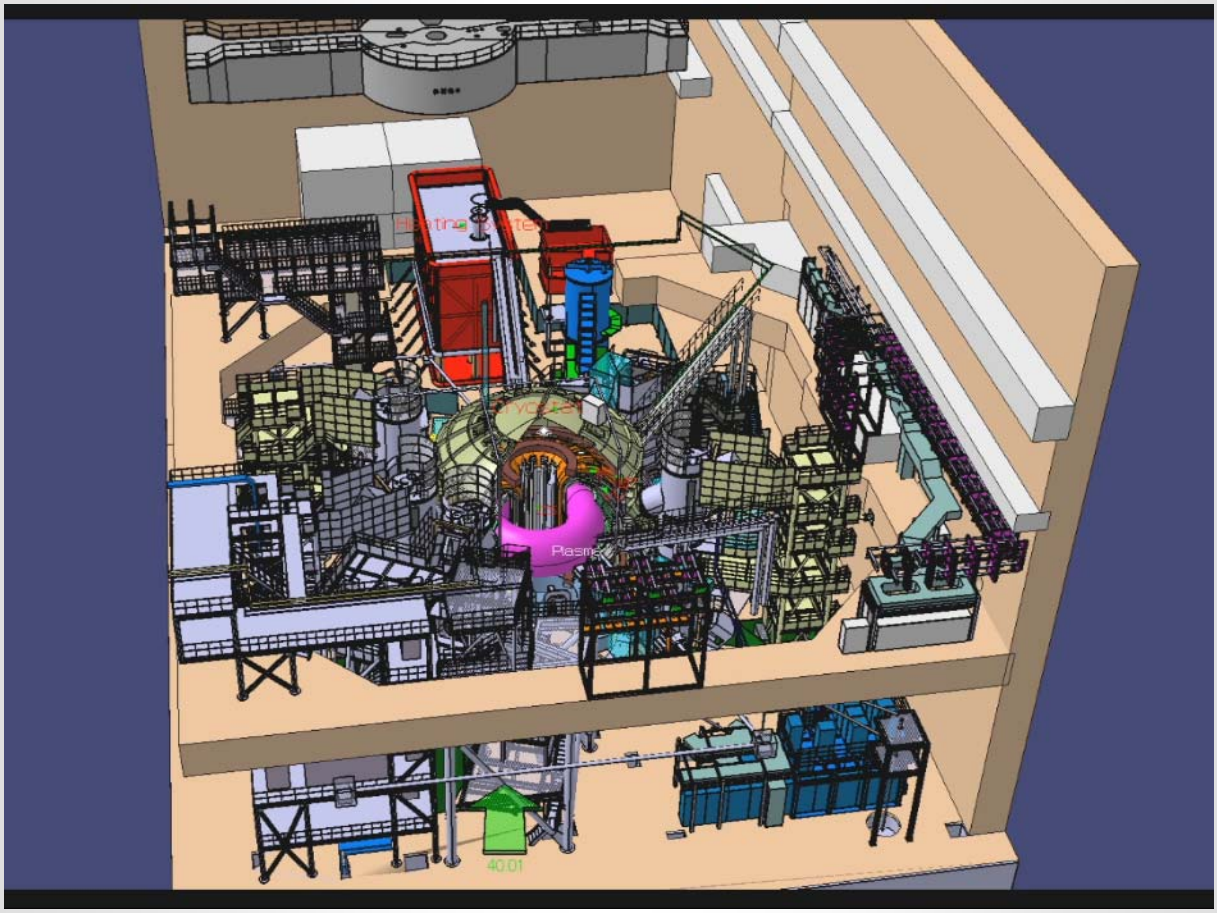
JT-60SA Newsletter
No.11, 30 November 2010

Virtual tour of rendering JT-60SA



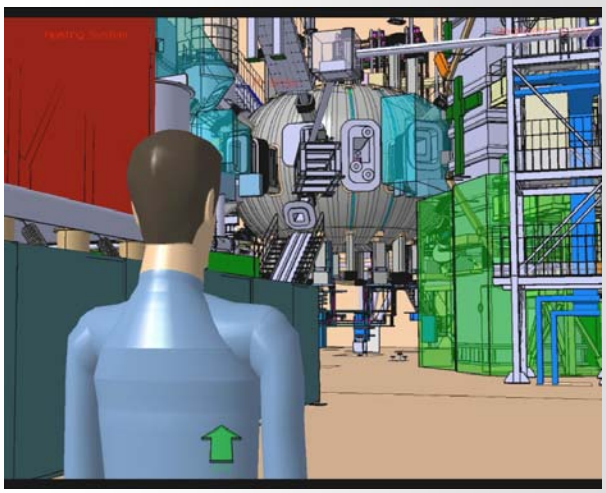
Movie 1 Flythrough of Torus Hall

All the components for JT-60SA have been drawn with the 3D CAD system. Recently, the CAD drawings were integrated, and now you can see how the completed JT-60SA will look when it is placed in the Torus Hall at JAEA Naka Fusion Institute in Japan.

In Movie 1, you can see JT-60SA from above, and have a closer look at it and its surrounding area. You will see most of the main components such as the Cryostat, Vacuum Vessel (VV), Toroidal Field (TF) and Equilibrium Field (EF) coils, Central Solenoid, Thermal Shield, heating systems, diagnostic systems, power supply feeders and so on.

In Movie 2, you can go inside the VV and see the detail. In this tour, the TF and EF coils, Thermal Shield and Cryostat are omitted for your convenience.

Click the above pictures or go to the JT-60SA website, and enjoy the virtual tours of JT-60SA!



Movie 2 Flythrough inside Vacuum Vessel

Technical specification of Toroidal Field coil power supply

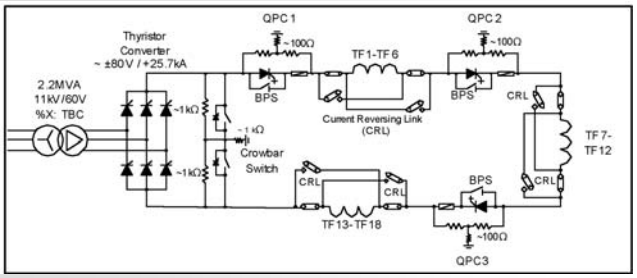


Fig.1

The JT-60SA Toroidal Field Coils (TFCs) are composed of 18 superconducting coils with a total inductance of 3.1 H. To limit the coil voltage insulation to ground, the TFCs are grouped in three blocks interconnected through three Quench Protection Circuits (QPCs) (Fig.1).

Usually, the TFCs are energised at the beginning of each working day (ramp up time ~ 20 min.) and remain energised also between one plasma shot and the next. As a consequence the TFC PS system is designed for continuous operation. Fig.1 shows the main features of the PS, consisting of a 6-pulse, two quadrant thyristor bridge. TFC current can be reversed in the load using the current reversing link.

In the case of a quench, all TFC QPCs are required to operate simultaneously a TFC current fast discharge including a total dump resistance of 0.33 Ω in the circuit. In order to prevent possible high overvoltages across the TFC, in case of a fault in the PS during a fast discharge, the crowbar is always switched on in case of QPC operation while the converter is operated in inverter mode.

Detailed computer simulation activities are on-going, both in JA Home Team (HT) and EU HT, to define the proper values of the grounding resistances in the crowbar switch and in the QPC. These values should be such as to allow:

1) ground fault current detection (with and without QPC operation) in the 100 mΩ shunt resistors between the coil casing and ground (cryostat base),

2) voltage limitation across coil insulation to <1.4 kV in normal operation,

3) limitation of ground current to <30 A even in the case of a fault to ground.

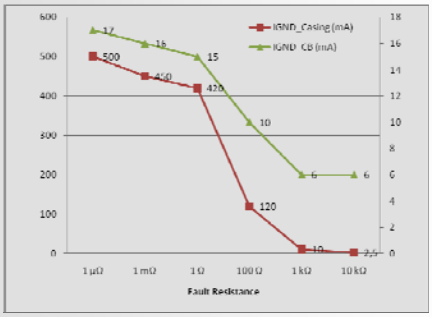


Fig.2 (a)

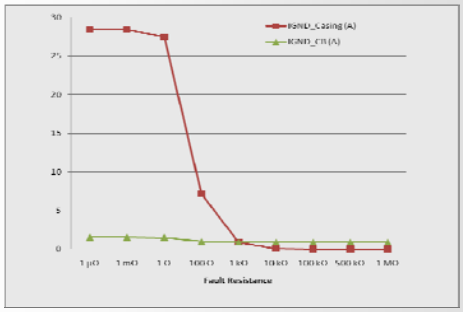
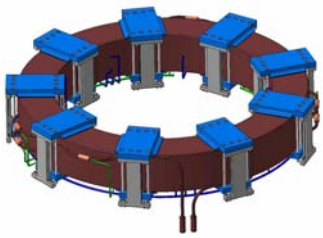


Fig.2 (b)

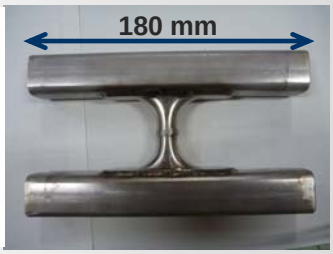
Fig.1 shows a possible set of resistances complying with the previous requirements on the basis of preliminary results of an EU HT simulation Fig.2 shows ground fault current detected in the shunt resistor (IGND_casing) and in the crowbar resistor (IGND_CB), without (a) and with fast discharge (b), vs fault resistance. In all cases the coil voltage to ground is <1.4 kV and the total ground current <30 A. An electrical model of one TFC has been developed by the EU HT to estimate the voltage distribution among the coil turns during a fast discharge. This voltage has been checked to be in line with the coil insulation specification.

Presently, the technical specifications of the TFC PS have been formally agreed among JA HT, EU HT and Project Team, while the above-mentioned grounding resistances are expected to be agreed soon to fully define the entire TFC PS system .

Helium inlet samples examined



Bird's eye view of EF coil



Test sample for compressive strength

In order to prevent the EF coils from overheating, supercritical helium will be used for JT-60SA. The blue line, shown in the above picture on the left connecting to the EF coil, is the helium feeder line.

To establish the manufacturing process of helium inlets for the EF coils, two inlet samples were prepared in order to examine their tensile and compressive strength. Twice the expected tensile or compressive loads in operation were applied to the samples 18,000 times in liquid nitrogen. After the tests the appearance was inspected, and no defect was found.

Further inspection to search for internal defects is going to be carried out at the manufacturer's factory using X-ray imaging, and a helium leak test is going to be performed as well.

Meetings

Topical Meeting on Technology of Fusion held in Las Vegas, USA

19th Topical Meeting on the Technology of Fusion Energy (TOFE), organized by American Nuclear Society, was held in Las Vegas, U.S.A. from 7 to 11 November. T. Hayashi, a member of the JA HT gave a presentation regarding the remote handling system, and two other JA HT members had poster presentations about the JT-60SA real time control system and real time diagnostic signals acquisition system respectively.

Visits

On 20 October, K. Lackner, a member of the EU HT, came to Naka Fusion Institute in order to discuss the JT-60SA Research Plan for future exploitation of JT-60SA. He reported that a framework for discussing the research plan has been constructed in the EU, and discussions will be started soon in the fusion research communities.

From 18 to 29 October, A. Ferro, another member of the EU HT, also came to Naka Fusion Institute, and had discussions with the members concerned regarding the Power Supply (PS) for Resistive Wall Mode (RWM) control. They evaluated the shielding effect of the stabilization plate in terms of RWM control.

Calendar

December 9-10, 2010
10th Technical Coordination Meeting
Cadarache, France

December 15, 2010
8th Meeting of the BA Steering Committee,
Madrid, Spain

March 23, 2011
8th Meeting of the STP Project Committee
Naka, Japan

April 13-14, 2011
11th Technical Coordination Meeting
Japan

Local

On 23 October, ahead of 26 October known as “the day of atomic energy” in Japan, Naka Fusion Institute organized an annual fair to introduce its activities to the public.

The event was very successful, attracting more than 1,000 visitors. The main building was decorated with a banner with a full scale drawing of JT-60SA (cross-sectional view), and the visitors enjoyed various attractions including a photo exhibition of JT-60 from the photo book “Build the future” by Joe Nishizawa.

Joe Nishizawa is a well-known photographer in Japan focusing on science and industrial technology as the key elements for building the future. His great works gave the visitors a rare glimpse of JT-60 from various viewpoints, and introduced them to the main features of this next-generation energy source.

JT-60, which achieved countless world records over 23 years, is being disassembled to be reborn as JT-60SA in six years.

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/