

# Report of the RIKEN SPring-8 Center Advisory Council 2014

## **General statement**

The SPring-8 campus hosts two world-leading accelerator based light sources. SACLA is the second operating hard x-ray free electron laser (FEL) in the world and the first compact FEL that has established the paradigm for such sources. From its earliest operations it has produced important scientific results and is on a strong and continuous growth. SACLA produces the shortest wavelengths worldwide and is a leader in investigations in non-linear x-ray physics.

The SPring-8 storage ring source has world leading capabilities. The 1 km beamline enables the development of unique x-ray optics as evidenced by the continued progress for hard x-ray reflection optics. The newly commissioned in-elastic scattering beamline on the 25 m straight section is the best in its class and has already produced important results that should further our understanding of the physics of high temperature superconductors.

The RSC is pursuing continuous growth of both facilities and is focusing on the upgrade path for the SPring-8 storage ring in step with the two other high energy 3<sup>rd</sup> generation synchrotron sources.

The RSC is also focusing on the management of the facilities on the SPring-8 campus with organizational changes as exemplified by the creation of the engineering section.

## **Comments on the specified issues**

### **Terms of Reference for RSAC**

1. How can we further improve the management systems of the RSC (especially its organizational structure and administrative systems), which strive to make the RSC a world-leading Photon Science Research Complex?

The RSAC still sees room for advancement in the biosciences. This is a most challenging area that is as often dominated, by necessity, by large, well-funded groups. An approach we favor is to develop a coordinated effort in structural biology amongst the three independent laboratories: the bio-structural mechanism laboratory, the SACLA science research group, and the bio-metal science laboratory. This has the potential to significantly improve the overall scientific impact of these independent teams.

The RSAC notes that often, at large facilities, there is a tendency to organize based on techniques. A possible managerial effort would be to form science based platforms across the organizations responsible for the operations of all beamlines at SPring-8 and SACLA. This has the potential to create a scientific environment that can increase scientific creativity leading to new results for the in-house staff and lead to

new capabilities for the user community. Such an effort would not involve increasing management but rather stressing science collaboration and cross technique approaches to common problems.

2. How can we promote sciences of, for and by high-energy photons in a manner compatible with the RSC's missions, to effectively confront the problems mankind is facing?

The role of the RSC to design, construct and operate accelerator based light sources implies that the science portfolio is to a large extent user driven. Many facilities share the common problem of promoting their usage by specific groups in the user community. The RSAC has a list of possible approaches to encourage best utilization of the unique high-energy photon capabilities of the SPring-8 complex. Possible ways to attract the best user groups from RIKEN, Japan and worldwide to utilize these unique capabilities to address important scientific problems are to:

- 1) Hold science based workshops
- 2) Establish collaborations with leading groups
- 3) Establish joint appointments with universities
- 4) Establish long-term user agreements for access
- 5) Establish priority proposal topics
- 6) Present important scientific results based on the use of high energy photons at important conferences

Amongst these possibilities, perhaps the best is to drive in-house research using the unique capabilities of SPring-8. The research must be focused to yield critical information, addressing an important scientific question that could not be answered in any other way than to use high-energy photon tools at SPring-8. To generate broad interest in the scientific community these results must be presented to national and international scientific meetings.

3. How can we optimize the roles for governance and efficacy that the RSC should assume in the research complex with the SPring-8 and SACLA facilities?

The RSC operates in a complex environment, where organizational and funding differences can appear to create boundaries that inhibit the maximization of the research output of the unique radiation sources on the SPring-8 campus. RSAC strongly urges that the RSC work to eliminate any boundaries that might exist between organizations responsible for the various aspects of SPring-8 and SACLA and that lead to inefficiencies and/or impede scientific output.

#### **President Noyori's suggested topics for deliberation by the Advisory Councils for RIKEN's Centers**

1. The key concept of the Third Five-Year Term is "mobilizing RIKEN's overall strength" for problem-solving research, and a new framework has been put into place to encourage cross-disciplinary research throughout RIKEN. In order to evaluate how well this new framework is functioning to promote cross-disciplinary research within RIKEN, each center

advisory council is asked to cover the topics in item (1).

- (1) Is the center's research output and personnel up to international standards? Is the center a world-leader in its field? Please make concrete proposals that could lead to quantum leaps.

RSAC recognizes the quality of the scientific output is on a par with the leading high energy 3<sup>rd</sup> generation synchrotron radiation facilities: ESRF in Grenoble, France, APS in Argonne, United States and PETRA III in Hamburg, Germany. The RSAC notes, however, that continued attention to the quantity of scientific output is necessary so that the RSC maintains a strong position internationally.

RSC is the world leader in the development of compact hard x-ray free electron lasers. The accelerator concepts for 'quantum leaps' in FEL performance have significant 'seeds' in the thinking of the SACLA team. Timely evaluation and implementation of these concepts are very important.

The RSC collaboration with Osaka University is world leading in the development of reflective optics for hard x-rays. The optics development would not have been possible without the world unique 1 km beamline at SPring-8 and the leadership of the RSC personnel in defining the scientific potential of achieving nm scale foci with long working distances.

2. RIKEN will be operating under a new system for Independent Administrative Institutions, starting in April 2015. As such, RIKEN's primary objective will be to maximize its research and development capabilities and define goals for creative, outstanding world-class results in selected areas of problem-solving research. Each center advisory council is asked to recommend specific research topics by which the center can apply its special attributes to contribute to those areas of specialty (not only issues confronting society, but also those specific to science and technology) in which RIKEN should be dedicating its comprehensive resources.

The understanding of the role of the RSC is: (1) to design, construct and operate accelerator based light sources with unique source capabilities for research and (2) to maximize the impact of the research using the RIKEN beamlines for the benefit of society.

RSAC evaluation for the design, construction and operation of accelerator based light sources with unique source capabilities for research.

The RSC operations and development of SACLA are world leading in the development of compact hard x-ray free electron lasers for basic science. This is clearly recognized by the acceptance of the compact design that is the basis for SWISSFEL and the Pohang Free Electron Laser.

The SPring-8 II design concept (upgrade of SPring-8) is well aligned with the worldwide efforts to upgrade the existing 3<sup>rd</sup> generation hard x-ray storage ring sources, ESRF and APS toward diffraction-limited sources.

RSAC recommends that these efforts should take into consideration progress worldwide in finalizing the design choices for SPring-8 II. We encourage further optimization of the performance of the new design without compromising the performance standards that users have come to rely on.

RSAC evaluation of the impact of the research using the RIKEN beamlines for the benefit of society.

It is important to ensure that the unique capabilities of the accelerator based light sources on the SPring-8 campus are utilized and impact the breadth of the RIKEN science portfolio. The scientific quality of the research carried out on the RIKEN beamlines is world class. To maintain the quality of the research carried out at the RIKEN beamlines the RSAC recommends that the RSC continue to reach out to the RIKEN scientific staff and more broadly both within Japan and worldwide to develop user science exploiting the unique RIKEN beamline capabilities.

## **Recommendations**

1. Develop a coordinated effort in structural biology amongst the three independent laboratories: the bio-structural mechanism laboratory, the SACLA science research group, and the bio-metal science laboratory.
2. Form science based platforms across the organizations responsible for the operations of all beamlines at SPring-8 and SACLA. This has the potential to create a scientific environment that can increase scientific creativity leading to new results for the in-house staff and lead to new capabilities for the user community. Such an effort would not involve increasing management but rather stressing science collaboration and cross technique approaches to common problems.
3. To grow the use of the high energy photons from SPring-8 begin by driving in-house research

using the unique capabilities that yields critical information to address a specific problem that could not be obtained in any other way than to use high-energy photon tools at SPring-8 and to present these results to national and international scientific meetings.

4. Eliminate any boundaries that might exist between organizations responsible for the various aspects of SPring-8 and SACLA and that lead to inefficiencies and/or impede scientific output.
5. Take into consideration progress worldwide in finalizing the design choices for SPring-8 II. The SPring-8 ring has, in comparison to APS and ESRF, the largest circumference and therefore the potential to yield the lowest emittance from the upgrade.
6. RSC should develop organized out-reach efforts focused on the RIKEN scientific staff and more broadly both within Japan and worldwide to develop user science exploiting the unique RIKEN beamline capabilities.