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幅広いアプローチ（BA）活動の現状と最近の成果
Present Status and Achievements of Broader Approach Activities

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Introduction

Five years have passed since the Broader Approach (BA) activities launched in June 2007 under the framework of collaboration between Japan and EURATOM. The BA activities aim at complementing the ITER project and at an early realization of fusion energy by carrying out R&D and developing some advanced technologies for the future demonstration power reactor (DEMO). The BA activities consist of three projects. They are 1) Engineering Validation and Engineering Design Activities for the International Fusion Materials Irradiation Facility (IFMIF/EVEDA) project, 2) International Fusion Energy Research Center (IFERC) project, and 3) Satellite Tokamak Program (STP) project.

A new research site was established in Rokkasho, Aomori, for the IFMIF/EVEDA and the IFERC projects. The site is named “International Fusion Energy Research Center”. Construction of the infrastructure including three research buildings was completed in March 2010, followed by the installation of research facilities and equipments. At present, about 180 people are working at the IFERC site.

Fig. 1. International Fusion Energy Research Center established in Rokkasho, Aomori.

IFMIF/EVEDA Project

The objectives of the IFMIF/EVEDA projects are to produce an engineering design of the IFMIF plant and to validate the main challenging technologies. They are 1) a full current (125mA/CW) prototype accelerator up to an energy of 9MeV 2) Prototype target facility with 1/3 width of the lithium jet and 3) a full mock-up for High Flux Test Module (HFTM).

Construction and commissioning of the prototype lithium test loop was completed in March 2011 at JAEA Oarai, and a lithium flow of 25 mm thick at 15 m/s was obtained in July 2012. Components of the prototype accelerator are being fabricated in European institutes; CEA Saclay in France, INFN in Italy, and CIEMAT in Spain. Injector has already been manufactured at CEA Saclay and will be delivered in Rokkasho in March 2013 followed by the validation test of the accelerator. The intermediate engineering report of the IFMIF facility will be delivered by June 2013.

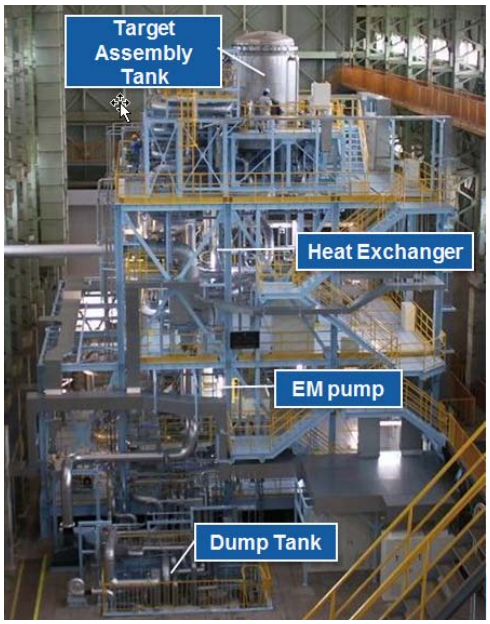

Fig. 2 Lithium flow of 15m/s was obtained in the prototype lithium loop constructed at Oarai.

IFERC Project

The IFERC project consists of three sub-projects; 1) DEMO Design and R&D Coordination Center 2) Fusion Computer Simulation and 3) Remote Experimentation Center (REC). Five R&Ds mainly on DEMO blanket are being carried out at a newly constructed DEMO R&D building. The DEMO R&D activities have been conducted under the strong

collaboration with Japanese and European laboratories and universities. In Japan, 18 universities and 2 institutes shown in Fig. 3 have involved in the DEMO R&D activities under 35 contacts between JAEA and the universities/institutes in 2012.

DEMO Design Activities (DDA) has entered a joint work stage since January 2011. An integrated Project Team is constituted by the union of the DDA unit of the IFERC Project Team, European Home Team, and Japanese Home Team.

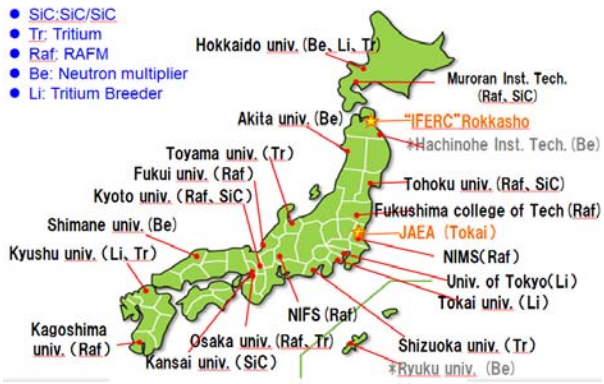

Fig. 3 Japanese universities and institutes involved in the DEMO R&D activities

A high performance supercomputer with a LINPAC performance of 1.27 Pflops is now operational since January 2012 for the fusion simulation.

Fig. 4 Supercomputer 'Helios' in Rokkasho.

Satellite Tokamak Program (JA-60SA)

The mission of the JT-60SA project, which is also undertaken as the Japanese national program, is to contribute to the early realization of fusion energy by supporting the exploitation of ITER and by complementing ITER with resolving key physics and engineering issues for DEMO reactors.

The JT-60SA is to be built jointly by Europe and Japan. Existing JT-60 facilities will also be utilized. In Europe, the procurement is being carried out by the European voluntary contributors who participate in the BA activities; CEA in France (cryogenic system, TF magnet, power supplies, TF coil test), ENEA in Italy (TF magnet, power supplies, TF coil test) and Consorzio-RFX in Italy (power supplies), KIT in Germany (high-temperature super- conducting current leads), CIEMAT in Spain (cryostat), and SCK-CEN in Belgium (TF coil test).

Two new buildings; coil winding building and jacketing building were constructed at Naka in 2009 for the procurement of the superconducting coils. The manufacturing of the EF4 coil was completed (see Fig. 5) and the manufacturing of the EF5 and EF6 has started. The first 40 degree Vacuum Vessel sector was delivered to Naka in March 2011. Up to now, three 40 degree sectors (120 degree) have been delivered. Another 120 degree sectors will be delivered by March 2013.

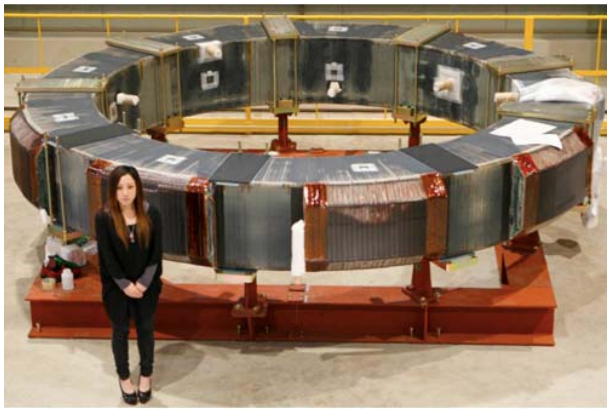

Fig. 5 Manufacturing of the EF4 coil was completed.

After shutting down the existing JT-60 in August 2008, disassembling of the JT-60 started in November 2009. This is the first experience of disassembling a radio-activated large fusion device in Japan. The disassembly will be completed by the end of Oct. 2012. Manufacture of tokamak components such as a cryostat are being fabricated on schedule. JT-60SA construction will start in Jan.2013.

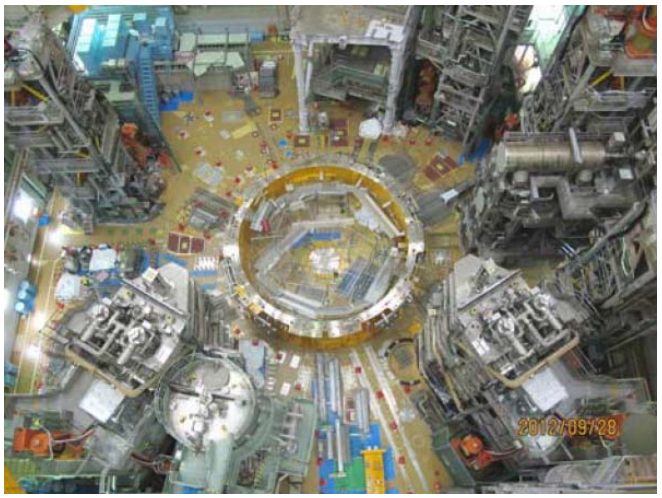

Fig.6 Disassembling of the JT-60 has almost been completed, and installation will start soon.