

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 from 2012A. Since then, we have operated SACLA in four years with reasonable stability and reliability.

II. Machine Operation & Beamlines

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

Table 4. Operation statistics for FY2015

	Time (h)			
Total operation time	6483			
User time	3924			
Facility tuning time	158			
Study time	2401			
Downtime	154			

In 2014, 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, 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), is due to be in operation in 2016. For more details, please refer to SACLA Beam Performance in this volume.

III. User Program and Statistics

SACLA calls for public use 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 5 shows the 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 5. Research themes for each group

Table 6, Figs. 6 and 7 provide statistics on proposals, users, and beamtime.



Table 6. Number of proposals submitted, proposals approved/carried out, cumulative users and beamtime available by research term

Half-vear		Proposals Approved / Carried Out				Boomtime Corried Out
Research Term	Proposals Submitted		(Priority Strategy Proposals)	(General Proposals)	Cumulative Users	(Shifts)
2012A	55	25	(12)	(13)	297	126
2012B	49	27	(19)	(8)	461	154
2013A	59	24	(15)	(9)	268	117
2013B	68	30	(19)	(11)	410	139
2014A	49	28	(20)	(8)	400	147
2014B	70	29	(17)	(12)	430	140
2015A	66	33	(23)	(10)	527	144
2015B	63	35	(23)	(12)	552	152

One shift = 12 hours at SACLA beamlines



Fig. 7.

IV. Research Outcome

In 2015, more than 30 papers from SACLA were published. These included three papers in Nature. Some of these studies, both scientific and technical, are included in this volume of SPring-8/SACLA Research Frontiers.

