

Headline

Prototypes of the PF and TF quench protection circuits successfully tested

Two type test campaigns have been completed with very good results at the Consorzio RFX facility, during the RFX-mod shutdowns in April-May and August-September 2012, on the whole PF and TF Quench Protection Circuit (QPC) prototypes.

The QPC system is procured by the Italian National Research Council, acting through Consorzio RFX, via a contract awarded to the company Ansaldo Sistemi Industriali (ASI) in December 2010. The prototype manufacture was launched after the completion of the system detailed design in summer 2011, and was completed at the beginning of 2012. Since then, the individual factory type tests on the main components have been performed at the manufacturers' premises.

The QPC scheme (Figure 1) is an advanced design solution based on a hybrid mechanical-static circuit breaker (CB). No industrial or research applications with this technology exist for a level of power comparable to the JT-60SA case. Therefore a full scale prototype both of the PF and the TF QPC was developed in the frame of the contract, to perform a wide range of type tests to check the design choices, to characterize the operation, and to verify the performance.

These tests, after a commissioning phase to achieve the correct operation of the QPC unit, allowed checking the interrupt capability up to the full current. Moreover, specific performance characteristics were verified with dedicated tests, such as the electric wear of the sacrificial contacts of the mechanical switch, the bidirectional operation of the PF static CB, the current sharing of parallel connected static components both in dynamic and static condition, the layout optimization in reducing the stray impedances, and the coordination of the internal protection systems. Several hundred pulses were carried out in total during the test campaigns, at different currents, many of them at nominal and higher values, with very satisfactory results in terms of compliance with the requirements.

In addition, since the contractual tests were concluded in time and thanks to the availability of all the partners, it was also possible to set up the necessary hardware and software tools and to perform first interface tests between the QPC control cubicle and a test stand simulating the future JT-60SA control, which also produced very good results and useful information.

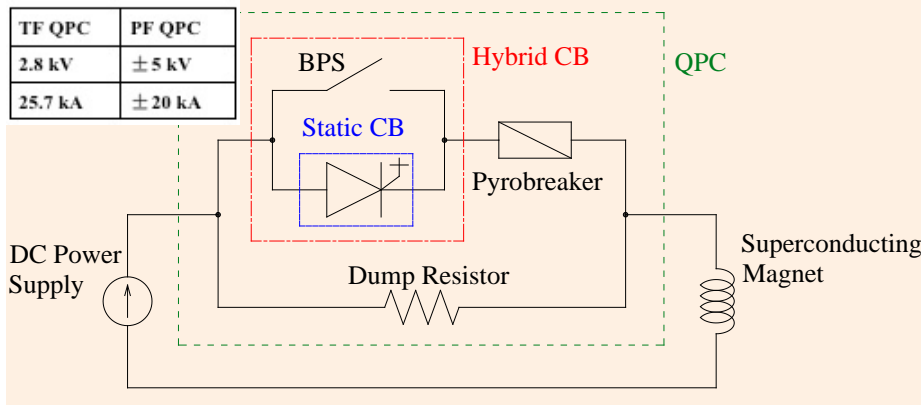


Figure 1



Figure 2



Figure 3



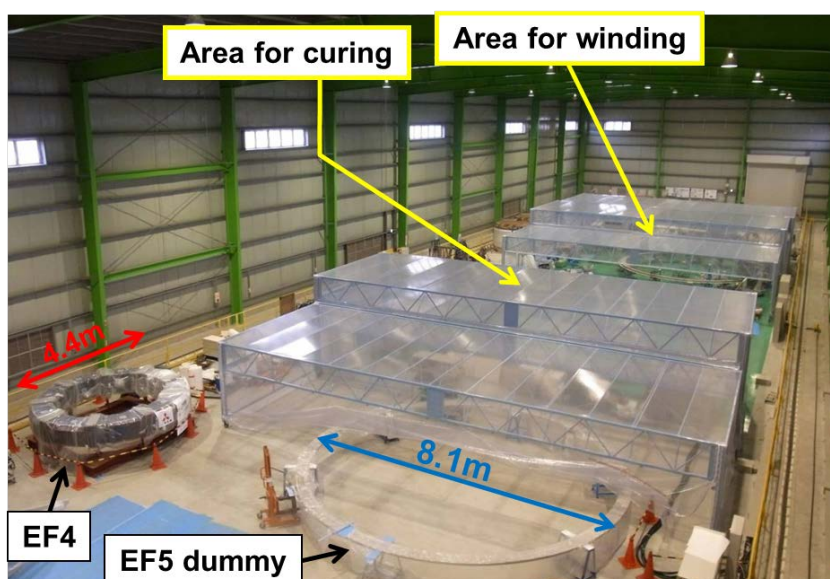
Figure 4

The pictures show the arrival of the QPC prototype at Consorzio RFX (Figure 2), the QPC prototype components (Figure 3): bypass switch and pyrobreaker on the left, whole prototype in the middle, SCB modules on the right) and the participants in the tests (Figure 4): the ASI company team, responsible for the QPC prototype design and manufacturing and for test results, the Consorzio RFX team who designed and set up the test circuits and managed the facility and the execution of the tests, and the F4E and JAEA colleagues who contributed to the test procedure definition and control interface tests.

Pictures courtesy Ansaldo Sistemi Industriali / Consorzio RFX

News

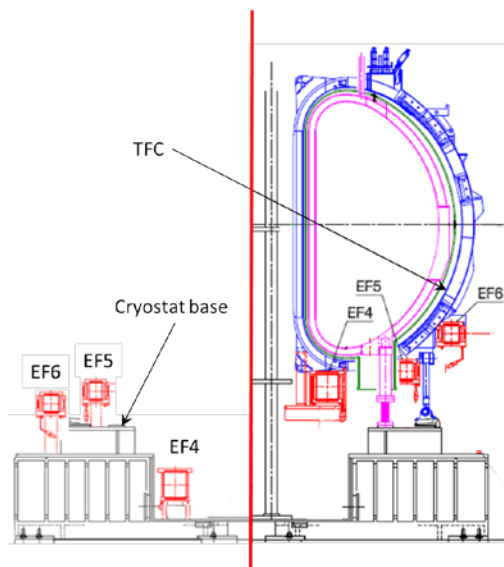
Manufacturing of conductor and EF coil in progress



Manufacturing tools transported to the Naka site

For the manufacturing of the conductor for the equilibrium field (EF) coil, two conductors for the EF coil No.1 (EF1) were completely manufactured and all the contracts for this year were completed. As a result, 42 of 92 conductors have been manufactured so far. For the coil manufacturing, the single pancakes (SP) 5 and 6 for the EF6 coil were completed and SP3 (the fifth of 14 SPs) is being wound. As for EF5, after the completion of winding of the double pancake (DP) 3 (the second of 7 DPs), it was prepared for curing of the epoxy resin insulation. Furthermore, a dummy pancake was placed as a monument in front of the JT-60 Control Building at the Naka site (see the article in "Local").

The manufacturing progress of the central solenoid jacket was also examined at the manufacturing company and it was confirmed that the manufacturing was progressing as scheduled towards the delivery date of March 2013.

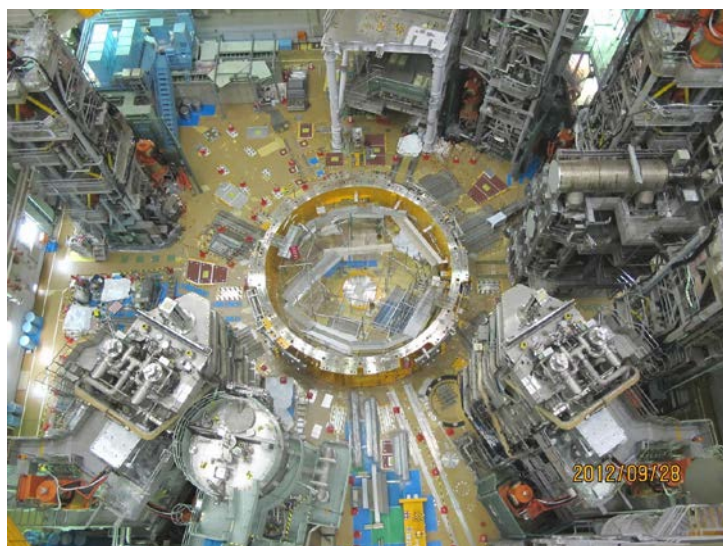


Temporary installation position (left) and final installation position (right) of EF coil

The lower EF coil temporary installation work procedure and its accuracy relative to the cryostat base were defined. The lower equilibrium coils need to be temporarily installed on the cryostat base then, after the assembly of the toroidal field coil, moved vertically from that position using jacks so as to reach their operating location accurately. For this purpose, in the temporary installation, it was decided to install the coil to an accuracy of $\pm 2\text{mm}$ with respect to the temporary coil orientation and direction using the electric current centre line of the coil and the marking on the cryostat base.

News

Disassembly of lower frame of vacuum vessel completed

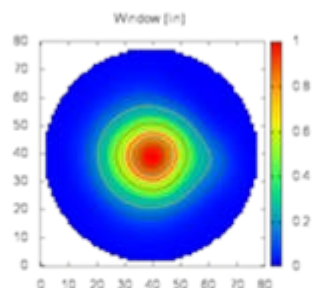
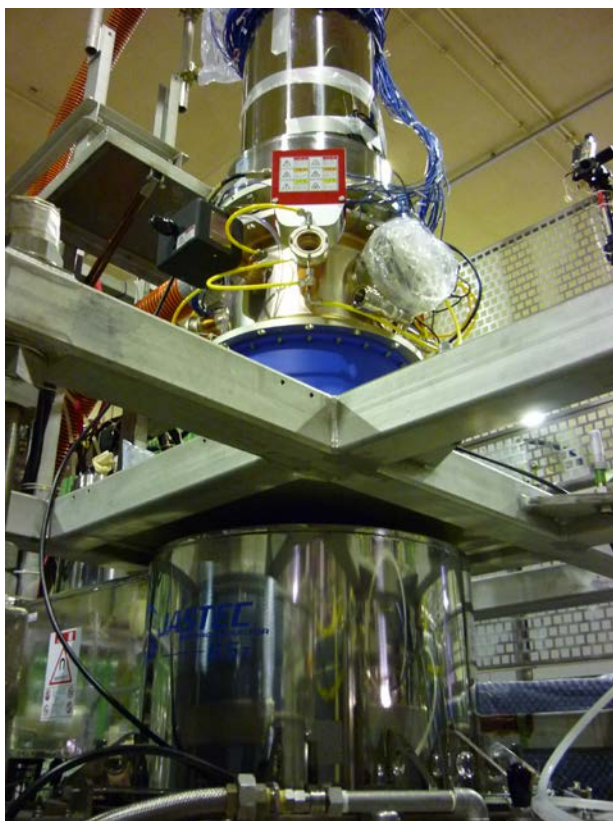


Torus hall after disassembly of lower frame

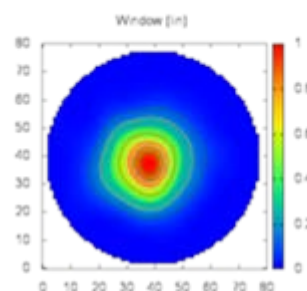
The lower frame and supporting column of the vacuum vessel (VV) were disassembled following the VV transportation to and storage in the JT-60 storage building in September. After this, the base frame and the very last supporting column (P-14) will be transported to and stored in the JT-60 storage building in October. The RF waveguide (LH-C) inside the wall penetration between the torus hall and RF Amplifier Room II was also removed and all the disassembly of the RF equipment in the torus hall was completed in September.

News

Oscillation of dual frequency gyrotron successfully achieved



110GHz



138GHz

Beam profiles at the output window (calculation)

New dual-frequency gyrotron and SCM

The ECRF system for JT-60SA will be used for a variety of purposes: (a) generation and sustainment of high performance plasmas through localized electron cyclotron heating and current drive, (b) reduction of the loop voltage required for plasma startup through preionization, and (c) cleaning of the first wall of the vacuum vessel using electron cyclotron resonance plasmas. To extend the capability the ECRF system, the development of a dual-frequency gyrotron was started in 2011. Operation of the newly designed and manufactured gyrotron, was started in June after its installation and commissioning. First, it was operated at 110 GHz using an existing superconducting magnet for JT-60, and oscillation at about 1 MW output with 0.1 s duration was confirmed. Then, it was operated at 138 GHz using a newly manufactured superconducting magnet, which can generate a higher magnetic field. After making fine adjustments to the magnetic field distribution and beam launch conditions, operation at about 0.5 MW output with 0.1 s duration was confirmed in October.

So far, expected oscillations efficiencies have been obtained, and the centres of the beam profiles have been found to occur at the centre of the output window at both frequencies. Operations aiming at extending the output duration and increasing the output power will be resumed in December.

Meetings

11th Meeting of the STP Project Committee



On 16 October, the 11th Meeting of the Satellite Tokamak Programme Project Committee (PC-11) was held by videoconference between EU and Japan. 38 participants in total joined the meeting, 5 members from the Project Committee, the Project Leader (PL), 6 experts from the Project Team, and 26 experts from the EU and JA Home Teams. At the meeting, the PL introduced the "Work Programme 2013" to be submitted to the Steering Committee. The current status and progress of the project were also reported in detail by the PL and PMs from the EU and JA Home Teams.

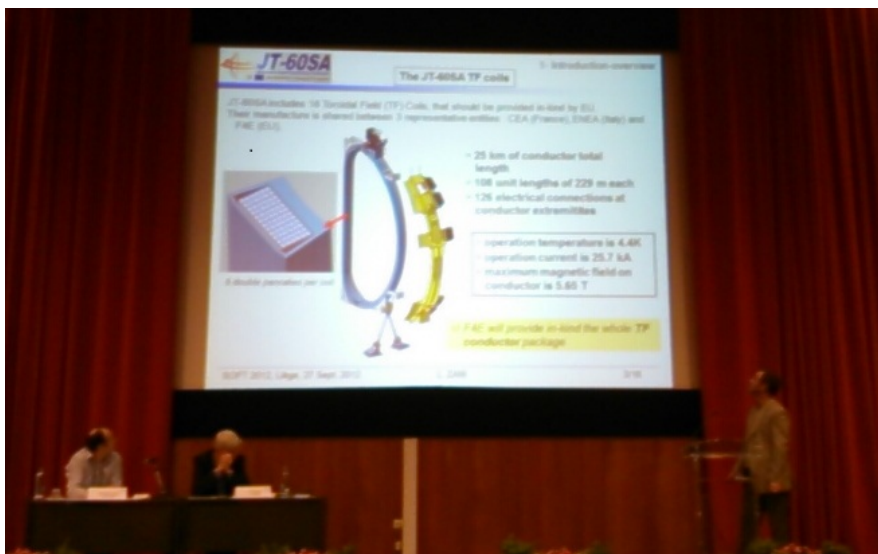
The Chair and the PC members took note of the status and expressed themselves satisfied by the favourable progress, in particular the progress in both EU and JA procurement implementation including the successful manufacturing of the cryostat base allowing its delivery to be ready in time for the start of assembly on site in Naka at the beginning of January 2013.

Meetings

27th Symposium on Fusion Technology and Applied Superconductivity Conference 2012



The 27th Symposium on Fusion Technology (27th SOFT) conference was held in Liège (Belgium) from 24 to 28 September 2012. The main goal of this conference is to gather worldwide the technology-oriented part of the fusion research community. The conference program includes plenary, oral and poster sessions covering a wide variety of topics. Additionally, many companies and institutions provided exposition booths. The total participation was around 1,000 persons.



A number of contributions from the JT-60SA EU and JA Home Teams were presented as follows (only presenters are shown):

- Oral presentations (4)
 - E. Gaio, from Consorzio RFX Padua, on the development and test of the full scale prototype of the JT-60SA Quench Protection Circuits;
 - B. Lacroix, from CEA Cadarache, on the quench detection system in JT-60SA;
 - L. Zani, from F4E Garching, on the manufacturing status of toroidal field coil conductor and strand for JT-60SA;
 - K. Tsuchiya, from JAEA Naka, on the Fabrication and installation of equilibrium field coils for the JT-60SA.
- Poster presentations (18)
 - V. Tomarchio, from F4E Garching, on the development of a user-friendly tool for the prediction of EM forces on the JT-60SA magnet system during operation;
 - G-M. Polli, from ENEA Frascati, on thermohydraulic analyses on the TF magnet during fast discharge;
 - I. Tiseanu, from INFLPR Bucarest (F4E subcontractor), on non-destructive examination of the JT-60SA TF conductor by tomography;
 - P. Decool, from CEA Cadarache, on the qualification activities prior to the TF coils manufacture;
 - F. Nunio, from CEA Saclay, one (on behalf of G. Disset) on the tests of the JT-60SA spherical bearings and another on qualification of the fastening components of the JT-60SA outer intercoil structure;
 - L. Genini, from CEA Saclay, on the TF coil test facility (CTF) general overview;
 - P. Jamotton, from CSL Liège, on the development of the JT-60SA CTF cryostat by Belgium;
 - W. Abdel Maksoud, from CEA Saclay, on the design of the cryogenic system of JT-60SA CTF;
 - A. Serrand, from CEA Saclay, on numerical analyses of the cryogenic system of JT-60SA CTF;
 - A. Cucchiario, from ENEA Frascati on the supply of 9 TF coils by ENEA;
 - M. Medrano, from CIEMAT Madrid, on the manufacture of the JT-60SA Cryostat Base;
 - J. Botija, from CIEMAT Madrid, on the structural analysis of the JT-60SA Cryostat Vessel Body;
 - A. Ferro, from Consorzio RFX Padua, on studies on the requirements of the power supply system for the Resistive-Wall-Mode control in JT-60SA;
 - K. Yoshida, from JAEA Naka, on feeder components and instrumentation for the JT-60SA magnet system;
 - S. Moriyama, from JAEA Naka, on the development of a linear motion antenna for the JT-60SA ECRF system;
 - K. Shibamura, from JAEA Naka, on the assembly study for the JT-60SA tokamak components;
 - A. Kojima, from JAEA Naka, on the long-pulse production of the negative ion beams for JT-60SA;
 - Y. K. Shibama, from JAEA Naka, on the welding technology R&D on port joints of the JT-60SA vacuum vessel.

The Applied Superconductivity Conference 2012 (ASC 2012) was held in Portland (USA) from 8 to 12 October 2012. This conference is aimed at gathering the research community on superconductivity in the framework of its numerous possible application for industrial or research projects. The total participation was around 1,500 persons.

JT-60SA contributed to the conference with the following papers:

- Oral presentations (1)
 - Zani, from F4E Garching, on the analytical and experimental activities to support the TF strand and TF conductor manufacture for JT-60SA.
- Poster presentations (1)
 - K. Kizu, from JAEA Naka, on the development of central solenoid for JT-60SA.

Local

Monument of EF5 at Naka Fusion Institute



A dummy pancake for the equilibrium field coil No.5 (EF5) with an average radius of 3.914 m and a width of 0.315 m was placed as a monument in front of the JT-60 Control Building at the Naka site. Right next to the dummy pancake, there is the trial upper half of the vacuum vessel, which was placed as a monument last year.

On the Naka site open house day in September, many people living in Naka city and the employees' families visited and were very interested to see this giant doughnut-shaped monument.

Calendar

October 29 – November 2, 2012

54th Annual Meeting of the APS Division of Plasma Physics (APS DPP)
Providence, USA

November 6, 2012

11th Meeting of the BA Steering Committee (SC-11)
Naka, Japan

January, 2013

16th Technical Coordination Meeting (TCM-16)
Naka, Japan

March 19, 2013

12th Meeting of the STP Project Committee (PC-12)
Naka, Japan

May, 2013

17th Technical Coordination Meeting (TCM-17)
Grenoble, France

Contact Us

The JT-60SA Newsletter is released monthly by the JT-60SA Project Team.
Suggestions and comments are welcome and can be sent to masayasu.sato@jt60sa.org.

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