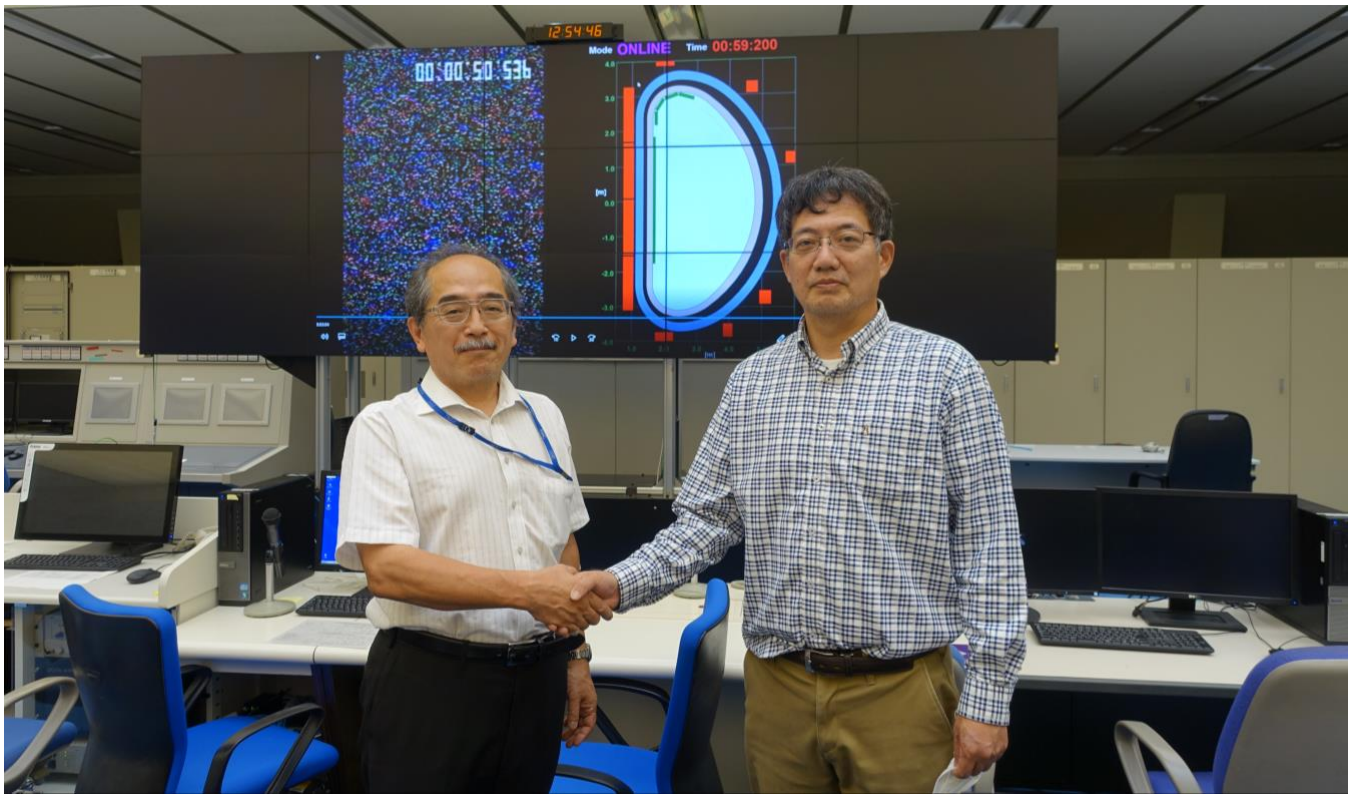
JT-60SA Newsletter
No. 114, October 2020

Headline

Change at the helm of JT-60SA project



Former PL, Y. Kamada (left) and New PL, M. Hanada (right)

At the 25th Broader Approach Steering Committee (BASC) held via video conference on 6 July 2020, it was decided that Masaya Hanada, the Japanese Project Manager, would take on the role of Project Leader (PL) of the Satellite Tokamak Programme (STP) Project to replace Yutaka Kamada.

Yutaka Kamada had been PL since 2018. Assembly of the JT-60SA tokamak main components was completed on 31 March 2020. He said “This is a big achievement of the European and Japanese Integrated Project Team (IPT) after 13 years' efforts from 2007. I deeply respect and appreciate all the European and Japanese JT-60SA members and collaborators. It was my big honour to report this achievement in the 25th BASC meeting as the STP PL.”

The project is entering the integrated commissioning, and the new JT-60SA experiment team will be organised in 2021 involving the European and Japanese research communities and collaborators from ITER and other countries. He said, “I believe that the spirit and culture of JT-60SA IPT as one team will resolve all the issues under the new PL, Dr. Masaya Hanada. I look forward to seeing the first plasma soon. Let’s create a clear and firm way of fusion research using JT-60SA towards ITER and DEMO (DEMOnstration Power Station).”

The new PL, Masaya Hanada is currently Deputy Director General of Naka Fusion Institute, QST and a beam engineer and system engineer.

He started work in the Japan Atomic Energy Research Institute (JAERI), predecessor to QST, in 1987. He has developed ion sources and designs of the beamline components in neutral beam injector (NBI) systems for JT-60 and ITER. The work in the field of NBI continued to 2015. During this period, he participated in the joint experiment on negative ion source development between the CEA Cadarache Laboratory and JAERI in 1991. During 1994–1996, he participated in the ITER project as a NB group member in the ITER Engineering Design Activities. In 2015, as the group leader, he contributed to the success of the first delivery of the Japanese components to the Neutral Beam Test Facility (NBTF) in Padua, Italy as planned.

In 2016, he joined the STP project. He was engaged on the management and coordination of manufacturing of Japanese components and tokamak assembly, and contributed to the completion of the construction of main tokamak components in JT-60SA.

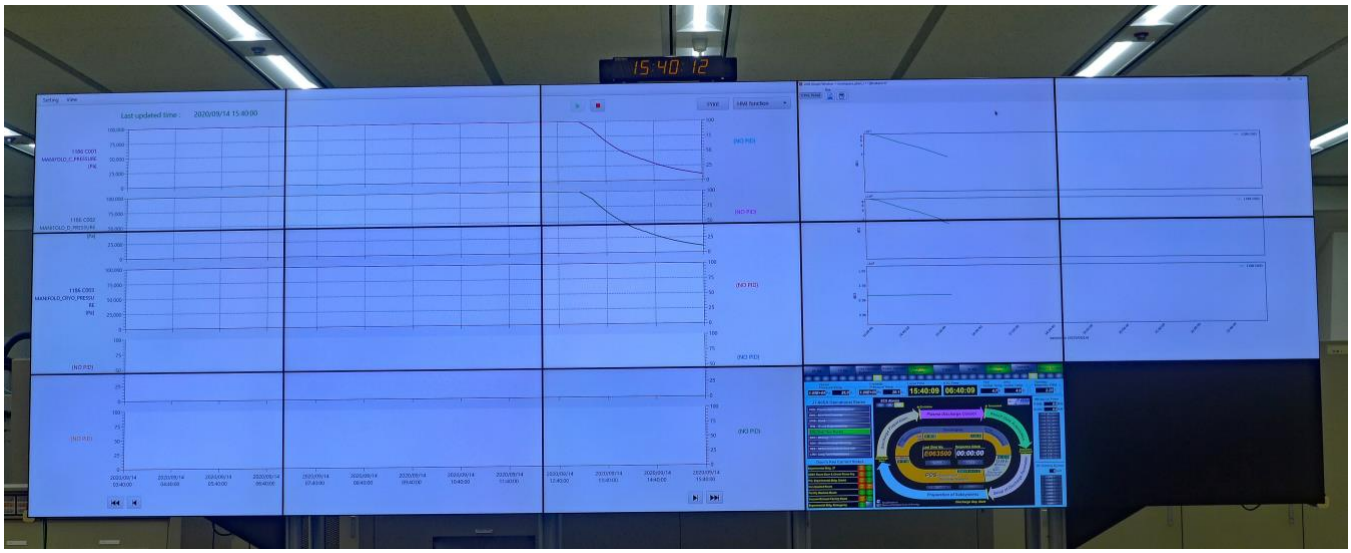
In addition, since 2016, he has been Vice Chair of the International Energy Agency (IEA) Fusion Power Co-ordinating Committee (FPCC). From April 2020, he has been working as the Japanese Project Manager.

He said, “I am very much honoured to be appointed as PL of the STP. I will do my best to manage and coordinate all of the activities with the leadership to succeed with the STP.”

Headline

Vacuum pumping towards first plasma started

JT-60SA central control room



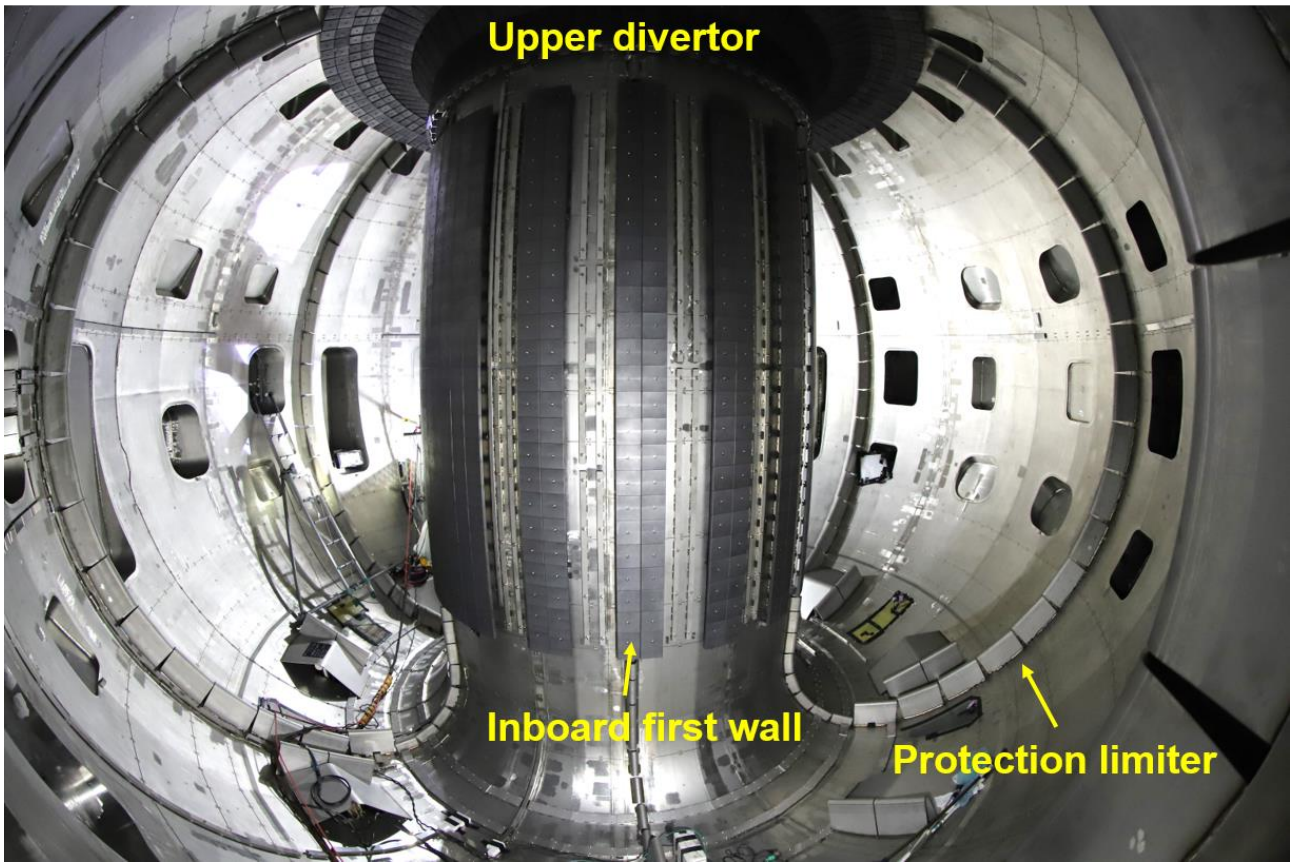
Time evolution of vacuum pressure

As an important step forward towards the first plasma, the pumping of the vacuum vessel (VV) was started on 14 September 2020. S. Ide (Japanese Deputy Project Manager) and S. Moriyama (Director of Department of Tokamak System Technology) pushed the switch to open the gate valves to connect the VV and pumping system. The target vacuum pressure in the VV is 10^{-5}-10^{-6} Pa after 200°C baking.

The vacuum pumping system consists of pre-exhaust (mechanical booster pumps and dry pumps) and main exhaust systems (turbo-molecular pumps, mechanical booster pumps and dry pumps). There are two identical pumping lines connected to the VV. The pumping speed is 6.6 m^3/s (N_2).

News

In-vessel components for first plasma



Vacuum vessel interior

Installation of in-vessel components in preparation for the first plasma was completed in March 2020.

The upper (uncooled) divertor must withstand the divertor heat load of the first plasma and full power 5.5 MA plasma disruptions. The maximum temperature, on the graphite tiles, is expected to be 340°C.

The inboard first wall (also uncooled) protects the magnetic sensors installed for the first plasma like 17 tangential probes for plasma control, two Rogowski coils, and one diamagnetic loop. The inboard first wall is also used as a limiter at plasma startup.

The protection limiter, cable trays, thermo-couples and glow discharge electrodes were also installed.

News
Fixing device for error field correction coil developed

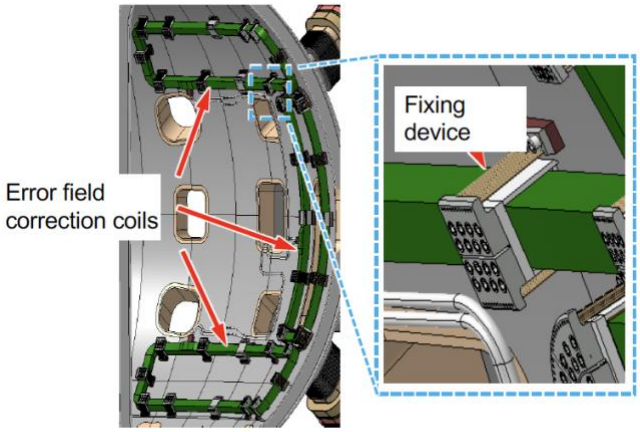


Figure 1: Error field correction coils and fixing devices

Figure 2: Prototype of fixing device

Eighteen error field correction coils (EFCCs) are installed on the inner surface of the vacuum vessel (VV) of JT-60SA to correct the error magnetic field due to any misalignment of the superconducting coils.

Since epoxy resin used in the EFCCs as the electrical insulation material degrades at 200℃ (baking temperature of the VV), the EFCCs are water-cooled to 40℃ during baking.

Therefore, the shape of the EFCCs is maintained, but thermal displacement occurs in the VV, which requires fixing devices of the EFCCs both to absorb the relative displacement and to withstand electromagnetic forces during their operation.

The structure of the fixing device has been developed, having 11 bar springs made of Ni-based alloy, each of which is 6 mm in diameter and 155 mm in length (Figure 1).

The fixing devices need to absorb a maximum relative displacement of 5.4 mm during baking, and it has been found that the maximum stress of 143 MPa occurs in the bar springs during the operation of the EFCCs.

To validate the feasibility of the structure of the fixing device, tests have been performed by cutting out specimens of the two bar springs from the prototype of the fixing device (Figure 2).

Displacement load tests at 200°C (baking temperature), and compression tests at 50°C (the operation temperature of the EFCCs) have confirmed the performance requirements.

The load of the displacement load test was set to 5.4 mm which is the maximum displacement calculated by the finite element method (FEM), and the load of the compression test was set at twice the maximum stress (143 MPa) calculated by the FEM, to give a margin of safety.

The numbers of load cycles were set to be ten times the assumed numbers of the operations (200 times for baking operation and 18000 times for operation of the EFCCs).

The tests with the two sets of specimens have not shown rupture and buckling, which demonstrates the design feasibility of the fixing device developed.

Meeting

35th Technical Coordination Meeting

TCM-35 via video conference

The 35th Technical Coordination Meeting (TCM-35) took place on 20–21 April 2020 via video conference. A total of 75 experts attended the meeting: 39 from the European Home Team, 28 from the Japanese Home Team, 3 from Japanese Universities and 5 from the Project Team.

At the beginning of the plenary session, Y. Kamada, Project Leader (PL), introduced TCM-35. The PL reported the completion of assembly of tokamak main components, the start of the BA Phase II, a report of the 26th meeting of the Satellite Tokamak Programme (STP) Project Committee (PC-26), the Integrated Project Team of BA phase II, the JT-60SA Experiment Team from April 2021, future schedule of JT-60SA, and collaboration with ITER.

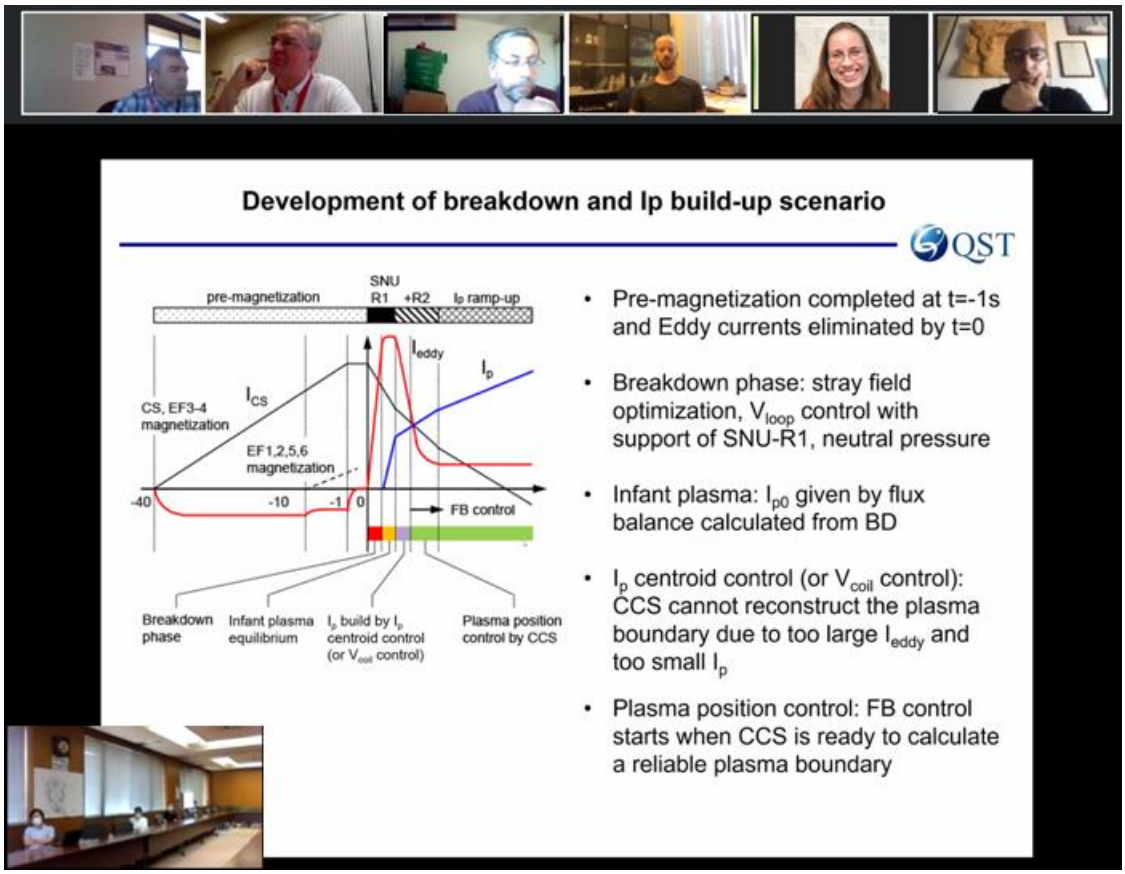
On the first day, the progress of activities towards the first plasma was presented including the assembly of the central solenoid (CS), top cryostat thermal shield (TCTS), top lid, current feeder, coil terminal box (CTB), valve box (VB), cryogenic piping, toroidal field coil (TFC) sensors, inboard first wall, magnetic sensors, upper divertors, plasma diagnostics and electron cyclotron range of frequency (ECRF) system. The status of vacuum vessel (VV) baking system and VV sensors, integrated linkage test, cryogenic system, combination test of power supply (PS) system, and preparation for integrated commissioning were reported. The schedule of machine enhancement was also reported and discussed.

On the second day, machine enhancement items were presented including stabilising plate, in-vessel coils, pellet launching system (PLS), massive gas injection (MGI) system, Thomson scattering, cryopumps, VUV divertor spectrometer, ECRF PS, resistive wall mode (RWM) PS, tokamak simulator, fast-ion loss detector (FILD), actively cooled divertor and future diagnostics. The configuration control models, Plant Integration Document (PID) updating status, and updates of the action list were reported and summarised.

Finally, the PL announced that the next TCM (TCM-36) would be held in Naka, Japan.

Meeting

1st Plasma Team Meeting



Discussions during 1st Plasma Team Meeting

About 20 European researchers were scheduled to participate in the integrated commissioning of the JT-60SA device, but there is no knowing when they will come to Japan due to strengthening border measures related to the coronavirus (COVID-19). In such a situation, to share information about the investigation towards the integrated commissioning, it has been decided to hold a “Plasma Team Meeting” regularly via video conference for all the researchers participating in the integrated commissioning.

The first meeting was held on 23–25 June 2020, and a total of 35 researchers attended the meeting, 19 from Europe and 16 from QST.

At the beginning of the meeting, the target of the integrated commissioning, the schedule, the system of the plasma team, and the relationship with the JT-60SA operation were introduced. The plasma team will develop and execute the test plan, and evaluate and summarise the test results. The plasma team members will cooperate with each other to support the data analysis and evaluation to achieve the aim of each test.

Next, the main person in charge of each test reported the aim of the test, the summary of the test content and the preparation for it.

The European researchers asked many questions about the plasma control logic and discharge conditions of each item and asked for more detailed explanation for the control method.

In the meeting, the European and Japanese researchers were able to share the target and procedures of the integrated commissioning.

It is expected that the active information sharing and opinion exchange about more practical issues made possible through this regular meeting will lead to the successful achievement of the integrated commissioning, and lay the groundwork for the rapid development and execution of the experimental programme thereafter.

Meeting

25th BA Steering Committee Meeting

Participants in BASC-25

On 6 July 2020, the 25th Broader Approach Steering Committee (BASC) meeting was held via video conference with representatives and experts from Europe and Japan in attendance. They confirmed the progress of all the activities and approved the Annual Reports 2019 for the three projects (IFMIF/EVEDA, IFERC and Satellite Tokamak Programme (STP)).

Concerning the STP Project, the Project Leader (PL), Y. Kamada, mentioned that the assembly of the major components was completed as planned in March 2020. The BASC commended the PT, both the Implementing Agencies (IAs) and Voluntary Contributors (VCs) for their efforts in the many achievements of the STP Project. It was also proposed from Japan that M. Hanada, Project Manager (PM) of the Japanese Home Team and Deputy Director General of QST Naka Fusion Institute, would take on the role of STP PL to replace Y. Kamada, which was approved by the BASC.

The next BASC meeting will be held in Karlsruhe, Germany on 3 December 2020.

Calendar

26 October 2020
27th Meeting of the STP Project Committee (PC-27)
Naka, Japan

27–30 October 2020
The 29th International Toki Conference on Plasma and Fusion Research
Toki, Japan (Connected Online for Video Conferencing)

3 December 2020
26th Meeting of the BA Steering Committee (SC-26)
Karlsruhe, Germany

24–29 January 2021
24th International Conference on Plasma Surface Interactions in Controlled Fusion Devices (PSI-24)
Jeju, Korea.

21–25 June 2021
47th European Physical Society Conference on Plasma Physics (EPS2021)
Sitges, Spain

Contact Us

The JT-60 Newsletter is released by the JT-60SA Project Team.

Suggestions and comments are welcome and can be sent to newsletter@jt60sa.org.