2 Operation and Proposals

2-1 Operation Summary

In FY2014, the machine operation schedule of the PF ring and PF-AR was not like in past years as shown in Fig. 1. The PF ring and PF-AR did not deliver beams to users during the winter term from January to March 2015. This was due to a reduction in operation funding and higher electricity charges. As a result, the total user beam time of the PF ring was 2,317 hours, and that of the PF-AR was 1,955 hours, which are about half of the user beam time in the past (~4,000 hours). This situation seriously affected the allocation of beam time to users, which was evidenced by a much higher oversubscription ratio than usual at the highly popular insertion-device and bending-magnet beamlines. Both the facility staff and user community (PF-User Association, PF-UA) worked to resolve this situation in FY2014 by launching a campaign for collecting signatures from other academic communities (physics, chemistry, biology, engineering, etc.) and industrial companies in which synchrotron radiation users have been actively involved. Thanks to these comprehensive efforts by facility staff and users, the user beam time in FY2015 is expected to recover partly to ~3,000 hours. We deeply appreciate all the efforts and actions by the user community to support and maintain the activities of the PF. The operational statistics for the PF ring and PF-AR are summarized in Table 1. The statistics of the accelerator's operation for more than twenty years are shown in Fig. 2 for the PF ring and in Fig. 3 for the PF-AR.

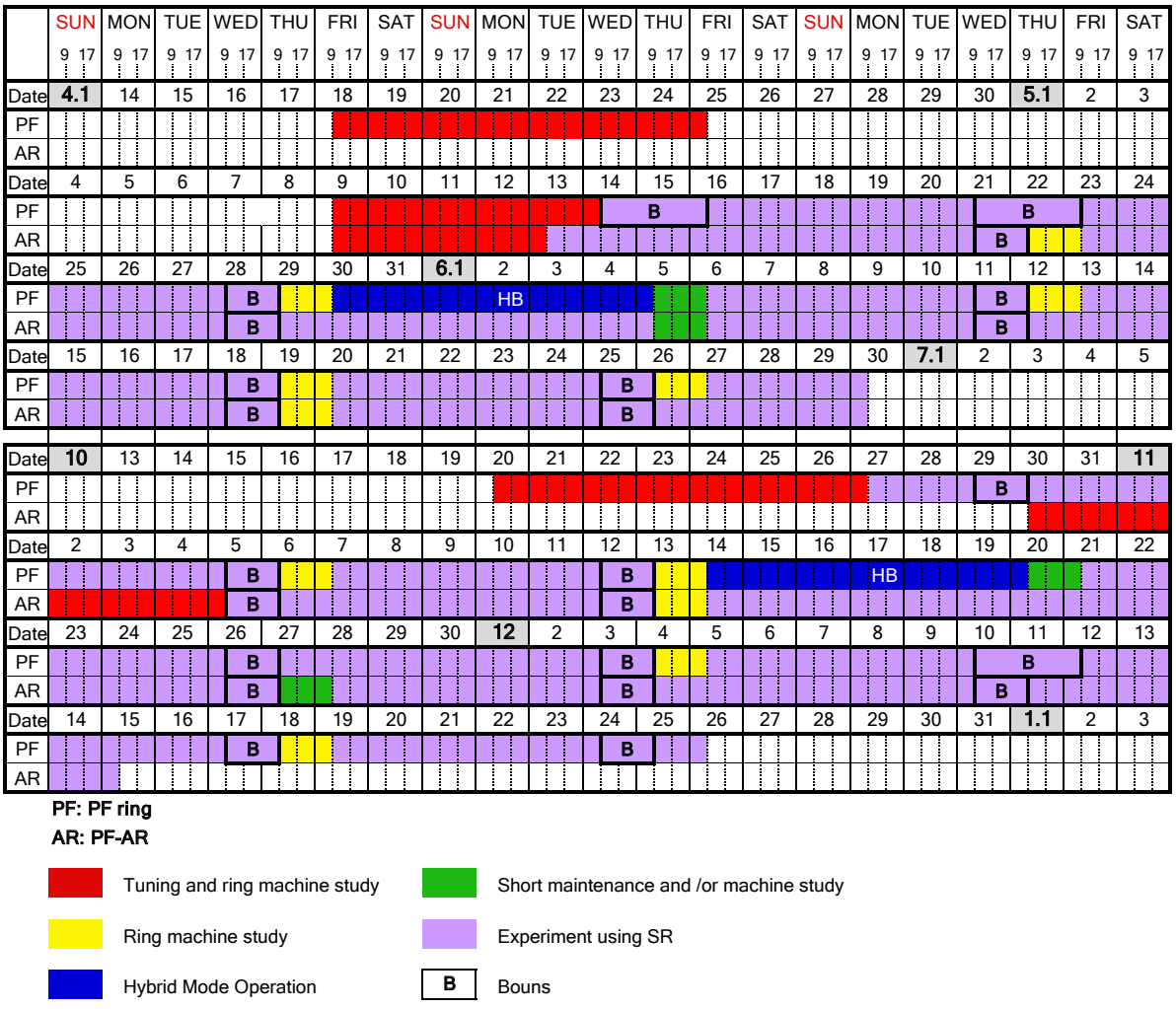

Figure 1: Timetable for PF ring and PF-AR operations in FY2014.

Table1: Operation statistics for PF ring and PF-AR in FY2014.

	PF- ring	PF-AR
Ring operation time (h)	3024.0	2352.0
Actual user time (h)	2316.6	1955
Machine adjustment time (h)	696.0	360.0
Failure time (h)	11.4	37.0

To demonstrate the good performance of the PF ring, the failure rates as a percentage of the total operation time are shown in Fig. 4.

In the PF ring, the user operation was delayed by one week from the primary schedule due to a leak of the gate valve with RF contacts, which was installed just upstream of undulator #02-2. Except for this accident, the operation has been smooth, although beamline #14 was closed till June 2014 due to a problem with the superconducting wiggler.

The numbers of failures in the PF-AR from FY2005 to FY2014 are listed by component in Table 2, and the downtimes in FY2014 are classified by component as a pie chart in Fig. 5.

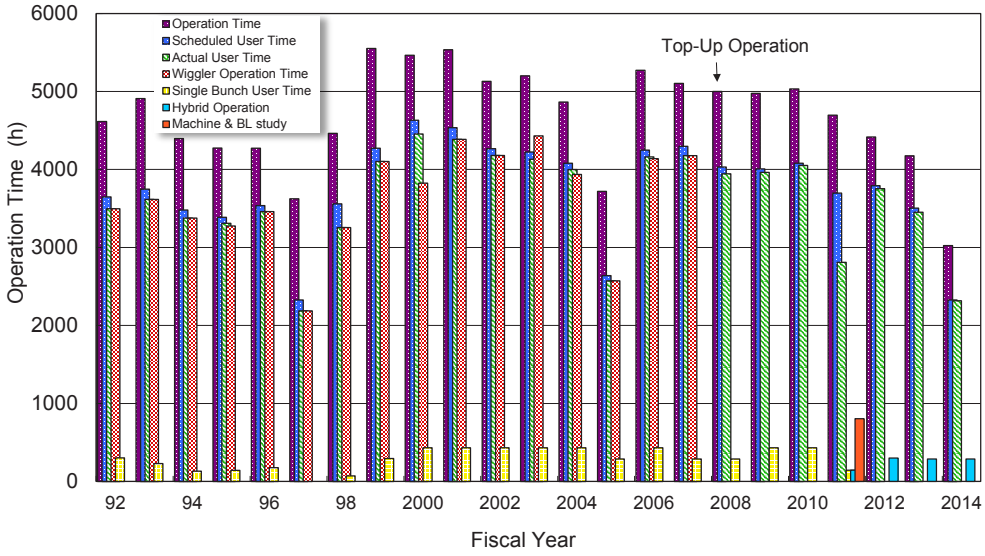

Figure 2: Total operation, scheduled user, actual user, and single-bunch user time for PF ring.

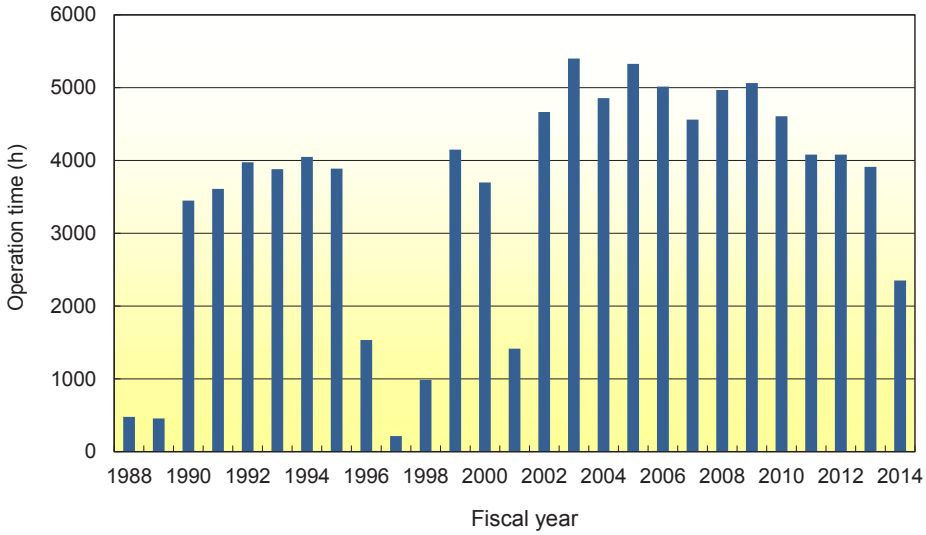

Figure 3: Total operation time for PF-AR.

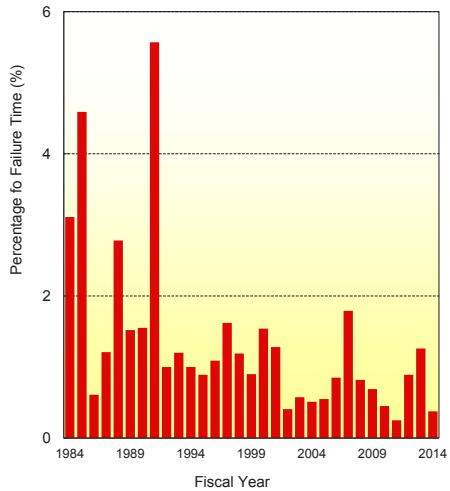

Figure 4: Failure rate for PF ring.

Table 2: The numbers of failures in the PF-AR from FY2005 to FY2014.

Fiscal year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
RF	12	10	1	4	8	10	5	4	5	2
Magnet	4	1	1	2	2	10	8	3	4	9
Injection	4	3	8	9	1	6	4	3	18	7
Vacuum	2	6	2	0	2	1	0	1	0	0
Dust trap	37	24	39	15	16	24	20	13	3	2
Insertion devices	0	1	0	0	0	0	0	0	0	0
Control / Monitor	4	0	1	1	1	2	1	2	8	0
Cooling water	5	1	0	3	4	4	1	0	2	0
Safety / Beamline	9	4	5	5	7	17	3	4	3	1
Earthquake	2	0	1	0	0	0	5	3	1	0
Electricity	0	1	2	1	0	0	2	0	3	1
Total	79	51	60	40	41	74	49	33	47	22

Fiscal year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total operation time (h)	5313	5016	4561	4969	5063	4608	4080	4080	3912	2352
Scheduled user time (h)	4456	4032	3624	4344	4392	4032	2904	3672	3478	1992
Ratio of user time (%)	83.9	80.4	79.5	87.4	86.7	87.5	71.2	90.0	88.9	84.7
Number of failures	79	51	60	40	41	74	49	33	47	22
Total down time (h)	69.3	55.1	45.2	41.7	91.0	73.7	38.7	29.7	99.6	37.0
Failure rate (%)	1.6	1.4	1.2	1.0	2.1	1.8	1.3	0.8	2.9	1.9
MTBF (h)	56.4	79.1	60.4	108.6	107.1	54.5	59.3	111.3	74.0	90.5
Mean down time (h)	0.9	1.1	0.8	1.0	2.2	1.0	0.8	0.9	2.1	1.7

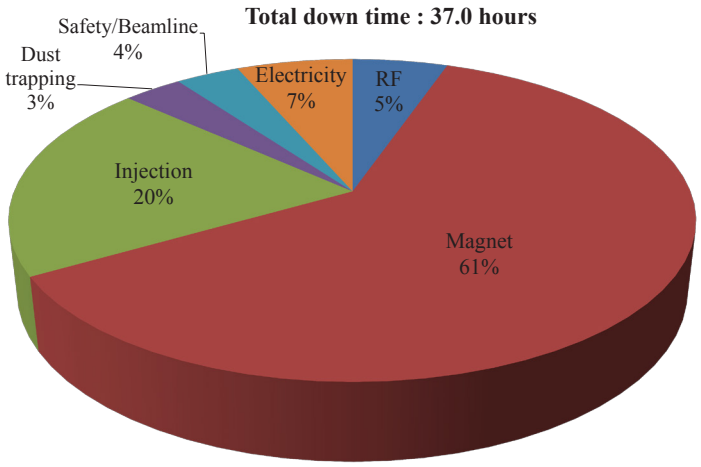

Figure 5: Pie chart of the down time in FY2014 of PF-AR.

2-2 Scientific Proposals

The Photon Factory accepts experimental proposals submitted by researchers mainly at universities and research institutes inside and outside Japan. The PF Program Advisory Committee (PF-PAC) reviews the proposals, and the Advisory Committee for the Institute of Materials Structure Science formally approves those that are favorably recommended. The number of accepted proposals over the period 2003–2014 is shown in Table 3, where S1/S2, U, G, and P denote Special, Urgent, General and Preliminary proposals, respectively. Category T is a new type of proposal for supporting researches by PhD students. The number of current G-type proposals each year has exceeded 800 for the past few years. A full list of the proposals effective in FY2014 and their scientific output can be found in Part B of this volume.

Table 3: Number of proposals accepted for the period 2003–2014.

Category	FY2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
S1	1	1	0	1	0	0	0	0	0	0	0	0
S2	2	0	3	6	1	4	6	3	2	4	5	4
U	2	4	0	1	7	3	2	2	0	4	1	0
G	318	382	310	386	403	402	397	407	415	454	447	407
P	9	13	10	22	14	14	14	16	11	18	18	5
T												6

Table 4: List of S-type proposals effective in FY2014.

Proposal No.	Spokesperson	Title
2014S2-001	R. Kumai KEK-PF	Structural sciences for the understanding of the origin of physical properties and optimization of functions in the organic molecular assemblies
2014S2-003	H. Sawa Nagoya Univ.	Study of the new quantum lattice liquid system by crystal field analysis
2014S2-004	Y. Fukaya JAEA	Topmost surface structure determination using total reflection high-energy positron diffraction
2014S2-006	S. Nozawa KEK-PF	Dynamic study for optical functional materials by high-efficiency time-resolved XAFS
2013S2-001	T. Matsushita KEK-PF	Development of Time-Resolved X-Ray Reflectometory and its applications
2013S2-002	Y. Murakami KEK-PF	Synchrotron radiation research on element strategy project_electronic materials:The study of functionalities in lightelement anion systems
2013S2-003	Y. Takahashi The Univ. of Tokyo	Development of sustainable science by scanning transmission X-ray microscopy (STXM)
2013S2-004	K. Amemiya KEK-PF	Complementary studies on magnetic thin films aiming at control of their properties by external factors mainly by means of soft X-ray XMCD
2013S2-005	Y. Nagashima Tokyo Univ. of Sci.	New developments of the Ps- photodetachment experiment and applications of the energy tunable Ps beam
2012S2-001	T. Takahashi Tohoku Univ.	Quantum phenomena of Dirac fermion systems studied by highresolution angle-resolved photoemission spectroscopy
2012S2-004	A. Waseda AIST	Crystal evaluation of silicon crystals for the determination of the Avogadro constant
2012S2-005	H. Nakao KEK-PF	Materials structure science by resonant soft x-ray scattering under external field
2012S2-006	J. Yoshinobu The Univ. of Tokyo	Physical chemistry at surface and interface of energy-conversion materials using VUV/SX SR spectroscopies
2011S2-003	M. Oshima The Univ. of Tokyo	Operando analysis of green nano-device structures by high-resolution electron spectroscopy

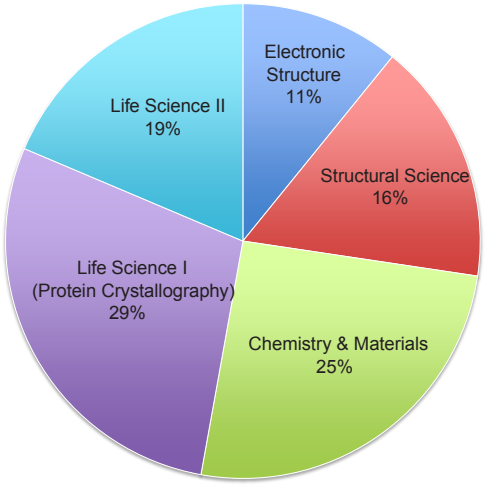

Figure 6: Distribution by scientific field of experimental proposals accepted in FY2014.

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. Table 4 lists the S-type projects effective in FY2014. The proposers are requested to report the current status and results to date of S1 and S2 proposals at the PF Symposium held at the end of every Japanese fiscal year. The scientific output of S1 and S2 proposals is presented in the Highlights of Part A and in the Users' Reports of Part B of this volume.

Proposals are categorized into five scientific disciplines, and reviewed by the five subcommittees of PF-PAC: 1) electronic structure, 2) structural science, 3) chemistry and materials, 4) life science I (protein crystallography), and 5) life science II (including soft matter science). Figure 6 shows the distribution by research field of the proposals accepted by the subcommittees in FY2014.

2-3 Industrial Proposals

Proposals by users in industries can be accepted in the following categories:

Trial use: Only for users who have not used the PF in the field of analytical methods such as X-ray absorption fine structures (XAFS), topography, imaging, X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), and small-angle scattering (SAXS).

Time-designated proposal: A certain amount of beam time can be used for a fee. The experimental results can be kept confidential.

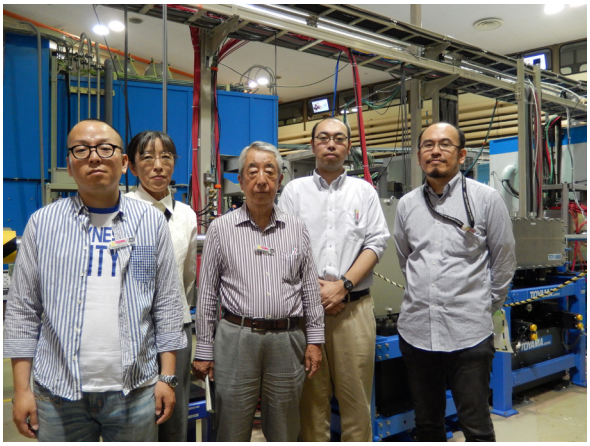

Figure 7: A group photo of technical support staff for the trial-use program.

Collaborative research: A certain amount of beam time can be used for collaborative research between an industrial organization and a research group in PF, IMSS or KEK for a fee.

(A) Trial use: Sixteen trial-use programs for industrial applications were carried out with the financial support of a MEXT project, the Open Advanced Research Facilities Initiative. Among these, twelve were newly approved and four were continued from FY2013. A total of six staff members, including the five persons shown in Fig. 7, supported these research activities. After ending the trial-use program in FY2012, a nonproprietary collaborative study was performed in FY2014.

(B) Time-designated proposal: In 2014 we accepted 22 proposals from industrial organizations at beamlines for various fields such as XAFS, XPS, and SAXS.

(C) Collaborative research: In 2014 we accepted 20 proposals from industrial organizations at beamlines. Topics in collaborative research cover a wide range of fields, from materials science to biochemistry.

2-4 Statistics of the Proposals

The number of users, for all types of proposals, has reached 3,074. Although the number of experimental stations has decreased, the approved scientific proposals and number of users have increased annually, as shown in Fig. 8. This indicates a high and increasing demand for synchrotron radiation and can be attributed to continuous improvements in the storage rings, beamlines, and experimental stations. The synchrotron has become one of the most important research tools for carrying out advanced science experiments and development. About 22% of the proposals are conducted by new spokespersons, which indicates that the Photon Factory is open to public academic scientists. Figure 9 shows the distribution of users by institution and position. About three-quarters of the users belong to universities, with approximately 73% of the users associated

with national universities. Over two-thirds of the national university users are graduate and undergraduate students; this indicates that the Photon Factory plays an important role in both research and education. The geographical distribution of the Photon Factory users is shown in Fig. 10 and Fig. 11, which also indicates the immense contribution of the Photon Factory to research and education throughout Japan. The registered number of papers published in 2014 based on experiments at the PF was 531 at the time of this writing and is expected to exceed 590. In addition, 11 doctoral and 45 master theses have been presented.

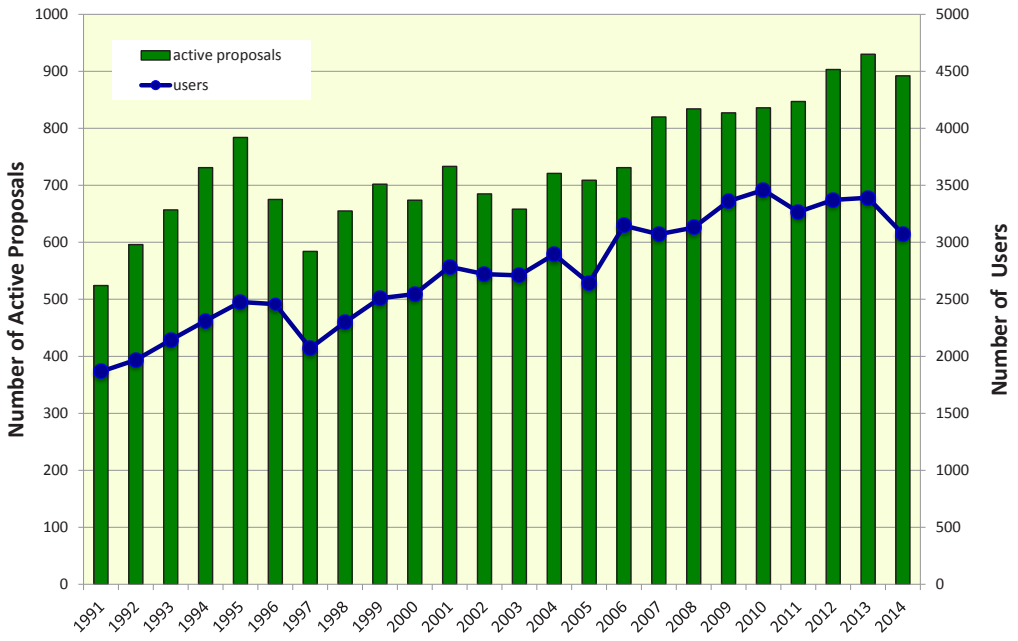

Figure 8: Number of registered PF users and scientific proposals over the period 1991–2014.

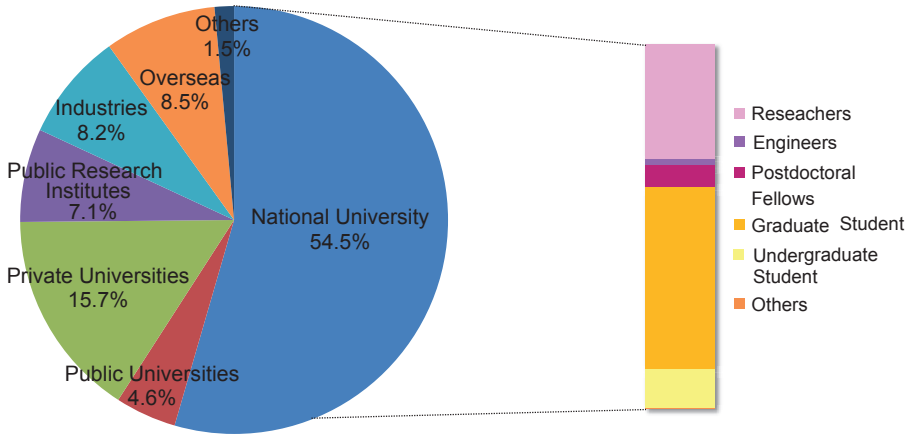

Figure 9: Distribution of users by institution and position.

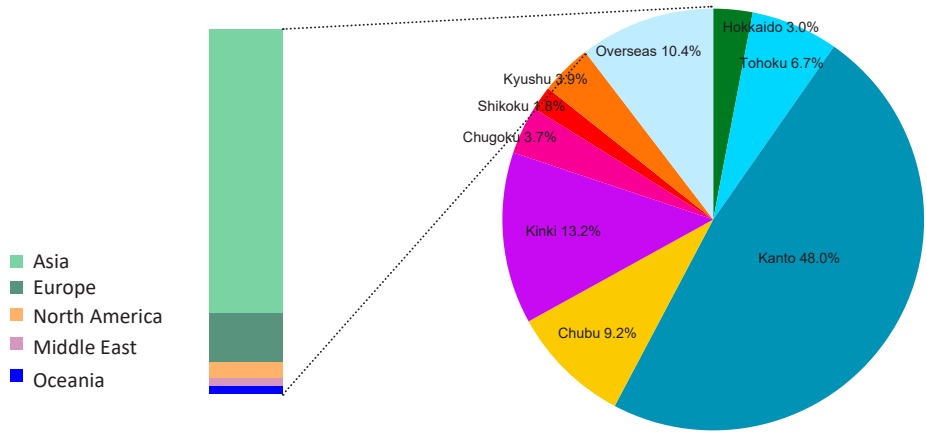

Figure 10: Regional distribution of the spokespersons of proposals accepted in FY2014. We corrected the pie chart on 2019/09/02.

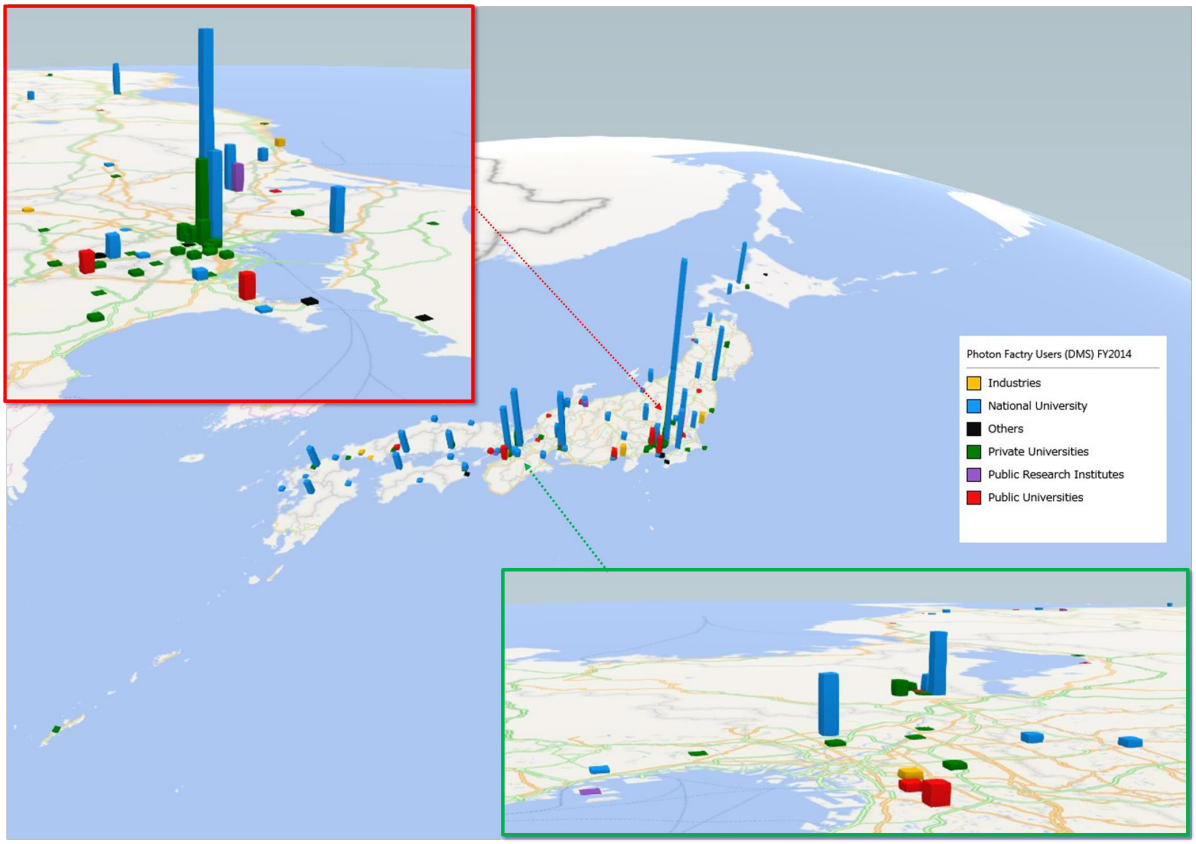

Figure 11: Geographical distribution of Photon Factory users in FY 2014 (domestic users only).