

平成 29 年 5 月 22

国立研究開発法人理化学研究所 放射光科学総合研究センター
利用システム開発研究部門 山本 雅貴 殿

国立研究開発法人理化学研究所
理事 松本洋一郎

平成 28 年度実施主任研究員の研究業績レビュー（中間）の結果について

主任研究員、准主任研究員及び上席研究員研究業績評価実施細則(平成 28 年 4 月 28 日細則第 46 号)に基づき主任研究員の研究レビュー（中間）を実施し、レビューアーから事務局に送られた評価結果は以下のとおりです。

1. 評価対象：利用システム開発研究部門山本 雅貴部長

1) 評価体制

実施日：平成 29 年 3 月 27 日（月曜日）

4 名の所外有識者を評価委員とするヒアリングレビューを実施。

評価者：

Yoshiyuki AMEMIYA, Professor
The University of Tokyo

Youichi MURAKAMI, Professor
Institute of Materials Structure Science,
High Energy Accelerator Research Organization

Shin-ichi ADACH, Professor
Institute of Materials Structure Science,
High Energy Accelerator Research Organization

Gwyndaf EVANS, Principal Beamline Scientist
Diamond Light Source

2) 評価結果の概要等

General comments:

【Reviewer 1】

Dr. Yamamoto and his team members have been developing some new technologies for the high-brilliant synchrotron radiation of SPring-8. The reviewer was strongly impressed their achievement in protein micro-crystallography at BL32XU with 1-micron focused X-rays. This beam has made it possible to collect high-resolution data from micro-crystals. Using this beamline they have succeeded to determine many membrane protein structures. The reviewer highly appreciates their development of the measurement technologies. The scientific results are shown in a lot of high-level publications. They are also promoting high-throughput protein crystallography at BL26B1 & B2. The automation of measurements makes a pipeline for structure

analysis possible, which will improve the efficiency more than ever. They are also pushing forward the development of two experimental techniques using X-ray free electron laser SACLA; femtosecond crystallography for the radiation damage free structure determination and coherent X-ray diffraction imaging in structural biology. The reviewer also highly appreciates the developments of these techniques, which may open up a new world of structural biology. They have achieved many substantial results in SR Materials Science Unit, Soft X-ray Spectroscopy Unit, and SR Imaging Unit. These scientific results are highly appreciated by the international community. They also support the RIKEN beamline operations very well.

The management ability of Dr. Yamamoto as the division director is excellent. The team members show their great facilities in their cutting-edge studies and collaborate with each other and with SR users very well. The future plans of this division sound good and are enough competitive ones.

In summary, the achievements of Advanced Photon Technology Division are excellent and outstanding. The reviewer highly appreciates the results and strongly recommends that RIKEN continue to support the activities of this division.

【Reviewer 2】

Research and Development Objectives

The Advanced Photon Technology Division displayed a clear mission to develop and implement cutting edge methods and instrumentation for X-ray science at Spring-8 and SACLA. Further, it provides strong expert support for user operation of the RIKEN beamlines at Spring-8. Three key targets are i) the provision of brilliant and stable synchrotron radiation at the sample, ii) delivery of innovative experimental techniques for MX, Coherent X-rays and Time/Spatially resolved measurements and iii) the standardization of beamline usage through beamline control systems and hardware environments. These goals are coherent and a strategy is in place to further develop particular areas such as automated data analysis where major benefits are still to be obtained.

Research & development results - Achievements in operation of the facility.

Although the Division's goals are broad sweeping in their range, there are examples where the Yamamoto laboratory is world leading in delivering to these goals. BL32XU is a world leading microbeam facility and was the first to routinely enable delivery of a 1 micron beam for Macromolecular Crystallography (MX). Complemented by efficient automatic sample changing it has set a standard for other microfocus MX beamlines worldwide. The beamline staff are dedicated to providing excellent support to users of the beamlines and were very enthusiastic about their research and development. They showed knowledge of the higher-level vision for the developments. Importantly, they all understood the benefits of sharing knowledge across beamlines so that all instruments move forward in capability while trying to maintain a uniform software and hardware interface for users of the facility.

The results and impact of the many MX software developments that have been made in recent years are very impressive. Software is often neglected at other synchrotrons so it was particularly pleasing to see the high quality of software being delivered and the importance that is attached to it by Prof Yamamoto and his team. The operation of

a successful remote and mail-in service for MX is noteworthy and is indicative of the growing trend in MX particularly.

The quality of the R&D programme and beamline support is finally evidenced by the high number and high impact of the scientific results being produced by users of the beamlines. Of particular note are the large number of membrane protein structures determined at BL32XU.

I would like to congratulate Prof Yamamoto and his staff for their brilliant work and the world-class facilities that they offer and support.

Management of the Laboratory

The management of the whole team is effective and the group members are enthusiastic, dedicated and understand their mission. In the Life science and Imaging Units this is particularly true where Prof Yamamoto provides strong direction in terms of strategic goals. Of particular note was the dedication of the beamline staff to their users and the user science. Without this level of engagement by the staff much of the science achieved at the beamlines would not be possible.

Future Research and Development Plans

The future directions set by Prof Yamamoto for his staff and the Division illustrate a clear vision and awareness of the needs of the scientific community in structural biology and imaging. This includes an understanding that cryo-electron microscopy will, in the future, play a significant role alongside X-rays in delivering atomic structural information about macromolecules, their complexes and larger biological assemblies.

【Reviewer 3】

The Advanced Photon Technology Division which is headed by Dr. Yamamoto includes Research infrastructure group and Bio-specimen platform group.

The research & development objectives of Research infrastructure group, which is to lead the new SR technologies at SPring-8 and to promote the SR science in RIKEN is very-reasonably set, which is highly evaluated. Its activities and results are also highly evaluated, in spite of the limited number of the staff to cover as many as nine beamlines and four research fields.

Research infrastructure group includes four research unit (SR life science, SR materials science, Soft x-ray spectroscopy, SR imaging). Among the four units, the activities of SR life science are outstanding, which is to be highly appreciated.

The research fields of the other three units are a little bit different from Dr. Yamamoto's own fields. Nevertheless, he is doing good management by encouraging and giving liberty to the staff so that they can pursue their own research with their full capacities.

Regarding the Bio-specimen platform group, the activities are focused on sample preparation and crystallization. They are very important to produce good scientific results.

In order to make the best use of the advantage that SPring-8 and SACLA are located in the same area, further collaboration and communication between them are encouraged.

【Reviewer 4】

The Advanced Photon Technology Division lead by Dr. Yamamoto aims to perform R&D projects of synchrotron radiation (SR) technologies, and to implement the outputs from the R&D effectively to the RIKEN beam lines at the SPring-8. The Division covers wide variety of SR science and technology including life science, materials science, soft X-ray spectroscopy, and imaging. The achievements are mostly excellent, especially those of the SR Life Science Unit, to which Dr. Yamamoto's expertise is strongly related.

Outstanding scientific outputs have been produced from the macromolecular crystallography (MX) beam lines at SPring-8. Among them, the micro-crystallography beam line BL32XU is targeting micro-crystals of human membrane proteins. The Unit has been developing key technologies for effective data collection and analysis of protein micro-crystals, which eventually led to considerable amount of papers published in high-impact journals. Their activity at SACLA is another direction of brand-new structural biology. Crucial methods for damage-free MX using XFEL were originally developed by them at SACLA. These achievements are highly evaluated. Other beam lines for high-throughput MX and small-angle X-ray scattering (SAXS) also seem to be operated properly. The beam lines for materials science, soft X-ray spectroscopy, and imaging are not only conducting their R&D projects, but also producing outstanding scientific outputs individually.

Overall, the Division is well organized toward maximizing scientific impacts produced from the RIKEN beam lines by effectively implementing the state-of-the-art SR technologies developed at the SPring-8 and SACLA to the RIKEN beam lines.

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