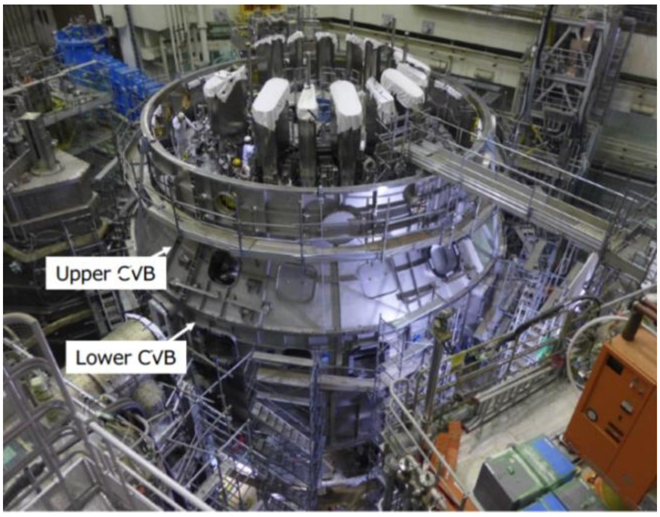
JT-60SA Newsletter

No. 112, December 2019

Headline

Upper CVB installed



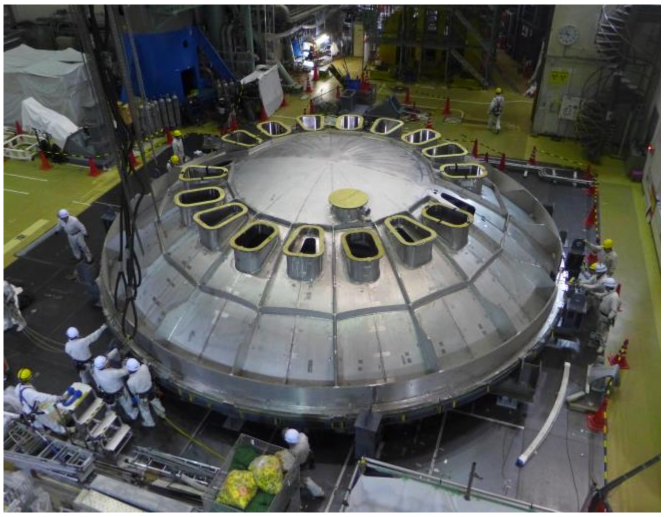


Figure 1: Upper CVB installed on lower CVB

Figure 2: The two cryostat top lid modules being integrated

The cryostat thermally insulates the tokamak device from external sources of heat. For land transportation in Japan, the vertical part, the cryostat vessel body (CVB), was designed to be divided into two: 8 lower sectors and 4 upper sectors. The upper CVB with a height of 4 m has recently been integrated in the assembly hall and installed on the lower CVB with a height of 7 m already embedded in the JT-60SA tokamak device (Figure 1).

For an accurate integration of the upper and lower CVBs on site, the design requirement of < ± 8 mm was achieved for the position and direction of the ports during temporary assembly at the factory, and locating pins were prepared there for each combined part. Using them, positioning which satisfies the design requirement has again been realized on site. The bolt fastening, vacuum seal welding and leak test of the lower and upper CVBs have been carried out and the assembly has been successfully completed.

Two 180° modules of the cryostat top lid manufactured at the factory, and already delivered to the Naka site, have been brought into the assembly hall. To weld and integrate them, the shape has been confirmed by combining components and comparing them with the factory production results (Figure 2). They will be welded for integration, and the port stubs which have not yet been set up will be installed at the junctions. These, as well as leak tests, will be completed by February 2020.

News

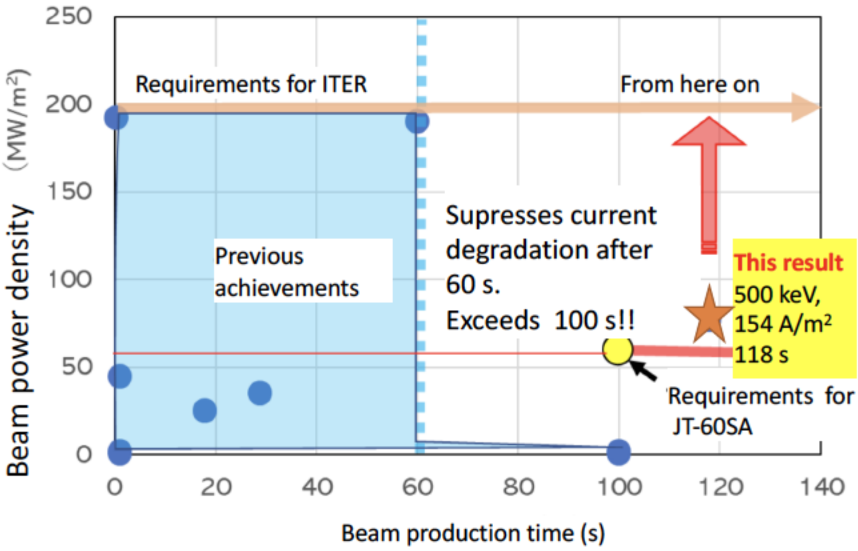
100 s high power negative ion beams produced

Negative ion beams have been produced with a power density of ≥ 70 MW/m^2, operating continuously for 100 s, demonstrating the performance necessary for the Neutral Beam Injector (NBI) of JT-60SA to heat the plasma to several hundred million degrees.

In addition to knowledge of electrical insulation technology of large-area electrodes and orbit control technology of negative ion beams cultivated over the years, new knowledge of how to maintain the temperature balance within the ion source to stably produce negative ions for a long time period has been integrated to establish and achieve the necessary technology to produce long duration negative ion beams.

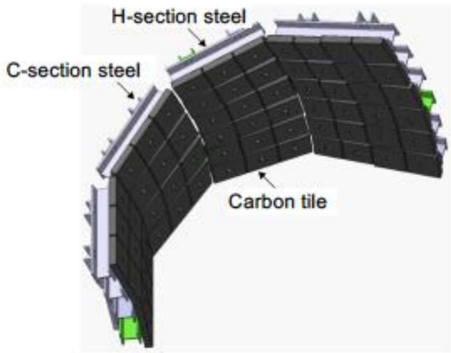
This result is not only a significant milestone for the steady operation of NB which directly contributes to the performance demonstration of NBI needed for JT-60SA, but also can be applied to the 1000 s level beam development required by ITER.

In addition, this high-current negative ion beam power has medical applications, and can lead to higher beam efficiency in many fields.



News

In-vessel components installed



H-section steel supports installed in the upper divertor region

The structure of Upper divertor

The divertor is located in the upper and lower region of the vacuum vessel to extract heat and particles from the plasma. The divertor also protects the vacuum vessel walls from the thermal load. In the initial research phase of JT-60SA, only the upper divertor is installed. The upper divertor consists of a support structure in stainless steel and armour of carbon tiles.

To make the upper divertor conform well to the curved surface, commercial C-section steel supports customised to the curved surface shape are welded to the vacuum vessel. Then commercial H-section steel supports are installed on the C-section steels. Finally carbon tiles are mounted on the H-section steel supports. The heat removal performance of the upper divertor makes repeated discharge experiments possible with a peak heat load of 1.5 MW/m_2 for ~ 3 s during the discharge period of 1800 s. The welding of the H-section steel supports of the upper divertor has been completed for the 10 port sections in December 2019.

In addition, 19 TC probes (Tangential probe for Plasma Control) and two Rogowskii coils have been installed. The installation of the cable tray for probes and coils in the vacuum vessel has been also completed.

News

Installation of Valve Boxes started

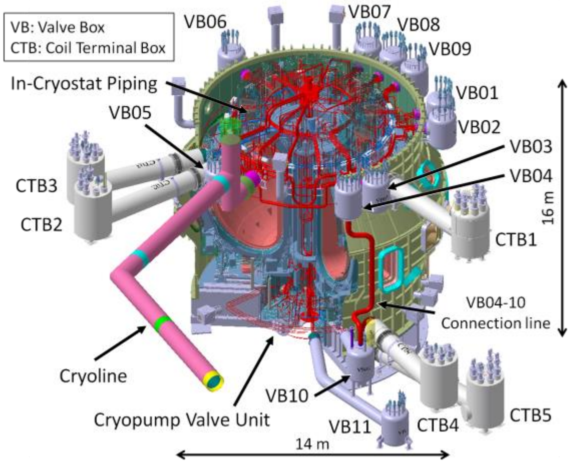


Figure 1: Layout of cryo-distribution system

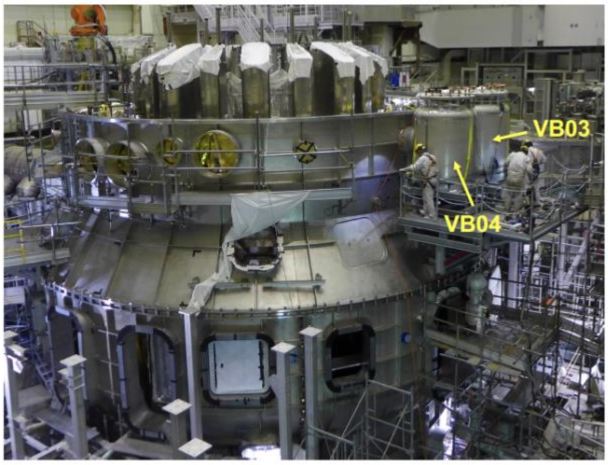


Figure 2: VB03 and VB04 installed

The helium refrigerator system (9 kW at 4.5 K) supplies cold helium to superconducting coils, thermal shields, and high temperature superconducting current lead.

The cryo-distribution system connects between the helium refrigerator system and cold components with pipes, sensors for the measurement of the coolant temperature, pressure, and flow rate, and valves to adjust the flow rate of coolant. Figure 1 shows the arrangement of the main components of the cryo-distribution around the JT-60SA tokamak. The cryoline from the helium refrigerator system passes directly into the upper cryostat vessel body (CVB), then it branches to the 11 Valve Boxes (VB) placed around the tokamak through in-cryostat piping.

The eleven VBs have already been manufactured. The dimensions of the VB body are 2 m in height and 1.4 m in outer diameter. Installation of VB10 and VB11 for the lower CVB began in October 2019, and VB03 and VB04 for the upper cryostat are being installed at present (Figure 2).

News

VIP visits QST Naka site

Group Photo taken in the JT-60SA central control room with Mr. Shuhei Aoyama, Parliamentary Vice-Minister of MEXT (third from right)

Mr. Shuhei Aoyama, Parliamentary Vice-Minister of Education, Culture, Sports, Science and Technology (MEXT), visited the QST Naka site on 12 December 2019 to inspect the progress of the JT-60SA construction, which has been supported by the collaboration between Europe and Japan. He was accompanied by two MEXT officials.

The representatives of QST including Yasuhiro Itakura (QST Executive Director), Kenkichi Ushigusa (Managing Director of the Fusion Energy Research and Development Directorate of QST), and Kenichi Kurihara (Director General of Naka Fusion Institute) welcomed them and took them on a tour of the present JT-60SA central control room and JT-60SA device..

Meeting

25th STP Project Committee Meeting

Participants in 25th STP Project Committee Meeting

The 25th Meeting of the Satellite Tokamak Programme Project Committee (STP-PC) was held on 16 October 2019. A total of 25 participants joined the meeting also by videoconference. There were 6 members from the Project Committee, the Project Leader (PL), 5 experts from the Project Team, and 13 experts from the European and Japanese Home Teams.

In this meeting, the PL and the European and Japanese Project Managers reported on the progress of the STP project. The STP-PC expressed satisfaction with the achievements and the progress in both European and Japanese procurements as well as the assembly, installation and commissioning activities since the last STP-PC Meeting. These include delivery of the central solenoid (CS), electron cyclotron range of frequency (ECRF) power supplies (PS) and cryostat top lid to the Naka site, progress of commissioning of superconducting magnet power supplies (SCMPSs), progress of PS combination tests, and the steady progress of the assembly work of CS, the vacuum vessel gravity supports, cryostat thermal shields, port thermal shields and cryostat vessel body. The STP-PC appreciated the completion of the poroidal field (PF) coils manufacturing Procurement Arrangement (PA), thermal shield PA and SCMPS PA as scheduled. The STP-PC commended the strenuous efforts of both Implementing Agencies for the assembly recovery activities with three-shift work of toroidal field (TF) coils and CS modifications to keep the whole assembly on schedule to be completed by March 2020.

The STP-PC recommended the "Update of Project Plan for BA Phase I", "Work Programme 2020 (BA Phase I)", "Work Programme 2020 (BA Phase II)" and "Update of Value Estimates, Allocation of Contribution of the Parties" and "Update of Project Team" for approval by the BASC.

The STP-PC decided that the next STP-PC meeting (PC-26) would be held on 17 March 2020.

Meeting

34th Technical Coordination Meeting

Group photo of TCM-34

The 34th Technical Coordination Meeting (TCM-34) took place on 29–30 October 2019 at The Max Planck Institute for Plasma Physics (IPP) in Garching Germany. A total of 63 experts attended the meeting in person or via video-conference: 32 from the European Home Team, 26 from the Japanese Home Team and 5 from the Project Team.

Topical sessions were held on 28, 30 and 31 October 2019 on Thomson scattering, the fast-ion loss detector, integrated commissioning and the vacuum-ultra-violet divertor spectrometer.

At the beginning of the plenary session, T. Donné, EUROfusion Programme Manager, gave the welcome talk and stated that TCM-34 was the first meeting co-organised by Fusion for Energy (F4E) and EUROfusion. Y. Kamada, the Project Leader (PL), reported on the BA Steering Committee (BASC-24) and STP Project Committee (PC-25), and explained the update of the Project Team from January 2020, collaboration with ITER and the future schedule of JT-60SA.

On the first day, the progress of activities towards the first plasma was presented including assembly of the cryostat vessel body cylindrical section, thermal shield, coil terminal box, valve box and in-vessel components. Manufacturing of the cryostat top lid and progress in power supply combination tests, supervisory control system and data acquisition system (SCSDAS), EDICAM (event detection intelligent camera), and tokamak simulator were reported. The following machine enhancement items were also reported and discussed: in-vessel components, diagnostics, error field correction coil power supply, massive gas injection system, Thomson scattering, cryopumps, and fast-ion loss detector.

On the intermediate evening, the TCM attendees enjoyed traditional Bavarian cuisine and beer at Gasthof Neuwirt in the centre of Garching.

On the second day, machine enhancement items were presented including the NBI system, the electron cyclotron range of frequency (ECRF) system, pellet launching system and vacuum-ultra-violet divertor spectrometer. The status of preparation for integrated commissioning and the plasma shape controller were also presented. 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-35) would be held in Naka, Japan in April 2020.

Discussions during the TCM-34 in the IPP Lecture Hall

Banquet at Gasthof Neuwirt

Calendar

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

20–21 April 2020
35th Technical Coordination Meeting (TCM-35)
Naka, Japan

22–23 April 2020
26th Meeting of the BA Steering Committee (SC-26)
Naka, Japan

31 May–5 June 2020
24th International Conference on Plasma Surface Interactions in Controlled Fusion Devices (PSI-24)
Jeju, Korea.

22–26 June 2020
47th European Physical Society Conference on Plasma Physics (EPS2020)
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.