

## Headline

### Important signatures for the cryogenic system

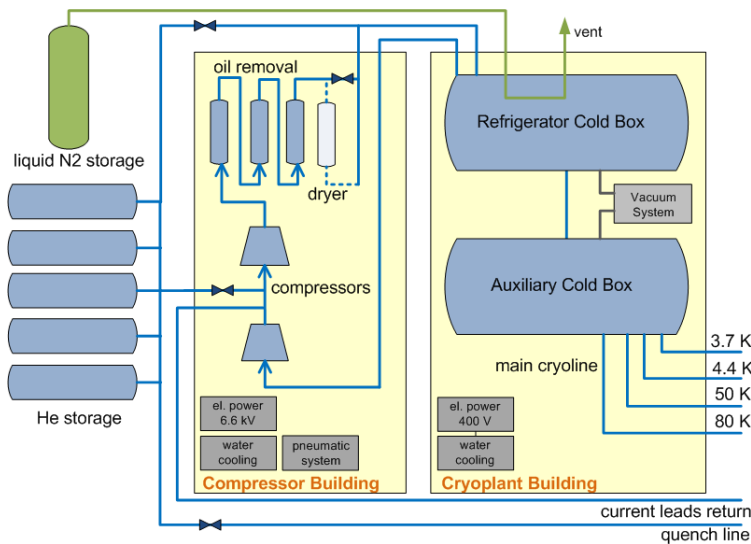


Figure 1

During November a series of important signatures took place for the cryogenic system. After finalisation of the competitive call for tender the Agreement of Collaboration between CEA and F4E was signed on 6 November. This event was followed by the signatures of the Procurement Arrangement and the sub-arrangement for on-site activities between JAEA and F4E, and the signature of the procurement contract between the French Voluntary Contributor, CEA and Air Liquide Advanced Technology (ALAT).

These signatures form the end of an intensive period of optimisation of the cryogenic system. This system has to cool and maintain the superconducting coils of JT-60SA (eighteen TF coils, six EF coils and four CS modules) at 4.4 K, provide refrigeration at a temperature of 3.7 K for the divertor cryopumps, deliver helium at 50 K to the high-temperature superconducting current leads, and keep the magnet thermal shields at a temperature between 80 K and 100 K. When converted to a temperature of 4.5 K these cryogenic loads sum up to an equivalent plant capacity of 7,900 W, in line with assessments of contingencies. A particular design challenge of the cryogenic system is the very large variation of the heat which has to be removed during plasma operation.

The European scope of supply (Figure 1) comprises a set of cycle compressors with oil removal system, several helium storage vessels, a helium dryer, a refrigerator cold box with liquid nitrogen pre-cooling, an auxiliary cold box with cryogenic circulators and a buffer, as well as a pneumatic and vacuum system. JAEA is contributing the infrastructure including a new compressor building, supplying electric power and cooling water, and installing liquid nitrogen storage. Installation and commissioning of the whole cryogenic system will be carried out in 2016 by ALAT on the Naka Site under working conditions agreed between JAEA and F4E in the dedicated sub-arrangement.



Figure 2: The teams ALAT, CEA and F4E at the kick-off meeting (Credit photo: ALAT)



Figure 3: Japanese and European flags welcome the kick-off meeting

In a formal kick-off meeting on 18 December, the engineering work officially started at ALAT in Sassenage near Grenoble (Figure 2 and 3). Two further technical meetings are already scheduled in France and Japan in January 2013.

## News

### Cryostat base leaves Spain



One of the double ring sectors being brought alongside the ship for loading

The cryostat base is the first major component to be made in Europe and delivered to Japan for JT-60SA. Since the cryostat base supports the entire tokamak, assembly of the rest of the machine cannot begin until it is in place.

The complete structure weighs approximately 270 t and is divided into seven welded stainless steel sectors to allow it to be transported. These must be bolted together after arrival in Naka. Because the sectors are up to 6.7 m wide they are very difficult to transport by road. Fortunately the factories in which the cryostat base was fabricated (IDESSA) and machined (ASTURFEITO) are very close to one another and also very close to the port of Aviles in Spain.



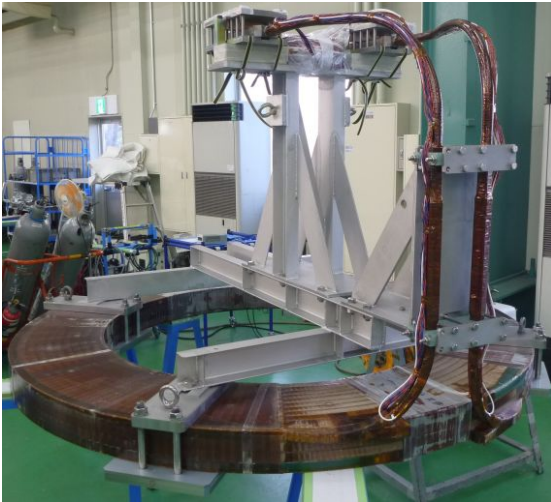
One of the lower structure sectors is made secure on board the ship

Fusion for Energy awarded the transport contract on 23 July to the Italian company Fagioli, who are managing all aspects of the transportation up to the port of entry in Japan. The cryostat base was collected from the factory on 12 November and transported to the port. After loading on board, the ship "IYO" set sail on 22 November, and many JT-60SA team members have been closely following its progress across the ocean since then.

The IYO took on further cargo at other European ports before heading out into the Atlantic. She arrived at the Panama Canal on 17 December and is expected to reach Hitachi port on 18 January 2013. Then the components must be transferred to trucks again for the final journey by road to Naka along a carefully planned route.

## News

### Manufacturing progressing well for superconducting CS and EF coils



CS model coil

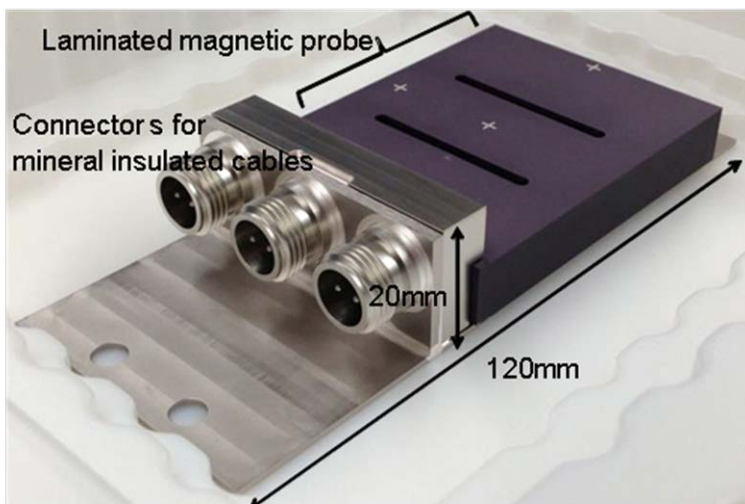
A measurement test structure was attached to the central solenoid (CS) model coil and the vacuum pressure coil impregnation was made. After passing the withstand voltage test and the helium leak test, the manufacturing of the CS model coil was completed. The completed CS model coil was delivered to the National Institute for Fusion Science (NIFS) to be installed in the cryostat for test at the beginning of December, and the electrical current test will be performed next February.

In the manufacturing of the equilibrium field (EF) coils, the third double pancake for EF5 and the sixth single pancake for EF6 were completed.

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## News

### Sensors developed for built-in laminated magnetic probe



In JT-60SA, a number of magnetic diagnostic coils will be installed as sensors for plasma control and in order to measure the basic plasma parameters. These sensors include magnetic field probes, Rogowski loops, one turn loops, diamagnetic loops and saddle coils. They are also utilized for measurement of low frequency MHD instability modes.

A laminated magnetic probe with three built-in sensors has been developed for the magnetic field probes. This probe consists of 40 layers of ceramic substrate, which have a metalised coil pattern, and has connectors for the mineral insulated cables laid inside the vacuum vessel so as to make the probe replaceable. Its validation test including a noise-proof test will be performed using the QUEST experiment at Kyushu University, a spherical tokamak, in the future.



## Meetings

### **1st Design Review Meeting on thermal shield**



The 1st Design Review Meeting (DRM) on the thermal shield was held by videoconference on 27 November, with the attendance of 18 experts from Germany (Fusion for Energy), France (CEA) and Japan (Naka Fusion Institute).

The main objectives of the meeting were to review the technical specifications of the thermal shields and their design basis, and the Procurement Arrangement draft text, both of which were presented by JAEA experts. It was agreed to proceed with finalizing the Procurement Agreement after taking into consideration the comments at this meeting.

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## Meetings

### **2nd Design Review Meeting on assembly**

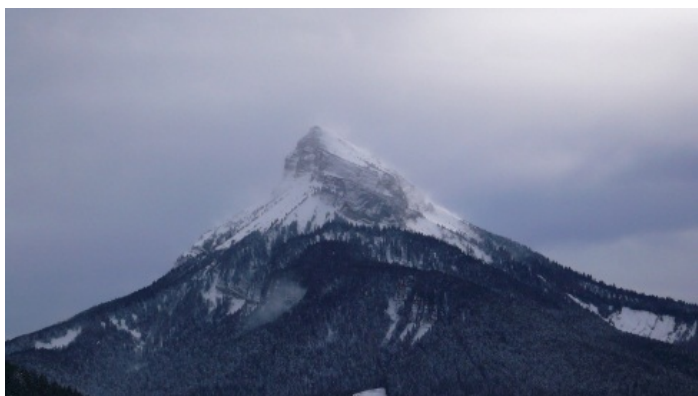


The 2nd Design Review Meeting (DRM) on assembly of the vacuum vessel (VV) and VV thermal shield (TS) was held by videoconference on 29 November with the attendance of 14 experts from Germany (Fusion for Energy) and Japan (Naka Fusion Institute).

The main objectives of the meeting were to review the VV and VVTS assembly procedure and assembly tolerances, the technical specifications for the assembly, and the Procurement Arrangement draft text. It was agreed to proceed with finalizing the Procurement Arrangement based on the discussion at this meeting.

## Local

### Grenoble and the Alps



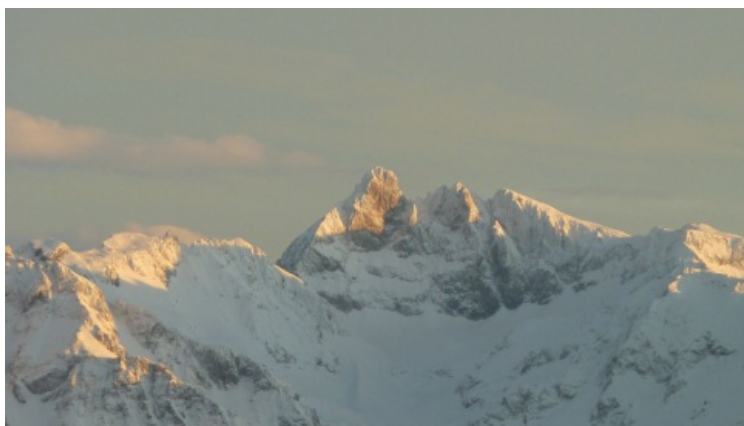
Chamechaude  
© Stéphane Moreau



Moucherotte  
© J-S Danel

Grenoble has been a city of winter sports ever since 1968 when the Winter Olympics were organized in the city and the nearby mountains. The winter season started early this year: the first snowfall surprised its inhabitants at the end of October with 30 centimetres in the streets of Grenoble! The winter sport resorts around Grenoble opened on the first weekend of December to the joy of the skiers. The nearest ones, Chamrousse, les Sept Laux, or Villard de Lans, can be reached by car or by shuttle in 30-45 minutes from the city centre.

Grenoble, at the altitude 204 m, is surrounded by three mountain ranges: Vercors, with the Moucherotte dominating Grenoble at 1,901 m, Belledonne and its highest peak, Le grand Pic de Belledonne at 2,977 m, and Chartreuse, with the well-recognizable shape of the Chamechaude Mountain (2,082 m).



Grand Pic de Belledonne  
© Toz

Many villages near Grenoble offer lodging to families in cosy chalets and traditional houses, in an exceptional natural setting, allowing them to taste the mountain activities - downhill skiing, cross country skiing, ski touring, snow shoe or snow racket treks, or even dog sledding.



“Le rêve du petit Michel”, Megève 1936,  
Photo exhibition « les Alpes de Doisneau »  
© Robert Doisneau/Rapho

Mountain settings can be enjoyed also in the city centre: at the Museum de l'Ancien Evêché, near Notre Dame square, a photo exhibition of the work of Robert Doisneau (1912-1994) "Les Alpes de Doisneau" shows some of his work as photo-reporter in the 1930's. 2012 is the 100th anniversary of his birth. Robert Doisneau is a French photographer who is well known worldwide for his romantic pictures of Paris after the second war. He also travelled for his work in the Alps where he made advertising pictures for the fashion and car industry. The exhibit also shows his reports on the traditions in the Alps such as the transhumance and the beginning of winter sport development at that time. Some personal pictures are full of good mood and tenderness and recall the human side to his art work. The exhibition can be seen in Grenoble until 14 April 2013.

For more information: [www.ancien-eveche-isere.fr](http://www.ancien-eveche-isere.fr)

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## Calendar

January 23-24, 2013  
16th Technical Coordination Meeting (TCM-16)  
Naka, Japan

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

April 23, 2012  
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

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

## **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](mailto:masayasu.sato@jt60sa.org).

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