JT-60SA Newsletter
No. 80, 31 August 2016

Headline

First TF coil - ”Annie” - arrives at Naka site

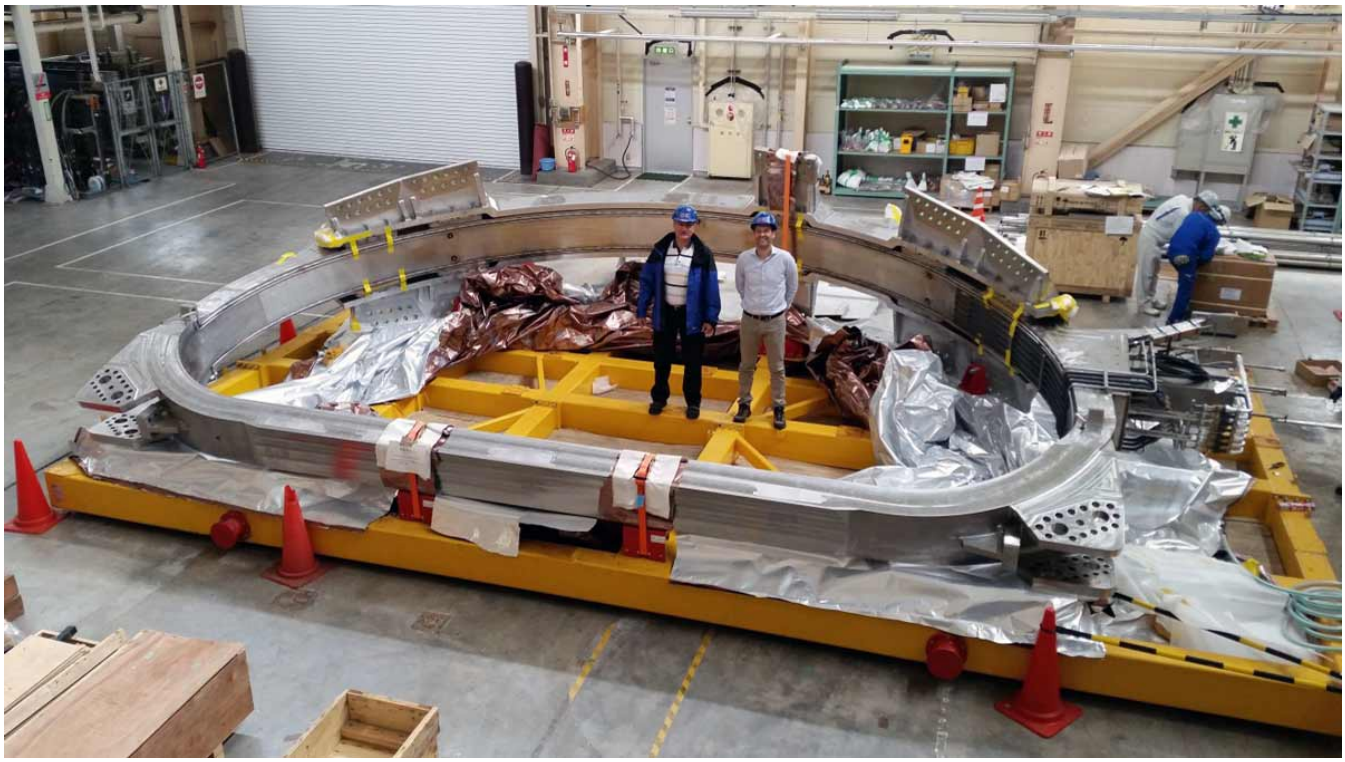

Figure 1: TF coil in the engineering experiment building at the QST Naka site after its packaging has been removed

Early on the morning of 20 July 2016, the first toroidal field (TF) coil arrived at the JT-60SA site in Naka, Japan.

The JT-60SA TF coil system consists of 18 D-shaped superconducting coils. The overall height, width and weight of a single TF coil (excluding its gravity support) are about 7.5 m, 4.5 m and 19.7 t, respectively. The core of the coil is the winding, 6 double pancakes, each of 12 turns, making 72 turns of niobium-titanium cable-in-conduit conductor (CICCs) with a total length of 1368 m. It is capable of carrying a current of 25.7 kA under a maximum magnetic field of 5.65 T, when cooled down to 4.4K by a forced flow of supercritical helium. The winding is enclosed in a casing of stainless steel, providing necessary mechanical strength when connected to the adjacent coils. Finally, an outer intercoil structure (OIS), which is also a part of the TF coil mechanical structure, completes an entire TF coil.

The design of the TF coils was developed and validated by the collective effort of the EU Home Team. The manufacturing involved 2 years of extensive industrial development to validate the techniques and prepare the production lines, before the actual production started in 2014. This first TF coil number 10 was manufactured by the General Electric Company (formerly Alstom S.A.) in Belfort, France (“10” represents the coil number in the overall numbering system of JT-60SA). The coil winding was made of CICCs supplied by F4E, utilising strand produced by the Furukawa Electric Co., Ltd. (Japan), and cabling/jacketing by the Italian Consortium for Applied Superconductivity S.C.r.l. (Italy). The casings were provided by ENEA through a contract with Walter Tosto S.p.A (Italy). The OIS was provided by CEA through a contract with SDMS (France).

Coil 10 was tested at the TF coil cold test facility at CEA Saclay (France), which includes some important components provided by SCK•CEN (Belgium). The coil 10 was then named “Annie” after she passed the tests successfully.

Eventually, Annie was assembled with the OIS at the CEA Saclay pre-assembly facility. After a final dimensional check, she was packaged in the dedicated transportation frame for departure.

Well protected for her final trip, “Annie” left Saclay by truck on 17 June, and the port of Zeebrugge, Belgium on 29 June 2016. After a voyage of more than 10,200 miles, she safely reached the port of Hitachi, Japan on 12 July 2016. After customs clearance and inspection at the port, and travel by night because of the large transport, she reached the QST Naka site, the final destination, on 20 July 2016.

She has been safely placed in the engineering experiment building at the QST Naka site. She is now undergoing incoming acceptance tests and being prepared for assembly.

The arrival of ”Annie”, which is soon to be followed by her sisters’, is an important achievement for the JT-60SA project in reward for the dedication of F4E and the European laboratories and industries, which have enthusiastically participated in this challenging enterprise.

Figure 2: TF coil being carried in the engineering experiment building

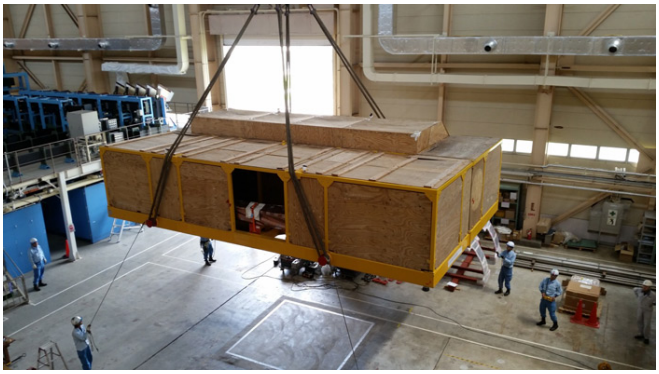

Figure 3: TF coil being positioned in the engineering experiment building

Figure 4: Preliminary inspection on the TF coil in progress (close-up of coil terminations)

News

Auxiliary power networks and piping for QPC completed

Completed auxiliary power networks and piping for the PF-QPCs (in the rectifier room on the 1st floor of the JT-60 rectifier building)

Completed auxiliary power networks and piping for the TF-QPCs (in the active beam line PS room on the 2nd floor of the JT-60 main building extension)

One of the Japanese contributions to the JT-60SA project, the development of the EU-JA interface systems for the quench protection circuits (QPCs), was completed in June 2016. The systems include auxiliary power networks, protective earthing networks, raw cooling water piping, and compressed air piping (see figures).

13 QPC units (10 for the poloidal field (PF) coils and 3 for the toroidal field (TF) coils) were delivered from Italy to the QST Naka site in 2014, then installed and tested on the site in 2015 by Europe. These interface systems connect each QPC unit to the site auxiliary systems, which consist of the reused JT-60 original auxiliary systems and the components newly procured by Japan.

After the detailed design and material procurement phases from September 2015 to February 2016, the on-site cabling and piping work was carried out from March to June 2016. The successful results of the site acceptance tests confirmed that all the networks and piping, developed for the QPCs, complied with the technical specifications.

News

Celebration of French procurement held in Naka

Figure 1: Congratulatory speeches were delivered by Mr. Felix, Ms. Faury, Mr. Darchis, Mr. Tajima and Mr. Mori (from left to right)

Figure 2: Listening to the explanation about the PS systems in the rectifier building

At the QST Naka site, installation, assembly and commissioning of the JT-60SA systems and components are steadily progressing. Pre-commissioning of the cryogenic system has been carried out since October 2015. The power supply (PS) systems for the toroidal field (TF) coil and the equilibrium field coils 2 - 5 were delivered to the QST Naka site on 27 June 2016. The first TF coil, “Annie”, arrived at the Naka site on 20 July 2016. All of these systems and components have been procured under the responsibility of CEA in France.

On this occasion, a “Celebration of Steady Progress of Delivery, Installation and Commissioning of JT-60SA Components Procured by France” was held at the Naka Fusion Institute on 26 July. This celebration also had the aim of expressing gratitude for the hard work of European on-site workers. Therefore, all the European people, staying at the Naka site on that day, were invited.

After a welcome buffet lunch at the entrance hall of the JT-60 control building, the following people delivered speeches (in programme order, also see Figure 1):

- Mr. Masahiro MORI (Managing Director, QST)
- Mr. Sunil FELIX (Nuclear Counsellor, French Embassy in Japan)
- Mr. Yasuhide TAJIMA (Executive Director, QST)
- Ms. Maria FAURY (Director of International Affairs and Large Research Infrastructures, CEA)
- Mr. Kenichi KURIHARA (Director General of Naka Fusion Institute, QST)
- Mr. François DARCHIS (Senior Vice-President, Air Liquide Advanced Technologies)
- Mr. Hiroshi SHIRAI (Project Leader of the Satellite Tokamak Programme)
- Ms. Christine HOA (On-site manager for the Cryogenic System of JT-60SA, CEA Grenoble)

The participants then took a quick site tour. In the torus hall, they saw the JT-60SA vacuum vessel with 8 thermal shields (a total of 160° in the toroidal direction) mounted on it. In the rectifier building, they inspected the PS systems for the TF and EF2 – 5 coils being installed just at that time (Figure 2). In the engineering experiment building, they were pleased to meet "Annie" again for the first time since they had seen her off at the "ceremony for the preparation of the shipment of the first TF coil assembly to Naka" held at CEA Saclay on 6 April 2016 (Figure 3). Finally, they visited the compressor building and the refrigerator building to observe pre-commissioning of the cryogenic system (Figure 4).

Although it was only a short visit, all the participants recognised the steady progress of the JT-60SA project.

Figure 3: Reunion with the 1st TF coil "Annie" recently arrived at the Naka site

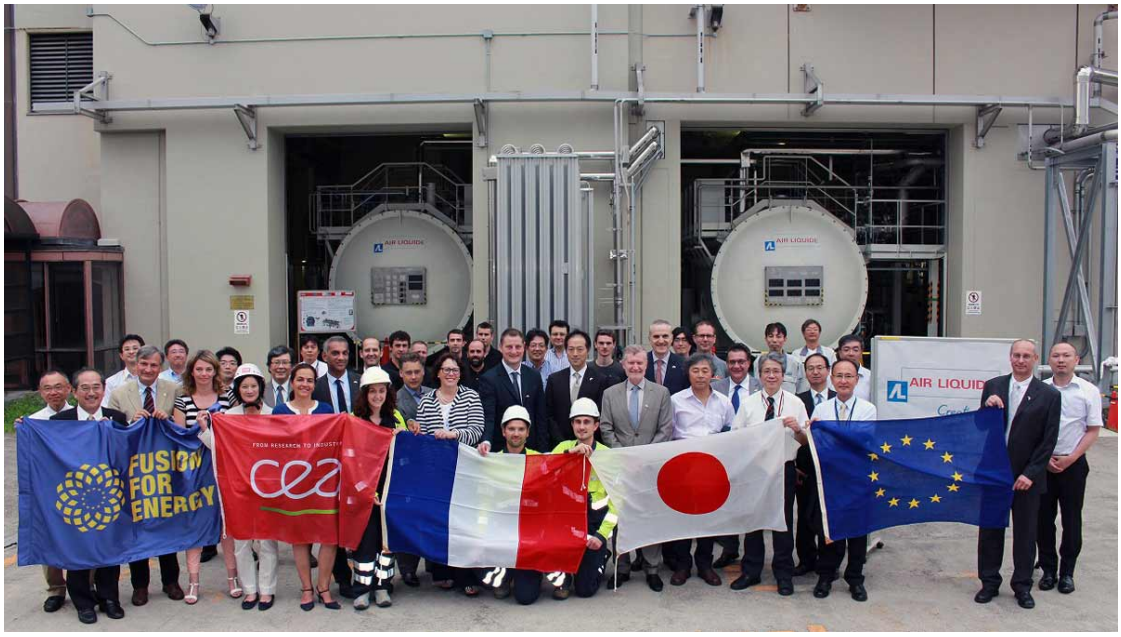

Figure 4: Group photo in front of the cryogenic hall

Meeting

25th TCM and 1st DRM for cryostat top lid held in Avilés

TCM-25

Figure 1: Handing some gifts to Ms. M. Monteserin, the Mayor of Avilés

Figure 2: TCM-25 in progress

Figure 3: Group photo in front of the CVBCS in production

The 25th Technical Coordination Meeting (TCM-25) was held on 6-7 July 2016 in Avilés, Spain, where Asturfeito S.A. (ASTURFEITO) is manufacturing the cryostat vessel body cylindrical section (CVBCS) of JT-60SA. A total of 62 experts

attended the meeting in person or via video-conference: 32 from the EU Home Team (France, Germany, Italy and Spain), 24 from the JA Home Team, and 6 from the Project Team.

Before the TCM-25 started, Ms. Marivi Monteserin, the Mayor of Avilés, delivered a warm welcome to all members of the JT-60SA Integrated Project Team (IPT). Y. Kamada, the JA Project Manager (PM), handed her a miniature of the JT-60SA tokamak and a letter of gratitude from M. Mori, the Managing Director of Fusion Energy Research and Development Directorate, QST (Figure 1).

At the beginning of the meeting, H. Shirai, the Project Leader (PL) of the Satellite Tokamak Programme, made an opening presentation. He explained the results of the latest Broader Approach Steering Committee held in April 2016 (BASC-18). The SC had expressed satisfaction with the progress and achievement in both European and Japanese procurements, as well as in assembly of the systems and components. The SC had commended the IPT for the positive test results of the first toroidal field (TF) coil in the cold test facility and the completion of shipping preparation to the QST Naka site, recognising this achievement as a major project milestone.

E. Di Pietro, the EU Deputy PM, explained the overall status of European procurements as an introduction. The JA PM reciprocated for Japan explaining, in particular, the progress of assembly and commissioning at the Naka site.

During the meeting, the status and actions in the following areas were reported and discussed: the manufacturing of TF coils, equilibrium field coils and central solenoid modules, CVBCS and cryostat top lid, thermal shields (TSs), high temperature superconductor current leads, magnetic shared components and power supply systems, assembly of the vacuum vessel (VV) system and VVTSs, pre-commissioning of the cryogenic system, plans of the integrated commissioning of the JT-60SA device, and configuration control models (Figure 2).

All participants visited the workshop of ASTURFEITO. They inspected the manufacturing progress of the CVBCS, admiring the high accuracy machining of the huge CVBCS (Figure 3).

Finally, the PL announced that the next meeting, TCM-26, would be held in Naka, Japan on 9-10 November 2016, and the TCM-27 would be held in Karlsruhe, Germany on 22-23 February 2017.

1st DRM for cryostat top lid

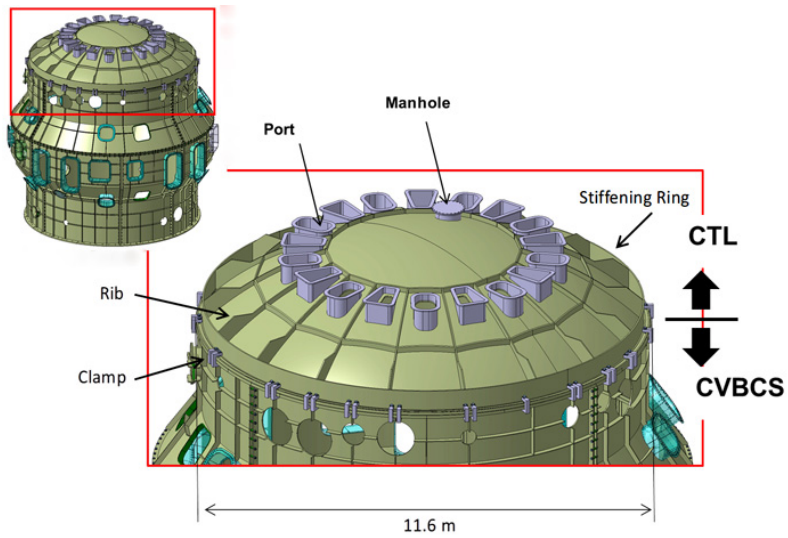

Figure 4: Bird's eye view of the CTL and CVBCS

Figure 5: Intensive discussion during the meeting

The Design Review Meeting (DRM) on the cryostat top lid (CTL, also see Figure 4) was held in Avilés, Spain on 5 July 2016 (the day before the TCM-25) with an attendance of 8 experts from F4E (Germany), CIEMAT (Spain) and QST (Japan).

The main objective of the meetings was to review the CTL design, including the structural analysis and technical specifications for its fabrication, to ensure a good interface with the CVBCS. After intensive discussion (Figure 5), the CTL design was approved by F4E, CIEMAT and QST without any pending issues.

Meeting

43rd EPS Conference on Plasma Physics

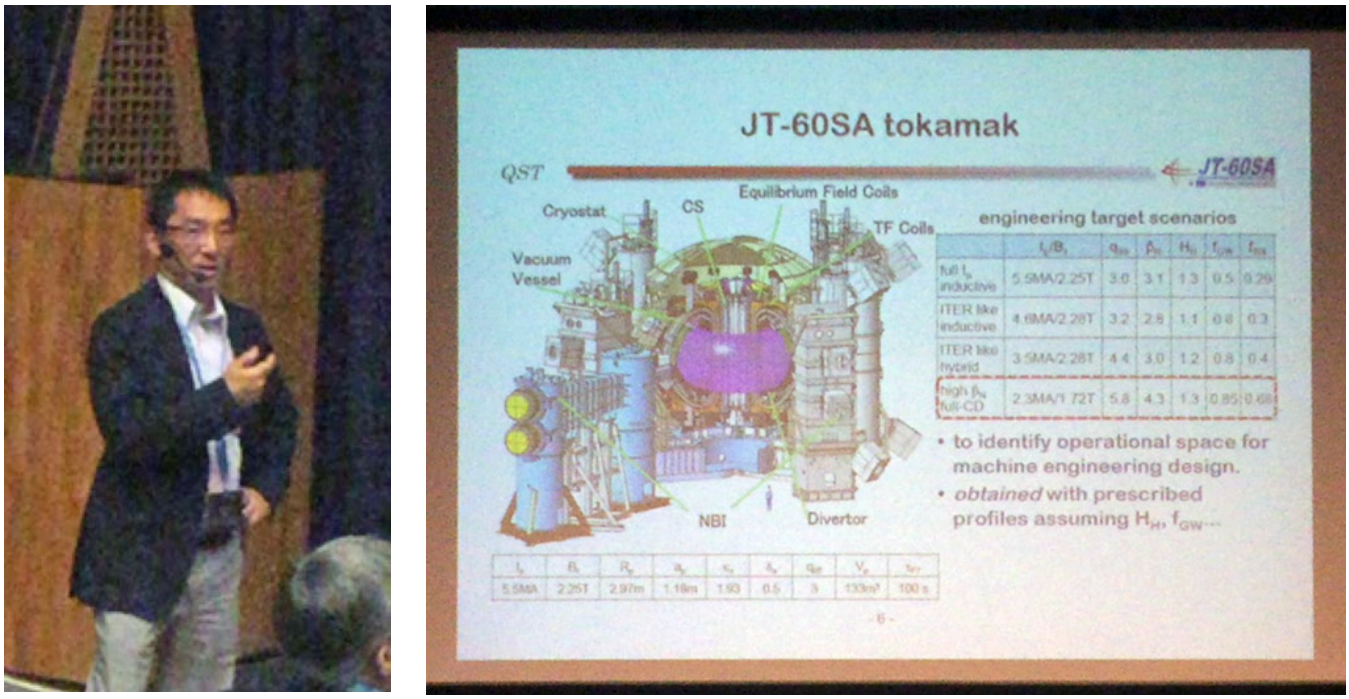

Figure 1: Mr. S. Ide giving an oral presentation about the modelling study for JT-60SA

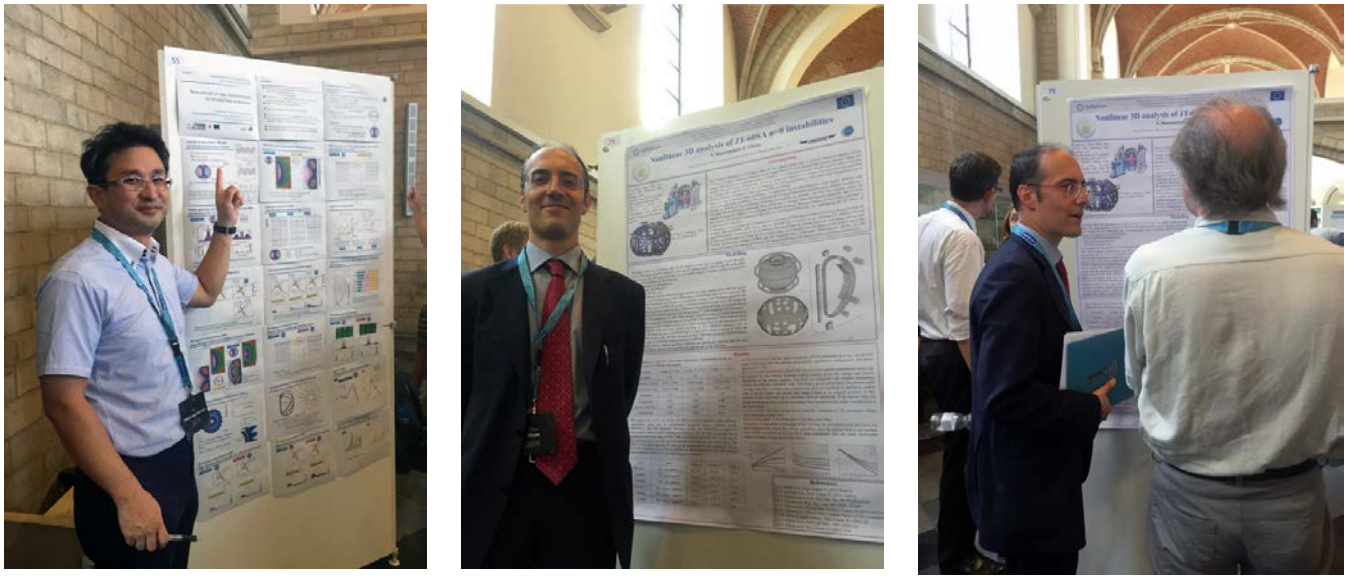

Figure 2: Poster presentations by Mr. G. Matsunaga and Mr. S. Guo (on behalf of Mr. L. Pigatto and Mr. S. Mastrostefano)

The 43rd EPS Conference on Plasma Physics, which is the largest conference in the fusion community, was held at KU Leuven in Leuven, Belgium, from 4 to 8 July 2016. More than 600 participants got together to present and discuss the latest progress in fusion research.

There were 4 presentations by members of the JT-60SA Integrated Project Team as follows:

- Invited oral presentation (1)
  - S. Ide from QST, on “Integrated modelling and validation of the physics models using tokamak experiments in EU and Japan for high beta tokamak physics”;

- Poster presentations (3)
  - G. Matsunaga from QST, on “New concept of edge stochastization by toroidal field modulation”;
  - L. Pigatto from Consorzio RFX, on “Resistive Wall Mode physics in JT-60SA high βn scenarios”;
  - S. Mastrostefano from ENEA/CREATE, DIEI, Università di Cassino, on “Nonlinear 3D analysis of JT-60SA n=0 instabilities”.

S. Ide orally presented results showing that the application of the validated transport model and self-consistent simulation platform, which were performed in both Europe and Japan, had progressed remarkably for integrated modelling, and predicted that JT-60SA plasmas, especially those with high βn (a measure of confinement strength), would be achieved with high quality (Figure 1).

These presentations attracted many participants and were well received.

The next EPS Conference on Plasma Physics will be held on 26-30 July 2017 in Belfast, Northern Ireland.

Meeting

PLM-57 held in Naka

PLs in front of the JT-60SA key contributor panels

PLM-57 in progress

Since 2008, the Project Leaders (PLs) of the 3 projects of the Broader Approach Activities: IFMIF/EVEDA, IFERC and the Satellite Tokamak Programme (STP), have held a meeting every 1 to 2 months. On 30 June 2016, the 57th Project Leaders Meeting (PLM-57) was held at Naka Fusion Institute.

This was the first PLM held in Naka, in which the 3 PLs: J. Knaster, N. Nakajima and H. Shirai, got together, since H. Shirai took over as STP-PL from S. Ishida in July 2014. For about 3 hours, they exchanged detailed information of each project and discussed key issues. They also discussed cross-project matters such as the remote experiment plan, network security policy and so forth.

It was decided that the next PLM (PLM-58) would be held on 18 August 2016.

Local

Avilés (Asturias, Spain)

Figure 1: Typical sight of Avilés town (at Galiana Street)

Figure 2: Camposagrado Palace

Avilés is an ancient city - actually there already existed some communities in the Palaeolithic era - although its present name has only been used since the Roman domination in Spain. The city had 2 different areas in former times: one surrounded by a wall (no longer existing), where the merchants used to live, the other across the harbour, where the fishermen had their coarse houses.

The merchant quarter is a medieval town organized just along 3 main streets: 2 parallel ones, La Fruta Street and La Ferreria Street, and another one perpendicular to both, Sol Street. Walking along 3 streets, you can see shady arcades, old churches and palaces from the 12th century (Figure 1). Buildings from the Romanesque, Gothic, Baroque periods can be enjoyed as well. The Camposagrado Palace is the most outstanding of these with a beautiful façade, built in the 17th century (Figure 2).

Moving away from the medieval area, you can even see Modernist buildings built in the late 19th or early 20th century by people who once emigrated to America and came back to the city at the end of their life.

The fishermen's area was outside the wall. Nowadays, it has become a very interesting quarter with nice squares and narrow streets. The ancient Sabugo Church makes the area look really lovely. Very close to it, Santo Tomás Church was rebuilt in the 19th century, because the old one could not accommodate the increased population in the area.

In the middle age, Avilés was the primary port of entry in Asturias. This old port is now El Muelle Park, built up on the wetlands which were reclaimed from the harbour by the residential area in the 19th century. The new port has been constructed close to this park on the west side of the estuary. On the city side of the port, there is a long promenade along the estuary, which allows visitors to enjoy walking (Figure 3). The port and industrial area are found on the other side of the estuary as well.

The current centre of Avilés is the Spain Square, where the City Hall dominates the 17th century square (Figure 4). There are a large number of restaurants and tapas bars in the area. Avilés offers tasty dishes prepared from seafood, meat and local garden products in a variety of ways.

In front of the City Hall, the square has a number of buildings with arcades. The Ferrera Palace and other constructions surround the beautiful Ferrera Park, the most peaceful place in Avilés (Figure 5).

Figure 3: Estuary of Avilés with the Niemeyer Centre on the right

Figure 4: City Hall

Figure 5: Ferrera Park

Calendar

5 – 9 September 2016
29th Symposium on Fusion Technology (SOFT 2016)
Prague, Czech Republic

11 October 2016
19th Meeting of the STP Project Committee (PC-19)
Naka, Japan

17 – 22 October 2016
26th IAEA Fusion Energy Conference (FEC 2016)
Kyoto, Japan

9 – 10 November 2016
26th Technical Coordination Meeting (TCM-26)
Naka, Japan

14 December 2016
19th Meeting of the BA Steering Committee (SC-19)
Madrid, Spain

Contact Us

The JT-60 Newsletter is released monthly by the JT-60SA Project Team.
Suggestions and comments are welcome and can be sent to newsletter@jt60sa.org.

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