JT-60SA Newsletter

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Headline

Final commissioning of TF coil winding lines underway

Figure 1: PL, representatives of JAEA, CEA, Alstom and F4E at the Alstom TF coil winding line

After the recent Technical Coordination Meeting (TCM-17), S. Ishida, the JT-60SA Project Leader (PL) and K. Yoshida, the head of the JT-60 Magnet System Group, visited the toroidal field (TF) coil manufacturer's premises in Europe. The first visit was to the Alstom facility in Belfort, France, on 31 May, and the second visit was to ASG Superconductors in Genoa, Italy, on 3 June. These companies are responsible for the manufacture of 9 (or 10) superconducting TF coils for the JT-60SA experiment, under the guidance of CEA and ENEA respectively.

During both visits, the PL gave an overview of the JT-60SA project including the plan of the tokamak assembly, and K. Yoshida reported about the status of the procurement of the Japanese components of the machine and provided detailed technical information about the Japanese procurement of the equilibrium field (EF) coils. Since the manufacture of the EF coils is the most relevant area of manufacture to both Alstom and ASG, this was very well received by both manufacturers.

For the Alstom visit, representatives from CEA and F4E were also present, while at ASG, representatives from ENEA and F4E were present. Both visits included a tour of the workshop, where key features of the winding line installations were described. The functionality of the components was demonstrated, and the PL was able to "drive" the winding equipment through a complete "D" shaped cycle of the winding table. This demonstrated how the components of the winding table and bending equipment move with respect to each other to create the required shape.

Final commissioning activities for both winding lines are ongoing, with the start of winding for the first double pancakes expected in the coming months.

Figure 2: PL in control of the Alstom winding line

Figure 3: PL and K. Yoshida inspect the terminals area mock-up at Alstom

News

Completion of winding and curing of double pancakes for EF5 and EF6

Completed pancakes in the Superconducting Coil Manufacturing Building at the Naka site.

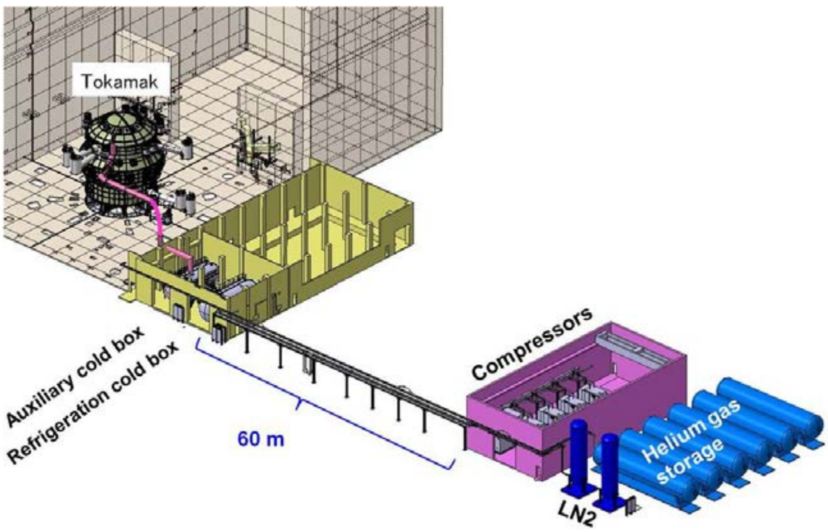
To meet the tokamak assembly schedule in the torus hall of JT-60SA, the equilibrium field coil No. 4, No. 5 and No. 6 (EF4, EF5 and EF6) will be temporarily installed on the cryostat base in the torus hall in January 2014. EF4 has already been manufactured and delivered to the Naka site.

EF5 (outer diameter: 8.1m) consists of 7 double pancakes. EF6 (outer diameter: 10.4m) consists of 14 single pancakes in which two single pancakes are wound and cured together at once like a double pancake. The winding and curing of all “double” pancakes for EF5 and EF6 has been completed by May 2013.

After the winding and curing of each double pancake, a visual inspection and dimension check will be carried out, followed by an electrical insulation test. The inlets and pancake joints of each pancake will also be machined before the pancakes are stacked.

News

Layout of cryogenic system designed



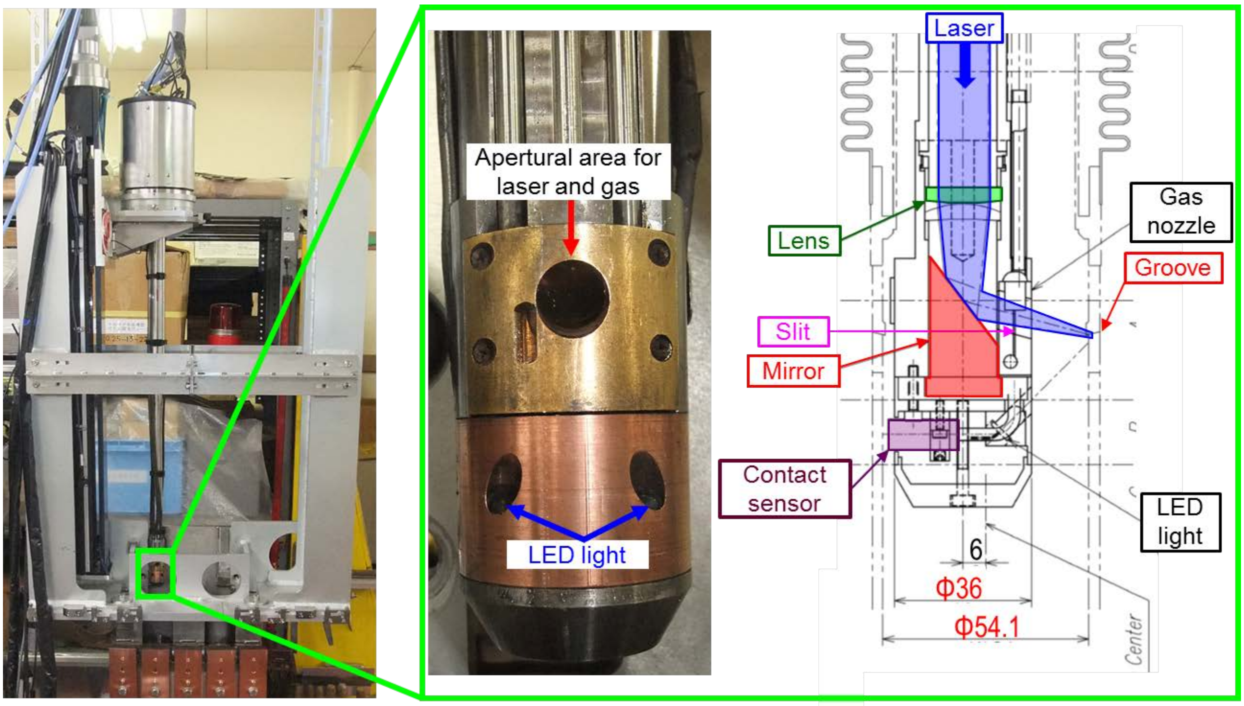
Layout of cryogenic system

The cryogenic system for the superconducting magnets, current leads, feeders, divertor cryo-panels, and the thermal shields, will be provided by Europe with a large helium refrigerator (9kW at 4.5K). The detailed manufacturing design is progressing at the European cryogenic company, ALAT.

The EU and JA Home Teams are meanwhile working together to prepare input data for the design of the compressor building and foundations for helium gas storage tanks which are to be provided by Japan.
The cryogenic hall in the existing building (coloured in yellow in figure), adjacent to the torus hall, houses the auxiliary cold box and the refrigeration cold box. A new building will be built for the warm compressors (coloured in pink). The distance between the warm compressor building and the cryogenic hall is about 60 metres. The helium gas storage and the LN2 tanks will also be located behind the warm compressors. The detailed input data for seismic design is already prepared for the foundations.

News

Pipe welding tool for divertor cassette delivered to Naka



Detail of the pipe welding tool with enlarged photo of a laser welding head

The water cooling pipe of the divertor cassette has a connection, on the outboard side of the vacuum vessel, which needs to be remotely cut and welded by special tools. These special pipe cutting and welding tools have been developed as a cassette remote handling tool. The pipe cutting tool was delivered to the Naka site last July and performed successfully.

At the end of March 2013, the pipe welding tool was delivered to the Naka site as scheduled. This tool consists of a laser welding head and its driving mechanism with controller (see figure). The laser welding head is remotely inserted from the plasma side into the pipe, and welds the pipe connection from the inside. A fibre laser source for the welding is used with the maximum output of 4 kW. The material, inner diameter and outer diameter of the connection pipe are SUS316L, 54.1 mm and 59.7 mm, respectively. The allowable fit misalignments for offset and gap are 0.5 mm in preliminary results, which approximately satisfies the expected misalignment in the real divertor cassette. Some welding tests will be performed in order to improve the usability of the welding tool before welding the actual pipe connections of the real divertor cassette.

Meetings

17th Technical Coordination Meeting held in Grenoble, France

The 17th Technical Coordination Meeting (TCM-17) was held at CEA-Grenoble on 28 and 29 May, and 65 experts in total (18 from the JA Home Team, 40 from the EU Home Team, 5 from the Project Team and 2 invited attendees) participated in the meeting including 29 experts from France, Germany, Italy, Japan and Spain via videoconference.

The meeting was opened by the welcome speech of A. Girard, CEA, introducing Grenoble city, CEA Grenoble and the Laboratory for Cryogenic Engineering (SBT - Service des Basses Tempèratures). The Project Leader (PL), S. Ishida reported about the outcome from the 12th Meeting of the Steering Committee (SC-12) in April, showed the progress of the milestones in the procurement arrangements, and encouraged the Home Teams to complete their procurement as scheduled. On the first day, interface issues on toroidal field (TF) coils, equilibrium field (EF) coils, the central solenoid (CS), the cryostat, and the thermal shield, were discussed with their progress in design and manufacturing. In the last session of the day, the present status and issues with the cryogenic system and the high temperature superconducting current leads were reported.

After the session, a technical tour was organized by CEA-Grenoble to visit the ARC Nucleart Laboratory, which has the mission to conserve and restore historic objects made from organic materials (wood, leather, fibres). The participants then visited the HELIOS test facility and the 400W cryogenic refrigerator at SBT.

On the second day, the procurement status and issues on in-vessel components, power supplies, remote handling, and assembly, were discussed. Lastly, the update of the Action Lists and the PID (Plant Integration Document) were reviewed and discussed for their finalization at this meeting. The PL confirmed that the next TCM-18 would be held in Naka on 23-24 October 2013 and the TCM-19 would be held in Garching in early 2014. He expressed his gratitude for all the assistance and hospitality of CEA-Grenoble staff.

Meetings

JT-60SA presented at 25th SOFE

Figure 1: W. Spears making the JT-60SA plenary presentation

The 25th Symposium on Fusion Engineering (SOFE-25) took place at the Stanford Court Hotel, in Nob Hill, San Francisco from 11-14 June. There were over 300 participants (of which 110 were from Europe and 100 from USA), and about 360 papers, of which 260 were presented as posters in two poster sessions.

The remaining papers were split into four plenary and six parallel oral sessions. Topics in the plenary sessions included an update on ITER and NIF (National Ignition Facility) progress overall, a description of the European and Korean fusion roadmaps, a summary of lessons learned by the design of ITER in-vessel components and in ITER licensing, and in the construction of Wendelstein 7X, as well as on the progress in constructing JT-60SA.

The first results from NIF were presented and, even though they currently were falling short of expectations, in mid-conference the participants made a visit to NIF and were impressed by the quality and scale of the equipment and the effort involved. The conference dinner was held at a winery in Pleasanton, not far from the NIF facility.

Conclusions on ITER in-vessel component design were also interesting. The shortage of space and difficulty of designing effective plasma control coils, and the need for more powerful than expected cooling and protection of the first wall, was calling into question the ability to design breeding blankets with high enough tritium breeding ratio in future devices. This raises the importance of studying the control of plasma to minimise these difficulties, something that JT-60SA will be well placed to help with.

The parallel oral sessions covered the latest experience operating existing experiments such as NSTX, MAST, and EAST, and their magnet, vacuum, fuelling and exhaust systems, and looked towards possible parameters, objectives and timescales of demonstration plants. In particular it was clear that at least three ITER Parties were considering leading Demo construction, in parallel, but nevertheless with the collaboration of others. This competitive approach was considered as a preferable organisation to a repeat of that of ITER, as commercialisation approached.

Figure 2: Stanford Court Hotel in San Francisco

Other sessions covered plasma control and divertors/first wall (where the new "snowflake" divertor configuration was much in evidence), heating and current drive, and assembly of ITER, especially its vacuum vessel and internals, the latter being especially interesting due to the two companies using different manufacturing techniques. IFMIF was presented, and interest was particularly shown in other presentations by the USA, Korea and China in joining the effort when it came to construction. Several talks were devoted to spherical tokamaks and their prospects, to stellarator engineering, particularly Wendelstein 7X, and to inertial fusion experiments and hardware engineering.

The last plenary presentation was devoted to JT-60SA construction and research plans, and was very well received.

In summary, this was a condensed but very useful conference, due to the good organisation and excellent environment for interaction.

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

- Invited presentations (1)

- W. Spears, from F4E Garching, on the JT-60SA construction and research directions.

- Poster presentations (3)

- A. Cucchiaro, from ENEA Frascati, on the manufacturing of the first toroidal field coil for the JT-60SA magnet system;
- V. Cocilovo, from ENEA Frascati, on the qualification process and quality control planning for JT-60SA toroidal feild coils construction;
- K. Tsuchiya, from JAEA Naka, on the mechanical design of the central solenoid assembly for the JT-60SA tokamak.

Local

Grenoble: University, research and industry in the mountains

Figure 1: Demolition of the Siloe reactor building (February 2013)

Figure 2: Grenoble University

Figure 3: CEA Minatec Entrance

On 28 and 29 May, Grenoble hosted the 17th JT-60SA Technical Coordination Meeting. This city of about 160,000 inhabitants is surrounded by a large urban area of about 600,000 people including 62,000 students

Grenoble is the most important research site in France after Paris. Grenoble is also one of Europe's foremost scientific and technological centres in the fields of microelectronics, computer science, hydraulics, materials science, chemistry, paper engineering and nuclear research and many high technology companies have settled there such as ST Microelectronics, Schneider Electrics, Hewlett Packard, Sun Microsystem, Bull, Soitec, Alstom, Air Liquide, and Cap Gemini.

Research in Grenoble accounts for more than 20,000 jobs, with 2 major French research entities CEA-Grenoble and CNRS and the large European research facilities ESRF (European Synchrotron Radiation Facility), ILL (Laue Langevin Institute), and EMBL (European Molecular Biology Laboratory). Other public or private research institutes are located in the Grenoble urban area such as INRIA (National Institute for Research in Computer Science and Control), CNET-France Telecom (National Centre for Telecommunications Research) and several university laboratories.

Grenoble has four universities: Joseph Fourier University (Science, Technology and Medicine) with about 20,000 students, Pierre Mendes France University (Human and Social Sciences) with more than 18,000 students, Stendhal University (Letters, Languages, Communication) with about 13,000 students and Grenoble-INP with six engineering schools and more than 5,000 students. The total number of PhD students reached 3,500 in 2012 with 45% from foreign countries.

Figure 4: Polygone Scientifique where CEA, CNRS and large European Facilities are located

CEA-Grenoble was created in 1956 by Louis Neel, who was awarded the Nobel Prize in Physics in 1970. Currently 4,500 people (including 2,500 CEA permanent staff) work every day on the site. CEA-Grenoble decided to stop its nuclear activities in 2001 and to launch the cleanup and dismantling of its nuclear facilities. Beginning of 2013 the walls of the Siloe research reactor of CEA-Grenoble have been demolished. This demolition symbolically marks the end of the nuclear decommissioning of CEA-Grenoble, which is now fully focussing on R&D for micro- and nanoelectronics (Minatec), healthcare technologies and new energy technologies.

Calendar

July 1-5, 2013
40th European Physical Society Conference on Plasma Physics (EPS-CPP-40)
Espoo, Finland

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

September 16-20, 2013
11th International Symposium on Fusion Nuclear Technology (ISFNT-11)
Barcelona, Spain

October 9, 2013
13th Meeting of the STP Project Committee (PC-13)
Naka, Japan

October 23-24, 2013
18th Technical Coordination Meeting (TCM-18)
Naka, Japan

December 17, 2013
13th Meeting of the BA Steering Committee (SC-13)
Saclay, France

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/