

8. 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, 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 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 2010 to June 2020 and is undertaking tasks as the IFERC Deputy PL (D-PL) from July 2020 (the role of PL is to coordinate the activities by EU and JA implementing agencies and the role of D-PL is to support PL). Moreover, 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.

BA activities have two Phases; BA Phase I from June 2007 to March 2020 and BA Phase II from April 2020 to March 2025 or later. As reported in the NIFS annual report 2019, all the planned activities of IFERC project in the BA Phase I have been completely accomplished on time and on budget. The results were disseminated as the peer-reviewed papers (557 papers for DEMO Design, 304 papers for DEMO R&D, 693 papers for CSC [Computational Simulation Centre] and 8 papers for REC [ITER Remote Experimentation Centre]). Also, all the contributions by both EU and JA have been completely accomplished on time and on budget. After BA Phase I, the BA Phase II started in April 2020 seamlessly, and the purpose of IFERC project was re-defined by BA Steering Committee (BA SC) so as to provide support for ITER, and other BA projects such as IFMIF/EVEDA and Satellite Tokamak Programme (STP) and to consolidate know-how for future fusion reactors through the production of databases, inputs to engineering hand books, and review of lessons learned in the existing fusion projects.

The 2020 JFY (from April 2020 to March 2021) has been a year of re-organization to orient IFERC activities following the priorities given by BA SC for BA Phase II mentioned above. Hereafter, the outline is described very briefly sub-project by sub-project.

Regarding CSC activity in 2020, the IFERC Project Team (PT) and the IFERC HPC Follow-up working group conducted preparation and signature of a Procurement Arrangement (PA), exploitation of the resources provided by JA on JFRS-1 as “host contribution” for 2 years, preparation for possible joint procurement of High Performance Computer (eventually, it was concluded that there was no advantage to a joint procurement), preparation for collaboration with IO, and organization of 2 workshops on simulation projects using resources provided.

As for DEMO Design activity in 2020, despite COVID difficulties, the activities took place on sharing of information/results of major reviews (the first DEMO gate review in EU and first C&R in JA) and on planning of 8 design tasks including joint activities and development of a Work Breakdown Structure (WBS). The eight tasks are 1) Plasma scenario development, 2) Divertor and power exhaust, 3) Breeding blanket design and tritium extraction and removal, 4) Remote maintenance, 5) Safety, 6) System codes, 7) Superconducting magnets, and 8) Balance of Plant (BoP) and plant system, where the first five items have high priority, and are directly relevant for ITER and JT-60SA exploitation so joint work is foreseen in these areas. In addition, on the last three items information will be exchanged to share the whole view of DEMO.

As to DEMO R&D activity in 2020, the preliminary research and the detailed planning for 4 year activities have been performed for four task areas: 1) R&D on Tritium Technology, 2) Development of Structural Material for Fusion DEMO In-Vessel Components, 3) Neutron irradiation experiments of Breeding Functional Materials (BFMs), and 4) Development of material corrosion database. Based on such preliminary research and detailed planning for 4 year, 4 new PAs were completed with WBS, responsible people identified, schedule refined, detailed research plan.

In 2020, the REC activity has gained visibility and urgency due to the COVID 19 pandemic situation. The REC activity consists in the collaboration with ITER Organization (IO), with IFMIF/EVEDA and with STP. Regarding collaboration with IO, a kick-off meeting to discuss the collaboration between IO and IFERC-REC was held in Jan. 2020 with ITER CODAC staff in Rokkasho, based on the “Cooperation Arrangement between the BA activities and the ITER project” signed in Nov. 2019. After these activities, in 2020, one PA was signed on Oct. 2020 for the procurement of equipment and services to implement the collaboration with IO (Note that in June 2021 the Implementing Arrangement No.2 corresponding to the above Cooperation Arrangement has been signed). Concerning the collaboration with IFMIF/EVEDA, the support to implement remote participation for the Linear IFMIF/EVEDA Prototype Accelerator (LIPAc) is ongoing. In March 2020, a Central Control Room (CCR) for LIPAc was completed in the REC Building and used now as shown below.



Collaboration of IFERC with IFMIF/EVEDA for remote participation in LIPAc

Technical Coordination Meeting (TCM) was held twice for the definition of activities, and one PA was completed for preparatory activities (planning and definition of collaboration with IFMIF/EVEDA), and the 2nd PA is in preparation. Joint Task Force is actively working on providing immediate remote access to LIPAc data for commissioning purposes, and long term solutions under study. As to collaboration with JT-60SA, IFERC Integrated PT has given feedback to STP on current remote access for system commissioning, and discuss proposals for further collaboration

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 of DEMO reactor, the head of the NIFS RCE tries to work as a coordinator.

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.

(N. Nakajima)