

9. Activities of Rokkasho Research Center

At Rokkasho village in Aomori Prefecture, the IFERC (International Fusion Energy Research Centre) project and the IFMIF/EVEDA project have been conducted under the Broader Approach (BA) agreement between the EU and Japan from Jun. 2007, in order to complement ITER and to contribute to an early realization of the DEMO reactor. The roles of the NIFS Rokkasho Research Center (RCE) established in May 2007 are to assist NIFS and universities in cooperating with those activities, and to prepare the environment for promoting various collaborative research activities, including technology, between Rokkasho and universities. As cooperation activities, the head of the NIFS RCE was undertaking tasks as the IFERC Project Leader (PL) from Sep. 2010 to May 2020 and those as the IFERC Deputy PL (D-PL) from Jun. 2020 to Mar. 2022. The role of PL was to coordinate the activities by EU and JA implementing agencies and the role of D-PL was to support PL.

BA activities have two Phases; BA Phase I from Jun. 2007 to Mar. 2020 and BA Phase II from Apr. 2020 to Mar. 2025 or beyond. FY 2021 has been a year of continuation of re-organization to orient IFERC activities according to the priorities given by BA Steering Committee (SC) for BA Phase II, and of a start-up of collaboration with ITER.

The original IFERC project plan for BA Phase II, including long and short-term objectives for a period of five years or more, was approved by SC in BA SC-25 (Jul. 2020) and updated year by year.

The long-term objectives of IFERC project are

- to build on the past successful collaboration in the CSC, in order to provide support to the ITER and JT-60SA projects, by fostering state-of-the-art modelling tools development and providing computer simulation resources, as well as remote experimentation facilities;
- to provide support for the JT-60SA, and eventually ITER exploitation by promoting simulation projects to develop reliable scenarios;
- to provide support to the IFMIF validation and design projects, both those taking place in the Rokkasho site (LIPAc) and the projected DONES and Advanced Fusion Neutron Source (A-FNS), including making use of the licensed materials laboratory;
- to consolidate and further the know-how on analysis/design of fusion reactors (e.g. DEMO) in strong collaboration with JT-60SA and ITER.

The short-term objectives of IFERC project are

- to provide support for ITER, IFMIF/EVEDA, and JT-60SA (STP);
- to consolidate the know-how for future fusion reactors (e.g. DEMO) through the production of databases, inputs to engineering handbooks, and a review of lessons learned in existing fusion projects, building on the results of BA Phase I.

Regarding the collaboration with ITER, a Cooperation Arrangement between the Broader Approach Activities and the ITER Project was signed in Nov. 2019 between F4E, QST and ITER Organization for promoting and furthering academic and scientific cooperation and establishing a collaboration between ITER and BA Activities. Regarding the IFERC project, following the approval of a new annex to the Cooperation Arrangement for IFERC, the Implementing Arrangement No. 2 of the Cooperation Arrangement was concluded in Jun. 2021. In Oct. 2021, the Coordination Committee approved the Work Programme 2021/2022. Based on the Work Programme 2021/2022, collaborations have started in the area of remote participation in ITER between ITER CODAC/IT and IFERC-REC, and in CSC with the provision of CSC resources to collaborative simulation projects in high priority areas related to disruption studies and edge/SOL/divertor. Collaboration with ITER in the preparation of DEMO design guidelines and knowledge management will also be considered.

Based on the Work Programme 2021/2022 including

- Participation in joint simulation projects, on the subjects defined by ITER as high priority: Modelling of disruptions in ITER, and ITER edge/SOL/divertor plasma simulations
- Participation of IO in HPC Follow-up Working Group,

collaborative activities between IFERC-CSC and ITER were implemented in 2021. Both activities started immediately after approval of the Work Programme. Regarding the Participation in joint simulations projects, ITER scientists joined two existing CSC simulation projects (“MHD” for disruption studies in ITER and “MISONIC” for ITER edge/SOL/divertor plasma simulations) while additional subjects were included. Resources for these projects were increased in JFRS-1 by reallocating unused resources assigned to other BA simulation projects. This allocation was concluded in Dec. 2021. Regarding the second activity, the ITER responsible person for the CSC collaboration has been invited and regularly attends the meetings of the HPC Follow-up Working Group.

The activity plan for cooperation with ITER CODAC was discussed at a kick-off meeting held in Sep. 2021, where the main points of the collaboration and the contact persons of each party for this collaboration were agreed. The Work Programme 2021/2022 includes:

- Construction of a connection environment using Layer 2 VPN (L2VPN)
- CODAC Application Testing
- Remote data access to ITER database
- Live data viewing of ITER operation status in REC
- Fast data transfer from ITER to REC.

The collaborative tests with IO have started. Real-time monitoring tests of the ITER facility from REC room are ongoing. The server installation in F4E Barcelona has been completed and will allow the installation of remote IO-CODAC virtual machines that will be used in the testing activities. The procurement of a 100Gbps network switch and the related work have been completed for better network connection in accordance with the upgrade of SINET. The ITER Dashboard installed at REC was tested as a “Live data viewing tool”, using the L2VPN dedicated line between REC and CODAC. In parallel, the collaboration with IFMIF/EVEDA on remote participation has enabled the commissioning and operation activities of LIPAc.

As for DEMO Design Activity, the progress of activities resulted in 54 publications. It was also reported that the first intermediate Check and Review of JA DEMO programme, similar to G1 Gate Review for EU in 2020, was successfully completed. The efforts to recover from problems caused by COVID-19 were implemented. In DEMO R&D Activity, steady progress in four task areas covering R&D in tritium technology, structural materials, functional materials, and corrosion database led to 52 publications, of which five were joint papers. The population of engineering databases had started. One concern is that the recent Russian situation would result in delays of activities in the task of functional materials, where irradiations in Russian reactors have been cancelled.

Additionally, the head of the NIFS RCE was working until Mar. 2022 as the leader of the general coordination group of the Joint Special Team for a Demonstration Fusion Reactor (DEMO) design, which is the organization as an all-Japan collaboration set in May 2015, for establishing technological bases required for the development of DEMO.

In summary, the NIFS RCE contributes widely not only to the success of ITER but also to the realization of fusion energy through the continuous efforts mentioned above.

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