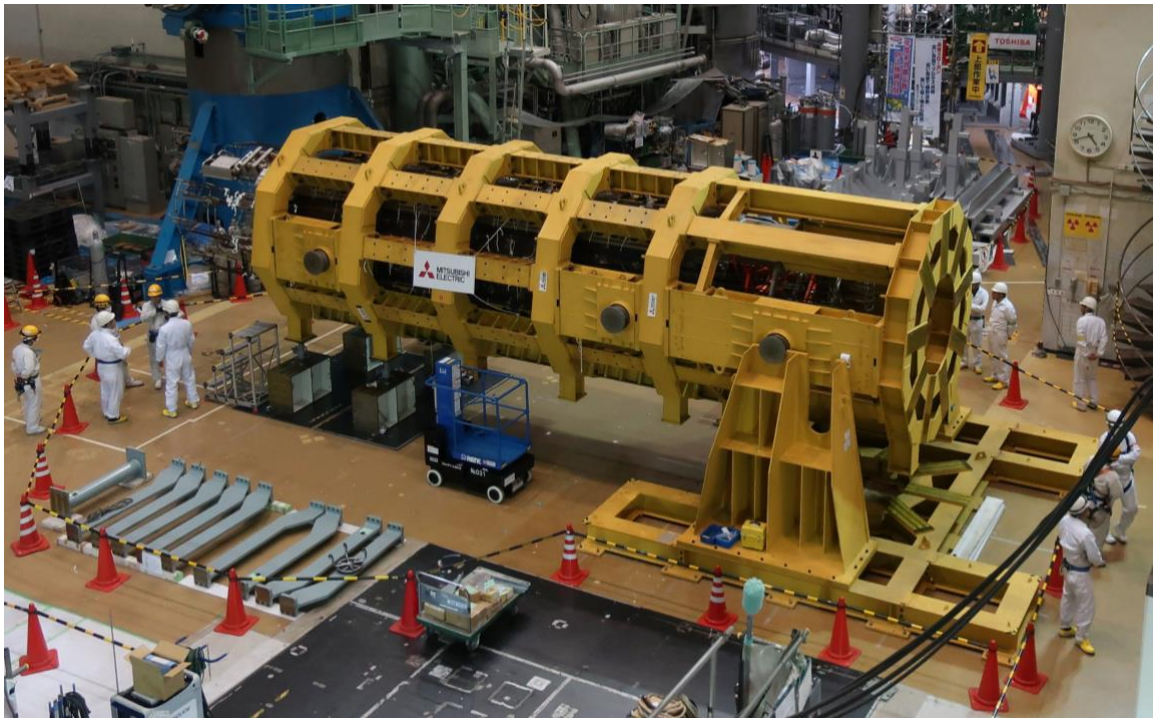
JT-60SA Newsletter
No. 109, March 2019

Headline

Central solenoid arrives at Naka site



Manufacturing of the Central Solenoid (CS) system has been completed, and it was delivered to the Naka site on 15 March 2019.

The CS is the key component for inducing a powerful current in the JT-60SA plasma and maintaining it during long plasma pulses.

The construction of the niobium-tin superconducting CS modules started in late 2007. The manufacturing of all CS modules was completed in March 2018 and they were stacked with jigs in July 2018. The CS modules were compressed in September 2018.

After minor adjustment, the completed CS system was delivered.

It will be installed in the centre hole of JT-60SA later in 2019.

News

Torus peripheral components installed

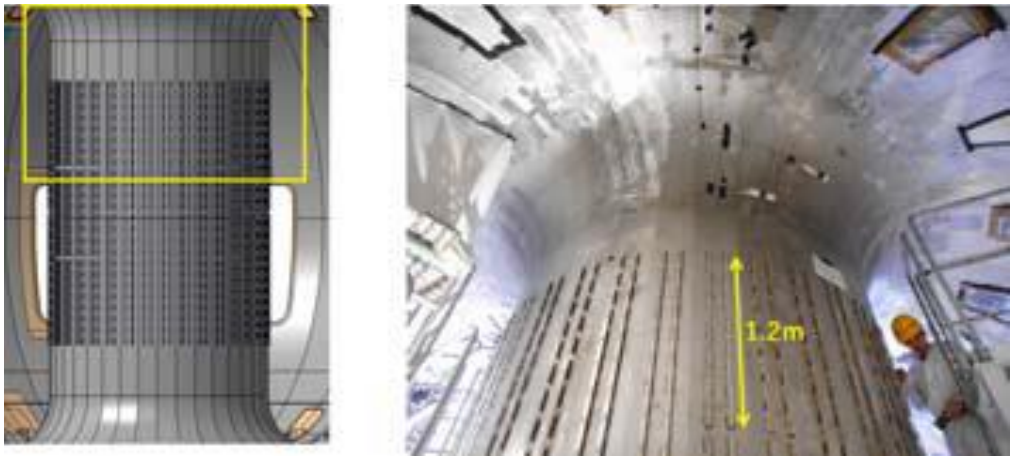


Figure 1: Pedestal for the inner first wall on the inboard side of the VV (CAD and reality)

Following the welding of the port frames of the vacuum vessel (VV) final sector and the installation of the upper port thermal shields (UPTSs) and the in-vessel components, and the installation of the thermal shield gravity support (TSGS), a pressure test of the vacuum vessel double wall (at 0.38 MPa, N_2 gas) has been successfully carried out.

Furthermore, a withstand voltage test of the port frames ended by satisfying the prescribed performance, and 1 UPTS has been newly installed and 8 out of 18 UPTSs have been assembled.

For the installation of the in-vessel components, the welding of the pedestals for the inner first wall to be installed on the inboard side of the VV has been carried out with two-shift works, and the pedestals in all 72 rows have been installed with an accuracy of ±1 mm as scheduled (Figure 1).

The TSGS is installed on an "installation part" attached to the top surface of the equilibrium field coil (EFC) 6 and each toroidal field coil (TFC) and is connected to the side surfaces of the horizontal port thermal shields (HPTSs) on both sides by arms stretched to right and left (Figure 2). Because the TFCs are at 4K and the thermal shields at 80K, a structure was adopted which can support about 5 t of TS weight at each place while gaining electric distance with a suspension shaft to reduce heat penetration to the TFC. Moreover, to respond to TFC-TS relative displacements (17 mm), a bearing structure with molybdenum disulfide coating was adopted at the top and bottom of the suspension shaft. All 18 TSGSs have been assembled and installed during February 2019.

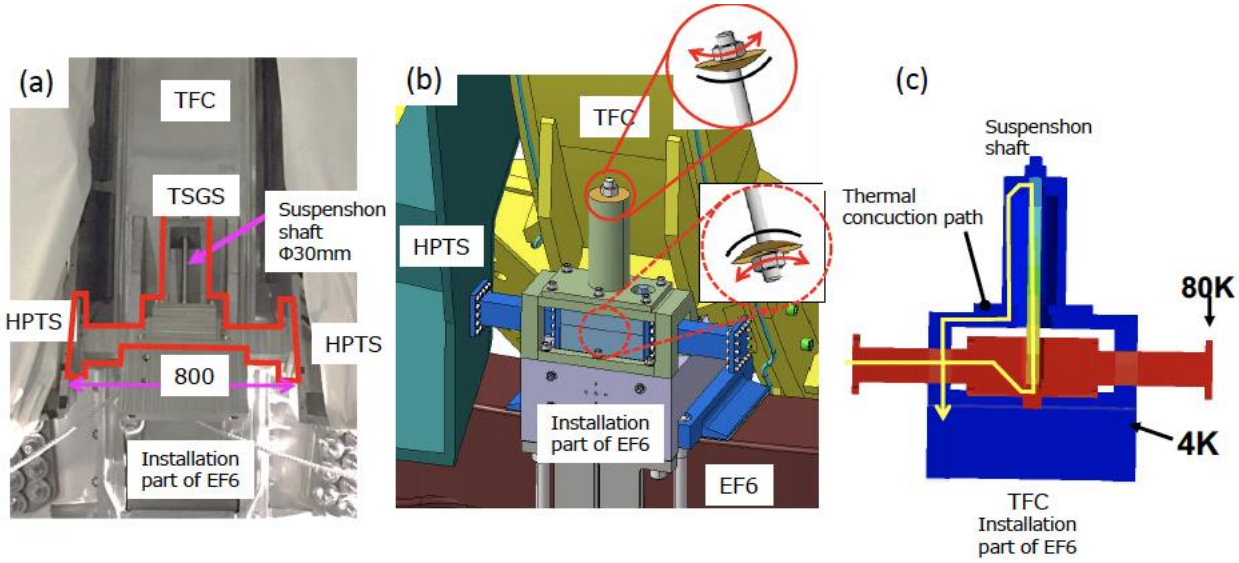


Figure 2: Installation state (a), structure (b) and thermal conductivity analysis result (c) of TSGS

News

Central monitoring system maintenance completed

Extended 3 × 5 screens

Maintenance has been carried out to extend 3 × 3 screens of the JT-60 central monitoring system to 3 × 5 screens.

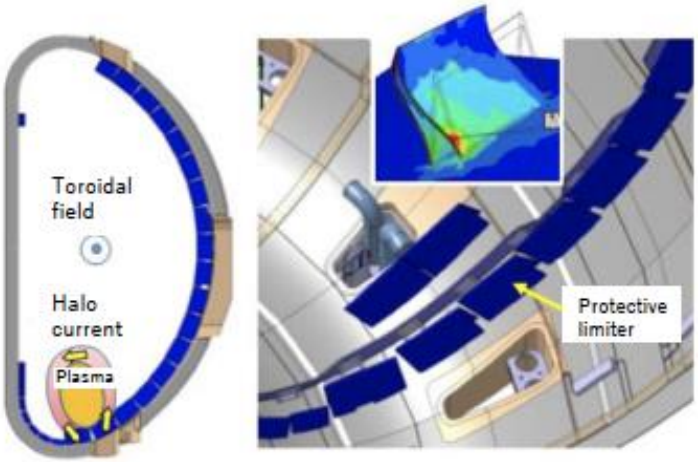
At the same time, to increase the number of input sources from the original 4, a PC which can output 8 screens simultaneously was connected to the central monitoring system.

Also, software has been developed and installed which manages input sources and screen layout synchronised with the discharge sequence progress.

These extensions and maintenance of the JT-60 central monitoring system were completed in March 2019, making it possible to monitor the status of the JT-60SA discharge sequence and the plasma discharge condition more comprehensively.

News

Protective limiter design for first plasma completed



Protective limiter in the VV

Poloidal section and assumed halo current (left)
Triangle-shaped limiter deformation and stress distribution at the time of halo current (upper right)
Protective limiters arranged in the VV (lower right)

The limiter to protect the electromagnetic sensors, wires and piping installed in the vacuum vessel (VV) for the initial plasma of JT-60SA has been designed. The protective limiter is triangle-shaped and is composed of two stainless steel plates (400 mm wide x 250 mm high x 10 mm thick) assembled to a base plate (100 mm wide). The limiters arranged in the poloidal direction over almost all the circumference are arranged in six places in the toroidal direction, and the two limiters arranged in the poloidal direction to protect the piping in the lower region are arranged in nine places in the toroidal direction. Stress analysis of the limiter under a maximum halo current of 1.25 MA during disruptions was carried out. The maximum stress was 65 MPa, which is half the permissible stress (130 MPa).

All the designs of the in-vessel components used for the first plasma have now been completed, and manufacture can now begin.

Meeting

32nd Technical Coordination Meeting in Padua Italy

The 32nd Technical Coordination Meeting (TCM-32) took place on 4–8 March 2019 at Consorzio RFX in Padua Italy. A total of 80 experts attended the meeting in person or via video-conference: 44 from the European (EU) Home Team, 27 from the Japanese (JA) Home Team, 6 from the Project Team, and 3 invited from EUROfusion.

Topical sessions were held on 4, 5 and 8 March 2019 on Thomson scattering and pellet launching system. A plenary session was held on 6 and 7 March 2019.

At the beginning of the plenary session, Y. Kamada, the Project Leader (PL), emphasised that the JT-60SA project was going on as scheduled towards the completion of tokamak assembly in March 2020 and the first plasma in September 2020, and the Broader Approach (BA) Phase II would start from April 2020 which included integrated commissioning, enhancements and experiments by the reinforced Integrated Project Team. He reported that Enrico Di Pietro had been appointed as the EU Project Manager as of 27 February 2019 to replace Pietro Barabaschi. He expressed his appreciation for Pietro Barabaschi's great contribution to the JT-60SA Project. He also reported that Pietro Barabaschi would continue his function of Head of Department within the Fusion for Energy (F4E) organization and overall manager of the entirety of all BA EU activities. After the secretariat introduced the agenda and action list as usual, the EU Project Manager and the JA Deputy Project Manager briefly explained each achievement since the last TCM.

On the first day of the plenary session, the substantial progress in manufacturing and installation of magnet power supplies, thermal shields, cryostat top lid, central solenoid (CS), coil terminal boxes, cryodistribution components, port extensions, vacuum pumping system, in-vessel components and toroidal field coil (TFC) sensors was presented. The current status of EDICAM (Event Detection Intelligent Camera), JA diagnostics for first plasma, SCSDAS (Supervisory Control System and Data Acquisition System) and real-time controller were explained.

On the second day of the plenary session, status of preparation for integrated commissioning, status of electron cyclotron range of frequency (ECRF) power supply, supply and installation procedure for waveguides and first plasma launcher, experience with ECRF protection systems and additional ECRF absorption coatings were presented. Then the following machine enhancement items were reported and discussed: massive gas injection system, Thomson scattering Procurement Arrangement (PA) design review meeting, pellet launching system, cryopumps, and the fast ion loss detector and vacuum ultra-violet divertor spectrometer. The status of the tokamak simulator and analysis support for cryomagnetic system operation were also presented.

The configuration control models, Plant Integration Document (PID) updating status, collaboration between ITER and JT-60SA and updates of the Action List were presented and summarised. The PL emphasised that the collaboration between ITER and JT-60SA would start soon after the endorsement by the BA Steering Committee (SC) in April 2019.

Finally, the PL announced that the next TCM (TCM-33) and 8th Research Coordination Meeting (RCM-8) would be held in Naka, Japan on 24–28 June 2019.

Group photo of TCM-32 at the entrance to the Consorzio RFX

Group photo of TCM-32 in front of NBTF (inside of the building)

Group photo of TCM-32 in front of NBTF (outside of the building)

Meeting

1st DRM for pellet launching system

Particle refuelling in a future fusion reactor will entirely rely on the injection of pellets of hydrogen frozen at about −260°C and then fired at high speed into the plasma. Taming the impact of edge localized modes (ELMs), which stress components by their heat load, is likely to become another important task for the pellets.

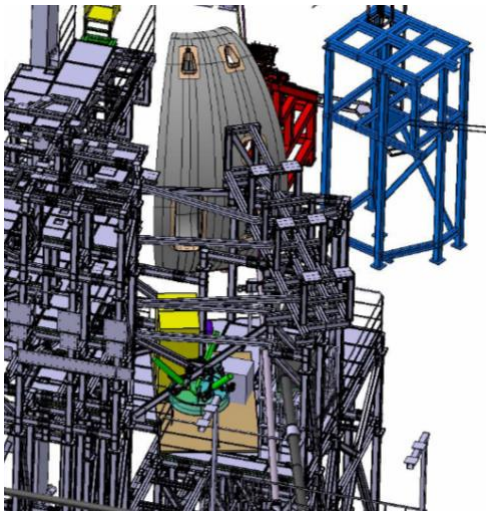
Consequently, JT-60SA plans to have a suitable pellet launching system (PLS) to allow reactor-relevant investigations. A PLS design able to cope with all the requirements as expressed in the JT-60SA Research Plan, has been elaborated over recent years, and in mid-February 2019 the design worked out in close collaboration between EUROfusion, F4E and QST experts was discussed in a first Design Review Meeting.

This meeting, attended by participants from QST, F4E and the EUROfusion consortium was held just after the 32nd Technical Coordination Meeting (TCM), and was also hosted by Consorzio RFX Padova, Italy. During the meeting, all the essential technical details such as testing procedures, scope sharing and overall quality assurance were considered. The approach was approved, subject to a couple of short-term actions.

The construction and implementation of the envisaged system will also take place in close cooperation between QST and EUROfusion. While essential parts to be inserted into the torus vessel and a significant part of the infrastructure will be provided by QST, EUROfusion and F4E will develop and build all different pellet sources, the accelerator and diagnostic units. It is foreseen to test the system first in a European test bed and transfer it afterwards to the Naka site.

The designed PLS system will try to take advantage of all capabilities developed in different smaller pellet systems used at several fusion research sites—and combine them all for the first time. Hence, the projected PLS will be the first of its kind and thus the first capable to perform simultaneously particle fuelling and ELM control. Common efforts have already allowed the installation of the PLS at JT-60SA—as yet only in the drawings used for a detailed planning of the construction in order to avoid problems later during the real installation, currently foreseen for 2022.

In good mood after a very fruitful discussion: participants in the initial DRM for PLS of JT-60SA



Success of a common QST and EUROfusion effort: the PLS inserted into the CAD model of JT-60SA (picture: Bernhard Ploeckl)

Meeting

24th STP Project Committee Meeting

Participants in the STP-PC

The 24th Meeting of the Satellite Tokamak Programme Project Committee (STP-PC) was held on 13 March 2019. A total of 26 participants joined the meeting also by videoconference. There were 6 members from the Project Committee, the PL, 6 experts from the Project Team, and 13 experts from the EU and JA Home Teams.

In this meeting, the Project Leader (PL) and the EU and JA Project Managers (PMs) reported on the progress of the STP project, and made recommendations on the "Annual Report 2018", "Project Plans for the BA Phase I and for the BA Phase II" and "Collaboration between ITER & JT-60SA" to be submitted by the PL to the 24th Steering Committee (SC) Meeting scheduled on 11 April 2019.

The STP-PC expressed satisfaction with the achievement and the progress in both EU and JA procurements as well as the assembly, installation and commissioning activities since the last STP-PC Meeting. These include progress of commissioning of Superconducting Magnet Power Supplies (SCMPSs), progress of electron cyclotron range of frequency (ECRF) PS component fabrication, progress of the central solenoid (CS) stacking and pre-compression, progress of fabrication of Coil Terminal Boxes, Cryostat Thermal Shields, and Cryostat Top Lid, and the steady progress of the assembly work of lower equilibrium field (EF) coils, the vacuum vessel (VV) final sector, VV Gravity Supports, and Port Thermal Shields. The STP-PC appreciated the Procurement Agreement (PA) completion of toroidal field (TF) coils including one spare TF coil (TFC#19). The STP-PC commended the strenuous efforts of both Implementing Agencies (IAs) for the VV closure by welding completion of the final sector including 6 port stubs with two-shift assembly works.

The STP-PC recommended the "Annual Report 2018", "Project Plans for the BA Phase I and for the BA Phase II" and "Collaboration between ITER & JT-60SA" for approval by the SC.

The STP-PC decided that the next STP-PC meeting (PC-25) would be held on 16 October 2019.

Calendar

11 April 2019
24th Meeting of the BA Steering Committee (SC-24)
Rokkasho, Japan

2–6 June 2019
28th IEEE Symposium on Fusion Engineering (SOFE 2019)
Georgia, USA

24–28 June 2019
33rd Technical Coordination Meeting (TCM-33)
& 8th Research Coordination Meeting (RCM-8)
Naka Japan

22–27 September 2019
14th International Symposium on Fusion Nuclear Technology (ISFNT-14)
Budapest, Hungary

16 October 2019
25th Meeting of the STP Project Committee (PC-25)
Naka, Japan

Contact Us

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

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