JT-60SA Newsletter

No.37, 31 January 2013

Headline

Cryostat base arrival and start of tokamak assembly

Figure 1: One of the lower structure sectors carried by truck

Last November, the manufacture of the cryostat base, a large-scale structure (diameter: 12 m, height: 3 m, weight: 250 t) to support all the JT-60SA device, was completed by CIEMAT. The cryostat base was divided into seven welded stainless steel sectors and left the port of Avilés in Spain for Japan on 22 November, 2012 (see Newsletter No.36) and arrived at Hitachi port on 16 January, 2013 passing through the Atlantic Ocean, the Panama Canal and Pacific Ocean. The transport from the port to the Naka Fusion Institute was conducted in seven stages each time requiring the road to be closed before dawn from 19 to 26 January due to the maximum sector width of 6.5 m (Figure 1). All seven sectors were delivered to the assembly hall and the torus hall (Figure 2).

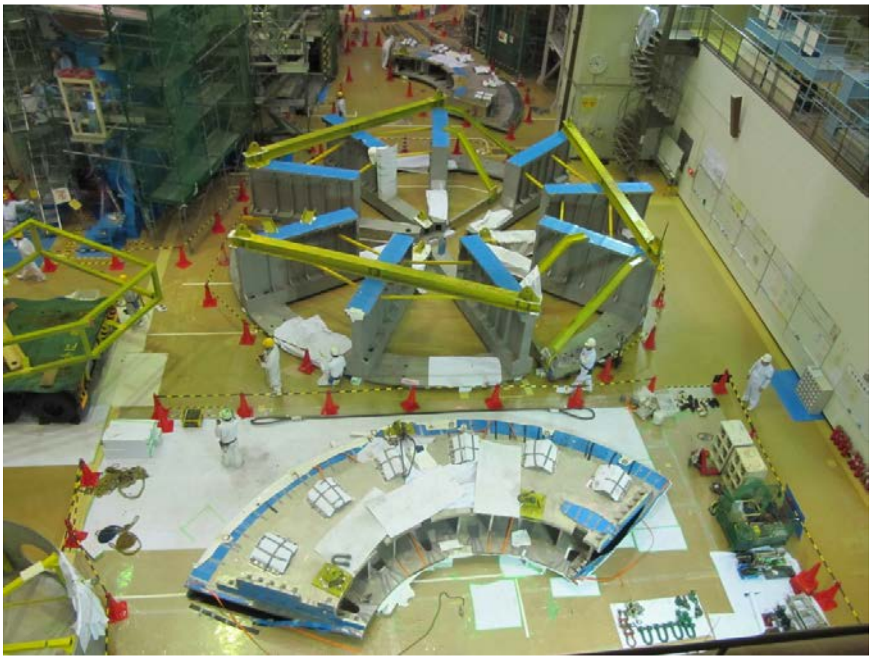


Figure 2: Three lower structure sectors in the assembly hall

Soon after the arrival of the cryostat base on 28 January (Figure 3), the tokamak assembly was started. The start was open to the press and many journalists were able to witness the real assembly work. For the next 6 years, the assembly of the JT-60SA tokamak will continue, enabling the first plasma to be achieved in March 2019.

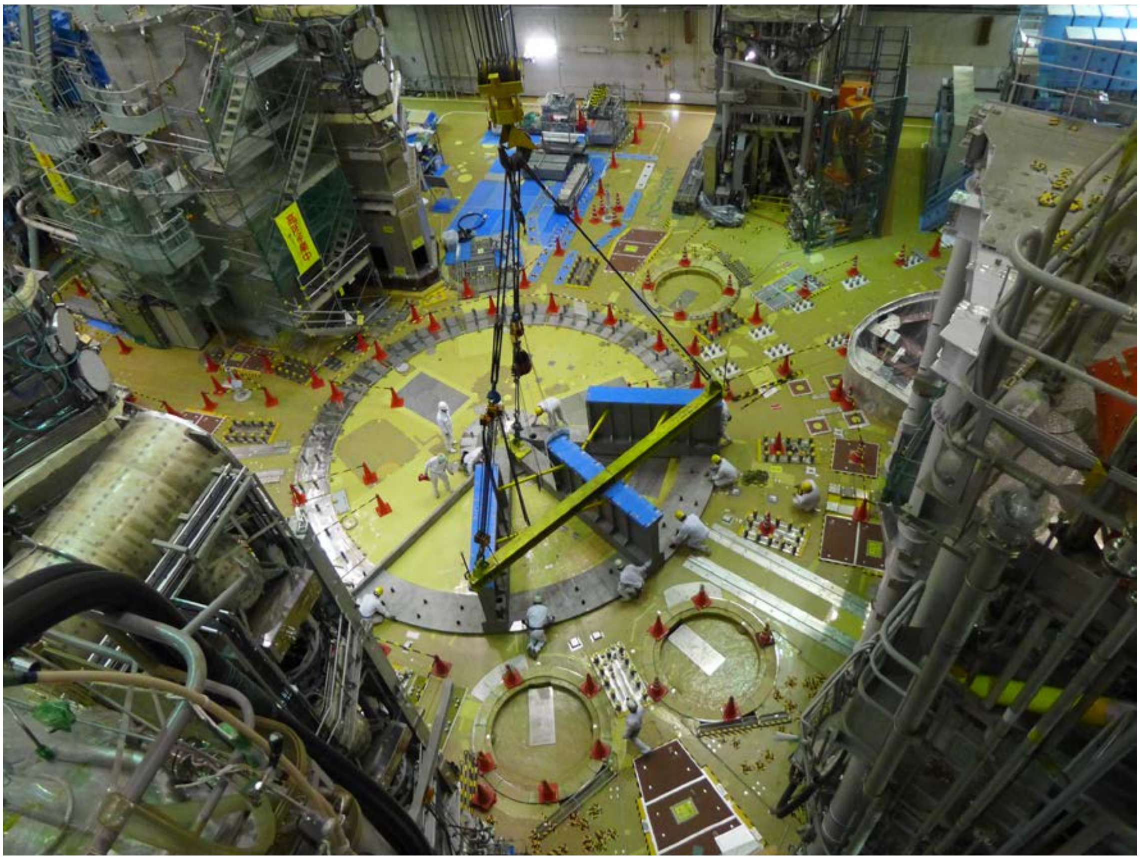
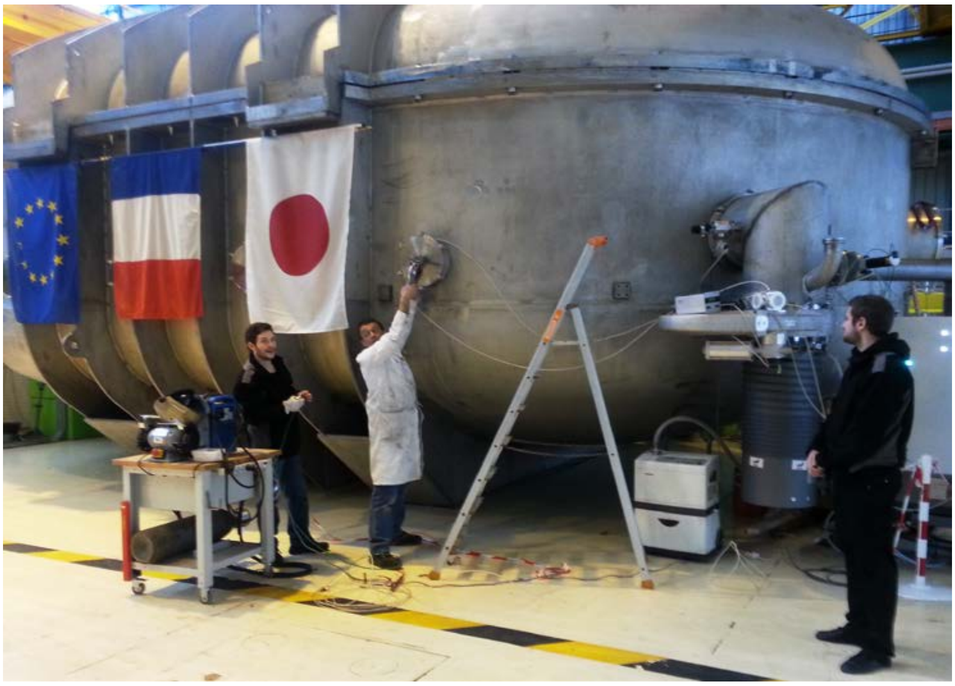


Figure 3: One of the lower structure sectors of the cryostat base being assembled in the torus hall on 28 January.

News

TF coil test facility cryostat tested under vacuum



With the delivery of the Belgian voluntary contributions (see Newsletter No. 33) to CEA in Saclay in September 2012, the TF coil test facility of the JT-60SA project is growing and taking shape. An upgrade of the crane was finished in early December 2012, which now allows the heavy cover of the test cryostat to be manipulated. After a careful cleaning of the interior of the test cryostat some 300 m³ of vacuum space were pumped before last Christmas. The volume was kept at vacuum pressures throughout the turn of the year to allow for intense outgassing of the inner surfaces. Detailed helium leak tests with high vacuum started at the beginning of January and did not reveal any leak (see photo). Also the valve box vessel which will feed the coils in the cryostat with helium from the refrigerator and with current from the power supplies has been successfully leak tested and thermally insulated.

In parallel to the set-up of the test cryostat, several other activities are progressing. Orders were placed for the main components of the valve box, in particular a pair of high temperature superconducting current leads (HTS-CL), the cryogenic circulation pump, valves and instrumentation.

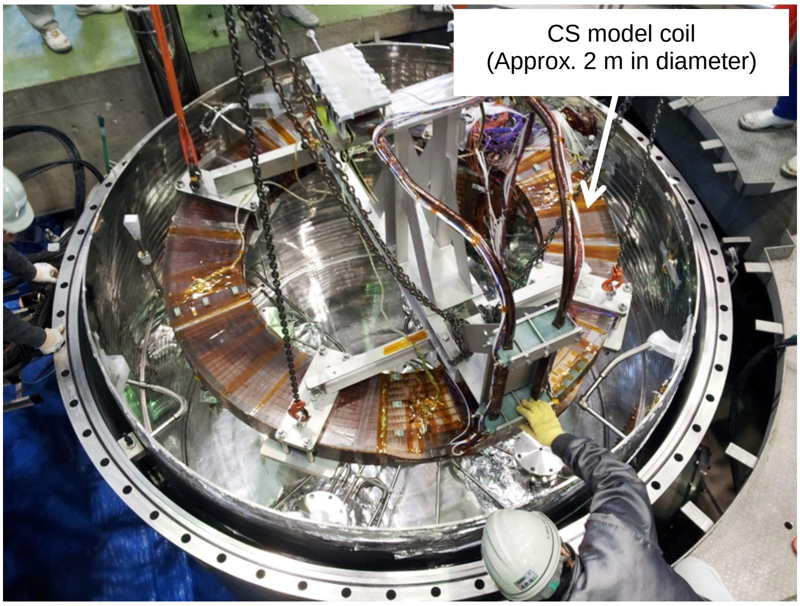
The superconducting feeder system, which will connect the HTS-CL with the coil terminals, is being designed and manufactured by the CEA team in Cadarache using lengths of superconductor for the TF coils provided by F4E.

The helium refrigerator has been moved from another hall in Saclay to the TF coil test facility site. Meanwhile, installation of the compressor station, the coldbox, the piping, and the control system, is finished and the subsystems have passed their functional tests. In February an integrated cool-down of the whole refrigerator system will be performed.

Thanks to the experience of the CEA team, gained during the tests of 70 superconducting coils for the W7-X project, the installation of the TF coil test facility moves on successfully and remains on schedule to be available for coil testing in spring 2014.

News

CS model coil installed in cryostat for test at NIFS

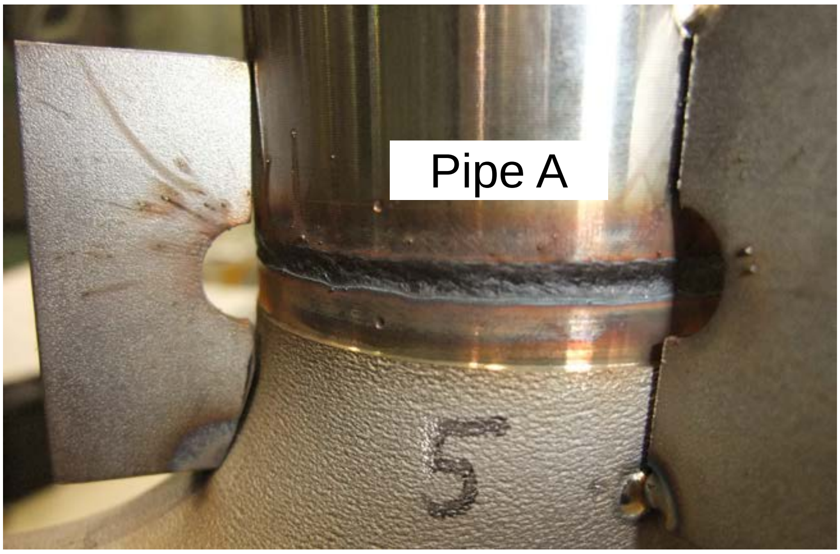


CS model coil installed in the cryostat for test

The installation of the central solenoid (CS) model coil was completed in the test cryostat at the National Institute for Fusion Science (NIFS). The CS model coil has a coolant, which has three entrance holes, a butt-type conductor joint, an insulation structure of 10 kV withstand voltage, and radiation-resistant instrumentation cable. Elements for measuring temperature, voltage, deformation, and magnetic field were set in various places in the coil to confirm the characteristics including the detailed data which would not be acquired for the real CS. The cooling and electrical current tests will be performed in February.

News

Testing of laser welding for divertor cassette remote maintenance



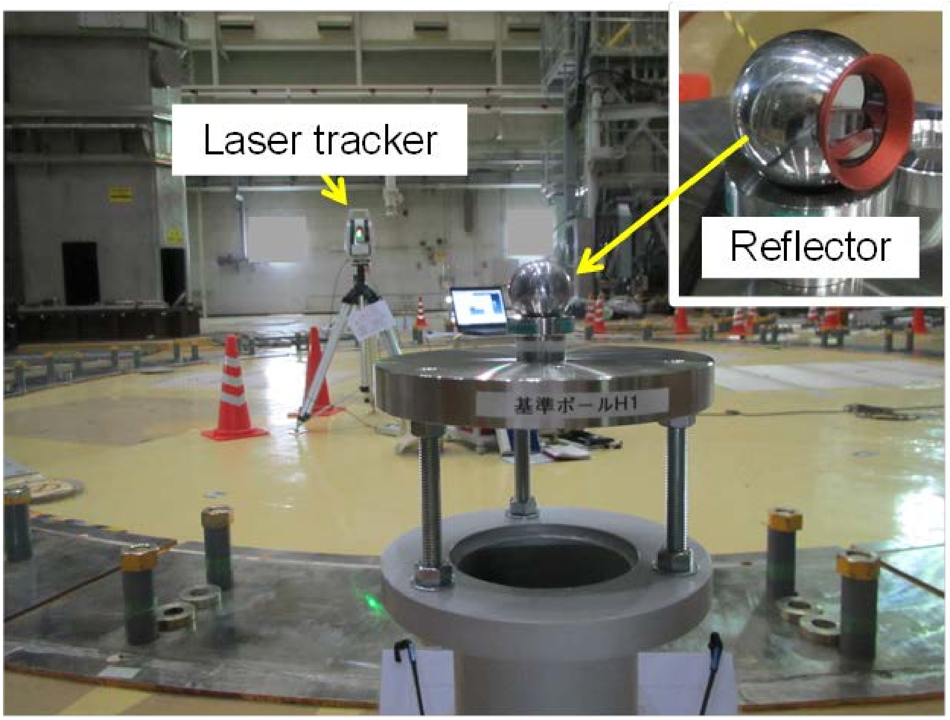
Welded pipes

A laser welding test was performed using piping materials for the real machine to decide the necessary setting conditions for the divertor cassette remote maintenance. In this test, a pipe and a tee (outside diameter: 60 mm, thickness: 2.8 mm) were welded from the inside. The allowable groove gap was thought to be less than 0.3 mm for laser welding without filler based on past R&D for ITER.

In this test the shape of the groove has been modified to allow welding with a wider gap. It was confirmed by the visual testing and penetrant inspection for 0.5mm groove gap that there is no problem with the welding. Optimization of welding conditions is ongoing for an 0.5-0.7mm gap. After that, the welding conditions including the offset and inclination between pipes will be clarified and the qualification test will be performed using the divertor cassette for the real machine in March 2013.

News

Preparation for assembly progressing well



Setting of reference points in the torus hall

In JT-60SA, high precision assembly is planned using a laser tracker. Reference points have recently been established in positions which do not interfere with the assembly stand, based on the existing benchmark on the floor of the torus hall. By mounting a reflector of the laser tracker at the reference point and on the target device, a very-high precision position measurement can be made. During the later assembly phases, this high precision position measurement and assembly will be continued by setting further derived reference points on the floor of the building.

Meetings

16th Technical Coordination Meeting held in Naka, Japan

The 16th Technical Coordination Meeting (TCM-16) was held at the JAEA Naka site on 23 and 24 January, and 78 experts in total (32 from the JA Home Team, 37 from the EU Home Team, 5 from the Project Team and 4 invited attendees) participated in the meeting including some experts from France, Germany, Italy and Spain via video-conference.

On the first day, interface issues on toroidal field (TF) coils, poloidal field (PF) coils, vacuum vessel (VV), thermal shield and cryostat were discussed with their progress in design and manufacturing. In particular, the delivery of the cryostat base to the Naka site was reported with the results of acceptance tests in detail.

After the session, a 'family' celebration for the arrival of the cryostat base at the Naka site was organized in a convivial atmosphere by the JA Home Team as the first major component from Europe to Japan. A certificate of appreciation was presented to Jose Botija on behalf of the CIEMAT team by the Director General, Masahiro Mori, of the Fusion Research and Development Directorate of JAEA.

On the second day, procurement status and issues on assembly, in-vessel components, research integration activity, cryogenic system, high temperature superconducting current leads, and power supplies, were discussed. Before lunch, a technical tour to visit the VV assembly building, the PF conductor jacketing building, and the JT-60 main building in the Naka site, was organized by the JA HT, in which a group photo was taken just in front of the cryostat base placed in the assembly hall (see photo above).

Lastly, the update of the PID (Plant Integration Document) was reviewed and discussed for its finalization at this meeting. The PL, S. Ishida, confirmed the next TCM-17 would be held at CEA Grenoble on 28-29 May. He expressed his many thanks for productive and cooperative discussions to all the participants, remarking that this had been one of the most memorable meetings.

Local

CEA Saclay developing world's largest whole body MRI magnet

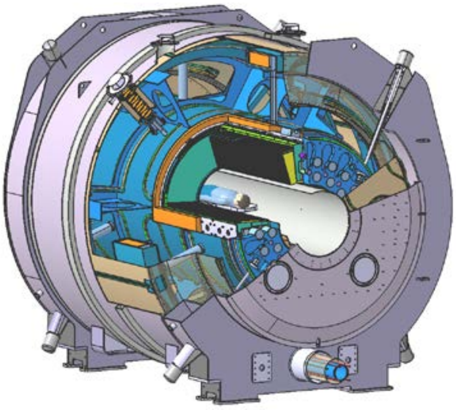


Figure 1: Cut-away view of the magnet and cryostat assembly

In the ISEULT/INUMAC project, France and Germany are focusing on very-high-magnetic-field molecular imaging to improve sensitivity, and spatial, temporal and spectral resolution, for pre-clinical and/or clinical magnetic resonance imaging (MRI) systems. In the framework of this initiative, CEA Saclay is currently developing the 11.7 Tesla ISEULT magnet (see Figure 1). The very high field of this magnet will be realized in a bore of 900 mm. The superconducting magnet will be housed in a massive cryostat weighting some 132 t. When energized 338 MJ will be stored in the magnetic field. This energy is equivalent to the kinetic energy of a full high-speed train (TGV) travelling at a speed of 100 km/h.

The magnet is manufactured from NbTi superconductor, and requires a current of about 1,500 A. To reach the high magnetic field the magnet has to be cooled in a helium bath to 1.8 K. In contrast to conventional whole body MRI systems, the ISEULT magnet will be composed of 170 individual magnet pancakes requiring also a vast number of electrical cold connections. A series of reduced scale prototypes have been built in the past to support critical design elements.

Alstom (Belfort, France) has meanwhile nearly finished the fabrication of the pancakes. It is aimed to finish assembly of the cold mass by the end of 2013. To service this new MRI-system, CEA is installing a dedicated cryogenic and power supply facility. Full tests and commissioning of the ISEULT magnet at 1.8 K requires also new cryogenic and electric facilities which will be established at the NEUROSPIN centre at CEA in Saclay.

The NeuroSpin building was designed by architect Claude Vasconi, designer in 1979 of the Forum des Halles shopping centre in Paris with G. Pencreac'h. The NeuroSpin building combines concrete, steel and glass in a linear complex comprising two parallel buildings either side of a 135 m long central nave. Below large, wave-like roofing shaped like a giant sine curve, separate arches are capable of housing up to five magnetic resonance imaging machines.

Also visit: http://www.sciencephoto.com/media/358047/view for high resolution pictures.

Figure 2: NEUROSPIN building at CEA Saclay

Calendar

March 25, 2013
Celebration of the delivery of the first component from EU and start of assembly of the JT-60SA tokamak
Naka, Japan

March 26, 2013
12th Meeting of the STP Project Committee (PC-12)
Naka, Japan

April 23, 2013
12th Meeting of the BA Steering Committee (SC-12)
Rokkasho, Japan

May 28-29, 2013
17th Technical Coordination Meeting (TCM-17)
Grenoble, France

June 10-14, 2013
25th Symposium on Fusion Engineering (SOFE-25)
San Francisco, USA

July 14-19, 2013
23th International Conference on Magnet Technology (MT-23)
Boston, USA

Contact Us

The JT-60SA Newsletter is released monthly by the JT-60SA Project Team.
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For more information please visit the website: http://www.jt60sa.org/