JT-60SA Newsletter
No. 66, 30 June 2015

Headline

Helium storage vessels delivered and installed

On 27 May 2015, all the 6 gaseous helium storage vessel for the JT-60SA cryogenic system were installed at the JAEA Naka site. The transportation on the public road from the port of Hitachi to the site and the installation in the storage yard outside the warm compressor building have been completed.

Each vessel has a length of 22 m, a diameter of 4 m and a weight of about 73 t. The 6 vessels will contain a total of 1500 m^3 of pure helium (3.67 t at ~15 bar and room temperature). Approximately 2 t of helium will circulate around the superconducting coils, cryopump panels, thermal shields and cryodistribution network during steady operation of the JT-60SA device.

The vessels were procured by Europe. F4E placed a contract with A. Silva Matos – Metalomecânica, S.A. (ASMM) in Portugal, which was in charge of the final design, manufacture, test and delivery to the port of entry. JAEA was responsible for unloading and transporting from the port of entry to the site.

Following the final works acceptance on 5 February 2015, the vessels were loaded onto the ABB Vanessa in Leixões, Porto on 23 March.

After a 44 days voyage, the ship arrived at the port of Hitachi on the morning of 8 May. The cargo deck fixtures were removed the same day. The vessels were then unloaded to the pier on the next day. After customs clearance on 13 May, first the 6 steel sliding plates, with dimensions of 400 cm x 75 cm x 2.5 cm, were transported to the site, and were installed by KINKO,

an ALAT/ALEJ's supplier, the same day. These plates were inserted between one of the two vessel saddle supports and the concrete foundation, so that the vessel saddle support slides on the steel plate when the vessel's thermal expansion or contraction occurs. The ground transport was carried out only in the midnight hours (starting at 1:00 am) by Nippon Express Co., Ltd. (NE) following an exact schedule (1 vessel every other night).

The first vessel arrived at the site on 16 May. The final vessel unloading from the heavy truck and the precise positioning onto the foundations were performed by the teams of NE and Kinko under supervision of F4E, ALAT and JAEA in a fully coordinated collaboration. NE used a huge 550 t crane, which they had assembled at the yard solely for this purpose. After lifting the vessels up to about 30 cm above the foundations, NE and Kinko successfully positioned them, allowing all of the 16 anchor studs of each foundation pair to be inserted precisely into the corresponding holes of the vessel's saddle supports.

The procurement and final installation have been completed within about 1 year since the kick-off meeting with ASMM, being perfectly on time and on budget, and with an outstanding collaboration among all parties concerned. With the completion of this installation, the JT-60SA project made another step forward toward the device completion.

News

PA for the RWM PS signed

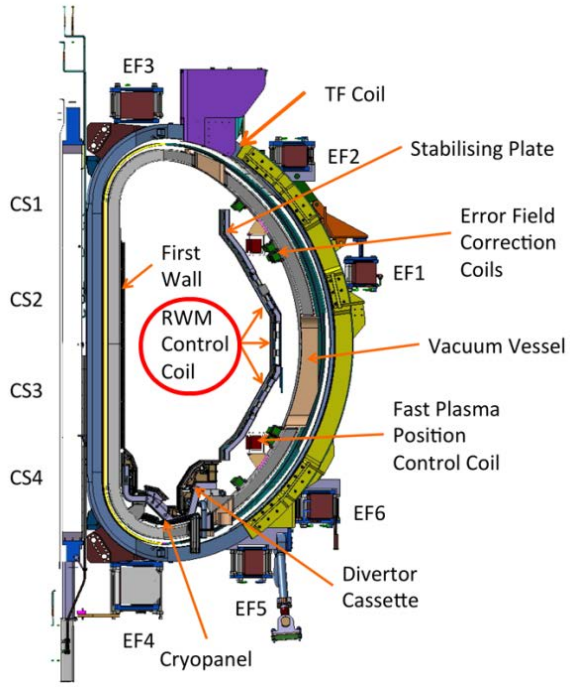


Figure 1: The RMW control coil in the vacuum vessel

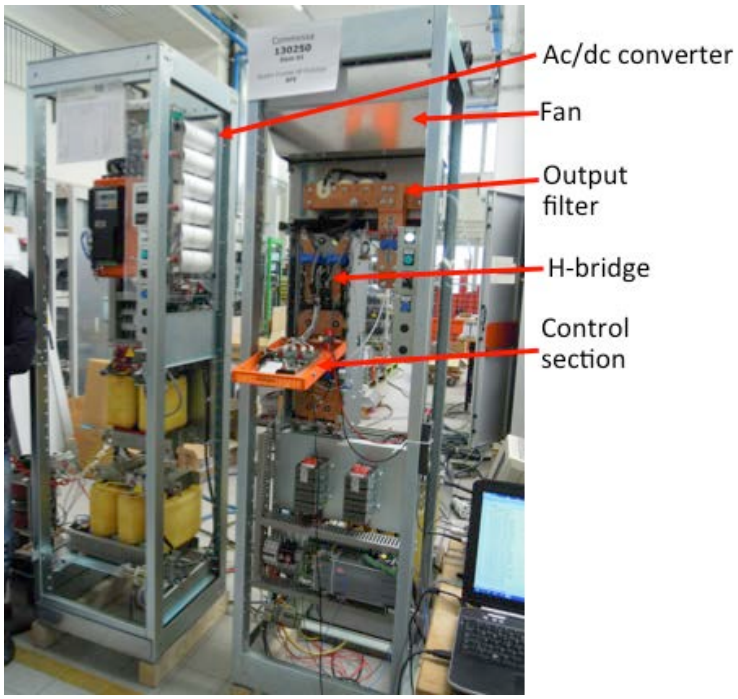


Figure 2: The RMW PS prototype and components

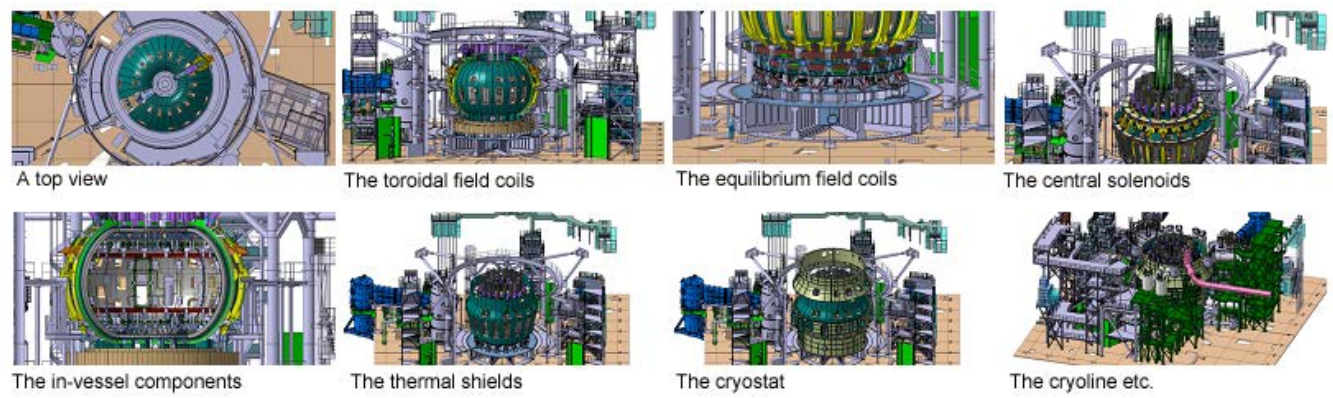
The Procurement Arrangement (PA) for the resistive wall mode control coil power supply (RWM PS) system was approved and signed by H. Shirai, Project Leader (PL) on 21 April 2015.

The resistive wall mode (RWM) is a kind of magnetohydrodynamic instability in magnetically confined, high-pressure tokamak plasmas. It occurs due to the influence of electrical resistivity in the conductive first wall, and limits the plasma performance. The RWM control coil system (Figure 1) was designed to suppress this instability by detecting the perturbed magnetic field from the plasma and applying a cancelling magnetic field as feedback through RWM control coils by adjusting its power supply input, thereby attaining high performance plasma in the JT-60SA device. This PA is for the supply of the RWM PS to be procured by F4E/Consorzio RFX.

Consorzio RFX, via a contract awarded to Equipaggiamenti Elettronici Industriali S.p.A. in Italy, developed a prototype of the RWM PS (Figure 2) in 2014. It achieved the desired results in terms of the feasibility to satisfy the demanding requirements of the proposed reference design (using the simplification of H-bridge inverters for enhanced reliability) and gave sufficient confidence to proceed with the procurement, fixing the number of units as 18 in the PA scope.

News

Overall assembly plan to first plasma finalised



JAEA, together with the vacuum vessel (VV) manufacturer, discussed and agreed the policy, sequence and schedule of each system and component assembly from the VV welding completion up to the first plasma. The work to be done covers

assembly of the toroidal field (TF) coils, equilibrium field coils, central solenoid modules, thermal shields, ports and bellows, cryostat, cryodistribution system, water cooling system and in-vessel components (see figure). It also includes subsystems and components such as the vacuum exhaust system, gas puffing system, baking system, glow discharge cleaning system, auxiliary heating system, bus bars for the superconducting coils power supply, diagnostics control panels and cables.

The JT-60SA project is now ready to enter the next assembly stage toward the first plasma right after the TF coils installation.

News

3D solid model of the torus hall interior generated

For secure interfacing among JT-60SA components without conflicts during assembly, a precise model of existing facilities with accurate dimensions is required. JAEA has therefore carried out a three-dimensional (3D) scan of the torus hall interior by using laser scanner, and converted the data into CAD format.

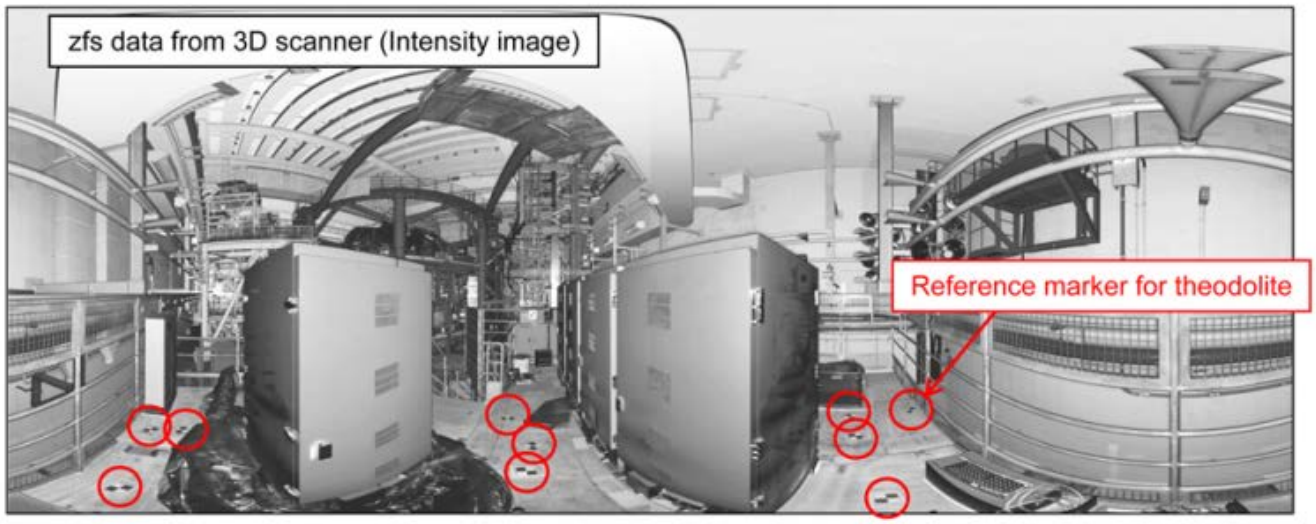


Figure 1: A sample of 3D laser scanned torus hall wall (a combined image into 360° view)

The 3D survey was conducted at 196 points on the ground floor, stages and 'cat walk' high level passages in the hall. Figure 1 shows an example of the scans. Every pixel has a distance and an angle from the measuring point. With reference to theodolite measurements, all scan data were converted and incorporated into position data in the 3D coordinate system assigned to the main building. Following solid modelling of the wall, pipes, ducts, panels etc. derived from such position data by various tools, their 3D CAD data were finally generated.

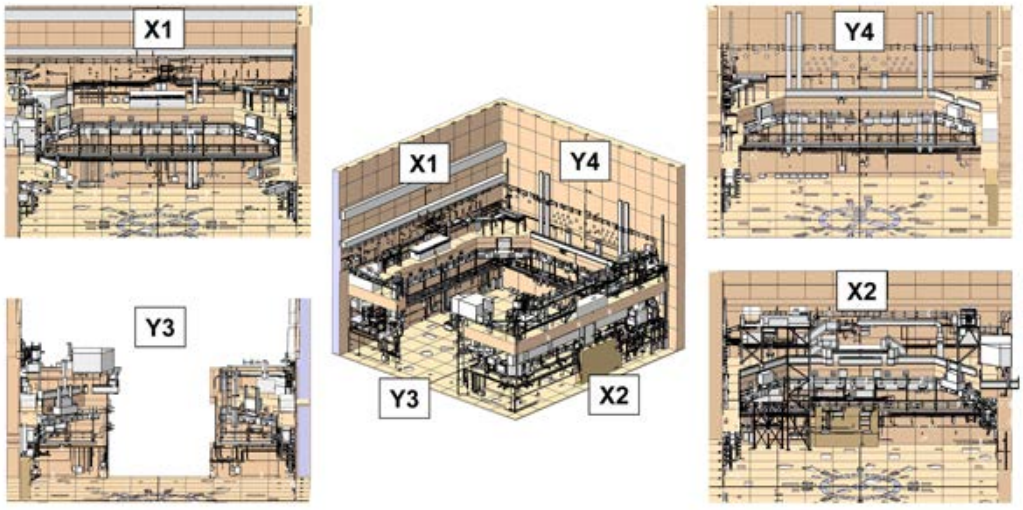
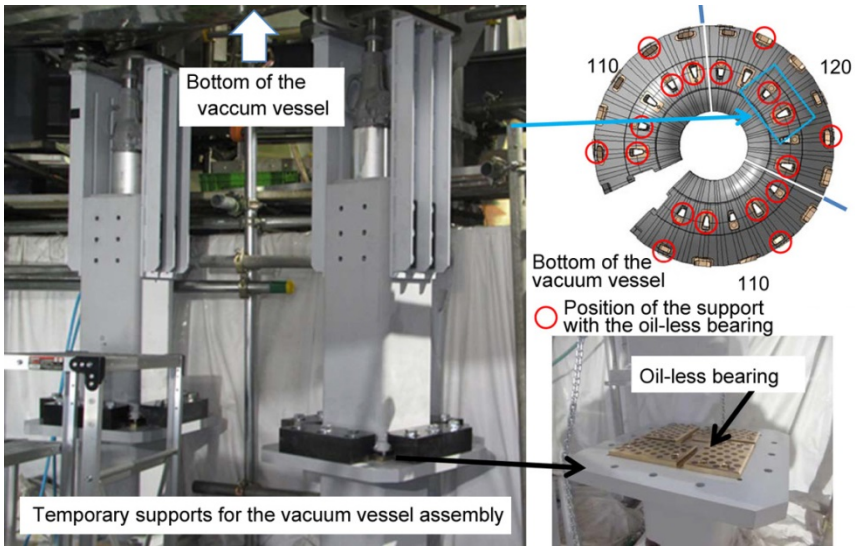


Figure 2: The 3D CAD models of the torus hall interior using information converted from the laser scanner data

So far, all the existing facilities installed on the torus hall walls have been reproduced in the 3D CAD models with an accuracy of ±4 mm (Figure 2). These models will provide high-precision and easy-to-use data for connection and interference check in the subsystem design.

News

Oil-less bearings installed in the temporary VV supports



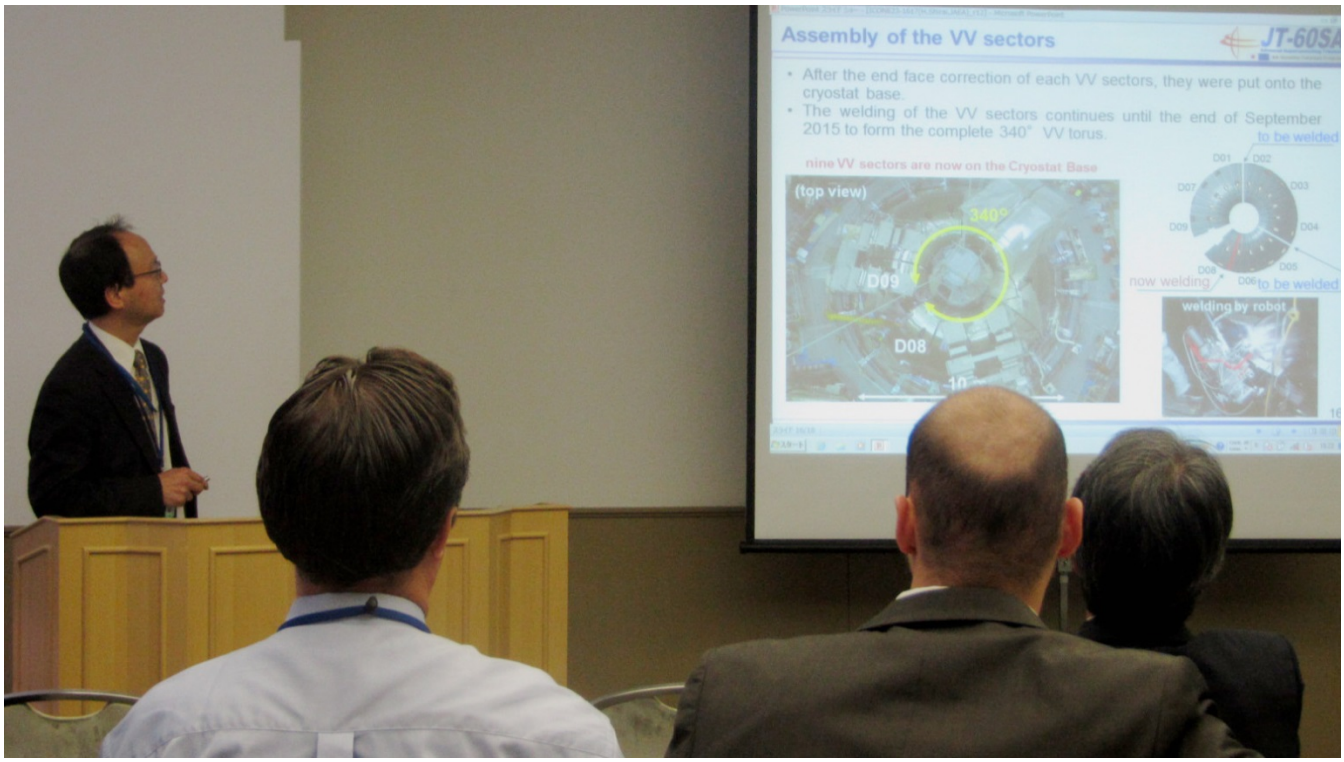
9 vacuum vessel (VV) sectors (D01 – D09) have been mounted on the cryostat base and form a 340° torus structure with an outside diameter of 9.95 m and a height of 6.63 m. Every set of 3 VV sectors has been welded and joined to form 1 set of 120° (D02 + D03 + D04) and 2 sets of 110° (D01 + D07 + D09 and D05 + D06 + D08) sectors.

These 3 sector sets are now to be welded to each other with splice plates. The heat contraction caused by the welding at the junction areas (approximately 8 mm) must be considered in this phase. After fixing the 120° sector at the designed position, taking it as a reference, the 110° sectors have been placed at each end with the extra gap needed for contraction.

At the same time, several oil-less bearings have been inserted in the temporary VV supports so that the 110° sectors can move to the target points (see figures below) after weld contraction. Adoption of the oil-less bearing has an advantage for supporting a heavy structure such as the VV, allowing it to slide slowly. This method enables the 110° sector position adjustment to be within 0.1 mm accuracy.

Meeting

23rd International Conference on Nuclear Engineering (ICONE-23)



The 23rd International Conference on Nuclear Engineering (ICONE-23) was held at Makuhari Messe in Chiba, Japan, from 17 to 21 May 2015. It was jointly organized by the Japan Society of Mechanical Engineers (JSME), the American Society of Mechanical Engineers (ASME) and the Chinese Nuclear Society (CNS).

H. Shirai, PL, gave an overview oral presentation entitled 'Recent Progress of JT-60SA Project for the Promotion of Fusion Research and Development'. He reported the mission, objectives and implementation framework of the JT-60SA project, the characteristics of the JT-60SA tokamak, the Europe - Japan research and project collaboration, and the status of its components fabrication as well as assembly and commissioning at the JAEA Naka site, showing that the project has been going well on schedule in both Europe and Japan thanks to the strong team spirit, and the audience appreciated his clear and forward-looking presentation.

2 other presentations were made related to the JT-60 project, as follows:

- By Y. Ikeda, on the accomplishment of JT-60U disassembly dealing with the radioactive components;
- By Y. Shibama, on the mechanical properties in closure welding for the JT-60SA cryostat.

Meeting

4th Research Coordination Meeting (RCM-4)

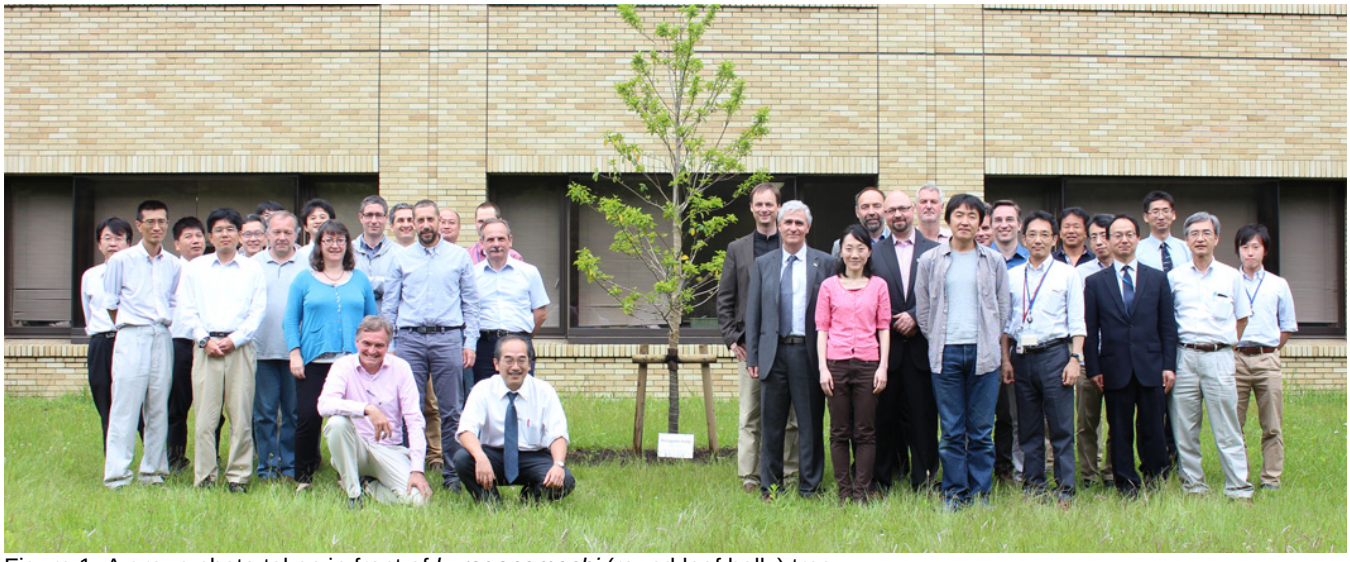


Figure 1: A group photo taken in front of *kuroganemochi* (round leaf holly) tree

The 4th Research Coordination Meeting (RCM-4) was held at the JAEA Naka site on 18 - 22 May 2015. 48 experts in total (19 from Europe, 28 from Japan, and 1 from the Project Team) including 4 experts via videoconference participated in the meeting (Figure 1). They actively and constructively discussed the revisions of the JT-60SA Research Plan (SARP), and the plans for future collaborations taking into account the latest progress on research and development related to the JT-60SA programme in Europe and Japan (Figure 2). In breakout sessions, research items in each area, such as plasma simulation, magnetic control, fuelling/pumping, diagnostics and electron cyclotron resonant heating (ECRH), were discussed.

During the meeting, they visited the torus hall to observe the construction status of the JT-60SA device. They also visited rooms and buildings to inspect the status of subsystems including the ECRH system (Figure 3) and the cryogenic system.

The participants agreed to the revision proposals in each chapter of SARP and the subjects of possible collaborations toward the update of SARP. The next meeting is planned in May 2016.

Figure 2: The discussion in progress on the RCM-4

Figure 3: The participants inspecting the high power gyrotron

Calendar

28 Jun – 2 Jul 2015
Cryogenic Engineering Conference / International Cryogenic Materials Conference 2015 (CEC/ICMC 2015)
Tucson, Arizona

9 Sep – 11 Sep 2015
15th International Workshop on Plasma Edge Theory in Fusion Devices (PET-15)
Nara, Japan

14 Sep – 18 Sep 2015
12th International Symposium on Fusion Nuclear Technology (ISFNT-12)
Jeju Island, Korea

29 Sep – 30 Sep 2015
23rd Technical Coordination Meeting (TCM-23)
Genoa, Italy

26 Oct 2015 (TBC)
The 17th Meeting of STP Project Committee (PC-17)
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.

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