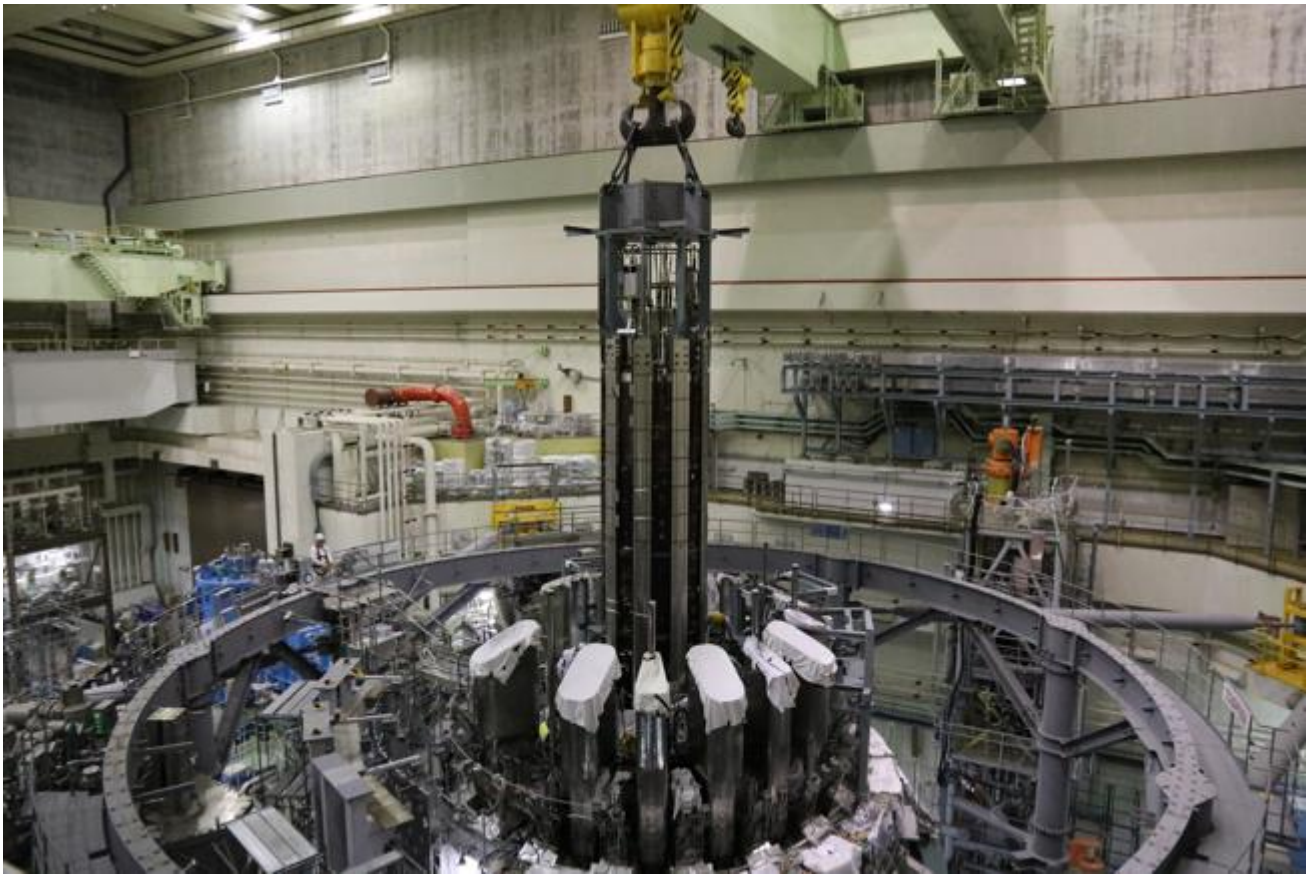
JT-60SA Newsletter
No. 110, June 2019

Headline

Central solenoid inserted



Insertion of central solenoid in the centre of the JT-60SA tokamak

On 8 May, the central solenoid (CS) was inserted into the centre of the JT-60SA tokamak. The event was open to the press and a total of 25 people, 21 reporters from 13 media organisations and four people from other organisations, were there to witness the installation. This event was broadcast by two TV stations, and reported by four newspaper and three internet articles.

The CS was transported from the Port of Hitachi to the QST Naka site on 15 March and carried into the assembly hall of the JT-60 experimental building on 16 March. Following acceptance tests such as a withstand voltage test (21 kV, 1 min), pressure test (2.5 MPa) and helium leak test, the CS was erected on 22 March. Installation of the scaffolding around the CS, surface cleaning, removal of the compression jigs, and lower part pipe welding were carried out.

The lower equilibrium field (EF) 4 coil was jacked up and fixed in its final position on the tokamak in the middle of April. The CS was then finally ready for installation, and was installed on the tokamak on 8 May, and its correct positioning confirmed.

Erecting central solenoid after the acceptance tests

Lifting central solenoid from its frame, surrounded by scaffolding

Central solenoid lifted

News

SCMPS site acceptance test completed

EF1-6 and CS1-4 PS alignments

PS incoming cables

PS DC reactors and busbar connection

31 May 2019 is the official completion date of the acceptance test of the superconducting magnet power supplies (SCMPSs) procured by the voluntary contributor ENEA, installed and commissioned in Naka directly by Fusion for Energy (F4E) by means of a contract with the Spanish company JEMA. The tests were performed in two different phases: the first phase, concluded on 13 December 2018, concerned power tests utilising the heating motor generator (H-MG). This phase had been prioritised at the request of QST in order to perform scheduled maintenance of the H-MG planned at a later date. Once the power tests were completed, the team focussed on the second phase aimed mainly at testing the communication between the SCMPS and the main PS control system.

This phase, along with the punch list clearing, started on 16 January 2019. The entire installation, commissioning and site acceptance test activities took 319 working days, from 16 October 2017 to the above-mentioned 31 May 2019.

No time to celebrate, though. On 4 June 2019, PS combination tests started as scheduled. We are willing to accept the new challenges we are facing now.

News

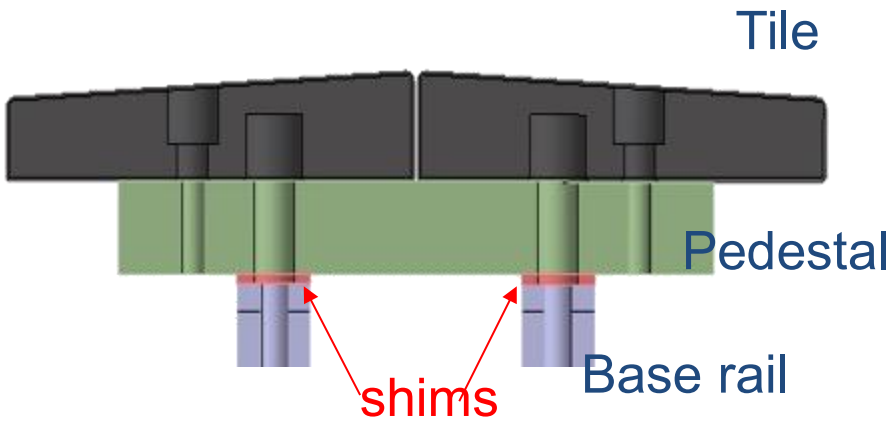
Inboard first wall graphite tiles installed

Inboard first wall inside vacuum vessel

The inboard first wall of the vacuum vessel (VV) is covered with graphite tiles for protection. Immediately following completion of the fixing pedestal in the middle of May, graphite tile attachment was started, and all 528 tiles (24 tiles x 22 arrays) for the first plasma were attached within June.

The rectangular graphite tiles （about 15 cm in length, 15 cm width, and 3 cm thickness) are not provided with a cooling mechanism. These tiles are required to withstand a maximum heat load of about 2 MW/m^2 for two seconds because they only make contact with the plasma at the start of the plasma discharge. To satisfy this requirement and to reduce the heat load to below the design value, an installation accuracy of ± 1 mm is needed in the radial direction, and an inclination of about three degrees has been made in the surface on the plasma side in the toroidal direction.

Graphite tiles of inboard first wall



Cross section of graphite tiles

News

ECRF PS factory acceptance tests

After an intensive period of preliminary tests and optimisation, official acceptance tests of the ECRF power supplies (PSs) have been performed in Jema (Spain) from 23 April to 20 May 2019.

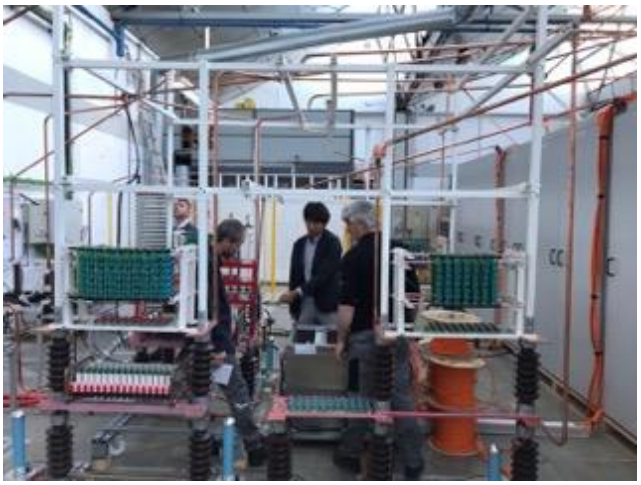
The five PSs forming the ECRF PS system and the connections between the different components have been installed according to the final layout: the distance between all high voltage components has been selected to reproduce the same conditions as in the final installation in Naka. This required the high voltage main power supply (HVMPS) and the two related bulky transformers to be placed in a separate room, connected with a long high voltage cable to the two anode power supplies (APS) and the two body power supplies (BPS) installed in another room.

A first set of individual tests has been performed for each of the five PSs, connecting them individually to a single dummy load. Different scenarios with different conditions were established, successfully testing the performance of each PS up to the nominal voltage and current values during fast ramp-up, slow power variation, fast modulation, load step and long pulse conditions (300 s).

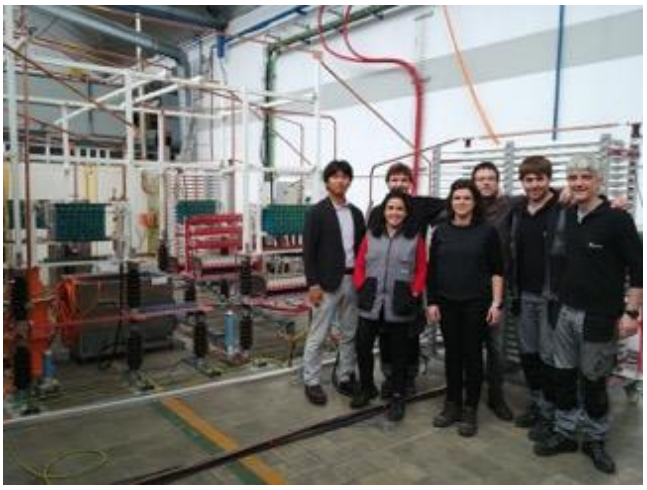
Successively the five PS have been connected to integrated dummy loads simulating the stray capacitance of the real gyrotrons. Several tests witnessed by F4E and QST representatives have been performed also in this condition, proving the capability of the system to correctly supply two gyrotrons under different operating conditions.

Moreover the capability of the PS to protect the gyrotrons in case of arc between the different gyrotron terminals has been successfully tested, simulating the arc by means of intentional short-circuits obtained with calibrated wires and verifying that the PS system is able to limit the energy delivered into the arc to less than 10 J.

After the tests the PS has been disassembled and prepared for the shipment to Japan, where the installation activities are planned to start in July 2019.



QST and JEMA representatives checking the circuit before the integrated tests



QST representative and the JEMA team involved in the integrated tests

News

JT-60SA torus peripheral components installed

Figure 1: 14 UPTSs installed

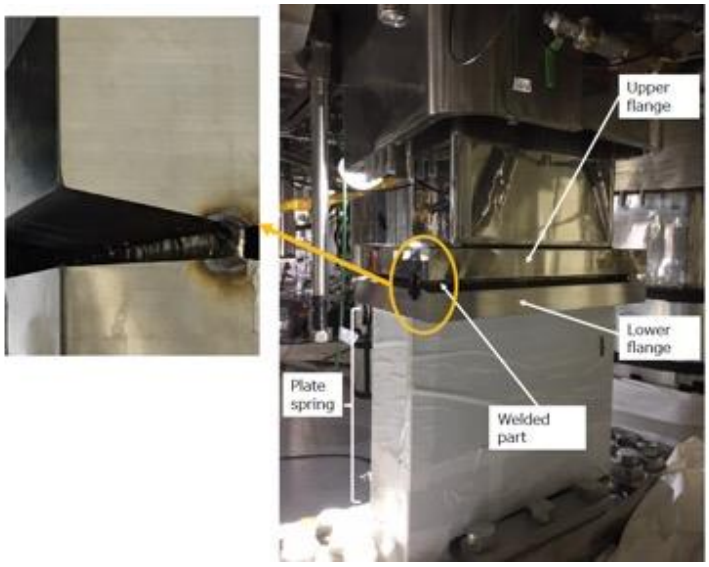


Figure 2: Welding of middle flange of VVGS

Installation of the upper port thermal shields (UPTSs) and the vacuum vessel gravity support (VVGS) has made further progress. Six UPTSs have recently been installed and 14 out of 18 UPTSs have been assembled (Figure 1).
The VVGS has a two-stage structure, and a total of nine VVGSs are arranged in the toroidal direction. The top flange of the upper VVGS is connected to the vacuum vessel (VV) and the bottom flange of the lower VVGS is connected to the cryostat base. The other ends of the upper VVGS and the lower VVGS also meet in a flange structure.

So far, the upper and lower flanges have been fixed with bolts and they are being welded. To prevent any deterioration in vertical positioning of the VV, the flanges of the nine VVGSs are welded one by one in turn to maintain a good balance. All 27 layers have now been welded (Figure 2).

The positions of the equilibrium field coils (EFs) 4, 5 and 6 have also now been finalised. The assembly precision is within the allowable range (centre position of the coil: $< \pm 2$ mm, flatness of the coils: $< \pm 2$ mm).

News

ECRF waveguide launcher manufactured

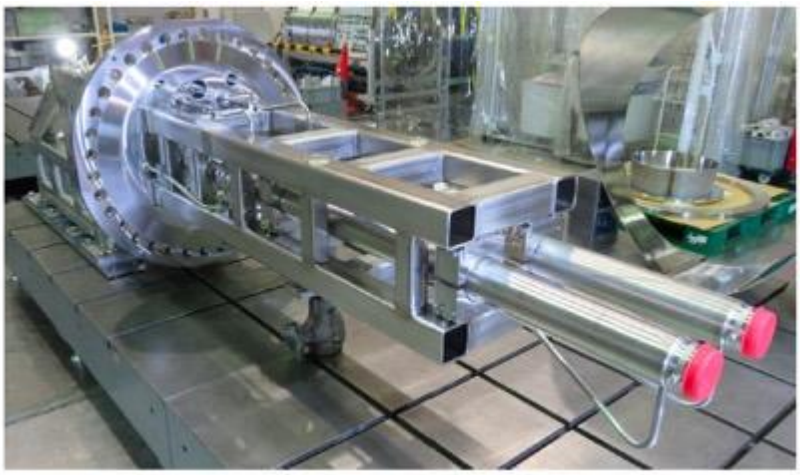


Figure 1: ECRF waveguide launcher

The electron cyclotron range of frequency (ECRF) waveguide launcher has been manufactured, and all the components of the ECRF system have been made ready for the first plasma.

A stainless steel corrugated waveguide is used in the launcher, and the inside of the waveguide is plated with nickel to reduce high-frequency wave loss.

In addition, the launcher has a double wall structure with a coaxial cooling jacket for cooling water if needed.

A static water pressure test (0.98 MPa), helium leakage test (10^{-9} Pa m^3/s), installation test on a mock-up stage, and a vacuum chamber simulating the upper oblique port of JT-60SA, were performed successfully (Figure 2).

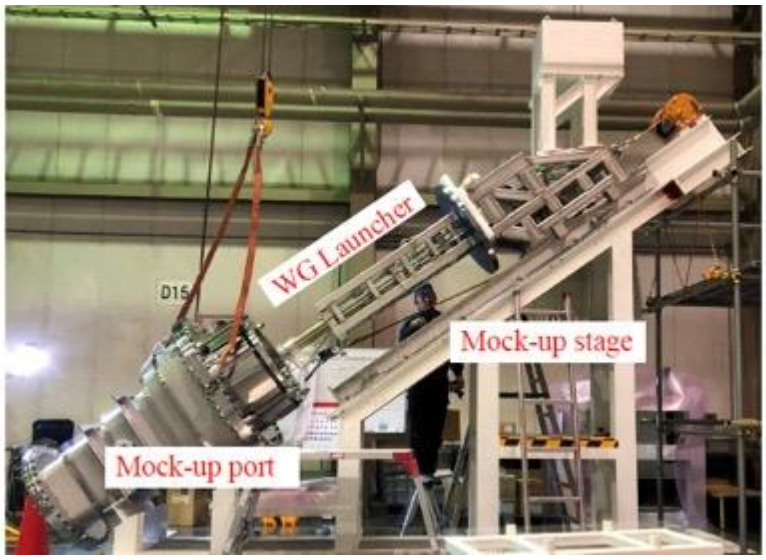
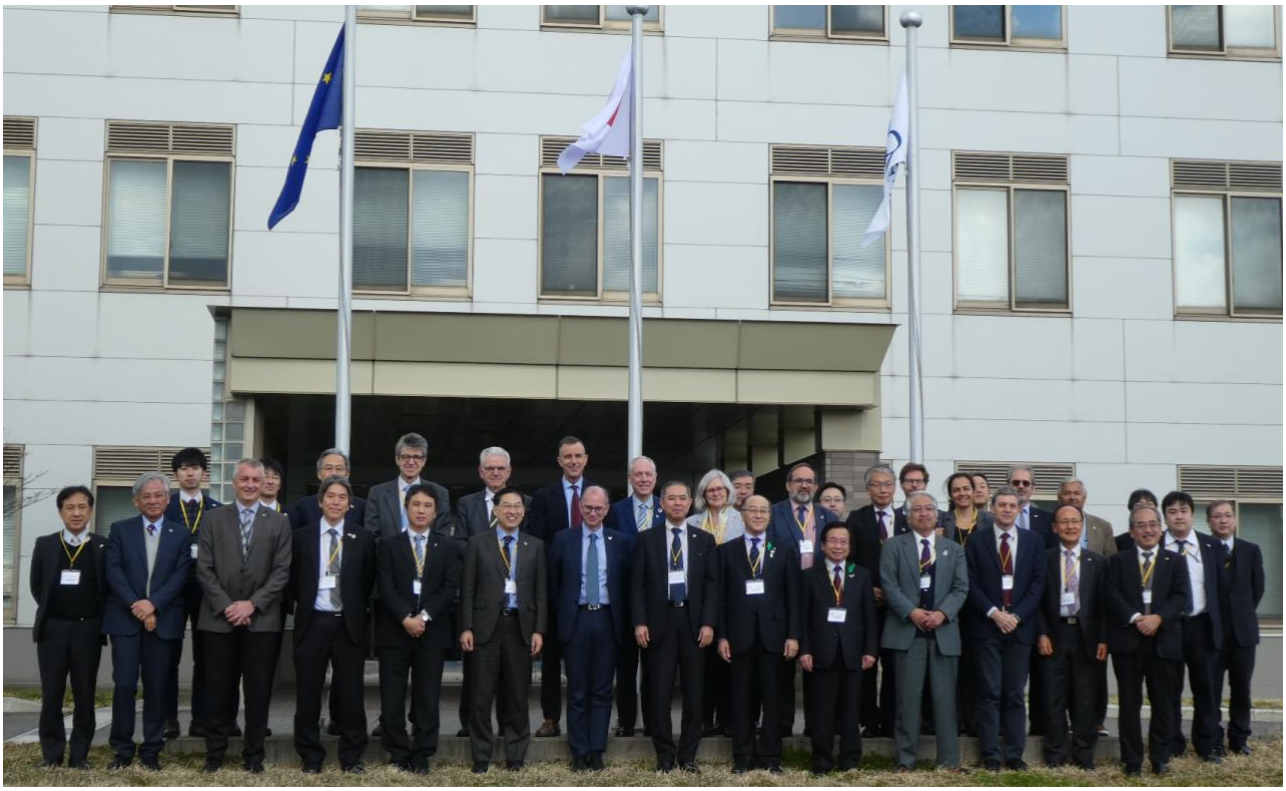


Figure 2: Installation test of ECRF waveguide launcher

Meeting

24th BA Steering Committee Meeting



EU and JA representatives

On 11 April 2019, the 24th Broader Approach Steering Committee (BASC) meeting was held at Rokkasho Fusion Institute (Rokkasho, Japan) with attendance of representatives and experts from Europe and Japan. They confirmed the progress of all the activities and approved the 2018 Annual Reports and updates of the Project Plans for the BA Phase I 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 vacuum vessel (VV) and toroidal field coils (TFCs) had been completed and that the central solenoid (CS) was ready for installation. All the installation and assembly works were progressing as planned towards the completion of tokamak assembly work in March 2020. The first plasma of JT-60SA was expected in September 2020.

The SC welcomed the proposal for a Collaboration Agreement between the ITER Organization and both Implementing Agencies, QST and F4E, on the STP Project, thus recalling the unique role that JT-60SA can play to support the assembly, commissioning and operation phases of ITER. This Collaboration Agreement will be signed in the coming months.

The 25th Broader Approach Steering Committee meeting will be held in Karlsruhe, Germany on 6 December 2019.

Calendar

19-21 August, 2019
17th International Workshop on Plasma Edge Theory in Fusion Device (PET-17)
La Jolla, USA

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

29–30 October 2019
34th Technical Coordination Meeting (TCM-34)
Garching, Germany

6 December 2019
25th Meeting of the BA Steering Committee (SC-25)
Karlsruhe, Germany

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.