

# 9. Activities of Rokkasho Research Center

At Rokkasho village in Aomori Prefecture, the International Fusion Energy Research Centre (IFERC) project and the International Fusion Materials Irradiation Facility/Engineering Validation and Engineering Design Activities (IFMIF/EVEDA) project have been conducted under the Broader Approach (BA) agreement between the EU and Japan from June 2007. The roles of the NIFS Rokkasho Research Center (RCE) established in 2007 are to assist NIFS and universities to cooperate with those activities, and to prepare the environment for promoting various collaborative research including technology between activities at Rokkasho and at universities. As cooperation activities, the head of the NIFS RCE is undertaking tasks as the IFERC Project Leader (PL) from September 2009, and the NIFS RCE has been set inside the Rokkasho Fusion Institute of QST, where the IFERC and the IFMIF/EVEDA projects are located. Also, the head of the NIFS RCE is working as the leader of the general coordination group of the Joint Special Team for a Demonstration Fusion Reactor (DEMO) design, which is the organization set in May 2015 for establishing technological bases required for the development of DEMO as an all-Japan collaboration. In addition, the NIFS RCE performs communication work with the organizations related to ITER-BA, the Aomori prefectural office, and the Rokkasho village office, and also publicity work so to have local residents understand nuclear fusion research.

In order to complement ITER and to contribute to an early realization of the DEMO reactor, the IFERC project implements the three sub-projects under the coordination by IFERC PL: DEMO Design and R&D Coordination Centre composed of the DEMO Design Activities (DDA) and the DEMO R&D activities, the Computational Simulation Centre (CSC), and the ITER Remote Experimentation Centre (REC). The IFERC project itself was and is implemented on schedule as originally planned. However, the update of the IFERC project plan with the extension until the end of March 2020 was approved in order to ensure the smooth transition to the BA phase II planned from April 2020 to March 2025.

In 2018, the DEMO Design Activity (DDA) continues to investigate key issues, which will impact the selection of main machine parameters and technical specifications for pre-conceptual designs of DEMO. In addition, new joint activities started in several topics in order to share and improve physics results and engineering designs were developed previously by either side or under different conditions.

The compilation of Material Properties Handbook is ongoing in the framework of the DDA, and the analysis of JET tile and dust continues in accordance with Work Programme 2018 for new specimens such as bulk Be limiter tiles and a new set of sample materials. Three shipments of samples occurred in July and September, 2018: (1) Be first wall and limiter tiles (ILW-1), (2) W-Lamella divertor tiles (ILW-1), (3) divertor tiles of W-coated CFC (JET-ILW 3rd campaign: ILW-3), and (4) dust (collected after ILW-3). The aims of research carried out in 2018 were threefold: 1) to conclude studies of the divertor and dust specimens from the 2011–2012 operation in ILW-1; 2) to begin studies of divertor cores and dust from ILW-3 in order to gather data for detailed comparisons of the two campaigns ILW-1 and ILW-3; and 3) to develop methodology and define a programme for analyses of beryllium limiters and to prepare for analyses of bulk tungsten tiles.

After successful completion of CSC activity, “IFERC HPC follow-up working group” was established in 2017. The main results of the “IFERC HPC follow-up working group” activities in 2018 are 1) to have shared experience and best practices in the design and operations of HPC centres for fusion users and in the usage of such centres by fusion users in Europe and in Japan, 2) to have finalized a new PA for providing the computer time for “Joint EU-JA HPC simulation projects” to EU and JA users from April 2019 to March 2020 (the PA was finalized in December 2018 and signed in January 2019), and to have set up the joint allocation committee

in parallel, and 3) to have confirmed a possible timeframe for the introduction of a joint supercomputer in the context of BA Phase II based on the expected lifetime of the current systems in EU and in JA.

As for REC, after completing preparation of the remote facility, the development of remote participation tools, and various verification tests in 2017, massive data transmission tests with LHD in NIFS via L2VPN, and data transmission tests with JET via L3 Layer were executed. After those, the demonstration of remote participation in the WEST experiment was successfully implemented on 28 November 2018 from 18:00 in Japan (10:00 in France) after much preparation work. The demonstration started by the pulse preparation in REC, where the remote session leader edited pulses remotely accessing the pulse editor, XEdit, on the Altair server prepared in WEST. The shot schedule was edited smoothly, and the sequence of plasma discharge started after the validation and approval by the authorized operator in WEST. The large video wall in the REC room displayed the real time countdown of the plasma discharge, a video of plasma generated in WEST tokamak, and the live data of the time trace of the main parameters of the plasma, such as the current and the plasma density, in addition to the view of the video conference system, as shown in the figure.

The head of NIFS RCE is also undertaking the role of the leader of the general coordination group of the Joint Special Team for a DEMO design. Since the collaboration among many researchers from NIFS and other institutions and technicians from companies is indispensable for the conceptual design investigations of DEMO reactor, which are spread widely across instruments, equipment and facilities, and the head of the NIFS Rokkasho staff works as a coordinator and provides advice on various design activities.

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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Large video wall in the REC room showing the video conference and countdown (left), the live data of the main plasma parameter (center), the video of the plasma (right), and so on.