

Headline

Successful completion of QPC procurement



Figure 1: Celebration of successful completion of the QPC procurement

The procurement of the JT-60SA quench protection circuit (QPC) was successfully completed at the end of July 2015 as originally planned. On 3 August 2015, a formal closure meeting (Figure 1) was held via videoconference with the participation of the Project Leader (PL), Project Manager of the JA Home Team, Deputy Project Manager (DPM) of the EU Home Team, and the President of Consorzio RFX.

The QPC is the power supply system which assures the safety of superconducting coils in case of a quench - where their superconductivity is lost. It rapidly discharges the huge amount of magnetic energy (more than 2.3 GJ in total) stored in the coils. This performance is ensured thanks to the operation of an innovative hybrid mechanical-static circuit breaker. It interrupts a direct current up to 25.7 kA, withstanding a reapplied voltage of 4.2 kV, commutating the current into a set of discharge resistors. An explosively activated circuit breaker, a so-called pyro-breaker, which acts as backup protection, increases the reliability of the system.

The National Research Council of Italy, acting through Consorzio RFX in Padua, procured the 13 QPC units of JT-60SA in the frame of an "Agreement of Collaboration" with F4E. As it is the first time such advanced hybrid circuit breaker technology has been used in an industrial application at this high current and voltage rating, dedicated R&D has been performed in Padua since 2007.

In 2010, Consorzio RFX entrusted a contract for the QPC, including its design, manufacture, test, transport, installation, commissioning and final acceptance tests, to an Italian supplier, Nidec ASI S.p.A. (NIDEC), which endorsed the innovative solution. An intensive qualification of the manufacturing and testing process was performed after the detailed design. Then, the series production of the 13 QPC units started in 2013.

Following the delivery to Japan, the QPC installation started in December 2014. It was the first occasion for European personnel to act directly at the JAEA Naka Site. A special visa, which is dedicated to promote the Broader Approach Activities, was issued by the Japanese government to the European personnel who were involved in the QPC installation. After the commissioning, the final acceptance tests were successfully performed in June 2015 (Figure 2). Then, a NIDEC technician gave JAEA staff a two day training on QPC operation and maintenance (Figure 3).

At the closure meeting, participants confirmed the conclusion of almost 6 years of QPC procurement and celebrated the success of the excellent collaboration among JAEA, F4E, Consorzio RFX and NIDEC.



Figure 2: Final inspection of the QPC



Figure 3: Training by a NIDEC technician to JAEA staff

News

PL's visit to VVTS manufacture

On 15 July 2015, H. Shirai (PL), Y. Ikeda (DPM of JA Home Team) and JAEA members visited the manufacturer of the vacuum vessel thermal shield (VVTS) and lower port thermal shields (LPTS), which is located about 30 km away from the JAEA Naka site, to inspect the pre-assembly process and the dimensional measurement method of the VVTS 40° sector, as well as to check conformity to the required specifications (Figure 1).

The thermal shields reduce the radiation heat and thermal conduction from the surrounding components at ambient temperature to the superconducting coils at cryogenic temperature. The manufacturer started designing and trial production of the VVTS and LPTS in 2014. The LPTS were already completed and the VVTS is now being produced one by one.

The VVTS, shown in blue in Figure 2, is a torus which has to be installed into the space between the vacuum vessel (VV) and the toroidal field (TF) coils. It consists of double 316L stainless steel panels, with a thickness of 3 mm, with helium cooling pipes located in between. The 360° torus structure is made up of thirty six 10° sectors. Each 10° sector consists of inboard and outboard segments.

At the manufacturer's workshop, 20° inboard and outboard sectors are produced as a shipping unit. Two 10° segments are linked by an insulation coupler, and the gap between them is covered by insulation plates. Such an electrically insulated coupling is expected to reduce electromagnetic forces and heat generation by eddy current for instance during plasma disruption. The 20° sectors, separated into inboard and outboard segments, are delivered to the JAEA Naka site after dimensional, pressure and leak tests and insulation resistance measurement.

In the torus hall of the JAEA Naka site, the VVTS installation is performed for every 20° sector. The pair of inboard and outboard segments is separately positioned around the VV, and thereafter they are linked with the coupler to form a complete 20° sector. The helium cooling pipes of the inboard and outboard segments are joined by welding. Then, the next 20° sector is installed and connected with mechanical couplers. The gap between the sectors is overlaid with radiation shield covers. Then, the cooling pipes of adjacent 20° sectors are welded. A considerable number of coupler connections and cooling pipe welds as mentioned above need to be performed in the torus hall. Therefore, it is essential to check and align two adjacent sectors before shipment so they can be linked precisely.

The factory visit this time was carried out to inspect a pre-assembly process of two 20° sectors forming a 40° sector, and to confirm the dimensional accuracy at the junction edges. The connection with the LPTS was also checked at another visit in the following week. After this inspection, the 40° sector is disassembled back to two 20° sectors and loaded on a special frame for transport. The delivery to the JAEA Naka site and the start of assembly is scheduled for the end of October.



Figure 1: Group photo taken in front of a VVTS 40° sector

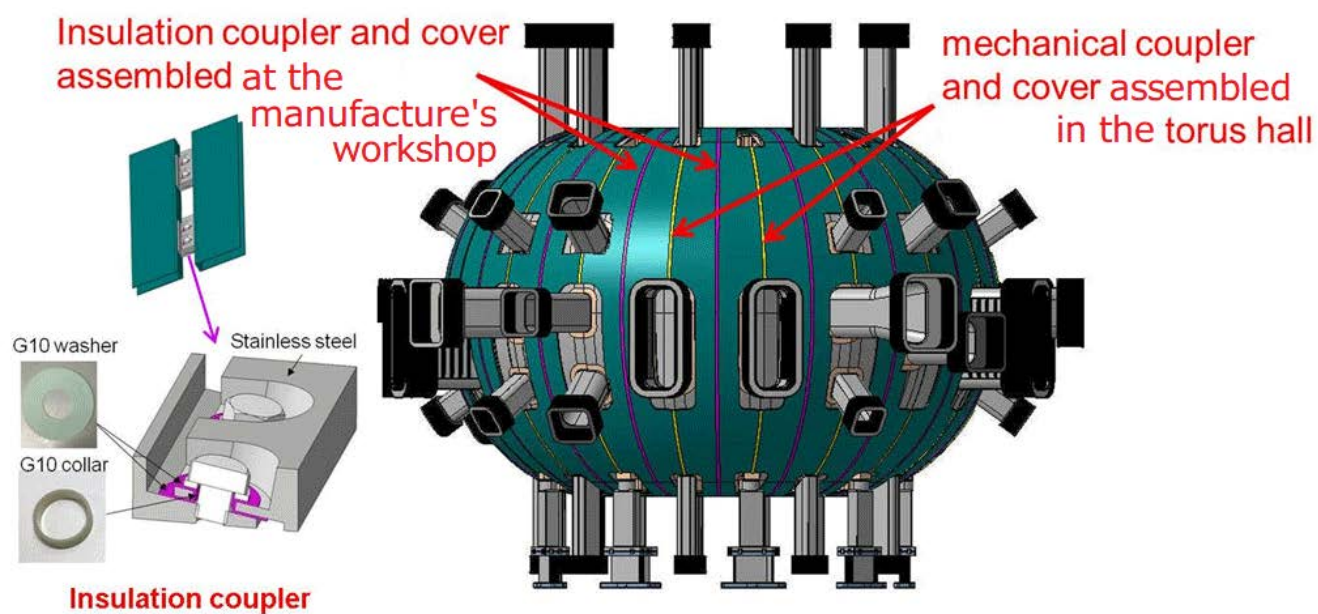


Figure 2: VVTS side view and couplers/covers

News

Production status of EF1 - 3

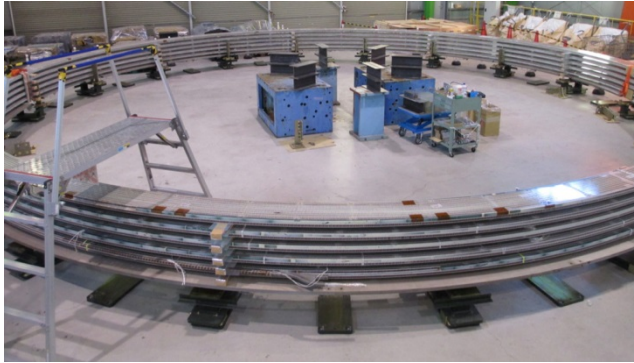


Figure 1: Completed pancakes for EF1



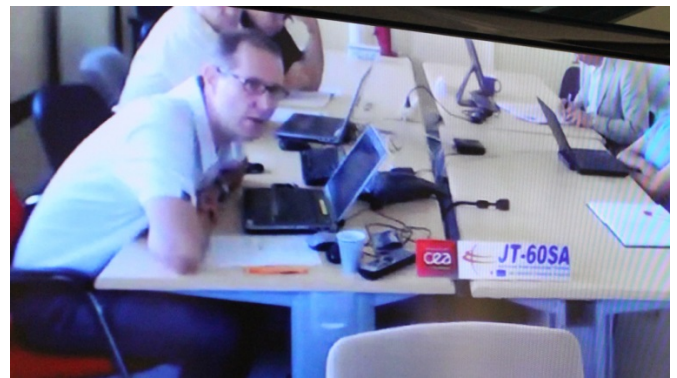
Figure 2: DP2 in winding process (for EF3)

The JT-60SA device has 6 circular equilibrium field coils (EF1 – EF6) with various diameters. The EF4, EF5 and EF6 were already completed and temporarily installed on the cryostat base in the torus hall, ready for later location in the lower section of the TF coils. The 340° VV torus is being assembled above them at the moment.

The production of EF1, EF2 and EF3, to be mounted on the upper section of TF coils, is making steady progress in the superconducting coil winding building. As for EF1, with an outer diameter of approximately 12 m (the world's largest superconducting coil as of August 2015), the last 2 single pancakes (SP11 and SP12) finished their curing process (insulation curing) in the end of May 2015. Thus all pancakes for EF1 (12 SPs in total) have now been completed (Figure 1). The EF2 pancakes (12 SPs in total) have also finished curing. They are already stacked and are now being electrically connected to each other. As for EF3, which is made up of 7 double pancakes (DPs), DP1 has finished curing and DP2 is in winding (Figure 2).

Meeting

DRM for SCMPS



A Design Review Meeting (DRM) on the JT-60SA superconducting coil magnet power supply (SCMPS) was held on 22 June 2015 via videoconference with the participation of F4E, CEA, JEMA and JAEA representatives. The final version of the design

report on the TF coil power supply (TF PS), issued by JEMA, was discussed and agreed during the meeting. The TF PS design report obtained a formal approval on 2 July 2015.

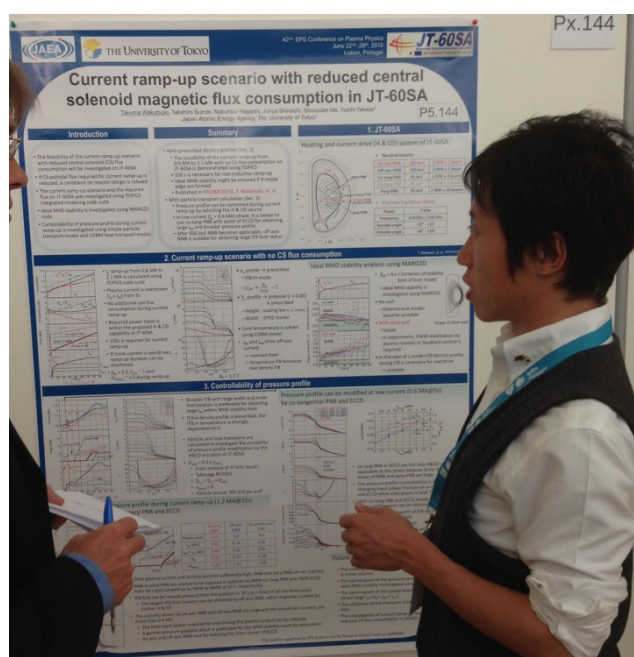
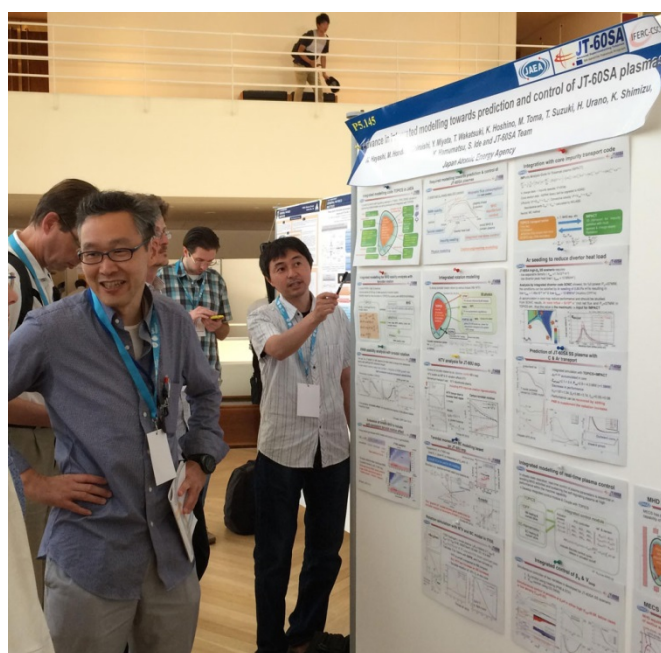
Once assembled and installed at the JAEA Naka site, the TF PS will serve to provide continuous direct current of 25.7 kA to the superconducting TF coils. It charges the TF magnet to its full current in less than 25 minutes with an output voltage of about 80 V.

Together with 4 sets of EF coil power supplies (EF PS), the TF PS is procured by CEA via a contract awarded to JEMA in March 2013. Because the detailed design of the TF PS took a long time, it was decided to proceed with the design of the EF PS and TF PS separately to reduce the impact on the procurement schedule. In fact, the EF PS design was approved in December 2014. This means that the manufacturing of the EF PS could be started in parallel with the finalisation of the TF PS design.

The TF PS design was finally approved at the meeting. This marks the achievement of an important project milestone, i.e. the completion of the overall SCMPs design and the start of TF PS manufacturing at JEMA premises in Spain.

Meeting

42nd EPS Conference on Plasma Physics (EPS-42)



The 42nd European Physical Society Conference on Plasma Physics (EPS-42), which is the largest conference in the fusion community, was held at the Centro Cultural de Belem (the largest cultural centre in Portugal) from 22 to 26 June 2015. More than 650 participants joined to present and discuss the latest progress in fusion research and development.

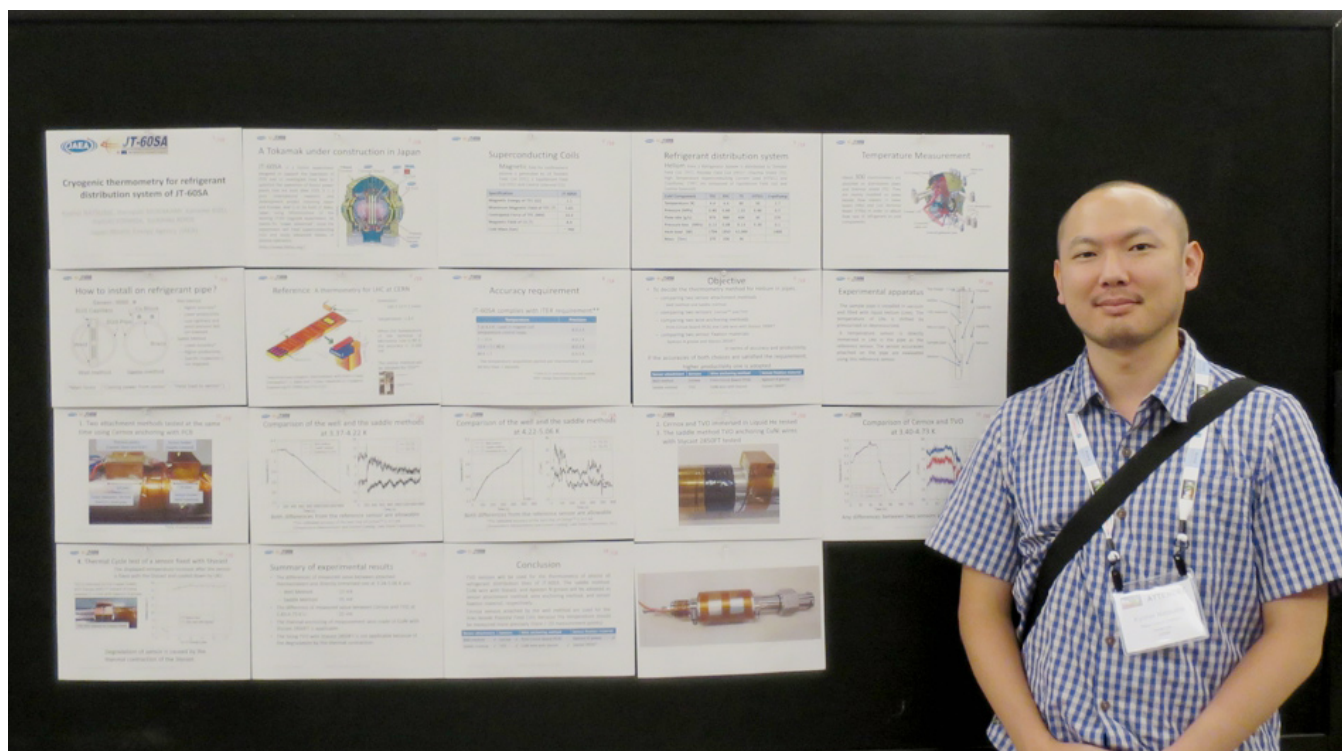
There were 2 poster presentations related to JT-60SA as follows:

- N. Hayashi from JAEA Naka on "advance in integrated modelling towards prediction and control of JT-60SA plasmas", included following topics in both physics and control engineering aspects:
 - resistive wall mode (RWM) stability including toroidal rotation and kinetic effects;
 - toroidal rotation with the neoclassical toroidal viscosity and boundary model;
 - impurity transport in core and scrape-off layer (SOL)/divertor plasmas;
 - integrated real-time control for kinetic parameters;
 - magnetohydrodynamic (MHD) equilibrium for shape/position control.
- T. Wakatsuki from JAEA Naka on "current ramp-up scenario with reduced central solenoid magnetic flux consumption in JT-60SA", included following topics shown in integrated simulations:
 - the possibility of density and temperature profiles control in the current ramp-up scenario with reduced central solenoid (CS) flux consumption.

These presentations attracted many participants and were well received.

Meeting

Cryogenic engineering and materials conference (CEC/ICMC 2015)



The 2015 Cryogenic Engineering Conference and International Cryogenic Materials Conference (CEC/ICMC 2015) were held in Tucson, Arizona USA from 28 June to 2 July 2015.

K. Natsume from JAEA Naka gave a poster presentation on "cryogenic thermometry for refrigerant distribution system of JT-60SA", including the following topics:

- selection of a method for the thermometry of the JT-60SA cryogenic distribution system;
- experimental comparison results by type of sensor, attachment method, thermal anchoring and sensor fixation material.

The presentation attracted many participants and lively discussions were conducted.

Local

Nukada festival



Local people in festival livery towing a float



People dancing and shouting encouragement on the parading float roof



Holy lion dance performed for happiness and health



Illuminated floats got together for the highlights of festival



Hare relief on the float wall representing growth by leaps and bounds



Cormorants sculpture on the float side wishing a big catch

Kashima Yahata Shrine (Nukada Shrine) at Nukada town in Naka city is a historic place of worship located about 5 km to the north of the JAEA Naka site. The Kashima Shrine was originally built in 806 and the Yahata Shrine in 1063. Then, they were jointly enshrined here as the Kashima Yahata Shrine in 1694 by Tokugawa Mitsukuni, a grandson of Tokugawa Ieyasu. A traditional "Nukada Matsuri" grand festival has been held here every 3 years since 1833. This year, the festival was held on 25 July.

Following the religious service and departure ceremony at 10:00 am, local people paraded through the town with 2 portable shrines transporting deities of the Kashima and Yahata Shrines, as well as 5 festival floats decorated with fine engravings (see figures). Special entertainments, including a traditional dance, were also performed.

With many stalls set up along the street, people from the vicinity and tourists from afar enjoyed and enlivened this rare festival.

Calendar

9 – 11 Sep 2015

15th International Workshop on Plasma Edge Theory in Fusion Devices (PET-15)

Nara, Japan

14 – 18 Sep 2015

12th International Symposium on Fusion Nuclear Technology (ISFNT-12)

Jeju Island, Korea

29 – 30 Sep 2015

23rd Technical Coordination Meeting (TCM-23)

Genoa, Italy

26 Oct 2015

The 17th Meeting of STP Project Committee (PC-17)

Naka, Japan

3 – 6 Nov 2015

25th International Toki Conference (ITC-25)

Toki, 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.

For more information, please visit the website: <http://www.jt60sa.org/>.