SPring-8 & SACLA

General Information

The SPring-8/SACLA complex, which is the only facility that has a third generation synchrotron light source collocated with an X-ray free electron laser (XFEL), is an international COE for high energy photon science. Since 1997, SPring-8 has delivered brilliant X-rays for a number of various experimental stations. SACLA, which was inaugurated in 2012 as the first compact XFEL facility in the world, generates ultrafast, intense X-ray pulses for selected experiments. The combination and demarcation of these light sources provide unique opportunities to develop a wide range of advanced research and innovations.

User operations: started from 1997~

8 GeV 100 mA Top-Up operations within 0.03 % current variation

5,063 hrs of operation with 4,156 h user time, 868 hrs stand-by and study time, and 39 hrs down time (~0.8%) in 2012 FY

Operations Budget: 8,392 B JPY (~84 M USD) in 2011 FY, 8,848 BJPY (~88 M USD) in 2012 FY (1 USD = 100 JPY)

15,249 visiting users in 2012 FY, welcomed the 150,000th user in 2012 FY since the inauguration in 1997

1,781 proposals submitted, 1,378 approved (77.4 %) in 2012 FY

User affiliation: 4.8% from abroad, 15.7% from national/ public institutes, 58.9 % from universities, 20.7% from industries

~800 publications/year in refereed journals

User operations: started from 2012~

Photon energy: 4~20 keV

Pulse duration: < 10 fs

7,016 hrs of operations with 3,151 hrs user time, 3,864 hrs stand-by and study time, and 241 hrs down time (~7.6% of user time) in 2012 FY

Operations Budget: 4901 B JPY (~49 M USD) in 2012 FY (1 USD = 100 JPY)

732 visiting users in 2012 FY*

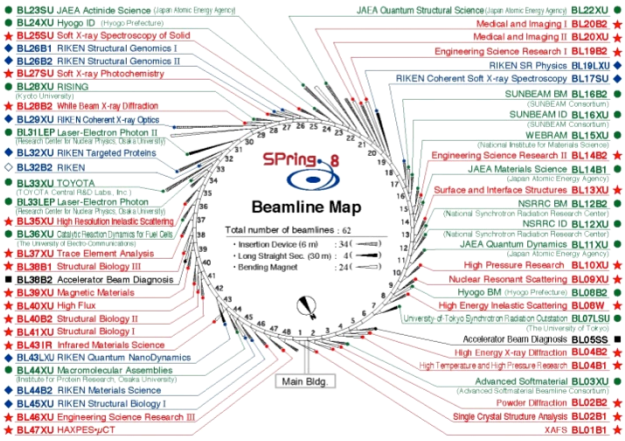
104 proposals submitted, 52 approved (50 %) in 2012 FY*

User affiliation: 23.1% from abroad, 26.9% from national/ public institutes, 46.2% from universities, 3.8% from industries

26 publications (since 2012) in refereed journals (high impact journals: >60%)

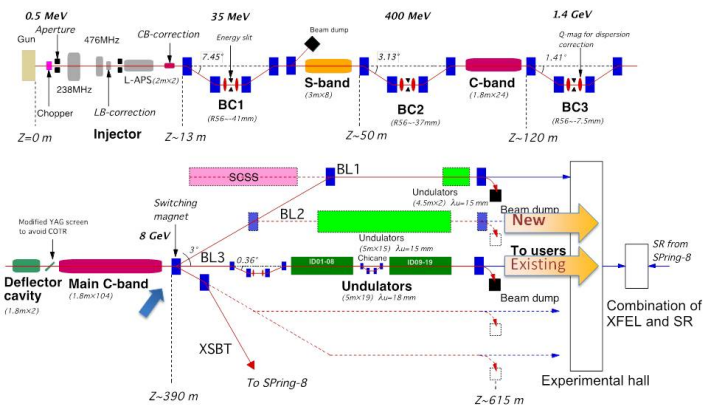
* including March, 2012

Beamline Map



57 beam lines are in operation. 5 await for construction.

Accelerator & Beamline Map



2 beam lines are in operation. 1 under commissioning.

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Current Activities

SPring-8

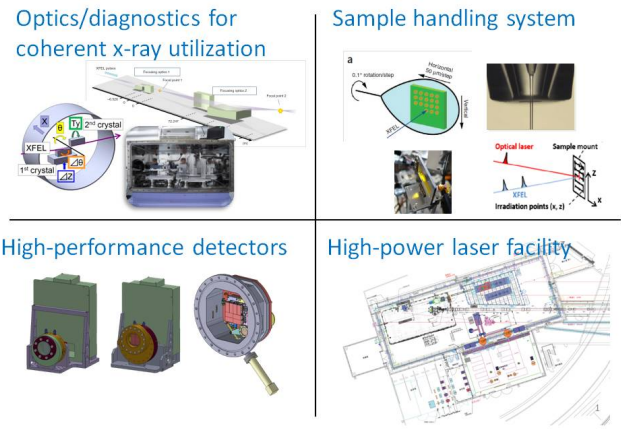
SPring-8 (Super Photon ring 8 GeV) is widely recognized for its contributions to global problem-solving. Research at SPring-8 has led to the development of a variety of energy-efficient industrial products that are currently available on the market. SPring-8 is also contributing to environmental sustainability, which is in great demand in Japan and around the world.

To tackle these challenges, SPring-8 has promoted research targeting industrial applications. Most of the research for industrial applications is conducted as SPring-8 general proposals using the public beamlines, supporting more than 180 companies and 2600 users every year. The ratio of industrial applications to pure research experiments has reached about 20%. Selected core applications, which are directly connected to product development for the private sector, are being conducted at dedicated beam lines.

The broad capabilities of SPring-8 have contributed to the development of many types of commercial products, including tires and catalysts for eco-cars, next-generation batteries, cosmetics, functional materials, electronics, and drugs.

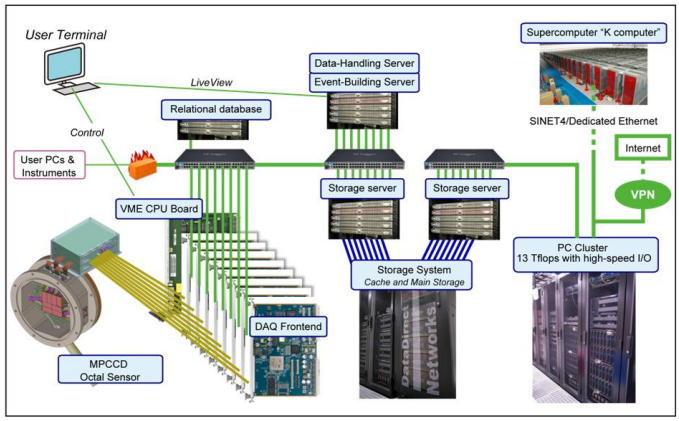
SACLA

SACLA is the world's first compact XFEL facility to provide a high-performance XFEL light source with moderate costs for construction and operations. The success of SACLA is enabled by state-of-the-art Japanese technologies, such as high-gradient C-band accelerators, precise timing and low-level RF systems, stable high-power supplies, high-performance klystrons, reliable control systems, short-period in-vacuum undulators, and high-quality X-ray optics. Shortly following the first lasing in June 2011, SACLA started operations for users in March 2012. Recently, a number of visible outputs in the initial phase have been reported, such as coherent imaging of live cells, damage-free crystallography for radiation-sensitive proteins, novel X-ray femtosecond spectroscopy, two-photon absorption in the hard X-ray region, and photon-photon scattering experiments.



To exploit the full potential of SACLA, we have conducted new technological developments in experimental systems, including coherent X-ray optics, sample handling systems, high-performance detectors, and high-power optical laser systems. We are utilizing a super computer K family for massive data analysis.

We will use these technologies and platforms for advanced utilization of the upgraded SPring-8, which is vitally needed for further explorations of photon science and new technologies.



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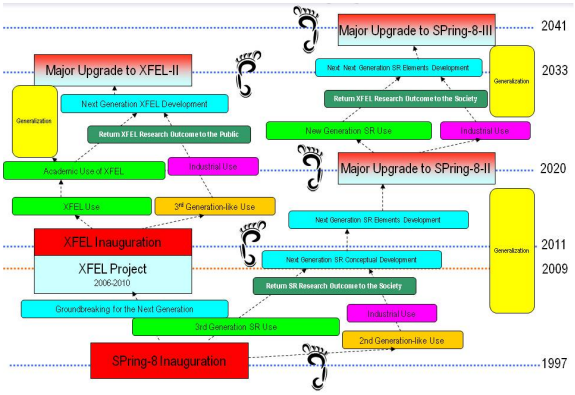
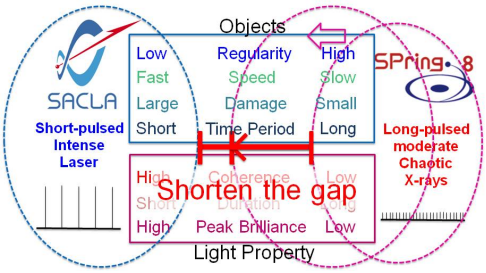
Future Perspective

Harima site took the first step in starting the user operation of SPring-8 in 1997. When SACLA started user operation in 2011, the site started bipedal walking with SPring-8 as the right foot and SACLA the left foot. The next step turns to the right which is a ring-based light source. We have prepared a conceptual design report of the upgrade plan which we call SPring-8-II project. The heart of SPring-8-II is to approach to the so-called diffraction-limited storage ring under several boundary conditions including the reuse of the existing accelerator tunnel. We are expecting the completion of SPring-8-II in early 2020s. Since the concept of the SPring-8 upgrade has mostly consolidated, we started serious discussion for the 4th step that is SACLA upgrade which we hope to implement in middle 2030s. One of the promising candidate would be further downsizing using novel acceleration technologies such as laser acceleration. The 5th step may be ring-based X-ray free electron laser the necessary technology of which is as yet known.



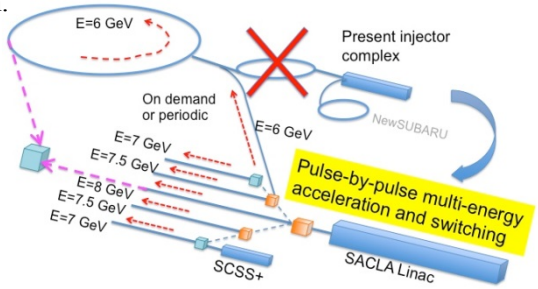
SPring-8

The design of SPring-8 II, an ultra-low emittance synchrotron light source with greatly enhanced brilliance and superior transverse coherence, has started in order to upgrade the SPring-8 site.



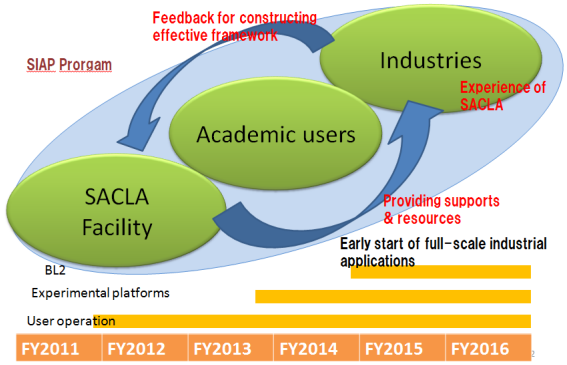
Comprising with SACLA and SPring-8-II to an advance photon science center can answer to not only a question of "what is happening", but also "why the event happens". A first target is to build a conceptual design of the upgraded storage ring, including lattices, magnets, vacuum system, RF components, monitors, and alignment. An advanced injector scheme is in process of development for the upgraded storage ring.

Integrated operations for SACLA and SPring-8 II, in which the SACLA linac serves as a low-emittance injector, will provide for both higher injection efficiency and lower power-consumption operations, compared with the present SPring-8 operation with the dedicated linac and the booster synchrotron.



SACLA

SACLA has great potential for exploring new approaches for industrial applications; however, the novelty of the XFEL source may be a hurdle to accommodating industrial users.



Thus, the SACLA Industry-Academy Partnership Program was launched recently to construct an optimized scheme for facilitating industrial research activities at SACLA with the help from both industrial and academic users.