

SACLA

I. Introduction

SACLA is the world's second X-ray Free Electron Laser (XFEL), following the Linac Coherent Light Source (LCLS) in the US. Currently, these are the only two XFELs in operation. SACLA delivers the shortest wavelength XFEL. SACLA achieved its first lasing on June 7, 2011, within three months of electron beam commissioning, and launched user operations in 2012A. Since then, we have operated SACLA in five years with reasonable stability and reliability.

II. Machine Operation & Beamlines

Our fifth year of operations proceeded without any significant issues. Operation statistics are summarized in [Table 1](#). The ratio of downtime to user time was kept below 4%, a reasonably low rate for linac-based light sources.

Table 1. Operation Statistics for FY2016

	Time (h)
Total operation time	5861
User time	4026
Facility tuning time	710
Study time	1749
Downtime	130

In 2012, two beamlines, BL3 for XFEL and BL1 for broadband spontaneous light, were open for users, while all experiments were conducted with BL3. As the newest beamline, construction of BL2 was completed during the summer shutdown of 2014, and first laser amplification was achieved on October 21. An upgraded beamline for soft X-ray FEL, BL1, which combines the prototype accelerator of SACLA (SCSS), started operation in 2016. For more details, please refer to SACLA Beam Performance in this volume.

III. User Program and Statistics

SACLA calls for public user proposals twice per year. Proposals fall into two categories: General Proposals for general research with no specific research theme, while Priority Strategy Proposals are on strategic themes that are designated by the national policy. Currently there are two strategic themes: Hierarchical Structure Dynamics of Biomolecules and Pico/Femto Second Dynamic Imaging. [Table 2](#) shows the research themes for each group.

In FY2016, JASRI introduced the proprietary research of General Proposals and the Proprietary Time-Designated Proposals. The project leaders of these proprietary proposals are not required to publish their research results, but required to pay each beamtime fee. In addition, to apply for the proprietary research the project leaders should be affiliated with a corporate enterprise located and registered in Japan.

Table 2. Research themes for each group

1. Hierarchical Structure Dynamics of Biomolecules	1-1 Structural Analysis of Drug-targeted Membrane Protein Nanocrystals
	1-2 Imaging of Whole Cell and Its Components in the Living State
	1-3 Single Molecule Structural Analysis of Supramolecular Complex
	1-4 Dynamics Research Combining Single Molecule X-ray Diffraction Experiments and Supercomputer Analysis
	1-5 Dynamic Structural Analysis Using Pump-Probe Techniques
2. Pico/Femto Second Dynamic Imaging	2-1 Gas-Phase/Liquid-Phase/Solid-Phase Reaction Dynamics
	2-2 Ultrafast Interface Reaction Processes
	2-3 Charge Generation/Charge Transfer Dynamics
	2-4 Ultrafast Processes under Extreme Conditions
	2-5 Dynamic X-ray Spectroscopy

Table 3, Figs. 1 and 2 provide statistics on proposals, users, and beamtime.

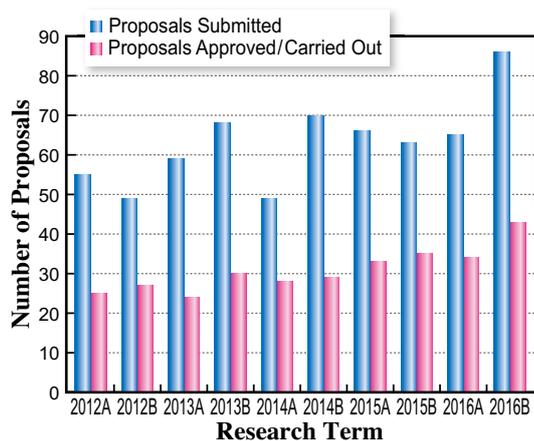


Fig. 1

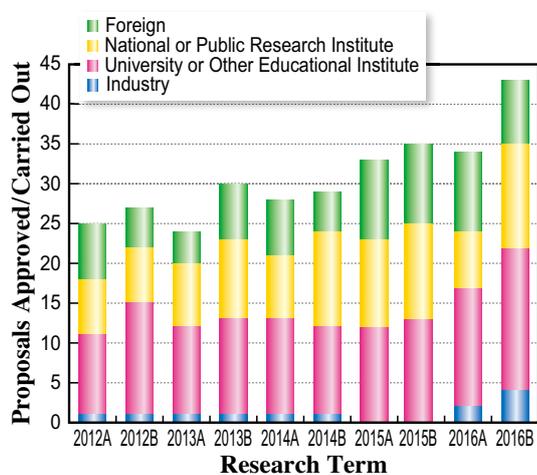


Fig. 2

Table 3. Number of proposals submitted, proposals approved/carried out, cumulative users, and beamtime available by research term

Half-year Research Term	Proposals Submitted	Proposals Approved / Carried Out		Cumulative Users	Beamtime Carried Out (Shifts)
		(Priority Strategy Proposals)	(General Proposals)		
2012A	55	25	(12)	297	126
2012B	49	27	(19)	461	154
2013A	59	24	(15)	268	117
2013B	68	30	(19)	410	139
2014A	49	28	(20)	400	147
2014B	70	29	(17)	430	140
2015A	66	33	(23)	527	144
2015B	63	35	(23)	552	152
2016A	65	34	(21)	538	158
2016B	86	43	(21)	650	197

One shift = 12 hours at SACLA beamlines

IV. Research Outcome

As of March 2017, the total number of registered refereed papers from SACLA was 316 many of which were published in high-impact journals. More details can be found at <https://user.spring8.or.jp/uisearch/publication2/>.