# F4E NEWS

FUSION FOR ENERGY QUARTERLY NEWSLETTER

No. 8 - March 2012

## INDEX

# THE POLOIDAL FIELD COILS BUILDING IS READY!

## Ready, in line with specifications and delivered on time. The Poloidal Field (PF) coils building has proudly claimed the title of the first out of 39 buildings to be constructed on the ITER site.

The building that we have followed from day one during the last two years, witnessing the erection of its foundations, the hours put in by its workforce and the arrival of its equipment, has been completed!

The contract for the construction of the PF coils building was awarded to Spie batignolles in collaboration with Omega Concept and SETEC for a total budget of 40 million EUR. Energhia was entrusted with engineering supervision of the project. The design of the building started in January 2010 and the construction kicked off in July 2010, involving on average 100 workers.

The building covers an area of 12,000m$^2$ and measures 257 metres long, 49 metres wide and 18 metres high. It is supported by 62 columns of concrete and 34 steel roofing trusses. The floor slab is 40 cm thick and designed to withstand 42 tonnes per m$^2$. It hosts two bridge cranes with a lifting capacity of 25 tonnes and 40 tonnes respectively. In this building, the biggest Poloidal Field coils to be manufactured will be assembled and then travel a few metres on the ITER site until they reach the Tokamak building in order to be placed in the machine.

The handover ceremony in Cadarche, brought together F4E staff, main contractors and members of the ITER International Organization. It was an occasion of significant importance. According to Frank Briscoe, F4E Director, this was “a symbolic day for the ITER project and Europe’s commitment to deliver. Images of how this building would one day look once completed, appeared in several presentations over the last couple of years. We are now proudly standing in the first ITER building.” Professor Osamu Motojima, ITER International Organization Director General, took the opportunity to thank Europe for its efforts to deliver on time and acknowledged the fact that this milestone was a stepping stone in order to bring the energy of the sun closer to earth.

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01 Professor Osamu Motojima, DG of ITER International Organization and Frank Briscoe, F4E Director, inaugurate the PF coils building.

02 Representatives of the F4E and ITER IO teams involved in the construction of the PF Coils building with the main contractors.

# "HELIOS" SUPERCOMPUTER EXCELS IN ACCEPTANCE TESTS AND GETS READY TO PERFORM COMPLEX PLASMA CALCULATIONS.

## The supercomputer is operational according to schedule at the International Fusion Energy Research Centre (IFERC) hosted by the Japanese Atomic Energy Authority (JAEA) in Rokkasho, Japan.

The machine that was manufactured by Bull and whose mission it is to perform complex calculations for plasma physics and fusion technology, has passed its acceptance tests achieving 1,132 Petaflop LINPACK performance. The Computer Simulation Centre (CSC), where "Helios" operates, is an important component of Europe's contribution to the Broader Approach (BA), an agreement signed between Europe and Japan to complement the ITER project through various R&D activities in the field of nuclear fusion. The European participation to the BA is coordinated by F4E. The supercomputer was provided by France as a part of its voluntary contribution to the BA, through a contract between the Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA) and Bull.

The acceptance tests of the supercomputer were carried out between 13-22 December 2011 in Rokkasho, Japan. The tight construction schedule was successfully met offsetting any disruptions caused by the great East-Japan earthquake in March 2011. It's the first time such a large piece of equipment stemming from an international scientific collaboration, is procured by a European team and assembled in Japan. The installation of the equipment was completed in early December and by the end of the month a 1.132 Petaflops LINPACK[1] performance was achieved, ranking "Helios" on the fifth position of the TOP-500 November 2011 list.

The operation of the supercomputer will kick off with four high-visibility runs, otherwise known as "light-house projects", which are expected to shed light on plasma calculations. From January to March 2012, the four selected codes will run one at a time to test-drive the capacities of the supercomputer and achieve maximum performance. The first call for proposals has attracted high numbers from both European and Japanese researchers, and submissions are under review. It is expected that routine operation will start in April 2012.

Based on the number of proposals submitted to the first call, there has been an oversubscription by a factor of three of the computer's time, demonstrating the great interest from the European and Japanese fusion communities to use the supercomputer facility. The majority of proposals address issues related to plasma physics (turbulence, MHD, edge physics and integrated modeling) together with an important number of proposals addressing technology issues.

CEA-F4E CSC team standing between a section of the "Helios" supercomputer: from left to right, Jacques David, François Robin, Jacques Noé (CEA) and Susana Clement Lorenzo (F4E).

[1] The LINPACK benchmark is a measure of a computer's floating point rate of execution. It is the performance parameter used to classify the TOP 500 list of supercomputers.

# INTERVIEW WITH THE CHAIR OF THE EXECUTIVE COMMITTEE, LISBETH GRØNBERG

"With time F4E has managed to stand on its own feet and articulate a voice vis à vis ITER International Organization and the other Domestic Agencies. I strongly believe that the secret of F4E's potential is its workforce."

Mrs Lisbeth Grønberg, Chair of the Executive Committee

In July 2011 Lisbeth Grønberg was appointed Chair of the Executive Committee (ExCo), the body that brings together 13 external experts at least six times per year to offer advice among other things on the F4E procurement strategy and decide on the award of contracts and grants. In her previous capacity as Vice-Chair of the ExCo between 2007-2011, she had the opportunity to approve some of the very first contracts awarded by F4E and develop a good understanding of the complexities that underpin an international project like ITER. She is a veteran in Denmark's vibrant research scene, having worked since 1976 in different management positions of what used to be until recently Risø, the National Laboratory for Sustainable Energy. In her first interview with F4E News, she explains how F4E has changed over the years and presents the objectives that she has set for the ExCo.

F4E News: In July you were appointed as Chair of the F4E ExCo and before that you served as Vice-Chair. How has F4E evolved during this period?

LG: I have witnessed the establishment of this organisation from the very start. I have seen it growing in size, expertise and gaining confidence and maturity. At first, it felt a bit like a toddler taking its first steps, trying to figure out how to fulfil its mission; drafting its rules and mapping procedures in order to approve grants and contracts. With time F4E managed to stand on its own feet, articulate a voice vis à vis ITER International Organisation and the other Domestic Agencies, and deliver. I strongly believe that the secret of F4E's potential is its workforce. The members of staff that I have met are very professional and committed to their job. Obviously, there are teething problems in the start up phase of any organisation, even more so within the international context in which the ITER project is carried out, but I am pleased that F4E has managed to overcome them. I always perceive challenges as an opportunity to bring out the best of all of us involved in the project and try to go the extra mile to defy sceptics.

F4E News: The composition and mission of the ExCo has also changed. What in your view have been the most significant changes?

LG: In its early days the ExCo was dealing mostly with giving advice on the different rules and regulations by which F4E should work, and the standard Agreements for grants and contracts. Previously, when examining grants and contracts, a lot of the ExCo input came towards the end of the cycle leaving little space for strategic input. Now we are entering into a more strategic phase of the ExCo, as we are now also mandated to look into the procurement strategies in more detail. It definitely makes more sense to give our input for upcoming procurements and grants at an earlier stage before all decisions are cast in stone. One should also bear in mind that other bodies, like the Administration and Finance Committee, have stepped into the panorama and alleviated us from certain duties so that we can focus more on how to get ITER up and running with the support of industry and Associations.

F4E News: What is the main objective that you have set yourself as Chair of the Exco?

LG: The first objective that I have set is to lead through consensus. I am authorised to chair and co-ordinate our deliberations but I do not have a vote. Therefore, I attach particular importance to outcomes that are reached though debate and dialogue. Furthermore, I would like the ExCo members to feel ownership of this project and participate in shaping its course with their views. Finally, I would like this Committee to offer critical but constructive input. It is my aim to build a good team spirit where members feel comfortable enough to question the working method and propose alternatives.

F4E News: As Chair of the Exco you lead a group of 13 experts, coordinate their input and steer the decision-making process. Which part you enjoy most and which you consider the most challenging?

LG: One of the biggest challenges we face is a very trivial one, namely planning our ExCo meetings in order to ensure a quorum. Currently, according to the Rules of Procedure, we need to have 9 votes in favour out of 13 in order to approve a decision. For most of us working for the ExCo comes on top of "regular" jobs back home. So finding a date suitable to all of us requires a lot of planning and flexibility from the members. Ultimately, our meetings have a very busy agenda which literally keeps us busy without having enough time to connect on a more personal level. I will try to bring out the best of the group dynamics and instil a vivid working culture. This brings me to the part that I am mostly fond of in chairing the ExCo: the opportunity to work with an international team of people towards a long term goal. I have spent my entire career in the field of science, surrounded by novel ideas. ITER is no exception to this. The thrill of seeing this project getting built and knowing that we have all played a part in it is incredibly rewarding!

# EUROPEAN PARLIAMENT AND COUNCIL AGREE ON ADDITIONAL ITER FUNDING

The Council and the European Parliament have adopted an agreement to provide 1.3 billion EUR of additional financing for Europe's contribution to the ITER project over the next two years, as proposed by the European Commission.

Being a large and long term international project, ITER needs a more flexible mechanism to safeguard Europe's funding and commitment. Therefore, the European Commission has proposed to set up a "Supplementary Research Programme" under the Euratom Treaty for Europe's contribution to ITER the period between 2014 to 2018. The proposal is in line with the European Commission's Communication "A Budget for Europe 2020" that proposed to finance this contribution outside the Multi-annual Financial Framework ("MFF") after 2013. The Supplementary Research Programme will ensure that Europe is able to honour its international obligations to the ITER project.

According to the proposal the project will continue to be managed by F4E. The current financial and staff rules will continue to apply and the Commission will carry on representing the EU in the different ITER bodies. The functioning of F4E, its management and staffing as well as the general technical and administrative support will also be covered by the Supplementary Research Programme for the ITER project.

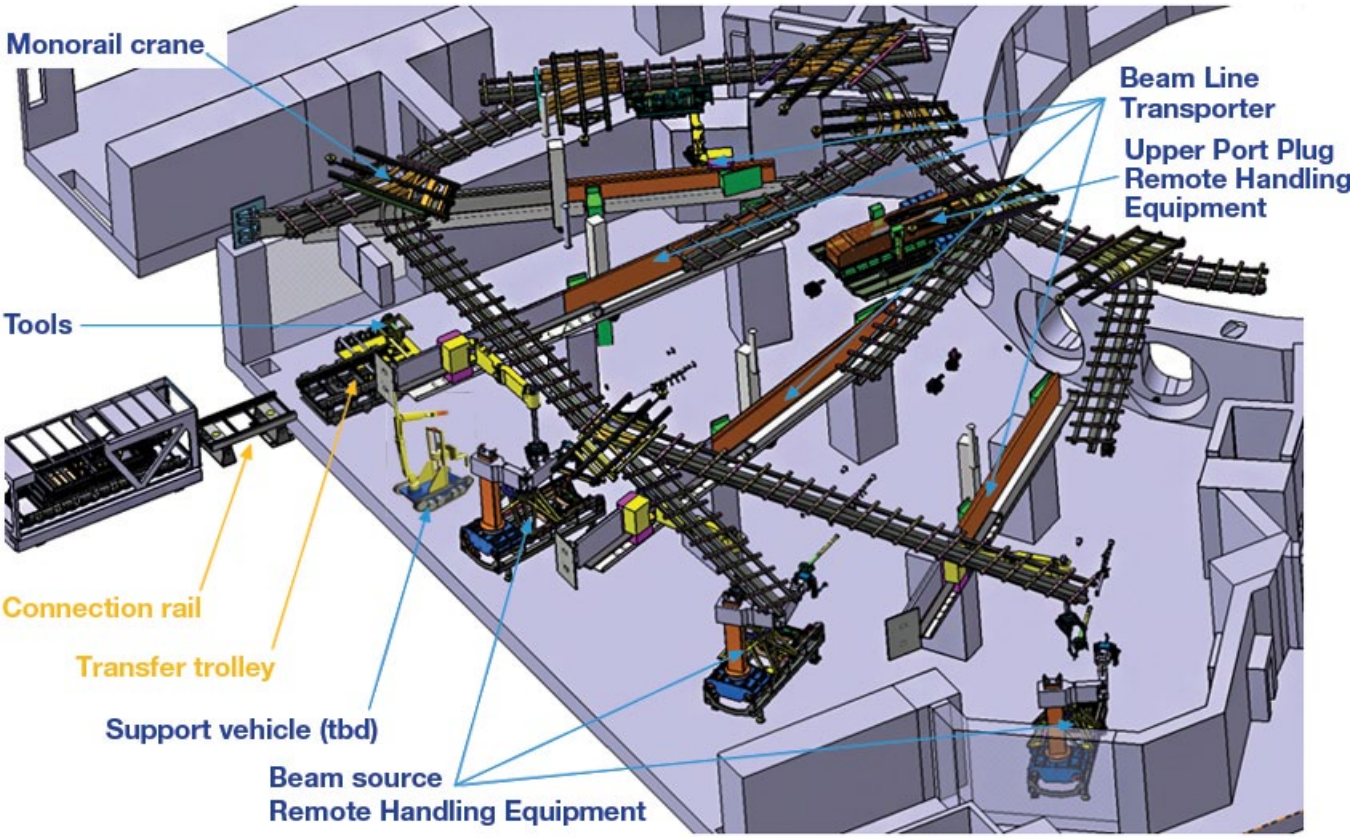
The activities of F4E, for the period 2014 – 2018, will be as follows:
(a) To provide the Euratom contribution to the ITER International Organization, including those Research and Development activities necessary for developing the basis for the procurement of the ITER components and the procurement of the ITER Test Blanket Modules;
(b) To provide the Euratom contribution to Broader Approach Activities with Japan;
(c) As appropriate, other activities in order to prepare the basis for the design of a demonstration reactor and related facilities.

The Supplementary Research Programme, with a duration of five years, will be adopted through a specific Council Decision.
For further information consult MEMO/11/938 on www.europa.eu

Aerial view of the ITER construction site, September 2011 © Altivue/ITER Organization

# HANDS ON REMOTE HANDLING

F4E has signed a contract to receive engineering support over the next four years in the field of remote handling with OTL, Assystem UK and CCFE for a budget in the range of 3.5 million EUR.




Neutral beam remote handling system

Mechanical, electrical, electronic and control systems engineering linked to remote handling systems and components will also be covered by the contract.

The work will be structured along the four packages for which Europe is responsible in this area: the divertor remote handling system, the cask and plug remote handling system, the in-vessel viewing system and the neutral beam remote handling system.

Furthermore, the framework contract could be used to verify the remote handling compatibility of other ITER systems like plugs and in-vessel components.

The scope of the contract is to support design and fabrication studies of remote handling equipment and their respective systems; industrial evaluation of remote handling concepts and solutions in the areas of remote maintenance and decontamination; radiation tolerance assessments of components and materials; review CAD models, technical specifications and safety evaluations.

The knowledge stemming from that contract is expected to be complemented by existing and future grants in the area of remote handling when needed.

When ITER starts operating, inspections or repair of any of the Tokamak components in the activated areas will be conducted by remote handling. Cutting edge technology underpinned by precision and reliability will be necessary to manipulate and replace components weighing up to 50 tonnes.

# ITER TOROIDAL FIELD (TF) COPPER CONDUCTOR DUMMY READY

ICAS, the Italian Consortium for Applied Superconductivity, bringing together ENEA, Tratos Cavi and Criotec, has completed in less than one year the commissioning of the jacketing line and the equipment needed for the manufacturing of the conductors for ITER and JT-60SA.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In the fields of Chivasso, 20 km outside Turin, a manufacturing facility has been erected to fabricate and carry out the rigorous qualification process for the conductors. Outside the facility, a platform measuring 800 metres has been assembled to guide the 10 tonne, 760 metre long TF copper dummy conductor in to the facility. The jacketing was completed after assembling all the sub-components provided by the different contractors. Tratos Cavi produced the cable which was then handed over to Criotec in order to insert it into stainless steel tube composed of 58 individual sections welded together.

Subsequently, the dummy conductor was compacted and spooled. Following the successful validation process, the conductor was packed into a 100 $m^3$ box for shipment to another facility in La Spezia (Italy), where the consortium responsible for the fabrication of the TF winding packs, would carry out trials.

As part of the TF conductor qualification, ICAS is expected to produce three TF dummy conductors. After the successful completion of the copper conductor, two super-conducting dummies will be fabricated within the first semester of this year. Once the qualification process is completed, ICAS will have to deliver 27 production lengths for the ITER TF coils.

01 The TF copper conductor dummy compacted and spooled in the facility
02 Inserting the cable in the tube along the jacketing platform

# 2011 HIGHLIGHTS FROM THE ITER CONSTRUCTION SITE

2011 has been the year that fundamentally transformed the ITER construction site in Cadarache. The designs of two key buildings have come to life and demonstrated even to sceptics that the collective commitment and determination of the ITER parties has paid off.

It's one of the first dawns of the year and we have decided to visit the ITER platform, located at one the highest points of the site, so as to observe the scale of progress. The activity is kicking off as the workforce resumes its tasks, the site is getting noisier and busier with trucks, cranes start moving materials and the first buildings stand out in what was until a year ago a field. So how did we get here?

F4E, managing Europe's contribution to ITER, is responsible for the financing and supervision of the construction of buildings, infrastructure and power supplies. A sequence of events starting with internal co-ordination for the drafting of specifications, the launch of procurement packages linked to the work on the site, awareness days with industry and SMEs, the signature of contracts, the deployment of resources on the site and steady supervision of contractors make up to the work behind the scenes.

After months of intense construction work the Poloidal Field Coils (PF) building is completed. Its impressive dimensions: 250 metres long, 45 metres wide and 17 metres high are a vivid reminder of the size of the coils that will be assembled here for the ITER machine. The cladding, insulation and the transportation of heavy equipment like the two cranes and the spreader have reached their final destination and have been assembled.

As we cross the site we arrive at the Tokamak complex, the heart of the ITER project. Only one year ago the excavation started with rock blast activities and bulldozers levelling the ground. In spring, what used to be an amorphous pit started transforming into the foundation of the Tokamak complex covered with a steel safety mesh in order to continue with the soil investigation activities and the treatment of rock joints. In summer we reached a breakthrough: the first steel reinforcement and the pouring of the first concrete. Two pumps were placed at the top of the Tokamak pit and for approximately ten hours 800m$^3$ of concrete were poured and leveled. This exercise was to be repeated 21 times in total in order to cover the entire surface of the Tokamak pit measuring 110 metres long and 80 metres wide, the equivalent to the footprint of a football stadium. In autumn, the plinths and anti-seismic bearings started populating the basemat exceeding 250 in total accompanied by the first glimpse of the of the retaining walls foundations.

The transformation of the site is only the beginning of what will follow this year. The signature of the site adaptations contract in August, is expected to deliver the necessary works on the ITER site in order to develop roads for the transport of material and equipment, extend power supply and water distribution, deliver the required amenities for a workforce of 3,000 people and streamline all protocols for safety, security and access to the site.

We will continue to bring you the latest news through images, clips and updates through Twitter and YouTube! To watch the two annual clips documenting the PF Coils building and the Tokamak complex progress during 2011 visit the multimedia section on our website.

The Tokamak complex in progress, October 2011

# 2010 F4E ANNUAL REPORT PUBLISHED

In November last year, the Annual Report was distributed to different stakeholders. The Annual Report offers a comprehensive account of all milestones achieved during 2010.
It provides readers with an overview of all activities on the operational and administrative side conducted by the organisation and highlights the major achievements of Europe's contribution to the ITER project.

F4E signed ITER Procurement Arrangements (PAs) with ITER International Organization (IO) for an equivalent value of 615 million EUR. In addition, 44 contracts and 23 grants were signed with industrial contractors and with European fusion laboratories for values of 826 million EUR and 8 million EUR respectively.

F4E also signed five Broader Approach PAs with the Japanese Domestic Agency for a value equivalent to 66 million EUR.

The main contracts signed with industrial contractors in 2010 include the contract for the Architect Engineer for the Buildings, the contract for the cabling and jacketing of magnet conductors, the contract for the Toroidal Field Magnet Winding Packs, and the contract for seven sectors of the Vacuum Vessel (each steel sector is 13 metres high and 6.5 metres wide).

Important achievements during 2010 include the production of all 62 tonnes of copper strand for the magnet conductor six months ahead of schedule as well as the first 8 tonnes of superconducting strand, and the fabrication of full-size mock-ups of the radial plates for the ITER magnets.

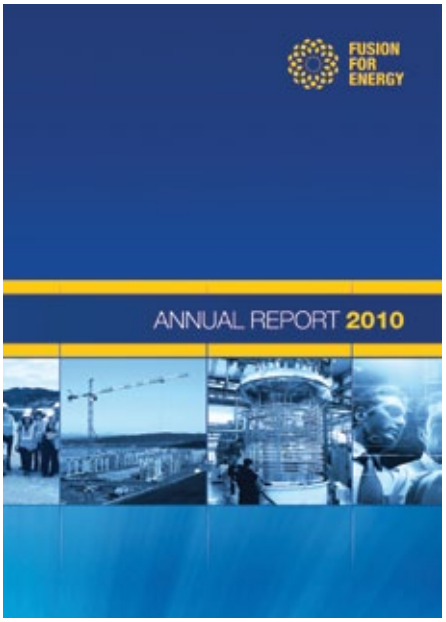
The pace of construction on the ITER site has also increased. The site clearance and levelling were completed in July 2010. The construction of the Poloidal Field (PF) coils fabrication building, which is approximately 250 metres long, 45 metres wide and 17 metres high began in August 2010. The required 20 metres deep excavation for the tokamak building began and by the end of the year 300 people (staff and external contractors) were working on-site.

F4E has continued to carry out its ITER activities during 2011 according to the baseline. Good progress was made on the PF Coils building where more than half of the work was completed. Following the excavation of 200 000 $m^3$ of rock for the construction of the lower basemat of the main tokamak building, the first pouring of concrete took place in August. In parallel, the signature of the site adaptations contract signaled the beginning of a series of works regarding the site infrastructure.

During 2010, F4E experienced a growing interaction with industry and associations which triggered off the need for the development and launch of the industry and associations portal, a platform that offers up to date information on F4E's procurement activity. The number of meetings held in F4E rose by 36% compared to last year, exceeding a total of 3,000. Several high profile visits were also planned in F4E such as the visit from the Members of the European Parliament ITRE (Industry Research and Energy) Committee and the official visit of the new Director General of ITER IO, Professor Osamu Motojima.

In terms of human resources, F4E grew in size and expertise counting more than 260 members of staff. New IT tools and platforms were introduced to store and track documentation. In the area of communication, the launch of the new F4E website, the media trip to ITER with 20 journalists under the Spanish presidency and the participation to the Catalan Education expo stood out.

You can either receive a hardcopy of the 2010 F4E Annual Report upon request (email: info@f4e.europa.eu) or download it from our website.



# PRIMA PROJECT LAUNCHED AT THE NEUTRAL BEAM TEST FACILITY

## Fusion expertise gathered at the launch of the PRIMA project launched at the Neutral Beam Test Facility in Padua, Italy.

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In the vast experimental hall, an impressive gathering of fusion expertise at the head table to celebrate the launching of the PRIMA project for the realisation of the ITER Neutral Beam Test Facility: ITER IO Director General, Professor Osamu Motojima, President of Consorzio RFX, Professor Francesco Gnesotto, Director of the Energy Directorate at Research Directorate General of the European Commission, Raffaele Liberali, and F4E's Director Frank Briscoe. The event, which took place at the Neutral Beam Test Facility in the northern Italian town of Padua on 27 February, highlighted the construction and development and testing of the injector system and the international collaboration which is taking place between F4E and RFX Consorzio. F4E has and will contribute a total of approximately 200 million EUR, in terms of grants and procurements.

In the 200-strong audience, high-level representatives from the Italian local authorities, national research organisations, politicians as well as industry and delegates from the Indian and Japanese ITER Domestic Agencies listened to presentations on the ITER project, the F4E contribution to the ITER project and the PRIMA project. "The success of the ITER project relies on the capabilities and skills of research laboratories such as RFX Consorzio and industry. Working together is crucial and fruitful", said Frank Briscoe, F4E Director. In addition, the advantage of having this scientific center located in Padua was highlighted together with the involvement of companies of the region allowing for the development of skills and knowledge.

The PRIMA project is a new plant to test and develop the ITER's Neutral Beam (NB) injector system. In ITER, two injectors will supply 33 MW of power, 16.5 MW each, in order to provide the high temperature necessary for fusion reactions to occur in the plasma. After the deployment of the two first ITER injectors, the laboratory will operate in parallel to the experiments in ITER to optimise Neutral Beam injector performance, also in view of the future fusion reactor. It is an enterprise with a strong innovative character that projects Consorzio RFX directly to "the heart" of ITER, confirming that, Italy is at the forefront Europe's fusion programme.

01 From left to right: Director of Consorzio RFX, R. Piovan, ITER IO Director General, Prof. O. Motojima, F4E Director F. Briscoe, and President of Consorzio RFX, Prof. F. Gnesotto in front of the RFX machine © martimex

02 The event marked the launching of the PRIMA project for the realisation of the ITER Neutral Beam Test Facility

# F4E AND EUROPEAN INDUSTRY PARTICIPATES IN THE ITER BUSINESS FORUM 2011


F4E participated in "ITER Business Forum 2011" (IBF/11), which took place in Manosque, France, on 7 and 8 December 2011. This event was organised with the support of F4E Industrial Liaison Officers Network, F4E and ITER International Organization, as well as local partners of the French ITER industrial Committee, the regional network of Chambers of Trade and Industry, the Community of Municipalities Luberon Durance Verdon and the Welcome Office for International Companies (WOIC).

IBF/11 aimed to provide European industry with updated information on the status of ITER project, the procurement process and forthcoming calls for tenders over the next two years. The 600 attendees were given a general overview of ITER progress as well as topics of high interest to the European industry: ITER and its industry involvement, the ITER International Organization's procurement policy, upcoming calls for tenders. A set of thematic workshops followed, each with participation of F4E and ITER IO staff: purchasing procedures of ITER IO and F4E, ITER internal components, diagnostics, Tokamak and buildings design integration, Codac, machine assembly, Hot Cell and Remote Handling System.

In order to facilitate contacts, business to business meetings ("one to one") were arranged. A visit to the ITER Site enabling the IBF/11 participants to measure the scale of this project with their own eyes was also carried out.

The high interest in the ITER project was clear at the ITER Business Forum 2011

# MANAGING INTELLECTUAL PROPERTY IN FUSION

F4E organised a conference about managing Intellectual Property (IP) in fusion on 28 and 29 November 2011. The event, which took place in Barcelona, was arranged in collaboration with the European Commission and the World Intellectual Property Organization's Arbitration and Mediation Center.

The conference raised awareness to potential F4E contractors and beneficiaries about the management of IP in the fusion programme, communicated the opportunities that fusion research may offer for innovation and technology transfer and analysed dispute prevention and resolution techniques in this area. Some practical tools for dealing with IP were also presented.

The conference addressed project managers, in-house IP practitioners and representatives from companies and research institutions currently operating with F4E or considering future involvement in our activities.

The conference showcased available examples of Intellectual Property Rights (IPR) generated in fusion that may have applications in other sectors. Companies and/or research institutions willing to contribute with their experience and innovations to this event participated.

To see the conference presentations visit the Intellectual Property section on our website.

# FAREWELL TO MAURIZIO GASPAROTTO, ITER DEPARTMENT CHIEF ENGINEER

Maurizio Gasparotto, ITER Department Chief Engineer

At the end of last year, Maurizio Gasparatto, the ITER Department Chief Engineer, left F4E. The only possible option to carry out this interview was during his last week at work given the fact that until then he remained consumed by his long list of tasks. For those who know Maurizio Gasparotto this should hardly come as a surprise. The dedication of F4E's Chief Engineer has been the driving force of the ITER Department for years. We met with him to obtain a rare personal interview on the highlights of his career and future plans.

He was born in Rome and from an early age he developed an interest for maths and physics. Italy's post-war economic climate pushed him to look for a job in a research institute, currently known as ENEA, contributing to build a plasma experimental machine while at night he would study in university from where he graduated with Honours in Physics and with his thesis focusing on Theoretical Plasma Physics. In ENEA his rank and responsibilities grew offering him the opportunity to coordinate the design and building of the upgrade for the Frascatti Tokamak machine. He became Vice-Director in Frascatti with an increasing interest in the machine that would follow JET, what came to be known as ITER.

In 2000, he moved for three years to Garching to coordinate the EFDA Long Term programme and from there he went to Greifswald to work on the stellarator. EFDA however claimed him back offering him the responsibility to coordinate all the technological work for ITER and the F4E Director at the time, Didier Gambier, asked him to join him in setting up F4E's ITER Department. Since January 2008, he has been the Chief Engineer of the ITER Department, by leading it and offering his expertise in all technical matters regarding Europe's contribution to ITER. His breadth of knowledge and thorough understanding of the Tokamak complexities can compete with that of information contained in an encyclopaedia.

Trying to scratch beneath the surface we asked him what attracted him to fusion research. He replies that "it has always been the prospective benefit for humanity and the constant competition with nature's forces through technology, materials and sophisticated engineering" that made him tick about this field.

He has seen the evolution of Tokamaks from the very beginning. So we asked him when did the so-called breakthrough happen in this domain? "In the beginning plasmas lasted for milliseconds but with Tokamaks coming in the picture there was widespread belief that they could be the way forward towards a future power plant. Nevertheless, we will still have to tackle some remaining obstacles." We asked him to list some of them. "In my view technical aspects can be managed as long as we refrain from carrying out redundancies on the safety and remote handling. Having said that, there are without doubt some critical points. To begin with, the interaction between plasma and the components needs further improvement in future machine designs. Second, we would need to invest in new structural materials with sufficiently good mechanical properties to sustain the high neutron activation. Last, the existing complexity of the machine flags the need for stronger collaboration between industry and engineers towards the development of a less complex machine."

We concluded the interview asking him about his future plans. His passion for fusion will take him back to Greifswald's stellarator as Chief Engineer. He will work there part-time and in parallel, he promises to take the remaining time to rediscover Rome and spend as much time as he can with his family.

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F4E News is a newsletter published by Fusion for Energy (F4E)

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For free subscriptions, please specify your requirements via e-mail: press@f4e.europa.eu

Printed in Belgium on chlorine-free paper
ISSN 1831-5887


FU-AB-11-004-EN-C