JT-60SA Newsletter
No. 45, 30 September 2013

Headline

Manufacturing of TF coil casings components started

Elbows for TFC casings with the PL, ENEA, F4E and Walter Tosto SpA representatives

ENEA representative explaining assembled elbows to the PL

ENEA contributes “in kind” to the Broader Approach program by manufacturing, among others, 18 JT-60SA toroidal field coil (TFC) casing components. The supply is provided by the contract between ENEA and Walter Tosto SpA.

In this context, S. Ishida, the JT-60SA Project Leader (PL), visited Walter Tosto SpA Company to personally verify the progress of the manufacturing activities of the JT-60SA TFC casing components on 19 September, 2013 (see figures). The first activity of the contract, consisting of the completion of the conceptual and detailed design prior to mock-up production and delivery, was completed successfully.

The subsequent activities of the contract, which consist of the completion of three sets of coil casing components, are currently in progress. Specifically, each set of casing components is made of a straight leg, 7.5 m long, with two elbows at the end, a curved leg, with a mean radius of about 4 m, three 15-mm-thick covers for the final inboard closure of the coils, and a number of miscellaneous smaller components that will be fitted during coil integration. Straight and curved legs weigh each more than 4.4 t and are equipped with several brackets and structures needed for the assembly in the torus hall.

External saddle jig for TFC casings under machining with the PL, ENEA, F4E and Walter Tosto SpA representatives

Curved "Spider" jig for TFC casings with the PL, ENEA, F4E and Walter Tosto SpA representatives

Moreover the components contain the chamfers defined according to the coil manufacturer's indications - due to tight tolerances a reverse engineering approach needed to guarantee matching between curved and straight legs has been adopted. The material chosen for the casing components is a modified AISI 316L.

Concerning the first three sets, the current status of manufacturing is described below:

- three straight parts of the straight legs are already welded;
- two of six elbows of the straight legs are under welding and the remaining four are in preparation for welding;
- components of three curved legs (six wings and three bases) are ready to be machined and assembled for welding.

The assembly of the various components of the straight leg and curved leg requires the use of dedicated jigs which have been studied, developed and manufactured by Walter Tosto SpA in parallel with the manufacturing activities of the casing components.

The completion of the three coil casings is foreseen before the end of 2013 with the shipment to the two coil manufacturers: one for ASG Superconductors in Genoa (Italy) and two for Alstom in Belfort (France).

The visit of the PL was concluded with a tour through the different WT workshops involved in the JT60-SA project with a dedicated description of each machine.

News

Winding of CS in progress

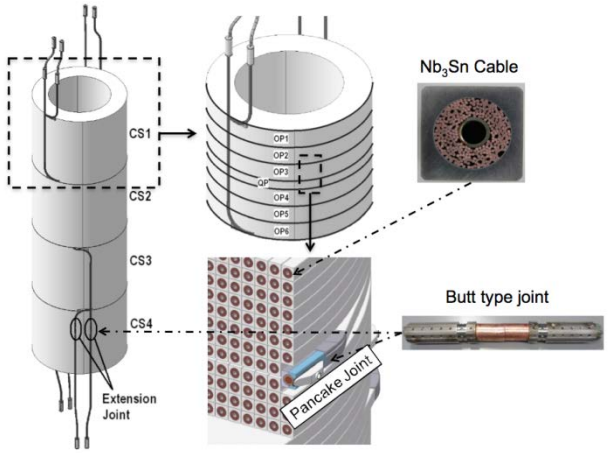


Figure 1: Schematic view of JT-60SA CS

Figure 2: Winding of first OP for JT-60SA CS

The central solenoid (CS) consists of four 2 m diameter and 1.6 m high modules. Each CS module contains 6 octa-pancakes (OP) and a quad-pancake (QP) (Figure 1). The pancakes are wound using Nb_3Sn conductors and connections between pancakes use a butt-type joint. The CS model coil was successfully qualified with a 30 kA charging test at 4 K (Newsletter No.43). There was no degradation of conductor performance and abnormal resistance in the joint. The winding of the first OP (OP2 for CS1) was therefore started in series production (Figure 2).

On 27 August, S. Ishida, the JT-60SA Project Leader (PL), visited the manufacturer's factory during the manufacturing of the first CS module in Hyogo prefecture, Japan (see Figures 3 and.4). The PL was therefore able to confirm that the manufacturing process, with a high degree of ±2 mm in radial accuracy (allowable manufacturing accuracy is ±6 mm), had been qualified during this critical-path winding process. He was also convinced that the manufacturing process will ensure the procurement of the CS as scheduled.

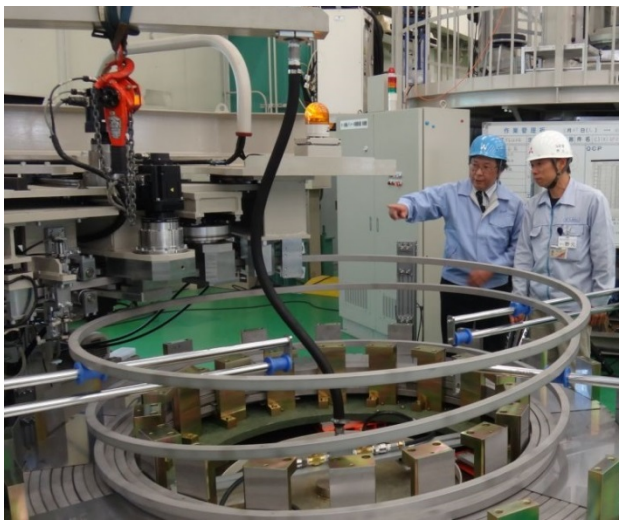


Figure 3: PL confirming the winding process

Figure 4: PL and representatives of the CS manufacturer

News

Superconducting conductor manufacturing for EF coils and CS

Jacket tube being welded at the Naka site

The superconducting conductor used for 6 equilibrium field (EF) coils and 4 modules of the central solenoid (CS) are manufactured in the superconducting conductor jacketing building at the JAEA Naka site. The length of conductors is changed to fit each coil size. The longest conductor length is 551 m and the total length of all conductors is 44 km.

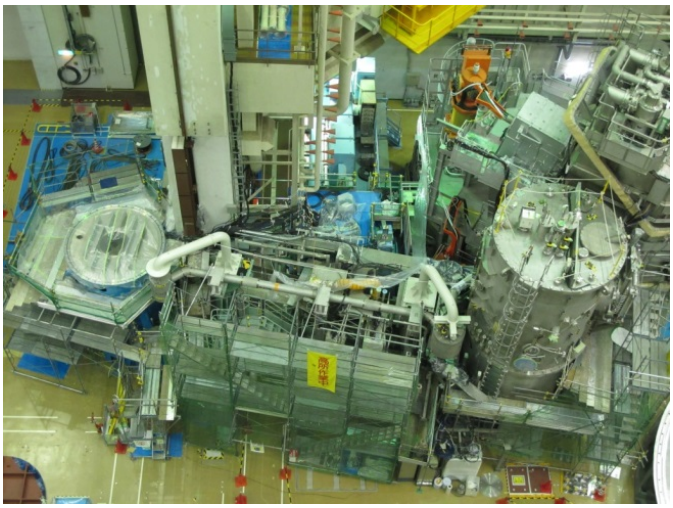
In the manufacturing process, a stainless steel “jacket” tube (7 m or 13 m long) is welded to make it longer, and a superconducting stranded cable is pulled into the jacket. The combined jacket and cable is compressed to form one complete superconducting conductor.

A total of 42 superconducting conductors (out of 92) have been manufactured since the manufacturing was started in February, 2010. Using the completed superconducting conductors, one EF coil (EF4) was completed and two EF coils (EF5 and EF 6) and one CS module (out of 4) are now being manufactured.

The remaining 50 superconducting conductors will be completed by the end of the year 2015 and they will be used for the three remaining EF coils (EF1, EF2 and EF3) and three CS modules.

News

N-NBI modification progressing



Neutraliser cell and ion source tank removed from the N-NBI system for modification

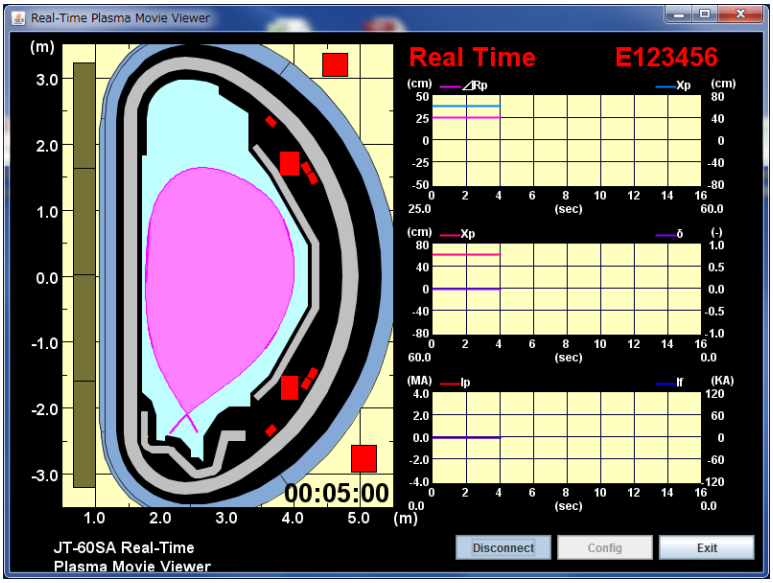
The modification work of the negative ion based neutral beam injection (N-NBI) system, a part of the construction work for JT-60SA, has been started by lowering the beamline injection position this past July (Newsletter No. 43) and it is still ongoing. As the next step of the modification work, replacing the base frame with a shorter one (shortened by 0.6 m) has been started after the neutraliser cell had been temporarily removed.

In addition, parts and peripheral devices in the lowest stair, which were located in the centre of the neutraliser cell and on the ion dump tank side, were also removed, and the one supporting column, which supports the neutraliser cell, was replaced with a newly rebuilt and shorter supporting column.

The foundation skirts of the newly rebuilt ion dump tank and the ion source tank will be replaced and the neutraliser cell has been installed in September. Subsequently, the laser beam axis will be confirmed and a leak test for the whole beamline will be performed.

News

Development of plasma cross-section drawing system launched



Plasma cross section drawing system (display screen)

The construction of the data control system for JT-60SA operation is underway in parallel with the design and manufacture. Currently, the development of the plasma cross-section drawing system has been started. This system will be used to determine the position and shape of the plasma cross section inside the vacuum vessel.

The data transmission network, which transferred the last closed flux surface data for JT-60U from the existing real time plasma video transmission server (used for JT-60U) to the client PC (general-purpose PC), has already been established. Using this transmission network, a drawing test was performed. The software operated without any problems and it is expected that it can be reused for JT-60SA (see figure).

In the future, other existing functions will be examined to check their reusability, and the system configurations including the real time drawing system and the real time plasma video transmission system will be checked.

Meetings

ISFNT-11

The JT-60SA oral presentation made by E. Di Pietro

A JT-60SA poster session presentation (T. Hayashi)

The 11th International Symposium on Fusion Nuclear Technology (ISFNT-11) was held at Palau de Congressos de Barcelona in Spain, from 16-20 September 2013. The symposium focusses on both near-term fusion devices and long-term reactor technologies with special attention to science, engineering, experiments, facilities, modelling, analysis, design and safety. The program consisted of plenary sessions, oral and poster presentations. There were over 800 participants and about 530 presentations in total were given at the conference.

E. Di Pietro from F4E orally presented the overview of JT-60SA construction, and remarked that JT-60SA is progressing steadily towards the objective to achieve first plasma in March 2019. The audience listened with interest and the presentation was well received.

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

- Oral presentations (2)

- E. Di Pietro from F4E, on the overview of engineering design, manufacturing and assembly of the JT-60SA machine;
- Y. Ikeda from JAEA Naka, on the safe disassembly and storage of radioactive components of JT-60U Torus / Disassembly of JT-60 for JT-60SA.

- Poster presentations (3)

- T. Hayashi from JAEA Naka, on development of the remote pipe cutting tool for divertor cassettes in JT-60SA;
- P. Rossi, from ENEA Frascati, on technical aspects and manufacturing methods for the JT-60SA toroidal field coil casings;
- S. Nakamura from JAEA Naka, on infrared thermography inspection for mono-block divertor targets in JT-60SA.

Local

Frascati's research centres

Aerial view of ENEA in 1960s

Aerial view of ENEA in 2005

Since the 1950s some of the most important European centres of scientific research developed within a radius of a few kilometers, in the area of Frascati, south-east of Rome and Monte Porzio Catone. Indeed, this area is hosting the Italian National Agency for new Technologies, Energy and Sustainable Economic Development (ENEA), the laboratory of the National Institute for Nuclear Physics (INFN), the European Space Research Institute (ESA-ESRIN), the Institute of Astrophysics and Planetary Space (INAF), the Italian National Research Council (CNR), and the University of Tor Vergata. Frascati's research pole became even larger during the 1980s when in the neighbouring area the Italian National Research Council (CNR) loaned from the University of Tor Vergata a surface of about 28 hectares, becoming one of the largest research areas of CNR to which belong several research bodies and laboratories, namely:

I.D.A.S.C. (Institute of Acoustics and Sensors "OM Corbino")
ISAC (Institute of Atmospheric Sciences and Climate)
I.F.T. (Institute of Translational Pharmacology)
I.S.M. (Institute of Structure of Matter)
I.I.A. (Institute of Atmospheric Pollution)
I.M.M. (Institute of Microelectronics and Microsystems)
I.S.C. (Institute of Complex Systems)
I.T.I.A. (Institute of Industrial Technologies and Automation)

ENEA (main, Frascati, fusion)
The Italian National Agency for new Technologies, Energy and Sustainable Economic Development is the national institution for research focussed in the field of energy, environment and new technologies. Since its very foundation, at the end of the 1950s, ENEA played an important role in research on plasmas, which then evolved towards more complex physics, technology and engineering systems.

Beside other activities on renewable energy sources and energy efficiency, climate and environment, safety and human health, as well as new technologies, ENEA performs R&D on nuclear fusion and fission. At present, activities are mainly focussed on research and development of advanced nuclear systems for innovative production plants. Moreover ENEA's research is particularly centred both on magnetic confinement – with activities relating to plasma physics and development of reactor technologies – and on inertial confinement. All these activities are part of the EURATOM nuclear fusion program. As far as plasma physics for magnetic confinement is concerned, ENEA performs specific tests with the Frascati Tokamak Upgrade (FTU). With regard to technologies, since the 1980s in the Frascati Labs many nuclear fusion technologies have been developed based on the most consolidated laboratory knowledge which could also interest and involve the national industry for applications far beyond the ones specific to nuclear fusion. The lines developed within the laboratories have been dedicated mainly to superconducting magnets, high-heat-flux plasma-facing components, materials, remote handling, neutronics and nuclear data, liquid-metal technology, and safety. Within nuclear fission, ENEA plays an important role for medium- and long-term problem solving related to both the availability of fuel resources and reducing long-life radioactive wastes, qualification of nuclear components and systems, ionizing radiation metrology, and radiation protection. ENEA hosts the National Contact Point for the transport of radioactive materials and the Integrated Service for the management of non-electro-nuclear radioactive waste.

INFN
The Italian Institute for Nuclear Physics (INFN) is the Italian research agency dedicated to the study of the fundamental constituents of matter and the laws that govern them, and is under the supervision of the Ministry of Education, Universities and Research (MIUR). It conducts theoretical and experimental research in the fields of subnuclear, nuclear and astroparticle physics. All of INFN's research activities are undertaken within a framework of international collaboration, and in close collaboration with Italian universities on the basis of solid academic partnerships. Fundamental research in these areas requires the use of cutting-edge technology and instruments, developed by INFN at its own laboratories and in collaboration with industry. Groups from the Universities of Rome, Padua, Turin, and Milan founded the INFN on 8 August 1951 to uphold and develop the scientific tradition established during the 1930s by Enrico Fermi and his school, with their theoretical and experimental research in nuclear physics. In the latter half of the 1950s INFN designed and built the first Italian accelerator, the electron synchrotron developed in Frascati, where its first national laboratory was set up. During the same period, INFN began to participate in research into the construction and use of ever more powerful accelerators being conducted by CERN, the European Organisation for Nuclear Research, in Geneva.

Around 1960, INFN started the development of a very new accelerator. Once ADA started working in 1961, the creation of the ADONE ring began immediately after. The early experiments on ADONE paved the way for a new era in the knowledge of structure of the particles making up the atomic nuclei. Today INFN have a new circular accelerator of intersecting rings of electrons and positrons, DAFNE, that is situated in the ADONE building. DAFNE has an energy below one GeV but a very high luminosity, enough to allow experiments, like KLOE and FINUDA, of elevated precision on fundamental ideas of particle physics.

ESA-ESRIN
The European Space Research Institute, known as the the European Space Agency (ESA) Centre for Earth Observation, is one of the five ESA specialized centres situated in Europe. Located in Frascati, ESRIN was established in 1966 and first began acquiring data from environmental satellites.

Earth Observation data has grown in importance as more and more international and national agencies recognize the many uses which this data can have. Satellites for Earth observation keep a constant watch over the Earth and the data they provide help us to safeguard the planet.

CNR
The Italian National Research Council (CNR) is a public organisation with the duty to carry out, promote, spread, transfer and improve research activities in the main sectors of knowledge growth and of its applications for the scientific, technological, economic and social development of the country. CNR is distributed all over Italy through a network of institutes aiming at promoting a wide diffusion of its competences throughout the national territory and at facilitating contacts and cooperation with local firms and organisations. CNR are divided into macro areas of interdisciplinary scientific and technological research, concerning several sectors: medicine, biotechnology, environment and land, materials, information and communications, advanced systems of production, judicial and socio-economic sciences, classical studies and arts.

Calendar

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

November 5-8, 2013
9th Asia Plasma and Fusion Association Conference (APFA-9)
Gyeongju City, Korea

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

February 26-27, 2014
19th Technical Coordination Meeting (TCM-19)
Garching, Germany

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 hisato.kawashima@jt60sa.org.

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