「専用ビームラインの再契約」について

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SPring-8 に設置されている専用ビームラインは、登録施設利用促進機関である JASRI の専用施設審査委員会において、「放射光専用施設の設置計画の選定に関する基本的考え方」に基づき、評価・審査等を実施し、その結果は SPring-8 選定委員会で審議されます。2020 年 2 月に開催しました SPring-8 選定委員会において、以下の専用ビームラインについて、2019 年 11 月に開催した専用施設審査委員会（以下、本委員会という）での評価・審査結果を審議し、承認されましたので報告します。

利用状況等評価／次期計画審査
・NSRRC BM・ID ビームライン（BL12B2・12XU）
（設置者：台湾 NSRRC）

台湾の NSRRC（National Synchrotron Radiation Research Center：國家同步輻射研究中心）が設置した「NSRRC BM ビームライン（BL12B2）および NSRRC ID ビームライン（BL12XU）」は、契約上の設置期間満了 1 年前に「再契約」の意思表示があったことから、本委員会で利用状況等評価および次期計画審査を実施しました。

評価・審査の結果は、再契約は承認するものの、次期計画については、3 年後を目処に中間評価を行うことが妥当との判断となりました。契約期間については、6 年程度が妥当と思われますが、今後 NSRRC と協議の上、決定することとなりました。

評価・審査結果の詳細については、以下、「Contract Beamline NSRRC BM and ID (BL12B2, BL12XU) Term-end Review Results Report and Review Results of the Future Plan for the Next Phase」を参照ください。

Contract Beamline NSRRC BM and ID (BL12B2, BL12XU) Term-end Review Results Report and Review Results of the Future Plan for the Next Phase

General statement

National Synchrotron Radiation Research Center (NSRRC) in Taiwan constructed BL12B2 and BL12XU at SPring-8, which were launched in June 2000 and March 2001, respectively. In 2011, the contract with SPring-8 was renewed for another 10 years. This is the term-end review of the 10-year contract, and evaluation for the renewal of the 3rd 10-year contract.

Comments on the specified issues

1. Facility Status and Developments

The Taiwan Contract Beamlines at SPring-8, BL12XU and BL12B2, have been well maintained and actively used by researchers from Taiwan, Japan, and other countries. In 2016, a new 3 GeV low-emittance storage ring, the Taiwan Photon Source (TPS), has started user operation. Standard experiments such as X-ray absorption (XAS), X-ray diffraction (XRD), and protein crystallography (PX) are now mostly performed in TPS. Therefore, the direction of the Taiwan Contract Beamlines in SPring-8 has been reconsidered after the interim review in 2016. They have made efforts to extend their activities of inelastic X-ray scattering (IXS) to the higher energy region and execute unique and challenging experiments such as in-situ/operando experiments and experiments in complicated environments. New directions are assumed to be compatible with the beamlines at TPS, and other facilities operated by the NSRRC. Therefore, the importance of the Contract Beamlines at SPring-8 remains unchanged.

In accordance with new directions, several developments have been done since the interim review in 2016. BL12XU mainline is designed for IXS experiments to explore frontier research on various forms of samples. The mainline includes high-resolution monochromator (4-bounce channel-cut Si crystals with 20 meV resolution) to provide various bandwidths. For high pressure researches of the samples confined in a small volume in a diamond anvil cell (DAC), small beam size is required. The K-B mirror system is installed and improved to achieve a beam size 10(V) × 30(H) μm^2 suitable for high-pressure experiment with a DAC. To study dichroism study, the diamond phase retarder has been introduced. The end-station of BL12XU mainline is equipped with unique three types of spectrometers for non-resonant IXS (NIXS) and resonant IXS (RIXS) measurements. A Si array detector with 32 channels was developed to be used with the spectrometer. A new spectrometer with a bent Laue analyzer optimized around 20 keV has been developed for NIXS in higher photon energy region.

BL12XU sideline is developed for Hard X-ray Photoemission Spectroscopy (HAXPES) in collaboration with the Max Planck Institute for Chemical Physics of Solids. BL12XU sideline employs a diamond beam splitter. It has a high-resolution channel-cut crystal and K-B mirrors. This design enables simultaneous operation of two experimental stations. The HAXPES end-station has two electron analyzers to efficiently run polarization-dependent experiments, which is very powerful to distinguish orbital characters of wave functions in materials. The upgrades of the sample manipulator for the in-situ/operando sample stage that allows to apply a bias to devices should be noted.

BL12B2 provides multiple research capabilities in XAS, powder XRD, and PX. After the opening of TPS in 2016, many experiments have become possible at TPS. The main part of PX has been transferred to the TPS and BL44XU at SPring-8 operated by the Institute for Protein Research (IPR), Osaka University, based on the close collaboration between NSRRC and IPR. Now more focus has been put on the in-situ/operando XAS and XRD experiments of energy-storage materials. The beamtime allocation of PX has been reduced from 50% to 10% and in-situ experiments have taken over the opened beamtime.

2. Operation and Management

The user supports have been done by the 5 NSRRC staffs and 2 staffs from external companies. The budget for maintenance and management of the two beamlines is

ensured. The Radiation & Operation Safety Division and Experimental Safety Review Committee of NSRRC are examining proposals for the safety at the beamlines. Users are further requested to follow the safety regulations of SPring-8. The safety examination at the beamlines is regularly conducted. Thus, the beamlines have a proper system to ensure safety during user experiments. The selection of the research proposals by the NSRRC Proposal Evaluation Committee (PEC) is fair and successfully functioning.

The beamlines are open for both domestic and international users and producing high impact outcomes. After the TPS operation, the number of Taiwanese users for BL12B2 is reduced from the period 2010-2014 to the period 2015-2019. However, BL12XU has enhanced the number of domestic users for the period 2015-2019. Furthermore, number of international users has increased for the period 2015-2019, showing high international interest and reputation.

3. Research Activities

At BL12XU, the total number of papers is almost the same between the periods 2010-2014 and 2015-2019. The number of papers produced by HAXPES measurements has increased. It is expected that more application-oriented publications will appear from the HAXPES station in the future. While the instrumentation of BL12B2 is standard, it is actively producing number of excellent publications with high scientific significance.

4. Future Plan for the Next Phase

As for the future plan, NSRRC carefully considered the directions of the beamlines at SPring-8 making them distinct and/or complimentary to the beamlines at TPS. The Taiwan funding agency expects more domestic proposals.

NSRRC presented three directions and upgrades for the next phase of Taiwan Contract Beamlines at SPring-8; (1) in-situ/operando measurements to attract Taiwanese researchers studying catalysts or battery materials, (2) experiments using intense high energy photons from SPring-8, (3) experiments in complicated environments. These directions are found to be reasonable and effective to enhance research opportunities for domestic and international users.

We expect continued efforts to attract users not only from domestic users but also international users and encourage them to publish papers. Use of the upgraded spectrometers for IXS is expected to produce publications with high quality. The HAXPES station will attract users in materials science and is expected to produce application-related papers.

Conclusion

Taiwanese scientists have learned synchrotron radiation science and techniques in high-energy region by the use of BL12B2 and BL12XU at SPring-8. The accumulated expertise has been helpful for the construction of the beamlines and end-stations in TPS.

The future plans presented by NSRRC are appropriate for renewal of the contract. As the important upgrades will be completed in 3 years, the Review Committee suggests an interim review in around 3 years to evaluate the achievements and adjust the future directions.

It is recommended to prepare for the SPring-8-II project in the near future. Upgrade of the undulator will be required.

To secure the safe operation of the beamlines, the committee recommends NSRRC to continue to take effective measures to promote the share of the experience and knowledge obtained in the safety management of the beamlines among the personnel involved in the beamline operation.