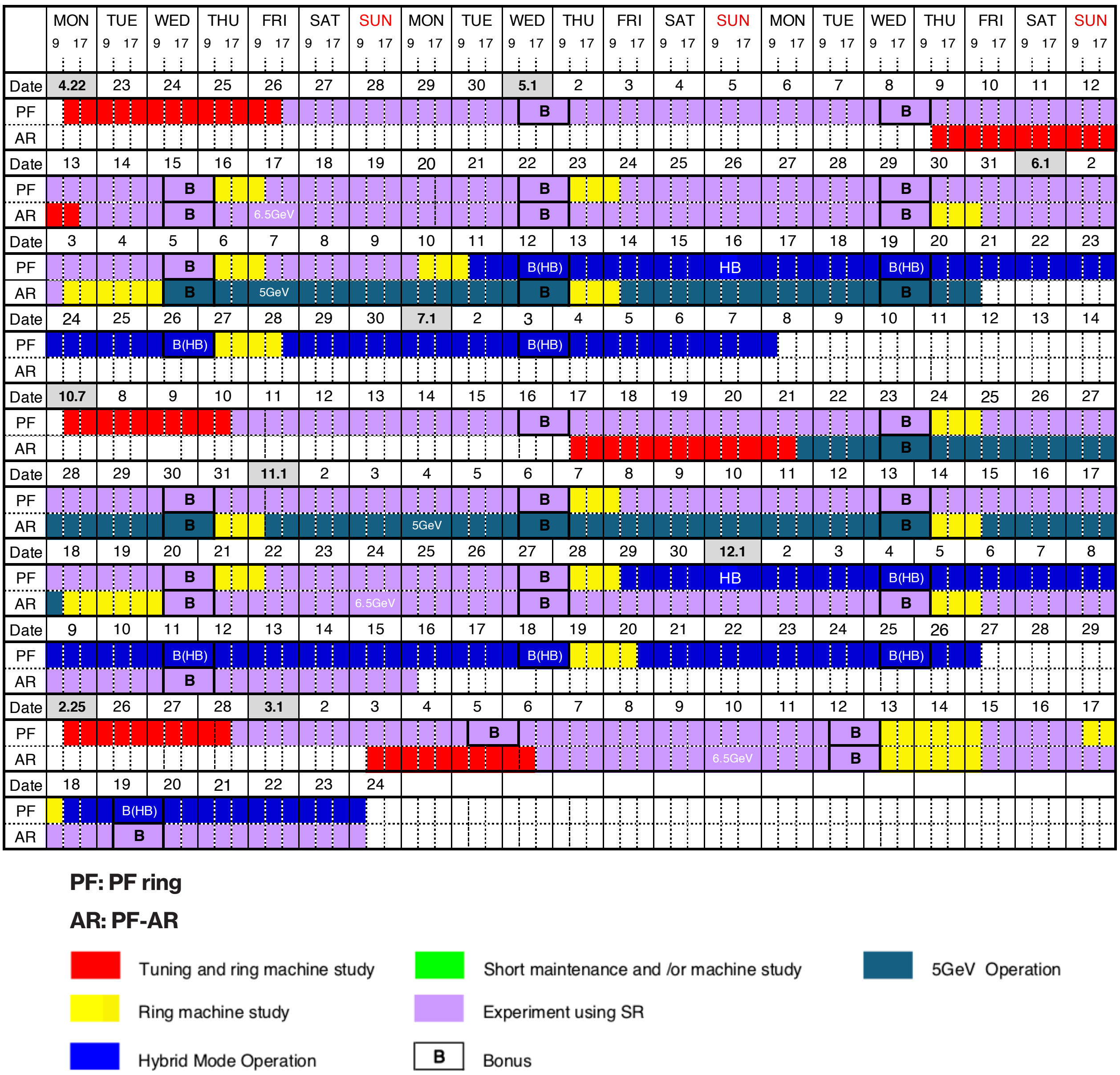
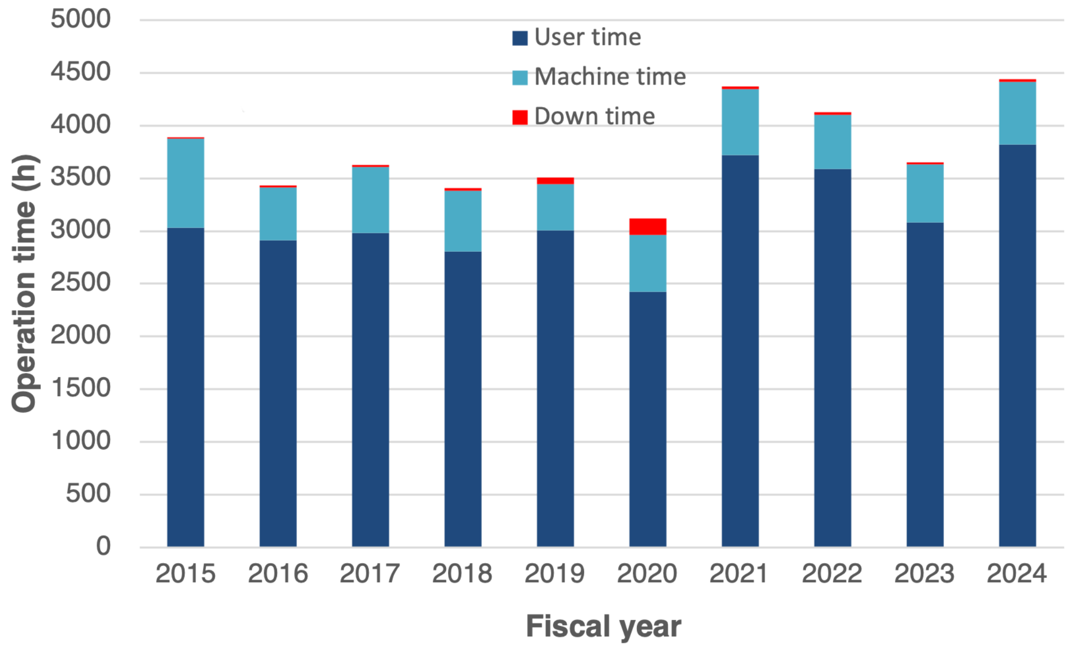


Figure 2-1: Operation schedule of PF ring and PF-AR in FY2024.

(a)



(b)

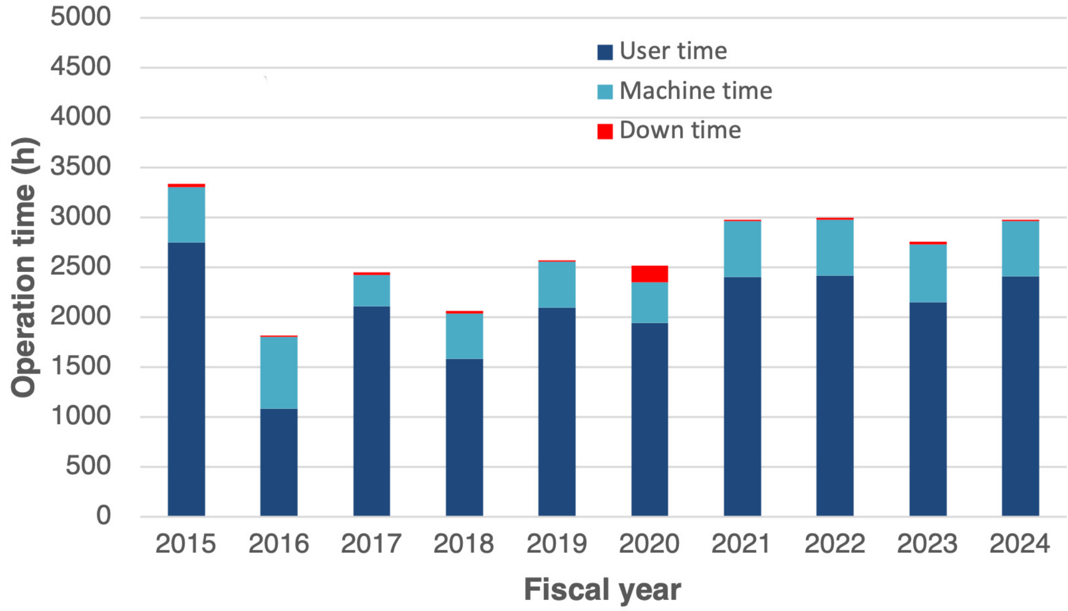


Figure 2-2: Total operation time for PF ring **(a)** and PF-AR **(b)**.

Table 2-1: Operation statistics for the PF ring from FY2015 to FY2024.

Fiscal Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total operation time (h)	3888	3432	3624	3408	3504	3120	4368	4128	3648	4440
Scheduled user time (h)	3048	2928	3000	2832	3064	2584	3744	3616	3096	3848
Ratio of user time (%)	78.4	85.3	82.8	83.1	87.4	82.8	85.7	87.6	84.9	86.7
No. of failures	23	18	14	17	20	15	17	25	18	20
Total down time (h)	14.4	17.3	16.6	28.4	59.9	158.4	23.2	25.8	15.2	27.5
Failure rate (%)	0.5	0.6	0.6	1.0	2.0	6.1	0.6	0.7	0.5	0.7
MTBF (h)	132.5	162.7	214.3	166.6	153.2	172.3	220.2	144.6	172.0	192.4
Mean down time (h)	0.6	1.0	1.2	1.7	3.0	10.6	1.4	1.0	0.8	1.4

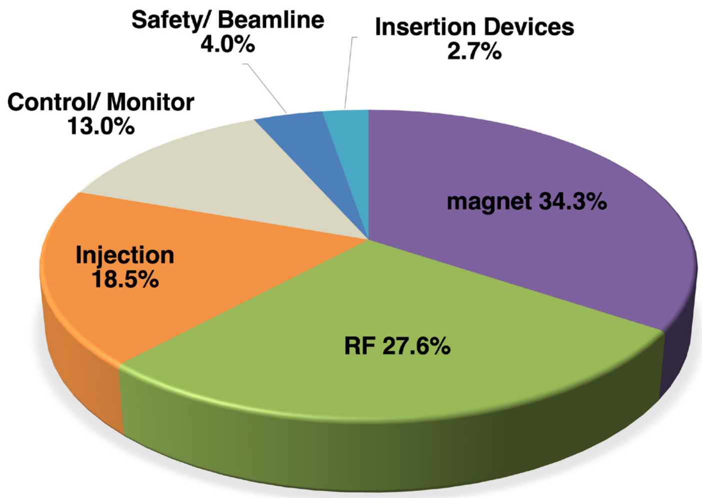


Figure 2-3: Breakdown of the down time for the PF ring in FY2024.

In the PF ring, a new interlock system for keeping the PF ring accelerator machine protection safety (MPS) and personnel protection safety (PPS) was installed from July to September 2024 and was commissioned in October 2024. The previous MPS and PPS system for PF ring was used over thirty years and was necessary for replacement. The new safety system adopted modern techniques such as wire-saving methods and risk assessment methods that conform to the ISO12100 safety standards. **Figure 2-4** shows the new safety system diagram for the PF ring. Since autumn 2024, operation of the PF has been conducted with the new accelerator operation safety system, which is running without significant problems.

To improve the stability of the beam orbit in the PF ring, we completed the renewal of the power supplies of the quadrupole magnets and sextupole magnets. While the conventional power supplies had under 100 ppm stability of output current, the new power supplies aimed at under 10 ppm stability and achieved 3 ~ 4 ppm stability of output current. We established the development of power supplies for electromagnets with high accurate current control. The new power supplies consisted of combinations of power supply unit modules. The rated power of power supplies can be changed by the number of power supply modules. This means that the rated power of the base unit module is 125 A/140-160 V or 500 A/45-50 V, and the rated power of A-type power supply achieves to 650 A/140 V and that of B-type power supply is 750 A/45 V by using these base unit modules (see **Fig. 2-5**). **Figure 2-6** shows the long-term stability of A-type power supply output over 10 hours. The combinations of power supply unit modules have the availability and capability easily to design and manufacture the desired various types of power supplies. And the short-time repair of power supply is possible by replacement of faulty unit module to normal one.

Since January 2025, we started to use the new BPM system with the fast-steering power supply system to establish a high-speed orbit stabilization system. Instead of replacing all BPM sensors and the control program at once, we gradually introduced changes and successfully established the new operation method for the BPM system. Thanks to this, no degradation in beam lifetime was observed even at the minimum gap of the in-vacuum undulators. According to the number of new BPM sensors connecting to the high-speed orbit stabilization system, it is expected that the beam orbit of the PF ring getting more stable

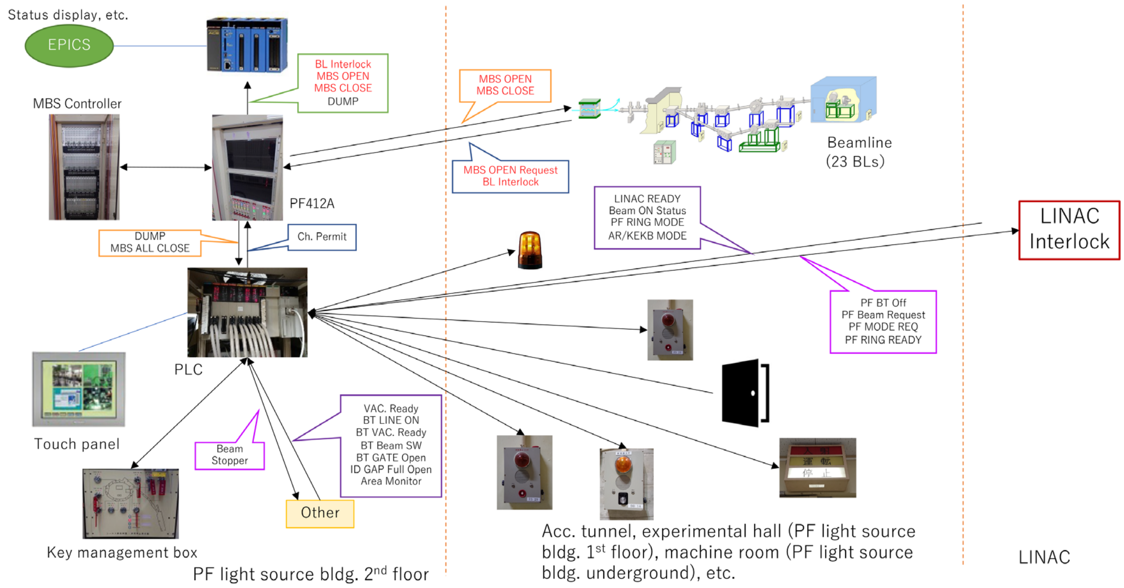
For the PF-AR, detailed operation statistics and the number of failures from FY2015 to FY2024 are listed in **Table 2-2**. A breakdown of the total down time in FY2024 is shown in **Fig. 2-7**.

The total failure time was about 10.8 hours, and the failure rate was 0.4%, which was slightly lower than in FY2023. Nearly 62.5% of the failure time was due to magnet power supplies for injection at beam transport.

Throughout the year, we conducted machine studies to establish 55-mA single bunch storage for user operation with improved emittance by preparing a cooling system of higher order mode (HOM) cables for RF cavities and introducing automatic tune feedback system to prevent overheating of the HOM cables. We started this 5-GeV 55-mA storage single bunch mode for user operation in October 2024. However, in the next month, we observed the temperature of one HOM cable getting higher. Therefore, we have decreased the single bunch current to former 50 mA. We have investigated the causes of temperature rise of the HOM cable under 55-mA single bunch operation and seek methods to be settled.

Meanwhile we also conducted machine studies to establish higher current storage with two bunches operation mode. The operation mode of two 32.5-mA bunches (total 65 mA) at 6.5 GeV was examined, and found to be stable for more than one hour, and the temperature rise was not observed in the HOM cables. At present, two bunches mode is not planned for user operation. To improve the accelerator performance, we have continued the machine studies with two bunches operation mode.

(a)



(b)

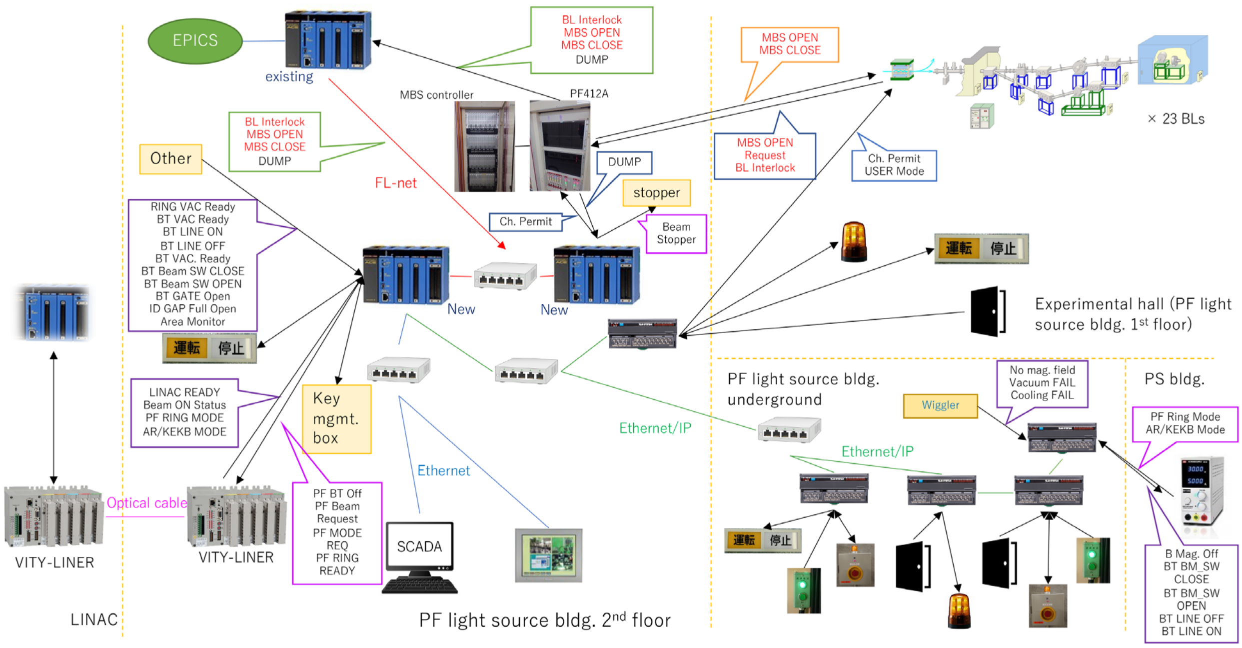


Figure 2-4: (a) Previous safety system diagram and **(b)** new safety system diagram for the PF ring.

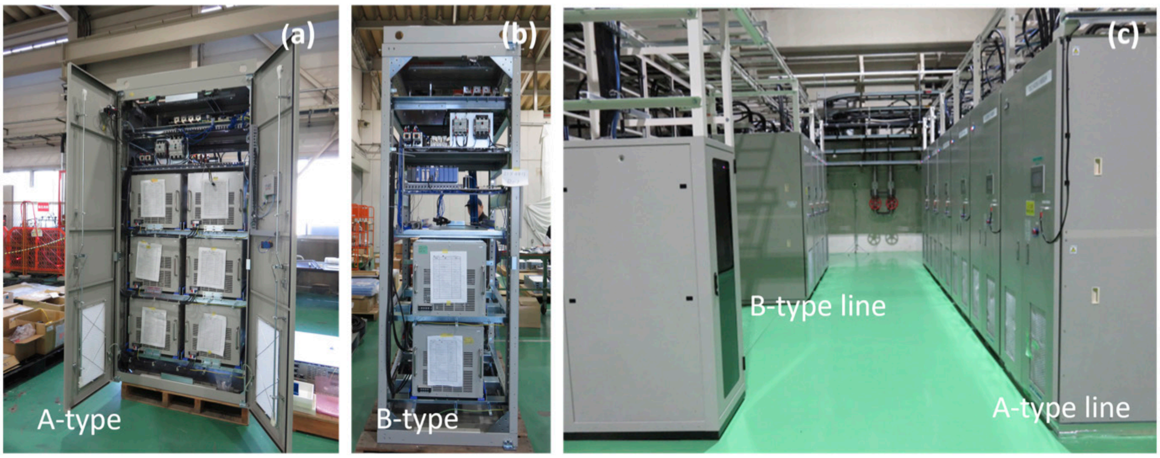


Figure 2-5: (a) A-type power supply of which the rated power is 650 A/140 V. **(b)** B-type power supply whose rated power is 750 A/45 V. **(c)** Layout of power supplies.

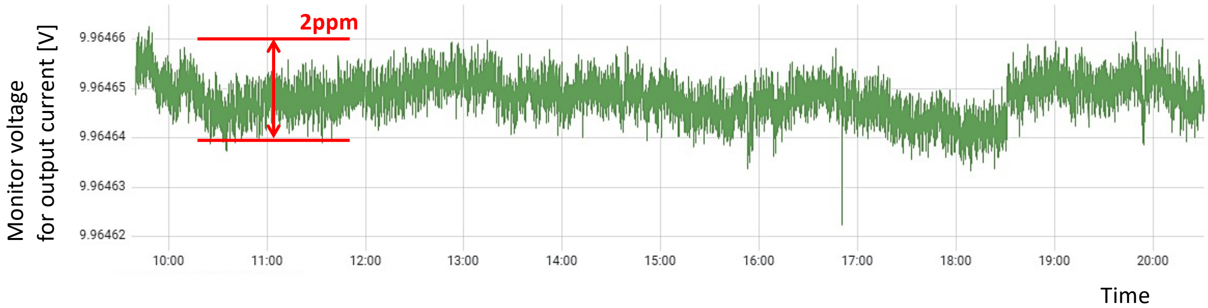


Figure 2-6: Long-term stability of A-type power supply output over 10 hours.

Table 2-2: Operation statistics for PF-AR from FY2015 to FY2024.

Fiscal Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total operation time (h)	3336	1821	2448	2064	2568	2520	2976	3000	2760	2976
Scheduled user time (h)	2784	1104	2136	1608	2112	2112	2416	2440	2184	2424
Ratio of user time (%)	83.5	60.6	87.3	77.9	82.2	83.8	81.2	81.3	79.1	81.5
No. of failures	18	13	55	25	8	14	10	17	16	14
Total down time (h)	31.0	18.3	24.7	26.4	12.3	168.1	11.3	21.7	30.3	10.8
Failure rate (%)	1.1	1.7	1.2	1.6	0.6	8.0	0.5	0.9	1.4	0.4
MTBF (h)	154.7	84.9	38.8	64.3	264.0	150.9	241.6	143.5	136.5	173.1
Mean down time (h)	1.7	1.4	0.4	1.1	1.5	12.0	1.1	1.3	1.9	0.8

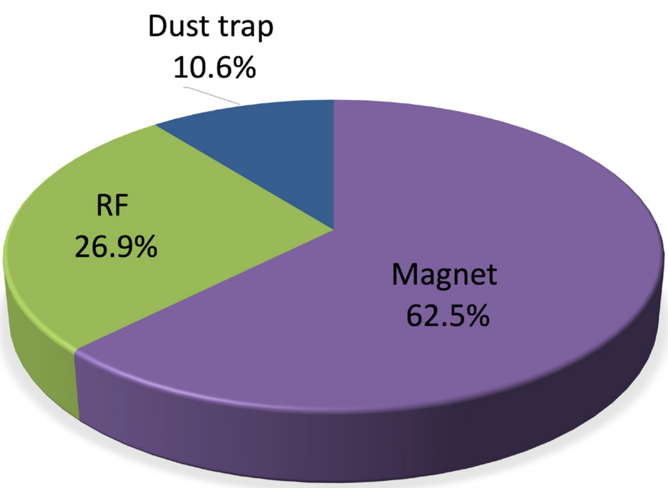


Figure 2-7: Breakdown of the down time for the PF-AR in FY2024.

3. Experimental Stations

Fifty experimental stations are in operation at the PF ring, PF-AR and slow positron facility (SPF), as shown in **Figs. 3-1**, **3-2** and **3-3**. Thirty-five stations are dedicated to research using hard X-rays, 10 stations for studies in the VUV and soft X-ray energy regions, and 4 stations for studies using slow positrons. At the Detector Test Beamline (AR-SE2A) constructed by the Institute of Particle and Nuclear Studies, electron beam can be used for detector developments. The construction of a wide-wavelength-range soft X-ray beamline, BL-12A, has been completed, and the beamline has been open for users after commissioning. The beamline covers a wide energy range of 50 to 5,000 eV, by switching between a soft X-ray path with a grating monochromator and a tender X-ray path with a double-crystal monochromator. At the BL-11 site, the construction of multi-functional R&D beamlines (BL-11A and -11B) is progressing. The beamlines consist of a hard X-ray branch (BL-11A) and a soft X-ray branch (BL-11B). In addition, by replacing and reinstalling the optical elements in the BL-11B, the multi-beam experiments, in which two beams (HX and SX) are simultaneously irradiated to a sample, will be performed in the experimental hutch of the BL-11A. **Tables 3-1**, **3-2** and **3-3** summarize the areas of research being carried out at the experimental stations on the PF ring, PF-AR and SPF. All beamlines are classified into six beamline groups as colored in **Figs. 3-1**, **3-2** and **3-3**, which correspond to subcommittees of the PF-PAC (Photon Factory Program Advisory Committee).

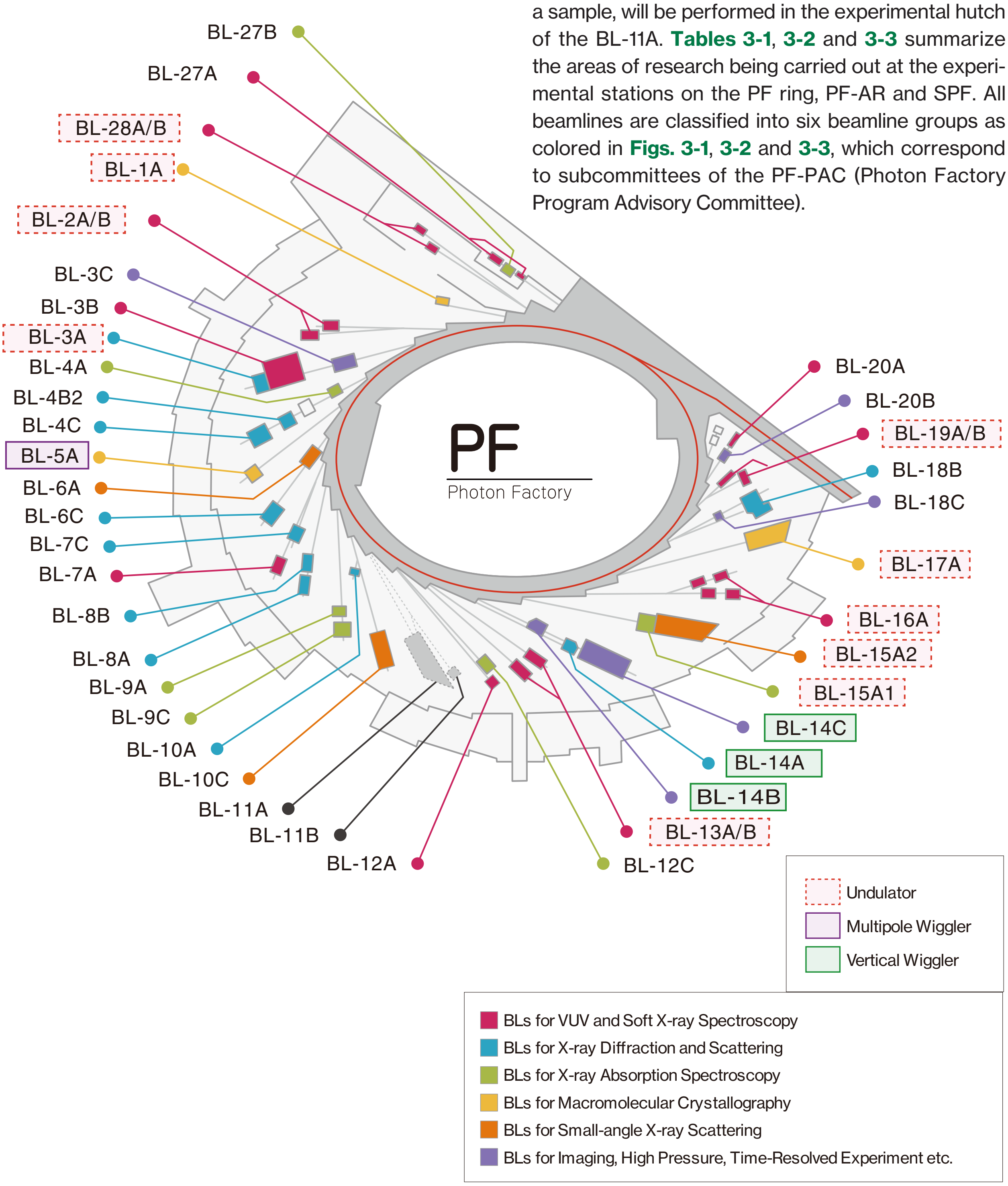


Table 3-2: List of the experimental stations at PF-AR.

Table 3-1: List of the experimental stations available for users at the PF ring.

BL	BL Gr.	LS	Org.	Station	BL Staff
BL-1					*N. Matsugaki*
BL-1A	4	SGU		Macromolecular Crystallography	N. Matsugaki
BL-2					*T. Ohigashi*
BL-2A/B	1	U		Multiple Undulator beamline for Spectroscopic Analysis of Surface and HeteroInterface : MUSASHI and Photoelectron Spectroscopy Station	T. Ohigashi
BL-3					*H. Nakao*
BL-3A	2	SGU		X-ray Diffraction Experiment under Extreme Condition	H. Nakao
BL-3B	1	BM	UG	VUV Photoelectron Spectroscopy	K. Ozawa/T. Sakurai (Univ. of Tsukuba), J. Yoshinobu (The Univ. of Tokyo)
BL-3C	6	BM		X-ray Optics/White X-ray Magnetic Diffraction	K. Hirano
BL-4					*H. Nakao*
BL-4A	3	BM	UG	Trace Element Analysis/X-ray Microbeam	Y. Niwa/M. Uo (Science Tokyo)
BL-4B2	2	BM	UG	Powder Diffraction	H. Nakao/H. Uekusa (Science Tokyo)
BL-4C	2	BM		X-ray Diffraction Experiment	H. Nakao
BL-5					*N. Matsugaki*
BL-5A	4	MPW		Macromolecular Crystallography	N. Matsugaki
BL-6					*H. Takagi*
BL-6A	5	BM		Small-angle X-ray Scattering	H. Takagi
BL-6C	2	BM	UG	X-ray Diffraction and Scattering	H. Nakao/N. Happo (Hiroshima City Univ.)
BL-7					*K. Amemiya/J. Okabayashi (The Univ. of Tokyo)*
BL-7A	1	BM	EX	Soft X-ray Spectroscopy (RCS, The Univ. of Tokyo)	K. Amemiya/J. Okabayashi (The Univ. of Tokyo)
BL-7C	2	BM		Multi-purpose Hard X-ray Experiment	H. Sugiyama
BL-8					*D. Okuyama*
BL-8A	2	BM		Powder/Single-crystal Diffraction under Extreme Conditions	D. Okuyama
BL-8B	2	BM		Powder/Single-crystal Diffraction under Extreme Conditions	D. Okuyama
BL-9					*H. Abe*
BL-9A	3	BM		High-intensity and Low-energy XAFS	H. Abe
BL-9C	3	BM		in-situ XAFS	H. Abe
BL-10					*H. Takagi*
BL-10A	2	BM	UG	X-ray Diffraction and Scattering	R. Kumai/T. Kuribayashi (Tohoku Univ.)
BL-10C	5	BM		Small-angle X-ray Scattering	H. Takagi
BL-11					*D. Wakabayashi*
BL-11A		BM		Multi-functional R&D beamline (under construction)	D. Wakabayashi
BL-11B		BM		Multi-functional R&D beamline (under construction)	D. Wakabayashi

BL	BL Gr.	LS	Org.	Station	BL Staff
BL-12					*T. Ohigashi*
BL-12A	1	BM		Soft and Tender X-ray Beamline	T. Ohigashi
BL-12C	3	BM		High-throughput XAFS	D. Kido
BL-13					*K. Mase*
BL-13A/B	1	U		Variable Polarization VUV and Soft X-ray Spectroscopy	K. Mase
BL-14					*K. Hirano*
BL-14A	2	VW		Single Crystal Structure Analysis/Detector Development	H. Sagayama
BL-14B	6	VW		High-precision X-ray Optics	K. Hirano
BL-14C	6	VW		X-ray Imaging and Multi-purpose Experiments	K. Hirano
BL-15					*Y. Niwa*
BL-15A1	3	SGU		Semi-microbeam XAFS	Y. Niwa
BL-15A2	5	SGU		High-brilliance Small-angle X-ray Scattering	H. Takagi
BL-16					*K. Amemiya*
BL-16A	1	U		Variable Polarization Soft X-ray Spectroscopy	K. Amemiya
BL-17					*M. Hikita*
BL-17A	4	SGU		Macromolecular Crystallography	M. Hikita
BL-18					*R. Kumai*
BL-18B	2	BM	EX	Multipurpose Monochromatic Hard X-ray Station (DST, India)	R. Kumai/ Mrinmay mukhopadhyay (SINP)
BL-18C	6	BM	UG	High Pressure X-ray Powder Diffraction (DAC)	Y. Shibazaki/H. Kagi (The Univ. of Tokyo)
BL-19					*S. Yamashita*
BL-19A/B	1	U		Soft X-ray Microscopy (STXM) and Spectroscopy	S. Yamashita
BL-20					*J. Adachi*
BL-20A	1	BM	UG	VUV Spectroscopy	J. Adachi/Y. Hikosaka (Univ. of Toyama)
BL-20B	6	BM		White & Monochromatic X-ray Topography and Diffraction	H. Sugiyama
BL-27					*N. Usami*
BL-27A	1	BM	UG	Radiation Biology, Soft X-ray Spectroscopy for Radioactive Samples	N. Usami/A. Yokoya (QST)/ Y. Okamoto (JAEA)
BL-27B	3	BM	UG	Radiation Biology, XAFS for Radioactive Samples	N. Usami/A. Yokoya (QST)/ Y. Okamoto (JAEA)
BL-28					*K. Ozawa*
BL-28A/B	1	U		Variable Polarization VUV and Soft X-ray Spectroscopy	K. Ozawa

Abbreviations for lightsources
BM : Bending Magnet
U : Undulator
SGU : Short Gap Undulator
(E)MPW : (Elliptical) Multipole Wiggler
VW : Vertical Wiggler
SP: Slow Positron

Abbreviations for organization
EX : Operated by external institute / Partially opened for general users
UG : Operated by user group / Opened for general users
Univ : Experimental stations for graduate courses education / Opened for general users

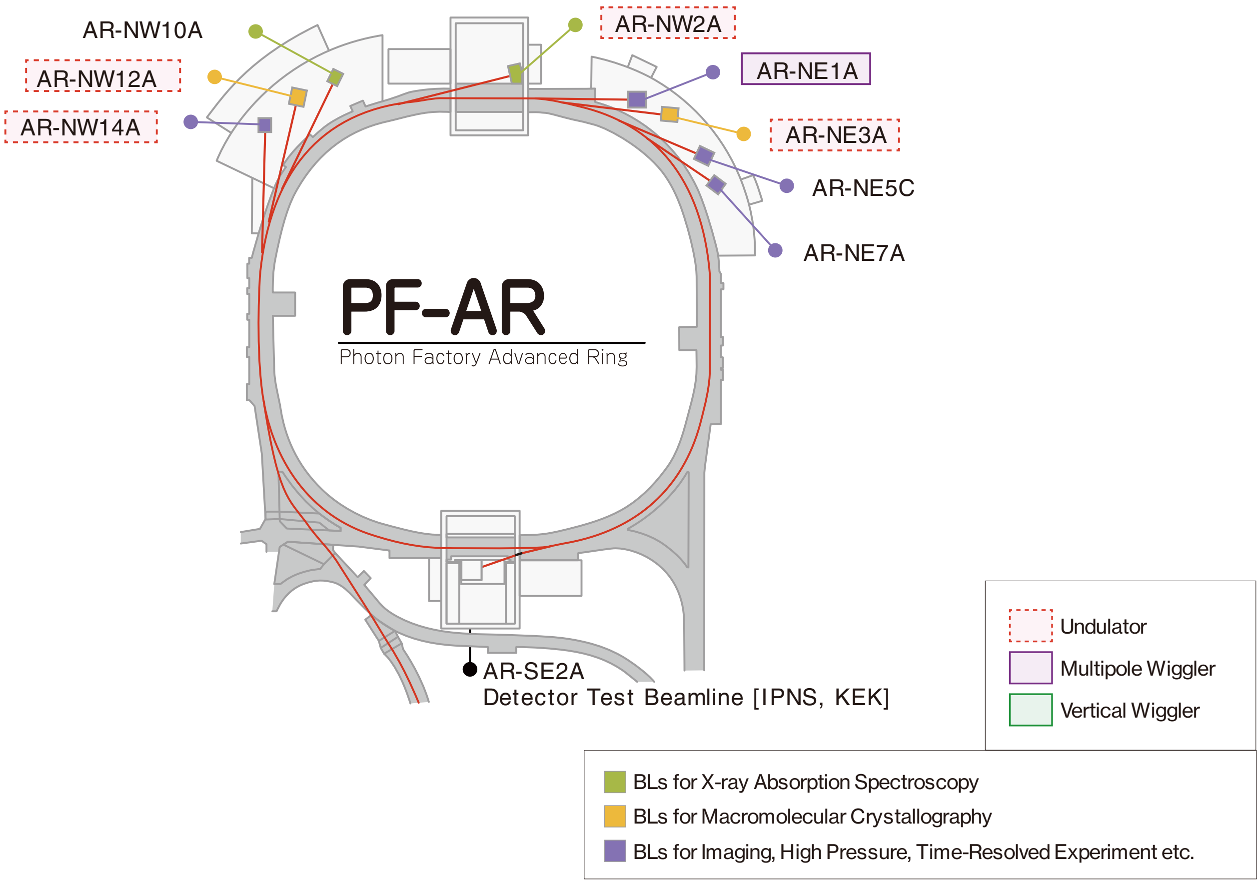


Figure 3-1: Plan view of PF experimental hall, showing experimental stations color-coded according to six beamline groups.

Figure 3-2: Plan view of PF-AR experimental halls, showing experimental stations color-coded according to six beamline groups.

BL	BL Gr.	LS	Station	BL Staff
AR-NE1 AR-NE1A	6	EMPW	X-Ray Diffraction and Mössbauer Spectroscopy at High Pressure	*Y. Shibazaki* Y. Shibazaki
AR-NE3 AR-NE3A	4	U	Macromolecular Crystallography for Drug Design	*N. Matsugaki* N. Matsugaki
AR-NE5 AR-NE5C	6	BM	High-pressure and High-temperature X-ray Diffraction (MAX-80)	*Y. Shibazaki* Y. Shibazaki
AR-NE7 AR-NE7A	6	BM	X-ray Imaging and X-ray Diffraction Experiments at High Pressure	*K. Hirano* K. Hirano
AR-NW2 AR-NW2A	3	U	Time-resolved XAFS, X-ray Microscopy	*Y. Niwa* Y. Niwa
AR-NW10 AR-NW10A	3	BM	High-energy XAFS	*D. Kido* D. Kido
AR-NW12 AR-NW12A	4	U	Macromolecular Crystallography	*M. Hikita* M. Hikita

BL	BL Gr.	LS	Org.	Station	BL Staff
AR-NW14					*S. Nozawa*
AR-NW14A	6	U		Time-resolved Diffraction and Scattering	S. Nozawa
AR-SE2A					*Institute of Particle & Nuclear Studies*
AR-SE2A	1	(electron beam)		Test Beam Line	N. Igarashi

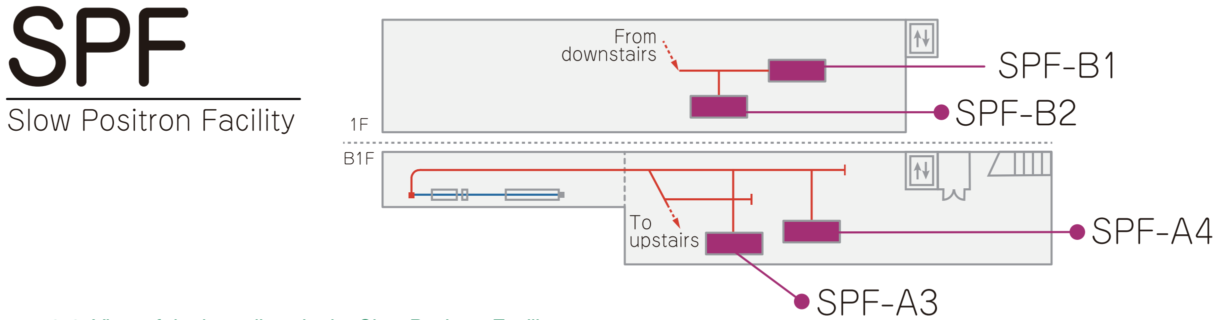


Figure 3-3: View of the beamlines in the Slow Positron Facility.

Table 3-3: List of the experimental stations in the Slow Positron Facility.

BL	Station	BL Staff
Slow Positron Facility		*K. Wada*
SPF-A3	Total-reflection High-energy Positron Diffraction (TRHEPD)	K. Wada
SPF-A4	Low-energy Positron Diffraction (LEPD)	K. Wada
SPF-B1	General Purpose Slow Positron Experiment	K. Wada
SPF-B2	Positronium Time-of-flight (Ps-TOF)	K. Wada

4. Summary of User Proposals

The Photon Factory accepts experimental proposals for academic research submitted by researchers at universities and research institutes inside and outside Japan. The PF Program Advisory Committee (PF-PAC) reviews the academic proposals, and the Advisory Committee for the Institute of Materials Structure Science approves those that are favorably recommended. The number of accepted proposals over the period 2013–2024 is shown in **Table 4-1**, where S1/S2, U, G, and P denote Special, Urgent, General, and PF-beginners proposals, respectively. S-type proposals consist of two categories, S1 and S2. S1 proposals are self-contained projects of excellent scientific quality and include projects such as the construction and improvement of beamlines and experimental stations which will be available for general users after the completion of the project. S2 proposals are superior-grade projects that require the full use of synchrotron radiation or long-term beam time. G-type proposal is valid for 2 years, thus the number of active proposals for the past few years has exceeded 600. Category T is a proposal to support research conducted by PhD students supervised by professors of both a university and PF. Category MP is a proposal in which at least two of the four beams, synchrotron radiation at the PF, slow positron beam at Slow Positron Facility, and neutron or muon beams at the Materials and Life Science Experimental Facility (MLF) in J-PARC, are required to be used, as a multiprobe experiment.

In addition to the academic proposals reviewed by PF-PAC, proposal categories also for industrial application are available. Category C is a proposal for collaboration between KEK and a research institute including a private company. Category I was

Table 4-1: Number of proposals accepted for the period 2013–2024.

category	FY-2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
S1	0	0	0	0	0	1	0	0	0	0	0	0
S2	5	4	7	6	1	6	3	2	4	1	1	3
U	1	0	1	0	0	0	0	2	1	0	1	1
G	447	407	361	372	392	321	350	297	336	306	343	292
P	18	5	16	10	16	16	18	9	12	18	13	16
T		6	4	3	3	2	3	0	2	2	1	2
MP			3	0	0	1	-	-	-	2	3	2
C	20	25	24	19	21	21	22	18	19	17	11	14
I	13	16	11	-	-	-	-	-	-	-	-	-
V	2	2	2	4	4	10	7	8	6	7	3	0
Y	41	22	33	39	30	39	37	28	39	42	35	37
L					3	7	15	12	5	7	4	9

a non-proprietary proposal for the integrated promotion of social system reform and research and development, supported by the Ministry of Education, Culture, Sports, Science and Technology (from 2009 to 2015). Category V is a non-proprietary grant-aided proposal that has already been reviewed and approved for a research grant; beam time for proposals in this category is allocated with high priority, and applicants are required to pay the stipulated fees for the beam time. Categories Y and L are proprietary proposals for general applicants and beginner applicants, respectively. Those applicants are required to pay the stipulated fees for the beam time.

About 60 facility-initiative projects were performed in FY2024, which include experiments by PF staff members for research and developments and projects of BINDS program (Basis for Supporting Innovative Drug Discovery and Life Science Research).

From FY2022, academic proposals are reviewed by the six subcommittees of PF-PAC corresponding to the six beamline groups. **Figure 4-1** shows the distribution of the proposals accepted by the six subcommittees in FY2024.

The number of registered users for all types of proposals is about 2,500. This is the number of users registered as radiation workers and does not include users only for remote experiments. **Figure 4-2** shows the distribution of users by institution and their positions. Over three-quarters of the users belong to universities. About two-thirds of the university users are graduate and undergraduate students, clearly showing the important role that the Photon Factory plays in both research and education. The geographical distribution of the PF users is shown in **Figs. 4-3** and **4-4**, which also indicates the immense contribution of the Photon Factory to research and education throughout Japan. The registered number of papers published in 2024 based on experiments at the PF was 508 at the time of writing (July 1, 2024). In addition, 44 doctoral and 233 master theses have been presented.

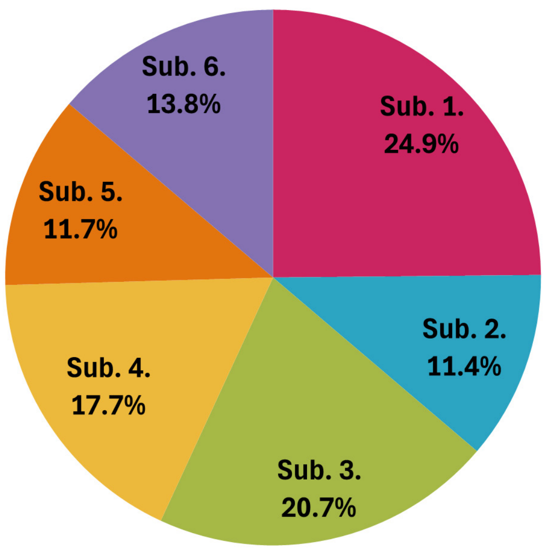


Figure 4-1: Distribution of experimental proposals accepted in FY2024 by six subcommittees of PF-PAC corresponding to six beamline groups.

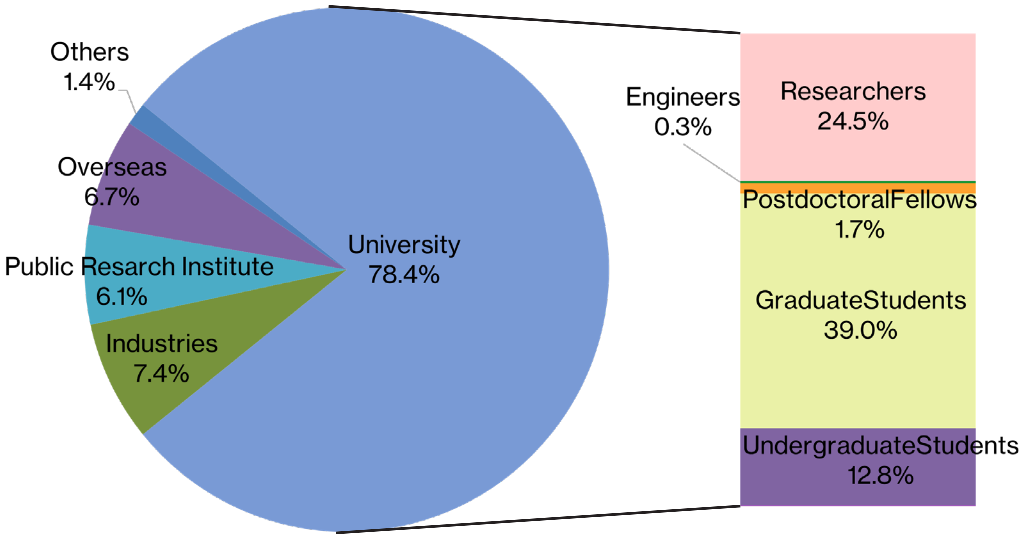


Figure 4-2: Distribution of users by institution and position.

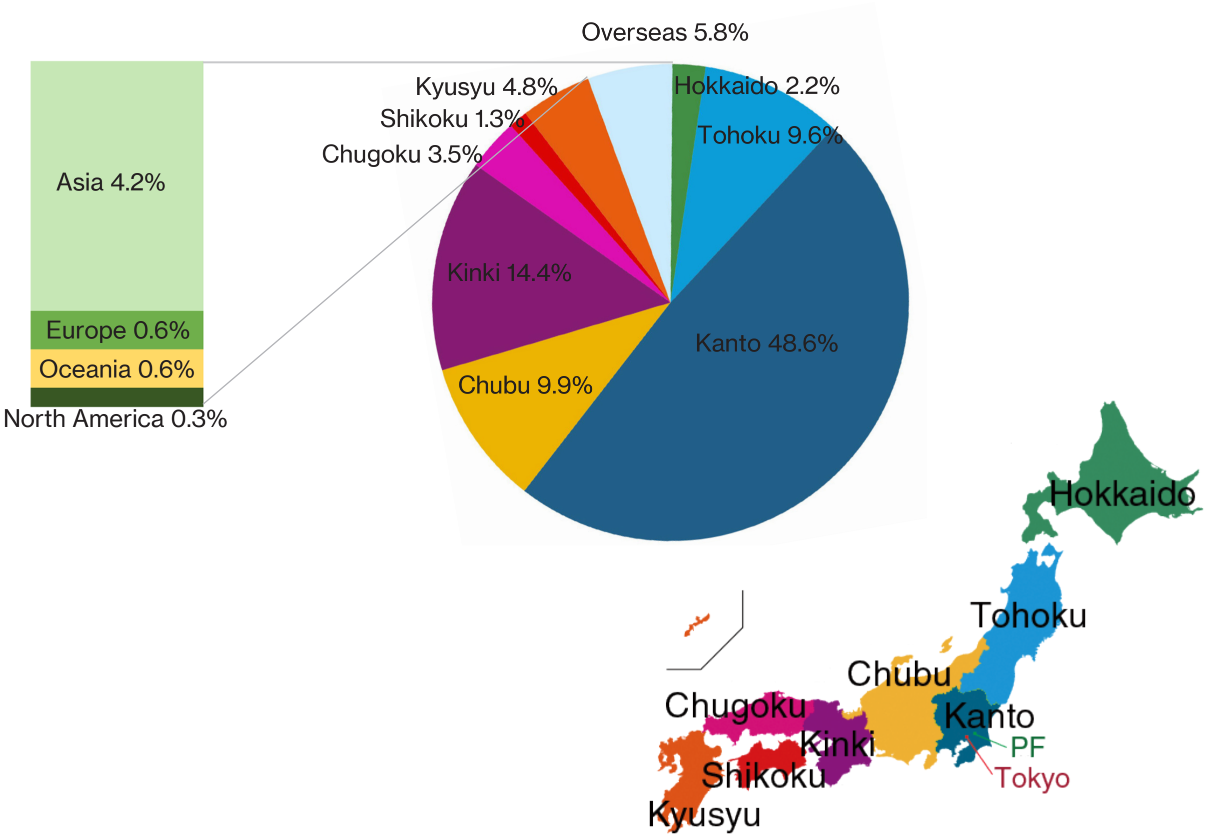


Figure 4-3: Regional distribution of spokespersons of proposals accepted in FY2024.

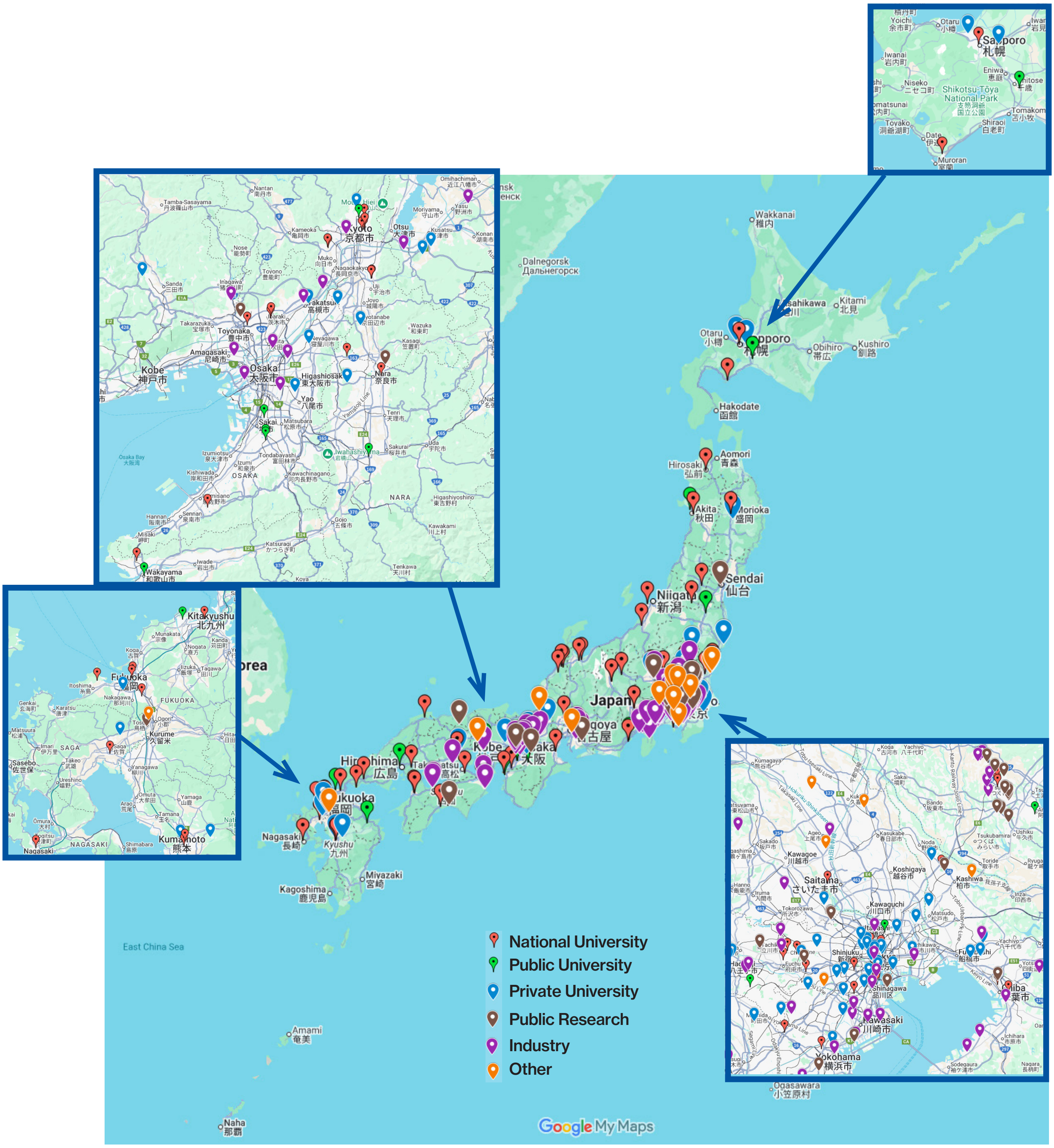


Figure 4-4: Geographical distribution of Photon Factory users in FY2024 (domestic users only).