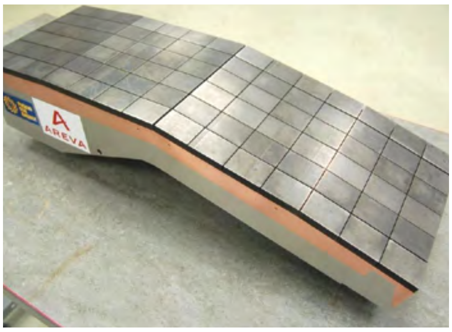
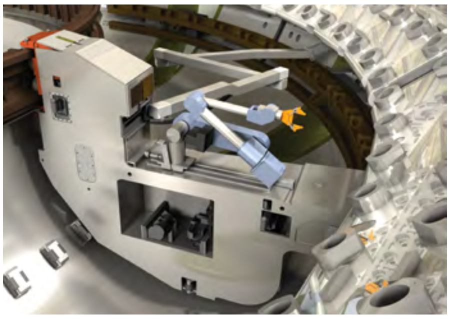
F4E NEWS

FUSION FOR ENERGY QUARTERLY NEWSLETTER

No. 15 - September 2014





EUROPE TO EQUIP THE BIGGEST CRYOPLANT IN THE WORLD

A major technological deal has been reached between F4E and Air Liquide, gas technology global leader, in order to equip the world's biggest cryoplant that will cool down the ITER machine to temperatures as low as -269° C. The works will be completed in five years and the budget foreseen is in the range of 65 million EUR. The contract covers the engineering, procurement, installation and testing of the facility and auxiliary systems.

Professor Henrik Bindslev, Director of Fusion for Energy, explained that "thanks to ITER, the frontiers of science and technology are pushed further and Europe's industry is becoming more competitive. To be part of the biggest international energy project means being confident enough to put your expertise to the test and brave enough to take it a step further". Cristiano Tortelli, Vice-President, Global Air Liquide E&C Solutions, commented: "Our participation to ITER is driven by technological innovation, underpinned by the recognition of our expertise and in line with our commitment to invest in tomorrow's energy mix."

What is the function of the cryoplant?

Think of the cryoplant as ITER's massive fridge that will produce and distribute the cooling power in the machine through different networks. The most advanced cryogenic technologies will be deployed to generate extremely low temperatures needed for the ITER magnets, thermal shields and cryopumps. For example, the magnets will be cooled with super critical helium to reach a superconducting state at 4,5 K, close to absolute zero, in order to confine the hot plasma.

What is the European contribution to ITER's cryoplant?

Europe will provide the Liquid Nitrogen Plant and auxiliary systems that will cool down, process, store, transfer and recover the cryogenic fluids of the machine. Two nitrogen refrigerators will be manufactured along with two 80 K helium loop boxes, warm and cold helium storage tanks, dryers, heaters and the helium purification system. The high performance requirements will be underpinned by high safety standards and a sophisticated operational system.

What are the main elements of the Liquid Nitrogen Plant and auxiliary systems?

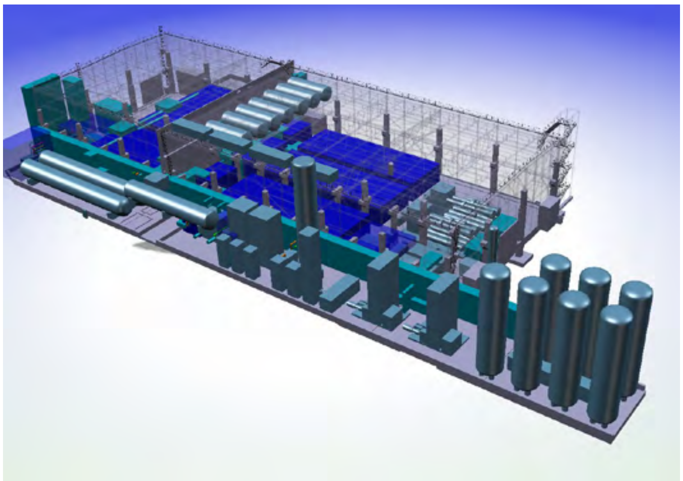
Two nitrogen refrigerators with a cooling power of 1 200 kW at 80K will cool down ITER's Liquid Helium Plant and the 80K helium loop boxes. In addition, they will supply the purification system, quench tanks, heaters and dryers with nitrogen in liquid or gaseous form.

The two 80K helium loops will cool down the thermal shields of the cryostat, vacuum vessel, and regenerate the cryopumps. It is estimated that 8 kg of helium per second will be processed.

A helium purification system is planned to recover and clean helium gas from any impurities. The largest components are two quench tanks each of them weighing 160 tonnes and measuring 37m by 4.4 m.

Watch the interview with xavier Vigor, Head of Air Liquide Advanced Technologies, in our youtube channel.

From left to right: Professor Henrik Bindslev, F4E Director, and Mr Benoit Hilbert, Director General of Air Liquide Engineering . Copyright: F4E



Layout of the ITER Cryoplant. Copyright: ITER IO

EUROPE SIGNS ITS FINAL CONTRACT FOR ITER TOROIDAL FIELD COILS

A landmark multimillion contract has been signed between F4E and SIMIC S.p.A, an Italian company specialised in high-tech engineering and manufacturing, marking the successful completion of Europe's strategy in the domain of the Toroidal Field (TF) coils, part of ITER's impressive magnet system.


Overview of the SIMIC facility in Italy, Porto Marghera, while works of radial plate tilting are being carried out

The Director of F4E, Professor Henrik Bindslev, explained that "thanks to this contract the last and most decisive chapter of the TF coils manufacturing is about to be written. We will produce magnets of unprecedented size and power following extremely complex techniques. This final procurement is a clear demonstration of Europe's commitment to the project and its capacity to be competitive and meet high technical standards". For Marianna Ginola, Commercial Manager of SIMIC S.p.A this milestone "is an impressive achievement that enhances the proven track record of our company and associates Italian manufacturing amongst the most skilled in the world. ITER has given us the opportunity to build international collaborations. In this contract for instance, we will collaborate with Babcock Noell Gmbh. This project has given us the possibility to access new markets and grow both in size and expertise".

The contract is expected to run for approximately five years and its budget will exceed the amount of 100 million EUR. Through this contract, the TF coils will be tested at extremely low temperatures reaching nearly -200 degrees Celsius/80 Kelvin and subsequently will be inserted within their cases in order to be finally assembled in the ITER machine.

What is the role of TF coils and their specifications?

ITER will demonstrate the feasibility of fusion energy. The temperature of ITER's superhot plasma is expected to reach 150 million degrees Celsius. The challenge is to keep the plasma burning without touching the walls of the vessel of the reactor. The TF coils are "D" shaped gigantic superconducting magnets whose main task will be to create a magnetic cage where the plasma will be confined. Europe is responsible for the manufacturing of 10 out of the 18 TF coils of the machine.

Magnets of unprecedented size, weight, power and technique

The TF coils are composed of a winding pack and its stainless steel coil case. Each TF coil is 15m high, 9m wide and has a cross section of about 1m^2. It weighs approximately 340 tonnes, which compares to six Boeing 737-800 planes! These will be the biggest Nb3Sn magnets ever manufactured, which once powered with 68000 A, they will generate a magnetic field that will reach 11.8 Tesla- about one million times stronger the magnetic fields of the earth.

The scope of this contract

First, the winding packs will be cold tested at -200 degrees Celsius/80 K using a combined cycle of nitrogen and helium. Next, they will be inserted into the TF coil cases, which will require sophisticated laser dimensional controlled technology and complex tooling in order to move and fit hundreds of tonnes with millimetric precision.

Then, the cases will be welded in compliance with the stringent ISO standard 5817 in order to close the metallic structure. Two important characteristics will add to the complexity: the thickness of the weld which will reach 130mm and the fact that welding will have to be carried out only from one side. For these reasons, ultrasonic technology will be deployed to inspect the quality of welding.

The gap between the winding pack and the TF coil case will have to be filled with reinforced resin to mechanically link the components. The high density of the resin makes this task particularly challenging. Try and imagine filling a tight gap that is 4mm thick and 35m long with 1m^3 of resin that has the thickness of honey.

ITER is a puzzle of many different interfaces that will need to be managed in a seamless way. Most TF coil components, like the winding packs and the radial plates are manufactured in Europe. The TF coil cases however, are manufactured in Japan while the thermal shields of the Vacuum Vessel that will be ultimately welded on the TF coils, in Korea. In other words, the multiple interfaces and their careful management will be fundamentally important for the successful execution of this contract.

FACTORY ACCEPTANCE TESTS OF THE ION SOURCE AND EXTRACTION POWER SUPPLIES (ISEPS) FOR THE SPIDER EXPERIMENT COMPLETED SUCCESSFULLY

Anticipation and excitement in the air. A wave of concentration falls upon the people in the hall. Focus and precision. With quiet optimism, the button is pushed and all attention is focused on the control panel.

The participants of the ISEPS Factory Acceptance Tests standing in front of the equipment (Image courtesy of OCEM)

The location, OCEM Energy Technology premises in San Giorgio di Piano, near Bologna, an Italian company employing around 70 staff. A gathering of people consisting of OCEM Energy Technology employees, representatives from the German sub-contractor Himmelwerk GmbH, as well as F4E and ITER Organization staff and representatives from the Italian European Fusion Laboratory RFX, huddle together in order to witness the outcome of the final Factory Acceptance Tests before on-site delivery of the full first unit of Ion Source and Extraction Power Supplies (ISEPS) for the SPIDER experiment. SPIDER (Source for Production of Ion of Deuterium Extracted from Radio frequency plasma) is one of the two independent test beds (the other one is MITICA) which make up the Neutral Beam Test Facility which is dedicated to the testing and developing of the ITER Neutral Beam Injectors, and located in Padua, Italy.

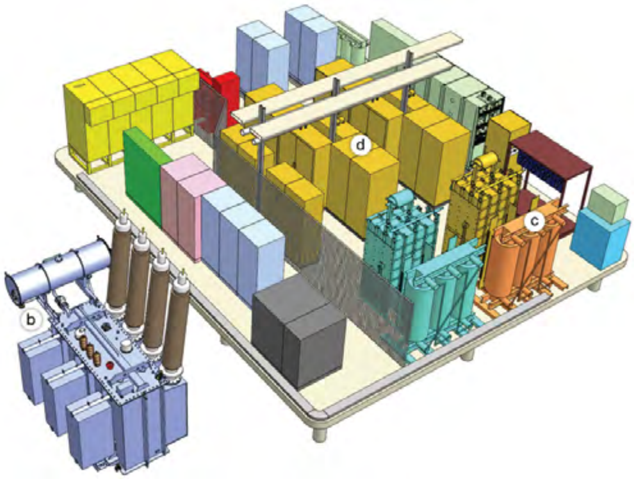
One of the main F4E contributions to ITER additional heating systems, the two Neutral Beam injectors are essential in supplying 16.5 MW of power each in order to inject high-energy beams of neutral atoms into the core of the ITER plasma and provide the high temperature necessary for fusion reactions to occur in the plasma. The neutral beam is obtained by creating a beam of negatively charged ions, then accelerating it to high speeds and finally neutralising it through an interaction with neutral gas of the same type. Any non-neutralised atoms are removed from the beam through an electrostatic field. The Neutral Beam injectors are unique in terms of high energy (1 MeV), pulse duration (up to 3,600 s) and power and therefore need to be tested before being installed in ITER. SPIDER is the test bed where the first full-scale ITER ion source will be tested and developed with an acceleration voltage of up to 100 kV.

The Ion Source and Extraction Power Supplies (ISEPS) include all the power supplies required for feeding the ion source of the Neutral Beam injector and for extracting an ion beam from the source, through the use of 4 radio frequency generators. The ISEPS unit has an overall power rating of 5 MVA and are composed of a heterogeneous set of items, ranging from power distribution equipment at 6.6 kV to solid state power converters (both high voltage, up to -12 kV and high current, up to 5 kA). Each radio frequency generator has a power capacity of 200kW and an operating frequency of 1MHz, and is fed by a direct current (dc) power supply of 12kV with a 140A output feed current. The power supplies are hosted on a platform insulated at -100kV from the ground over a surface of approximately 12 x 10 metres.

The final Factory Acceptance Tests, which were carried out over a three week period included test-runs of the major individual sub-assemblies of ISEPS, followed by power tests of the whole system connected to one of the four radio frequency generators supplied by subcontractor Himmelwerk GmbH (the remaining three radio frequency generators have already been successfully tested at the company's production site in Germany and the future on-site test will include all four radio frequency generators). Muriel Simon, the F4E Responsible Officer for this contract, explains, “This is the first complete, complex system (in fact, composed of several sub-systems, each of them with many main components) including its control, protections and interlocks procured for ITER which has been fully manufactured and successfully tested in factory”. Indeed, it was to the sound of applause amongst the participants that it was concluded that the testing had been extremely successful: the equipment performed in accordance with requirements and met without any issue all set criteria, including full power level and long pulses.The testing involved running the power supplies at the maximum nominal power of 200kW for a period of 15 minutes, a longer duration than foreseen in the test plan for such high power level. Tullio Bonicelli, Leader of F4E’s Project Team dealing with the technical and contractual monitoring in order to provide the ISEPs Unit for ITER, says, “OCEM Energy Technology have proven to be highly skilled collaborators and have shown great adaptability in terms of the demanding specifications for ISEPS. The expertise of German SME Himmelwerk GmbH has been very useful thanks to the company’s proven expertise in radio-frequency generators. Likewise, the RFX team has provided vital support to F4E in the technical monitoring of this key contract for the overall procurement of SPIDER power supplies”.

In total, the procurement contract signed between F4E and OCEM Energy Technology encompasses four almost identical ISEPS units being delivered, two of which will be used for the Neutral Beam Test Facility. The remaining two units will cover the needs of the two ITER Neutral Beam injectors on the ITER site in Cadarache, France.

Watch the interview of Giuseppe Tadia, OCEM Power Electronics Manager, in our youtube channel.



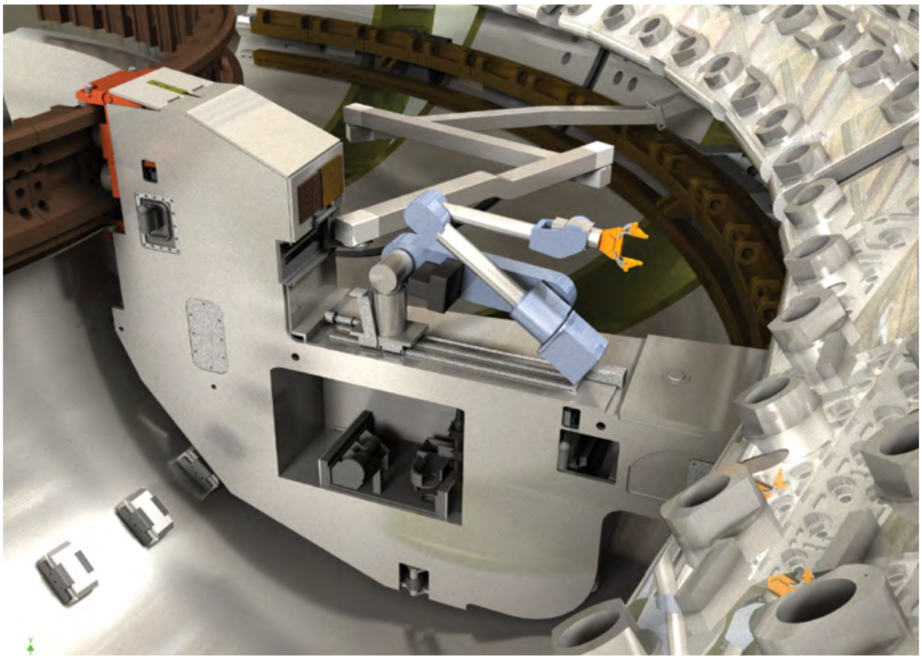
The ISEPS power supplies are hosted on a 12 x 10 m insulated platform. They are fed and insulated at -100kV from ground via an insulating transformer (22kV/6.6kV, 5MVA) located outdoors, (Image courtesy of OCEM).

Some of the ISEPS components, from left to right:

b. Insulating transformer (Image courtesy of OCEM)
c. Power supply feeding in the direct current (DC) the 4 radio frequency generators (1.6MW)
d. The radio frequency oscillators hosted in these cubicles generate high frequency (1MHz) energy used by the source to produce the plasma from which negative ions are then extracted (Image courtesy of OCEM.

F4E AND ASSYSTEM TO DELIVER REMOTE HANDLING SYSTEM FOR ITER DIVERTOR

ITER's high tech remote handling system has entered its most decisive phase so far thanks to a multimillion deal signed between F4E and Assystem, a leader in innovation and engineering consultancy.



ITER's high tech remote handling system has entered its most decisive phase so far thanks to a multimillion deal signed between F4E and Assystem, a leader in innovation and engineering consultancy. All activities ranging from design, manufacturing, delivery, on-site integration, commissioning and final acceptance tests for ITER's divertor will be covered through this contract as it unfolds progressively. Its value is estimated in the range of 40 million EUR and it will involve some of the pioneers from the area of remote handling in Europe such as the UK's Culham Centre for Fusion Energy (CCFE) and Soil Machine Dynamics Ltd (SMD) together with Finland's Technical Research Centre (VTT) and theTampere University of Technology (TUT). Through this contract, two multifunctional movers and two toroidal movers will be manufactured.

F4E Director, Professor Henrik Bindslev, explained that "this contract is a turning point for ITER's remote handling system because it will lead us to production mode. We have managed to bring together industry, fusion laboratories, SMEs and research centres under one contract that will unleash their potential and help them advance further in their domain". Commenting on the award, Peter Higton, Assystem's Energy and Nuclear UK Managing Director who has led the team effort, said: "We are very pleased to have been selected for this prestigious project. This contract is recognition that our capabilities and reputation for delivering high standards of innovative engineering, quality and safety are valued by our customers. We look forward to working with F4E and our partners to deliver these high tech components".

What is remote handling?
Remote handling helps us to perform manually a task without being physically present at the location it is carried out. It is widely used in space exploration missions, underwater or ground operations. The system brings together high tech robotics, advanced technological tools, powerful computers and virtual reality platforms. A high level of intuition and intelligence are inbuilt within the system which is handled by a human operator with extreme dexterity because of the degree of millimetric precision that is required.

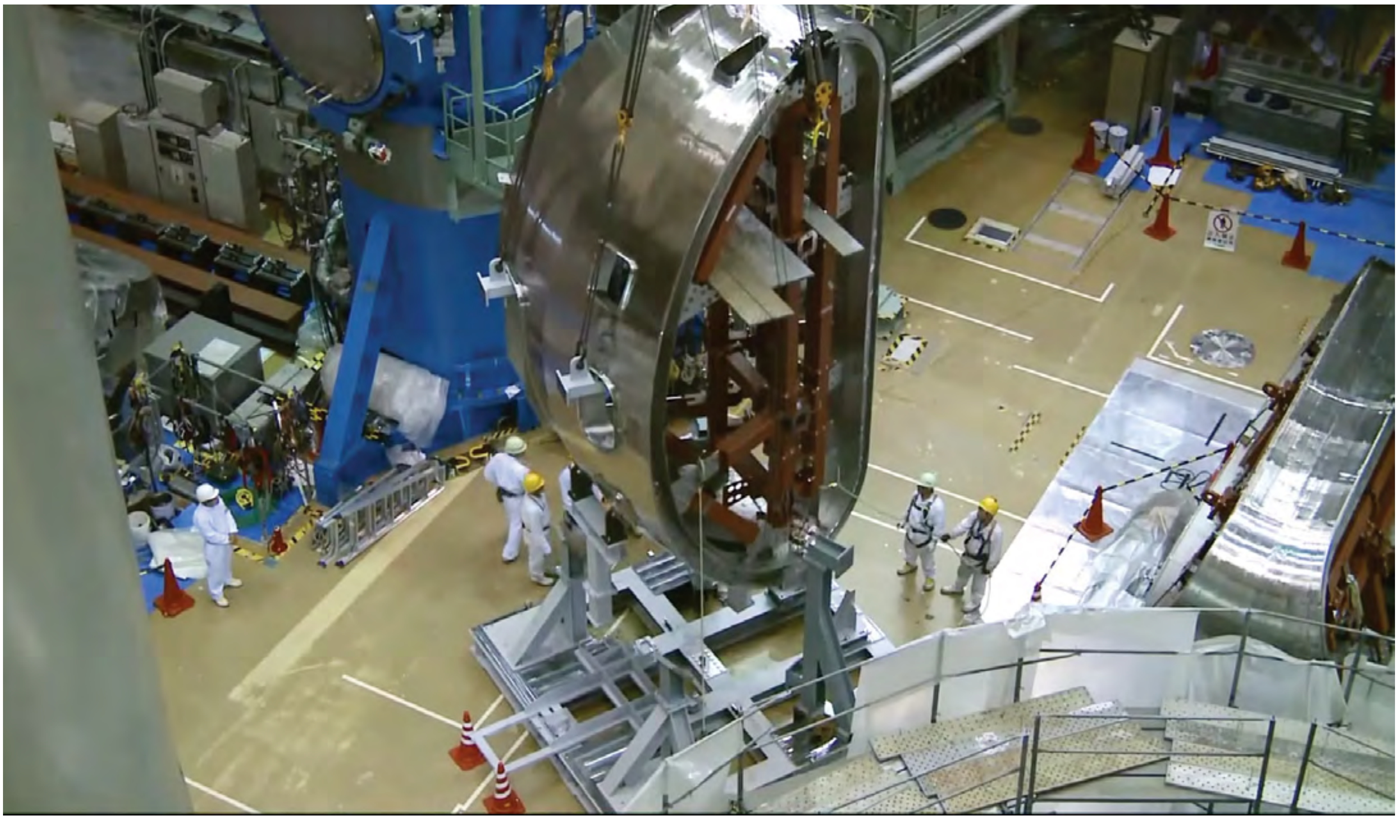
Why ITER needs a remote handling system for the divertor?
When the ITER machine is operational some of the components in the vessel will be exposed to radioactivity. Therefore, any maintenance, inspection and repair will be conducted through remote handling. The ITER divertor, located in the lower part of the ITER machine, will consist of 54 divertor casettes measuring 3,4m x 1,2 m x 0,6m and weighing 10 tonnes each. It is in this part of the machine that the superhot plasma temperature will be most felt. The divertor casettes will form the machine's massive ashtray where the hot ashes and impurities will fall in. It is foreseen that these components will be replaced three times during the lifetime of the ITER machine.

How will the ITER divertor remote handling work?
The 54 divertor cassettes will be installed by movers through three entry points, known as ports. If they need to be removed, they will be detached, unlocked from the ITER vessel, placed into a container and get transported.

3D image of the remote handling system for ITER divertor – photo credit: Assystem

IMPORTANT PROGRESS FOR JT-60SA

The JT-60SA project – one of the three projects being developed under the Broader Approach Agreement in Naka, Japan – is progressing well: the heart of the machine, the vacuum vessel, is now being built.



Implemented by the Japan Atomic Energy Agency (JAEA) and F4E, the advanced superconducting JT-60SA tokamak (SA stands for super advanced) will be used to quickly identify how to optimise plasma performance for ITER and will study advanced modes of plasma operation suitable for DEMO. Assembly started in 2013 and a first plasma is foreseen for March 2019.

The JT-60SA vacuum vessel consists of 10 sectors made of 316 L stainless steel, 6.6 m high and up to 3.5 m wide, each weighing up to 17 tonnes. The first two sectors have now been placed and will now be welded together. It is foreseen that the remaining sectors will be added to the structure at the rate of one per month, although, before the placing and welding of the last sector, the 18 Toloidal Field coils (magnets which will keep the plasma in place during the fusion process) produced in Europe will be threaded over the vessel and fixed in place.

To learn more about JT-60SA and its progress, visit its website: www.jt60sa.org

A film clip, courtesy of Ibaraki News, shows the placing of the first two sectors and can be accessed here: http://bit.ly/1oPTlld

The six year assembly of JT-60SA is moving forward: the heart of the machine, the vacuum vessel, is now being built. .

READY TO BUILD THE ASSEMBLY HALL OF THE TOKAMAK

The ITER construction platform is getting ready for another major development! The consortium made up of Vinci, Ferrovial and Razel has started the construction of the Tokamak Assembly Hall building in August 2014.

The 60 metres high building, adjacent to the Tokamak complex, will host the two 750 tonnes cranes that will assemble the components of the ITER machine. The work is part of the construction contract for the Tokamak complex which was signed in 2012.

In April 2012, works kicked off with the drilling of boreholes and the extraction of 12000 m^3 of soil and rock. Reinforcement works and the pouring of concrete for the 6000 m^2 basemat followed which lasted roughly one year.

The construction of the impressive steel-structure will be realised in 15 steps from the erection of columns for the structure foundations to the assembly of the roofing in the ground floor.
Work will end in the first quarter of 2015.

The upper basemat of the Tokamak complex is completed!

The construction of the 9,300 m^2 upper basemat, the so-called B2 slab, has come to an end in summer 2014. This slab stands above the anti-seismic layer, put in place for the Tokamak complex composed of a 1.5 metres thick slab and 493 plinths, equipped with anti-seismic bearings. The completion of this slab marks a significant milestone. Now that this is over, the construction of the ITER Tokamak complex can begin.
Currently, around 3,000 tonnes of reinforcement have been installed, totalling 6 layers of rebars on average.

Since December last year, concrete pouring activities have started performed by GTM and Vinci Group. All 15 plots have been poured already. A total of 15,000 m^3 of concrete has been used for the whole slab.

Watch the 2014 construction milestones video, in our youtube channel.

01

02

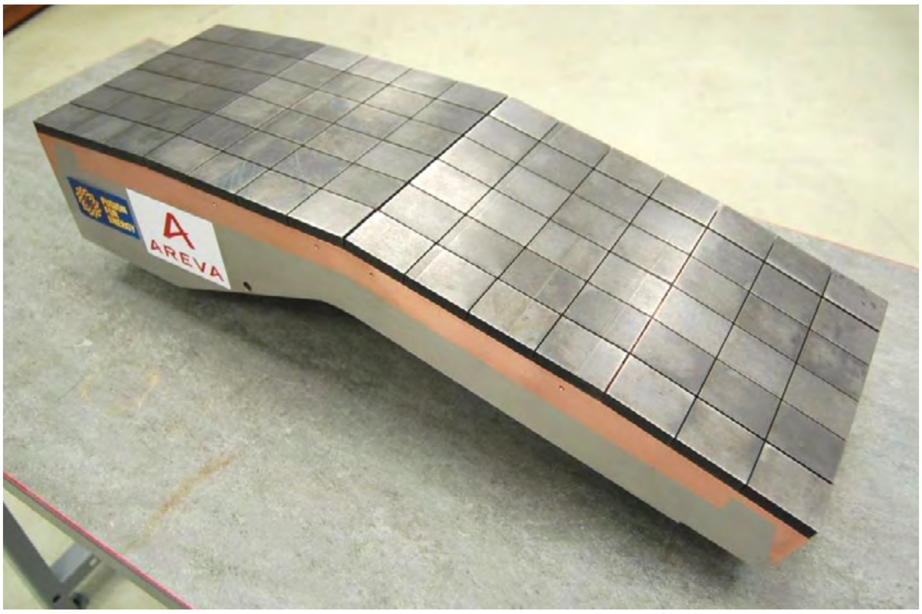
01 ITER Tokamak Assembly building – artistic impression (Courtesy: ENIA Architectes)
02 Panoramic view of the Tokamak complex upper basemat, June 2014 (Copyright : AIF)

MANUFACTURING OF THE BLANKET FIRST WALL SEMI-PROTOTYPE COMPLETED

A so-called semi-prototype of the Blanket First Wall (about 1/6 of the dimensions of a full-scale First Wall Panel) has recently been manufactured. This activity, based on specialised know-how and skills owned by only a handful of European companies, has been completed in roughly two years by French company AREVA.

The first wall panels are 1m x 1.5m detachable elements which together with the shield block (a block of stainless steel on which the first wall panels are fixed) form the Blanket modules. The Blanket is the part of the ITER machine that acts as a first barrier and protects the vacuum vessel, which is the heart of the ITER machine, from the neutrons and other energetic particles that are produced by the hot plasma. The First Wall consists of 440 panels, of which F4E will provide about half. Depending on the location of the modules in the Blanket, different design parameters are necessary. F4E is providing the Normal Heat Flux panels (the Enhanced Heat Flux panels will be provided by the Chinese and Russian Domestic Agencies). Normal Heat Flux panels are designed to withstand heat fluxes of up to 2 MW per m^2, whereas Enhanced Heat Flux panels can withstand heat fluxes up to 4.6 MW per m^2. The panels are made up of beryllium tiles which are bonded with a copper alloy and 316L (N) stainless steel using Hot Isostatic Pressing (HIP), a method that involves pressure generated by gas in order to compress the metals together homogenously from every direction. During operation, the ITER First Wall panels will be cooled by pressurised water.

The completion of the semi-prototype moves F4E a step closer to obtaining qualification by ITER IO for the manufacturing of the actual Blanket First Wall. Qualification is necessary for all components in the ITER machine and involves building and testing prototypes in order to gain and consequently demonstrate knowledge and practical skills for the manufacturing of the actual component.



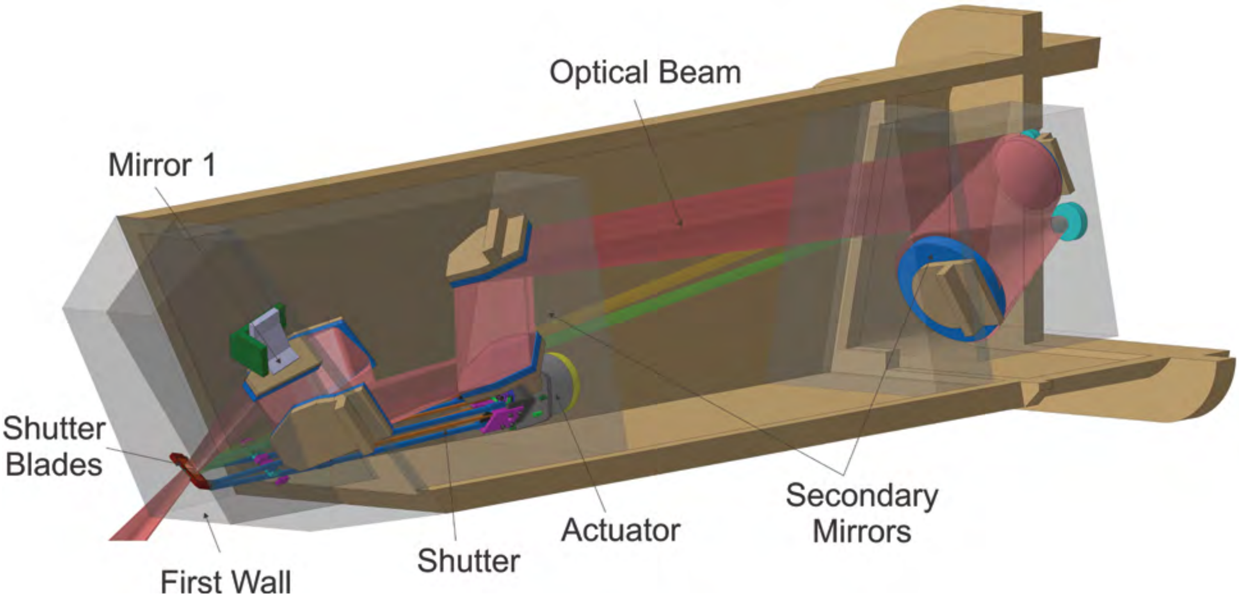
The semi-prototype of the Blanket First Wall. This prototype is about 1/6 of the actual panel which will be used in ITER. The wall itself will consist of 440 such panels.

With the manufacturing of the semi-prototype now completed, the next step will be its high heat flux testing. This involves subjecting the surface of the semi-prototype to an electron beam capable of applying the same heat flux the First Wall panels will endure in the ITER machine, resulting in the panels having a beryllium surface temperature of around 400°C during testing. F4E has awarded the grant for the high heat flux testing to German research centre Forschungszentrum Jülich and the testing is scheduled to be completed by the summer of 2014.

The associated Procurement Arrangement for the procurement for the actual First Wall Panels to be used in the ITER machine is scheduled to be signed in early 2015.

FPA SIGNED FOR DESIGN ON SYSTEM TO MONITOR ITER’S PLASMA CORE

F4E will work together with FZJ, KIT, the universities of technology in Budapest and Eindhoven, DIFFER and CCFE for four years. The F4E contribution of 4.9 million EUR will be used to design a diagnostic system to be used in the monitoring of ITER’s plasma core.



Example layout of components in the CP CXRS port plug

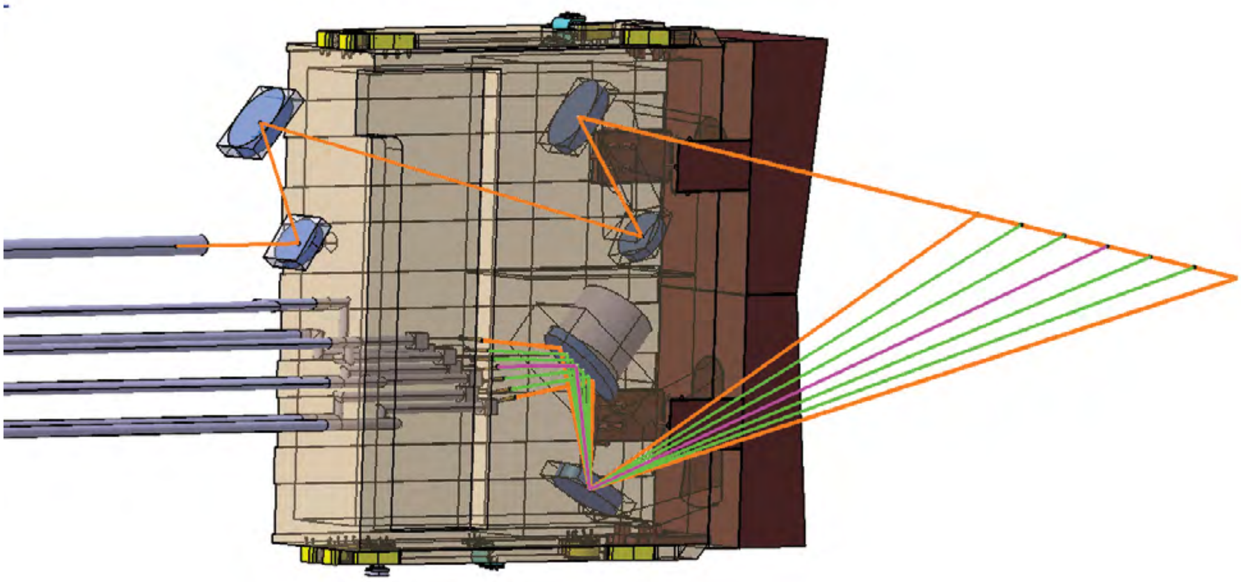
A Framework Partnership Agreement (FPA) for the design of the ITER Core Plasma Charge Exchange Recombination Spectroscopy diagnostic system (CP CXRS) has been signed by F4E and a consortium consisting of Forschung Zentrum Jülich (FZJ), Karlsruhe Institute of Technology (KIT); universities of technology in Budapest (BME) and Eindhoven (TU/e); the Dutch Institute for Fundamental Energy Research (DIFFER); and Culham Centre for Fusion Energy (CCFE) in the UK. Contributing third parties include the Spanish CIEMAT centre and the Hungarian Wigner-RCP institute. The FPA will run for four years with an F4E contribution of 4.9 million EUR.

The CP CXRS diagnostic will view a region of the ITER plasma illuminated by a high-energy beam of neutral hydrogen particles injected by a companion device (the Diagnostic Neutral Beam) being constructed by ITER’s Indian partners. Collisions of particles in this beam with particles in the fusion plasma will produce visible light. Measurement by the CP CXRS of the wavelength and spatial distribution of this light will allow conclusions to be drawn on various properties of the plasma. This includes the density of helium, which is formed during the fusion reaction and must be removed from the combustion chamber in order for the fusion reaction to be sustained. Other important parameters such as the concentration, temperature and velocity of different plasma species can also be determined using the diagnostic.

Once the CP CXRS diagnostic is designed, it will be procured by F4E and assembled into an ITER port plug to be installed in an inset at the upper edge of the vacuum vessel.

F4E WORKS WITH DANISH AND PORTUGUESE EUROPEAN FUSION LABORATORIES TO DESIGN DIAGNOSTIC SYSTEM FOR ITER

F4E and a consortium comprising the Danish and Portuguese Research Units (DTU and IST-IPFN) have signed a Framework Partnership Agreement (FPA) for the development and design of the Collective Thomson Scattering diagnostic system for ITER. The contract will run for the next four years.



The Collective Thomson Scattering (CTS) diagnostic system will monitor the behavior of the fast ions, that is to say, how the speed of the fast ions is evolving within the ITER plasma.The CTS system will measure 7 locations within the ITER plasma. Fast ions are elusive particles which are a natural consequence of the fusion process and plasma heating techniques. Although they represent less than five percent of plasma density, fast ions carry up to one-third of the plasma's kinetic energy. Optimising their confinement within the plasma is important as they play a major part in sustaining the high plasma temperatures required for the fusion reaction as they collide with and transfer their energy to 'bulk' particles in the plasma. However, fast ions are somewhat problematic as the behave unpredictably: some remain in the magnetic field, others escape the plasma and reduce confinement, or amplify plasma disturbances.

Confined fast ions have previously eluded experimental observation as traditional laser diagnostic techniques have not been able to capture these heavier ions. The CTS diagnostic system involves a different approach as rather than focusing on the individual particle, measurements focus on the collective motion of the whole group. CTS takes advantage of the fact that fast ions leave a wake as they travel through a cloud of electrons. Although the ions are themselves near impossible to monitor, their wakes are detected through the CTS technology.

The CTS diagnostic system will consist of mirrors and antennas integrated in the Equatorial Port Plug 12 of the ITER machine. The upper antenna and mirrors will launch a powerful, single and high frequency microwave beam (1 MW at 60 GHz, equivalent to 1,000 microwave ovens at full power) into the plasma and records the scattered electromagnetic waves through the lower mirrors and receiver antennas. The measurement enables establishing the dynamics and distribution of the ions in the plasma – especially the fast ions from the fusion processes.

The upper antenna and mirrors will launch a microwave beam (1 MW at 60 GHz) into the plasma and records the scattered electromagnetic waves through the lower mirrors and receiver antennas.

CNIM UNVEILS THE MANUFACTURING PROCESS OF THE RADIAL PLATES

The best way to understand Europe's contribution to ITER is to visit the companies producing the different components. This is where expertise, skills, high-tech machinery and trained workforces come together to manufacture the complex and strikingly massive components.

F4E together with CNIM organised a technical briefing for a team of journalists at their facility in Toulon, France. In 2013, a new 3,000 m² building was constructed to house the machines for the manufacturing of the radial plates. CNIM and SIMIC will have to produce 35 radial plates each for the European contribution to ITER's Toroidal Field (TF) coils. Each plate is manufactured in 316LN stainless steel to tolerances of less than a millimetre and weighs either 5.5 tonnes or 9.8 tonnes, depending on the type. One could think of the radial plates as cases where the superconducting conductor of the TF coils will be inserted within the grooves.

The components require machines of high precision and a lot of space. To fulfil these requirements, CNIM has developed a unique electron beam welding process which is ideally suited to large-scale high-precision items. Carried out under local vacuum, this innovative process was designed and tested by CNIM before being deployed. CNIM's new machining centre allows two plates to be machined simultaneously in the temperature - controlled conditions required to guarantee thermal stability. The adjacent shipping dock enables the finished product to be transported by sea.

During the visit, we also got a first glimpse of Europe's first radial plate, which is expected to be ready during summer 2014. Then, it will be delivered to ASG Superconductors in La Spezia, Italy, to be fitted into the ITER TF coil winding packs. After producing a second plate five weeks later, CNIM expects to reach cruising speed and manufacture the remaining plates at a rate of one every four weeks. Fifty CNIM members of staff will work round the clock in three eight-hour shifts for the duration of the project, which is expected to last until 2017.

Viewing a pre-machined radial plate ready for electron beam welding operations in the welding shop

EUROPE EXPLAINS ITS ITER CONTRIBUTION TO THE MEDIA

More than 50 journalists from all over the world passed through the gates of the ITER headquarters to witness the progress of the biggest international collaboration in the field of energy. The ITER media trip has officially become the meeting point for those who are eager to learn more about fusion energy, discover its merits and challenges, understand the complexity of the ITER components and their manufacturing.

Professor Henrik Bindslev, F4E Director, explaining Europe's contribution to ITER to BBC radio

Several high-level speakers were invited to explain key ITER technologies, elaborate on schedule and cost. Through their presentations one could sense their resilience and optimism that fusion energy will eventually be part of the energy mix. The presentations covered a broad range of topics such as the overall management of the project, the different interfaces of the ITER assembly, the compliance with the nuclear safety standards. Between sessions, a guided tour on the impressive construction site was planned, with Laurent Schmieder, F4E's Head of Construction, Buildings and Power Supplies, who offered a warm welcome to all participants and explained how the site has changed over the years. A few minutes later, the Tokamak pit turned into a massive TV studio. Crews started by fixing their cameras on the rebars, repositioned their microphones because of the wind and once the interviewers and interviewees took their positions, it was time for action: statements, soundbites and photos starting finding their way into articles, blogs, reports and social media.

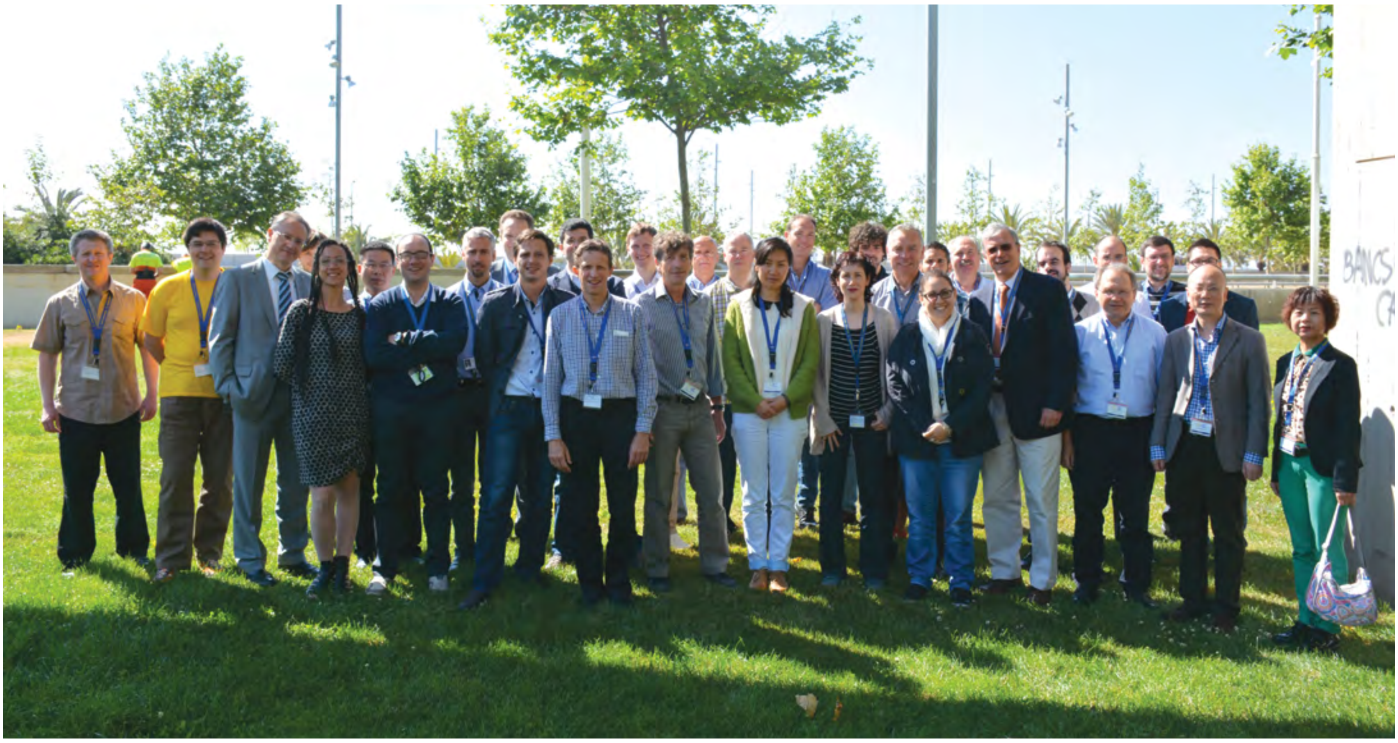
With Europe being responsible for nearly half of ITER's cost, a special media briefing was planned to explain the involvement of F4E in the project and the tangible benefits for Europe's industry and SMEs. Professor Henrik Bindslev, F4E's Director, opened the briefing with a report on what has been achieved so far in terms of construction, manufacturing and the list of incentives given to companies. He highlighted the role played by industry in delivering the ITER components and paving the way towards a fusion energy market.

Companies from different sectors were also invited to elaborate on their contribution and why it mattered to them to be part of ITER. Ferrovial was represented by Oriol Ribas Escola, who outlined the construction process of different ITER buildings and the rigorous specifications that have to be met down to the level of the concrete mix. On behalf of Atkins, Simon Layzell, explained the titanic tasks stemming from the Architect Engineer contract and the compliance with strict nuclear safety standards. Greg Willetts, illustrated the role of AMEC in the field of in-vessel technologies and spoke of ITER as a new knowledge platform for sustainable energy. For Stefano Pittaluga, the work undertaken by ASG Superconductors for the Toroidal Field Coils served as an opportunity to retrain staff with new skills and explore the potential of superconductors in the energy market. Finally, Mathias Zorn from the M+W Group, explained the engineering challenges of equipping the most emblematic building of ITER – the Tokamak complex.

The participants conveyed a message of commitment and pride to be associated with the project. Some spoke of ITER as a reference boosting their position in the market and the capacity to recruit talented people. Others highlighted the wealth of skills that they have acquired and their application in other domains. Irrespectively of their visions, they all coincided in one observation: the lessons we draw today from ITER will determine to a great extent tomorrow's energy choices.

F4E HOSTS THE BLANKET INTEGRATED PROJECT TEAM MEETING

The Blanket Integrated Project Team (BIPT) quarterly meeting, hosted by F4E on 14-15 May, gathered the Integrated Project Team for the ITER blanket consisting of ITER IO representatives and the Domestic Agencies from China, Russia as well as F4E in order to work together and share information on the design and activities of the blanket project.



The blanket is the part of the ITER machine that acts as a first barrier and protects the vacuum vessel, the heart of the ITER machine, from the neutrons and other energetic particles that are produced by the hot plasma. F4E is responsible for the supply of about 50% of the ITER first wall panels of the blanket (Russia contributes 38% and China the remaining 12%), which encompasses 218 panels. Each panel consists of a stainless steel support structure bonded to a heat sink material and beryllium tiles. The heat sink material is made up of a copper alloy which transfers the heat generated from the plasma to the water coolant, while the beryllium tiles act as an interface for the plasma. F4E also contributes with the manifolds, the stainless steel piping system used to bring cooling water to the inner in–vessel components. The series fabrication for the first wall panel will start in 2017, and the procurement for the manifolds in 2016.

During the BIPT meeting, two issues which have implications for the blanket design were in special focus. Firstly neutronics, due to the fact that the neutrons generated in deuterium–tritium plasmas (as will be produced in ITER) deeply penetrate into surrounding components where they cause damage which has repercussions for the performance and lifetime when shielding is not effective enough; and secondly, the new and more refined calculations of the values of the power that will be deposited in the ITER Vacuum Vessel have seen an important increase. In general, the meeting was very fruitful, enabling work to advance and communication to be enhanced.

Participants from ITER IO, the Domestic Agencies in China and Russia, as well as F4E attended the BIPT quarterly meeting

F4E'S EUROPEAN FUSION LABORATORY CONTACT POINTS GATHER FOR THE FIRST TIME

F4E has and is currently making a concerted effort to develop and strengthen its relationship with European Fusion Laboratories (EFLs) who possess much of the expertise needed to build some of the systems being provided by Europe to the ITER project.

To this end, a European Fusion Laboratory Liaison Officers (EFLO) Network has been created and its representatives gathered for the first time during a combined meeting with the F4E Industrial Liaison Officers (ILOs) at the F4E offices in June.

F4E Director Henrik Bindslev provided a comprehensive report on the progress of the ITER work and main highlights since the beginning of 2014. Activities and further ideas to strengthen the partnership between F4E and the EFLs were presented. It is extremely important for F4E to listen to the EFLs, one of its key stakeholders, emphasised the Director, as he highlighted the main actions which F4E is currently putting in place: simplifying and increasing flexibility in grant management, improving interaction between EFLs and F4E, and using EFL expertise. EFLOs were encouraged to raise issues of concern in their relation with F4E and put forward proposals to strengthen the partnership.

An information session on the strategy and status of implementation of the work related to the area of diagnostics, an area within F4E which is strongly linked to EFLs, was held. Sessions on ITER safety and Quality Assurance requirements, as well as Lump Sum Grants, also took place.

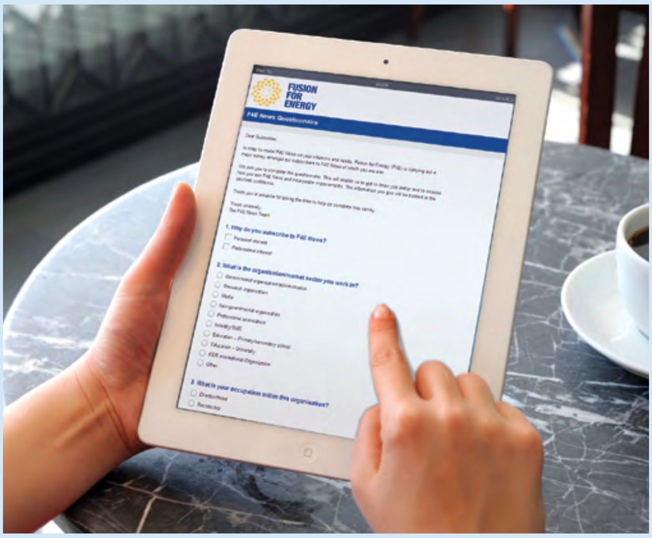
The next EFLO Network meeting will be in September on the occasion of the 28th Symposium on Fusion Technology (SOFT) taking place in San Sebastian, Spain, from 29 September – 3 October.

MAKE F4E NEWS *YOUR* PUBLICATION!

Help us model F4E News on your interests and needs, by participating in a survey that we are carrying out amongst our readers.

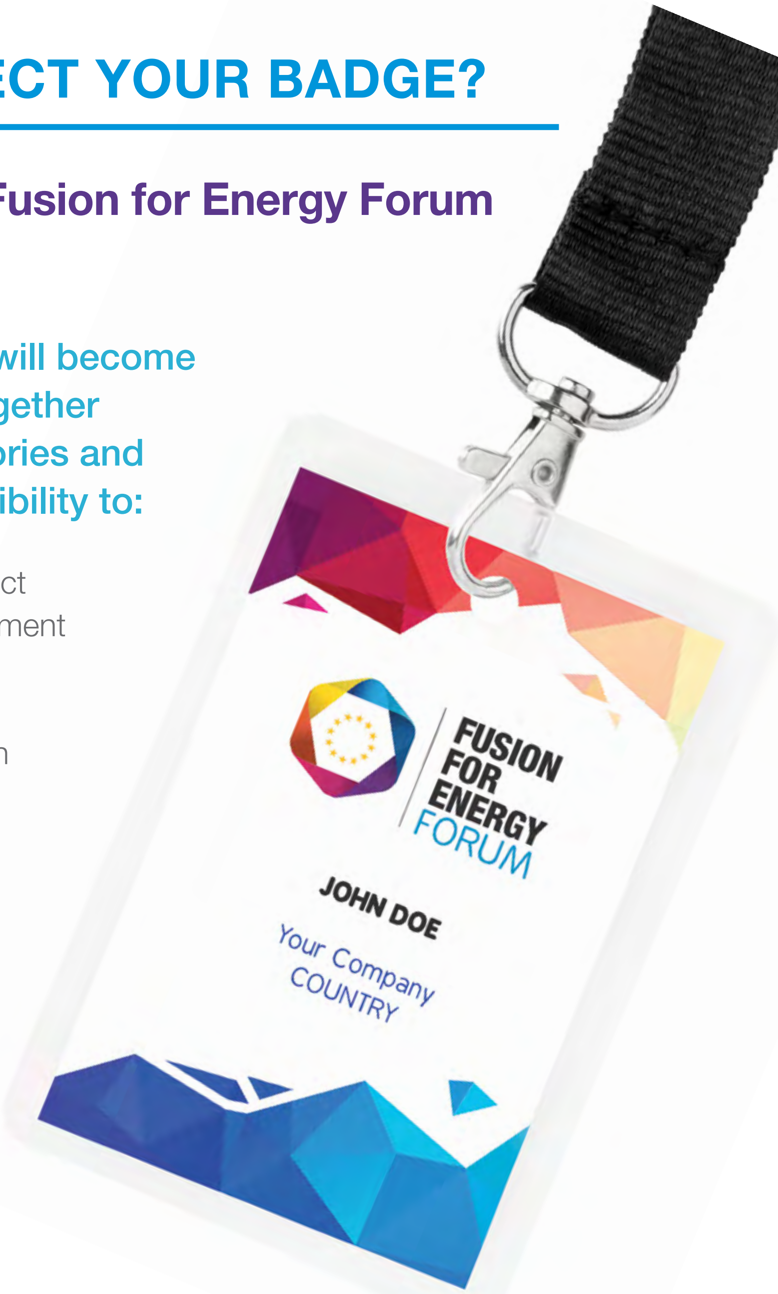
Completing the questionnaire will take less than 5 minutes. The information you give is anonymous and will be treated in the strictest confidence.

Thank you in advance for taking the time to complete the survey, which can be accessed here: **www.surveymonkey.com/s/f4e**



ARE YOU READY TO COLLECT YOUR BADGE?

The preparations for the first ever Fusion for Energy Forum have started!



Between 10 - 12 of June 2015, Barcelona will become Europe's fusion energy capital bringing together industry, SMEs, European Fusion Laboratories and fusion policy makers giving them the possibility to:

- find out more about the progress of the ITER project
- obtain the latest information regarding the procurement strategies
- discover upcoming business opportunities
- learn about the technologies, skills and expertise in demand
- understand how you can be involved
- meet with F4E's technical staff managing Europe's contribution
- network with other participants to seal new deals

More information to come on:
www.f4eforum.com

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