



F4E NEWS

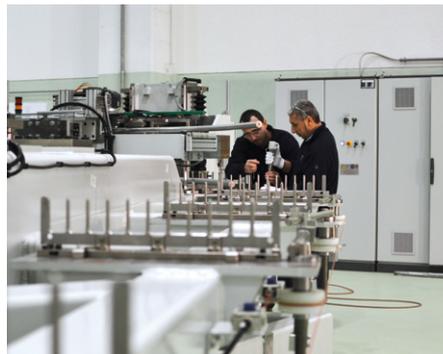
FUSION FOR ENERGY QUARTERLY NEWSLETTER

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EUROPE DELIVERS EDIPO: A WORLD CLASS FACILITY FOR TESTING SHORT SAMPLES OF SUPERCONDUCTING MAGNETS

If we are truly committed to the idea of a sustainable energy mix with fusion being one of its elements, then we need to invest in facilities that will bring us closer to the realisation of commercial fusion by helping us test the technology and the components of current and future fusion devices.

This is precisely the purpose of the European Dipole project (EDIPO), launched in 2005 whose mission is to manufacture a high field magnet that will be used to test ITER cable-in-conduit conductors (CICCs) with a current up to 100 kA. Switzerland's Paul Scherrer Institute (PSI), at the Centre of Research in Physics and Plasma (CRPP), is hosting this facility that has been constructed thanks to a collaboration that counts eight years, between CRPP, BNG (Babcock Nöll), F4E and the European Commission.

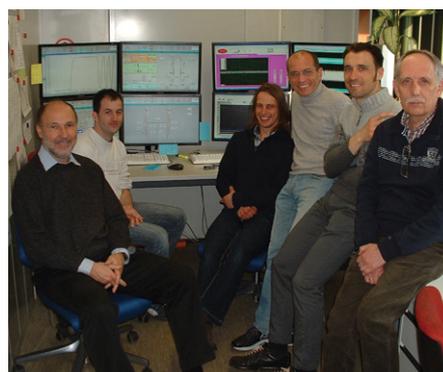
The stakes for EDIPO have been high since the very start because it had to meet two important conditions: first, to offer the fusion community the possibility to test short samples CICCs in a magnetic field of up to 12.5 Tesla, an unprecedented high level for this type of facility, in order to mimic the ITER environment in which superconducting magnets will operate; second, to test CICCs at a high magnetic field over a length equivalent of about 800 mm, which is roughly two times the high field length of the conductors currently tested in SULTAN, the other European facility for short sample CICCs testing which is also located in CRPP/PSI.

On 22 March, the fusion community witnessed a breakthrough. The EDIPO magnet, the core of the EDIPO facility, reached the magnetic field of 12.5 Tesla. In essence this means that the global fusion community has at its disposal a unique, state of the art facility that will allow testing of short CICCs samples, rather than the whole magnet, at these levels in order to verify their properties before production.

We spoke to F4E's Alfredo Portone, EDIPO's Project Leader, about the significance of this achievement and he explained that "the successful commissioning of the EDIPO facility planned for the end of July, will put a European-leading facility at the service of the whole fusion community. It has the potential of becoming an internationally renowned reference point in testing magnets technology."



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01 The EDIPO magnet getting ready to be inserted in the cryostat

02 Scientists witnessing the EDIPO break through (from left to right): P. Bruzzone, M. Hostenstein, S. March, A. Portone, G. Croari, B. Stepanov

F4E STARTS CONNECTING THE ITER SYSTEMS TOGETHER

A contract has been signed between F4E and GTD Sistemas de Informacion for a maximum period of four years and a total budget of five million EUR for services in the areas of software and control in order to integrate the ITER plant systems.



Approximately 2,000 sensors will feed the ITER magnetics diagnostic system in order to calculate some of the key plasma parameters, such as its current and shape.

Those who perceive challenges as opportunities will find themselves drawn to the levels of sophistication and complexity underpinning the ITER project. Connecting the different systems of ITER and ensuring their smooth operation is not an easy task. The glue, otherwise known as the Control Data Access and Communication (CODAC) system, which firmly holds the systems of ITER together, and allows them to 'talk' between themselves, is a building block for securing the success of the project.

A contract has been signed between F4E and GTD Sistemas de Informacion for a maximum period of four years and a total budget of five million EUR for services in the areas of software and control in order to integrate the ITER plant systems. The services may vary from implementing standard data exchanges between systems to the development of more complex software required for plasma diagnostics. GTD Sistemas de Informacion will collaborate with JMP Ingenieros and the United Kingdom's Atomic Energy Authority – Culham Centre for Fusion Energy (CCFE) in three main areas: diagnostics, cryoplant and buildings.

Europe is responsible for 13 systems in the field of diagnostics covering magnetics, reflectometry, spectroscopy, neutron cameras and X-ray detectors. Magnetics stands out as the area of pivotal importance and is by far one of the most challenging ones that will be tackled by the contractors. ITER will operate with at least 2,000 high frequency sensors, which is roughly four times the number of sensors operating in the Joint European Torus (JET), the largest magnetic confinement facility today. The long pulses will require high availability and reliability in order to keep the machine operational for one hour.

Another area that the contractor will have to work on is the integration of the ITER buildings to CODAC and the development of a plant system and graphic user interfaces. In simple terms this can be understood as platforms that will translate data between CODAC and the ITER central systems such as heating, ventilation and air conditioning, power distribution and fire detection.

Similarly, the integration of the European cryoplant systems will also be carried out through this contract. The integration activities in this domain include the design and implementation of plant system integration into ITER CODAC and the development of a human machine interface for this system. In the area of buildings, one of the first deliverables will be the development of a temporary alarm system that will be needed for operation of the buildings during the construction phase.

IFERC AND GÉANT COLLABORATION PAVES THE WAY FOR DATA HIGHWAY IN FUSION RESEARCH

As of 9 April 2013, GÉANT – the world’s leading high-speed research and education network managed and operated by DANTE in Cambridge, UK – will be providing data links to the International Fusion Energy Research Centre (IFERC), in Rokkasho, Japan.



IFERC hosts the Helios supercomputer, a system with a compute power exceeding 1 PFlops and attached to a storage capacity of 50 PB. The Helios supercomputer is provided and operated by the French Alternative Energies and Atomic Energy Commission (CEA), France, and is a Fusion for Energy (F4E) resource.

GÉANT is supplying a 10 Gbps (10 Gigabits per second) link to connect Helios with scientists involved in ITER and DEMO, the demonstration fusion reactor which is considered the follow-on project of ITER.

It is hoped, after the first fusion plasmas of ITER in Cadarache, France, planned for 2020 and beyond, that DEMO, an industrial demonstration fusion reactor, will lead to full-scale fusion energy reaching the commercial market in the second half of the century.

Massive data sets

HELIOS is producing vast amounts of data, which need to be shared with scientists all over the world. Via the Japanese National Research and Education Network (NREN) SINET, IFERC is connected to the pan-

European GÉANT network, and to all European NRENs, like RENATER, DFN, SWITCH, JANET (and many others), supporting the research activities for fusion in Europe.

The GÉANT-provided link is a 10Gbps connection between Geneva and Washington, matching the 10Gbps link between Japan and Washington which is provided by SINET. It will enable researchers in Europe to access this dedicated supercomputer in Japan. It may also eventually be used to complement the network resources allocated to other large scale projects, such as the CERN LHC experiment.

Roberto Sabatino, Business Solutions consultant, says: “The combination of major new scientific projects like IFERC and the use of supercomputers like Helios is creating an explosion of data for which we need to be ready. The provision of a 10Gbps link is a first and crucial step to support the data networking needs in the global search for cleaner, sustainable energy and to assist scientists in their groundbreaking work.”

Transporting high-volumes of traffic

Together with ever-growing data sets, greater collaboration in areas such as energy and genetics is necessitating access to shared central shared central databases of information across research disciplines, exponentially increasing network traffic. In the past, the most practical method for transferring bulk data from geographically dispersed clusters and end users was to physically ship disks by courier. With high speed networks such as GÉANT, data from many different sources can quickly be shared and analysed, thus leading to accelerated results.

Europe’s vision for sustainable energy

The ITER project is funded by and run by seven parties – Europe (contributing 45% of the cost), India, Japan, China, Russia, South Korea and the US. DEMO studies are carried out by individual ITER members, and in the case of Japan and Europe, jointly in the IFERC, within the framework of the Broader Approach Agreement. The investment in fusion research is in line with the EU’s focus within Horizon 2020 to find new and convincing solutions to the societal challenge of secure, clean and efficient energy. GÉANT is seen as an essential component in driving European ICT and allowing Europe to remain competitive whilst dealing with society’s grand challenges.

Susana Clement Lorenzo, F4E Group Leader for the IFERC says: “Helios users are running codes ranging from fundamental physics in hot ITER plasmas to technology and engineering calculations so as to build components in very challenging environments as expected in DEMO. Supercomputers are crucial in solving these complex problems and good data communication channels such as the high-speed GÉANT network can provide the essential links to help scientists all over the world to analyse their findings. Ultimately, all these initiatives will bring us a step closer to fusion as a potential energy source.”

Big science projects reliant on high-speed networks

IFERC joins many other big science projects supported by GÉANT which are changing the way the world collaborates. Examples include CERN’s Large Hadron Collider and global projects addressing climate change, medical diagnosis, bioinformatics and deep space research.

Supercomputer bullx® series. © Bull

JT-60SA: THE TOKAMAK ASSEMBLY BEGINS

There has recently been much excitement in Naka concerning JT-60SA, the “satellite” facility of ITER aimed at modelling proposals for optimising plasma operation and investigating advanced plasma modes that could be tested on ITER or used later on DEMO.

On 28 January, the Tokamak assembly began with the cryostat base (CB), the first major component to be delivered by Europe. This marks a very important step forward for the project, which is part of the Broader Approach Agreement signed between Japan and Euratom (The European Atomic Energy Community) and implemented by JAEA and F4E.

The CB, which supports the weight of the entire Tokamak, has a diameter of 12 metres, a height of 3 metres and weighs 250 tonnes. It consists of a double ring in three sectors, a lower structure in three sectors, and an inner cylinder and is assembled using connecting bolts. The manufacturing of the CB was carried out in Aviles, Spain, by IDESA and final machining and pre-assembly was done by ASTURFEITO, under the supervision of CIEMAT.



Anticipation started building already in November 2012 with the final pre-assembly of the CB at the manufacturer's facilities. An accurate dimensional tolerance check was performed with a 3D portable laser tracker, and results proved to be satisfactory with low error under the limits.

By 8 November, the manufacture was completed and all parts of the CB were packed for transport. Due to their large size (maximum width 6.5 m), the pieces were difficult to transport, especially by road, but fortunately the factories where the CB was fabricated and machined were close to one another as well as to the Aviles seaport.

Fagioli, contracted to F4E, managed all aspects of the transport up to the port of entry in Japan. The CB was collected from the factory on 12 November and

transported to the Aviles port. After loading the CB on board, the ship “IYO” set sail on 22 November, took on further cargo at other European ports, and then headed across the Atlantic and Pacific Oceans via the Panama Canal. After the 18,000 km long sea voyage, the CB finally arrived at Hitachi port in Japan on 16 January 2013.

The transport from Hitachi port to the Naka Fusion Institute was conducted by JAEA in seven stages during the week starting on 19 January. Transport was carried out before dawn on closed roads. All seven pieces of the cryostat base were delivered to the assembly hall at the Naka Fusion Institute by 26 January.

The Tokamak assembly began on 28 January. The start was open to the press, and reporters from 10 media organisations were able to witness the

real assembly work. This event was widely reported to the public through newspapers, web, and TV, including the national news.

This timely start to the assembly of the JT-60SA Tokamak is the beginning of a 6-year assembly and commissioning period which will enable the first plasma to be achieved in March 2019, ready for this project's role to support and complement ITER.

Preassembly of the cryostat base in the manufacturer's factory

ITER TOKAMAK COMPLEX TO WELCOME THE SECOND CONCRETE SLAB

The works for the second concrete slab of the Tokamak complex, consisting of the Diagnostics, Tokamak and Tritium buildings, are underway. The total weight of the buildings is in the range of 360,000 tonnes which is the equivalent of the Empire State building.



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The works are considered a key point in the progress of the ITER construction platform because the Tokamak pit officially opens a new construction chapter. The slab is going to support the 23,000 tonnes Tokamak machine and will require 4,000 tonnes of steel and 14,400 m³ of concrete.

The 493 plinths and anti-seismic pads covering the Tokamak pit, which has a surface equivalent to a football field (90 x 130) metres and is 17 metres deep, will soon be covered with steel and concrete for the realisation of the second reinforced concrete slab.

Following the successful completion of the works for the ground support structure, the retaining walls and

the seismic pads, we are happy to announce that the propping and formwork activities have now started. This is the first step towards the actual floor of the Tokamak complex.

The GTM consortium (GTM Sud, Chantier Modernes Sud, Campeon Bernard sud-est & Dodin Campeon Bernard) is in charge of the works. The main challenges they will have to face will be the complexity and density of the reinforcement inside the concrete and the tight time schedule. The slab is expected to be completed before the end of this year. The basemat, otherwise known as 'B2 slab' in the ITER construction jargon, will be 1.5 metres thick just like the concrete slab below the plinths.

- 01 The works for the upper concrete slab are under way
- 02 Formwork activities have started in the Tokamak pit for the realisation of the second concrete slab

DISCOVER HOW EUROPE WILL MANUFACTURE THE ITER TF COILS

Together with our audio-visual crew, we travelled all the way to La Spezia, Italy, to visit a 25000m² facility managed by ASG which will host the assembly of Europe's ten winding packs for the Toroidal Field (TF) coils.



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The first F4E clips reporting on the progress of an ITER component have just been released and producing them has been an incredibly interesting and gratifying experience. Since the start of this project, the complexity of the ITER machine has been widely discussed and debated between fusion experts to such extent that the moment we crossed the doorstep of an ITER clean facility with our audio-visual crew it almost felt like crossing the Rubicon. We think that seeing is believing! For this reason, we decided to travel all the way to La Spezia, Italy, to visit a 25000m² facility managed by ASG which will host the assembly of Europe's ten winding packs for the Toroidal Field (TF) coils.

We interviewed four experts whose main duty over the next years will be to carry out this extremely challenging task successfully. They will have to identify together with suppliers the best engineering solutions to manufacture

the TF coils, monitor closely the R&D together with the manufacturing activities and solve the technical issues that may occur. Moreover, they will have to co-ordinate the work between the different suppliers, travel to many locations and, last but not least, make sure that a stringent quality assurance process is applied. Each TF coil weighs approximately 300 tonnes and with Europe being responsible for the production of ten, they better get ready to lift 3,000 tonnes on their shoulders!

We have produced two clips to unveil the strategy behind the production of the TF coils, the key engineering moments and the thrill of being involved in a project such as ITER. Alessandro Bonito-Oliva, EU Responsible Officer and Group Leader for the TF coils, presents Europe's manufacturing strategy and explains the different stages involved in the manufacturing of these massive magnets. Robert Harrison, EU Technical

Officer, describes what happens in the winding facility and what is challenging about the work undertaken. Jordi Cornella, EU Technical Officer, invites us to visit the massive furnace that will heat-treat the TF coil components to temperatures reaching 650°C and last but not least, Antonio Pellechia, ASG project manager, explains the commitments taken by the consortium involved in this task together with the prestige and challenge of producing the first ever magnets of this size able to sustain such temperatures.

You can watch the clips in the multimedia library of our website and on the F4E YouTube channel.

- 01 The clean area. At the bottom it is visible the winding line and in the middle the side radial plate prototype during dimensional check with laser technology.
- 02 ASG operators working on the winding table

2013 ITER BUSINESS FORUM: INDUSTRY AND SMES ROLL UP THEIR SLEEVES TO DELIVER ITER

750 participants from at least 350 companies based in 26 countries. 48 hours filled with thematic sessions, discussions, networking events and one-to-one business meetings. The participants may come from different continents and different business cultures but the one thing that unites them is the fact that they see a clear opportunity for collaboration, growth and advancement of know-how within the ITER project.



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The third ITER Business Forum (IBF) was by all means the biggest and most diverse in terms of participation so far. The tireless efforts of France's Industrial Liaison Officer (ILO), Sabine Portier, in collaboration with all ILOs and Agence ITER France, hosting the event, have paid off and impressed all participants. The event has become the meeting point for those who mean business when they think of ITER and fusion technology. The response from industry, SMEs and fusion associations has grown for two main reasons: first, there has been real

progress in the areas of construction and manufacturing and companies start seeing the different pieces of the puzzle a bit more clearly; second, contracts have been signed and companies have moved from the learning curve to the phase of delivery. Six of the ITER Domestic Agencies (DAs) were represented and companies from inside and outside Europe made the effort to travel to Toulon, France in order to receive the latest information regarding the progress of the ITER project and meet with other potential interested parties to foster collaborations. Some of those informal first meetings will turn into formal partnerships, they will become consortia and apply to the Calls for tender launched by the different DAs. Some others will choose to become subcontractors and offer their expertise to bigger companies requiring their skills. One thing is certain: ITER offers a mix of opportunities for large and small economic operators around the world.

The opening session brought together the IBF hosts, local policy makers, the Director General of ITER IO and the Director of Fusion for Energy, Professor Henrik Bindslev who took the opportunity to express the following thoughts: "The market for sustainable energy is very large and growing. Fusion will take a large share of this market when the cost of electricity from fusion is competitive. That is why we want to build a fusion industry which is competent and capable, and can deliver a competitive price of electricity from fusion. To drive



the development of fusion and build the fusion industry, continued public investments are foreseen. In addition to ITER, we will construct IFMIF, DEMO and other large high-tech facilities. We want you to be the fusion industry of the future and to prosper in doing so. We want you to increase your competences and capacities and be able to exploit them. We want you to find opportunities in fusion and ITER. That is what this forum is about". The participants of the plenary session took part in a press conference, during which they commented on the progress of the works, budget and the benefits for industry and SMEs.

F4E's Head of ITER Department, Jean-Marc Filhol, was also among the keynote speakers offering a detailed presentation on the different packages that Europe is responsible. He explained that 185 contracts amounting to 1.8 billion EUR have already been signed by F4E. A roadmap of the tenders to come was presented per area such as buildings, magnets, in-vessel components, remote handling, diagnostics and cryoplat to name a few. More details on these systems were disclosed by the different F4E Technical Officers during the parallel thematic sessions.

An IBF exhibition was also organised to help Industrial Liaison Officers (ILOs) and Fusion Associations to present their involvement in ITER and showcase national success stories. F4E participated in the exhibition and took the opportunity to present a series



of short films from the progress of the Toroidal Field coils and Remote Handling system. In parallel, its members of staff offered short trainings on how to use Industry and Associations portal. Last but not least, F4E set up a small studio to film the impressions of ILOs and the expectations of different companies vis-à-vis the ITER project. When ready, the short clips will be uploaded on the F4E YouTube channel and will be distributed to all interviewees.

- 01 Professor Henrik Bindslev, F4E Director, explaining Europe's contribution to the ITER project during the press conference ©AIF
- 02 Anthony Courtial, from F4E's "Market Policies, Analysis and Reporting" team, communicating on business opportunities ©AIF
- 03 Company representatives exchanging contacts during the IBF business meetings

THE BUSINESS CASE STUDY OF THE DIVERTOR REMOTE HANDLING SYSTEM IS UNVEILED

One of the most fascinating technologies linked to the operation of the ITER machine is remote handling. The millimetric accuracy required for the inspection and replacement of large multi-tonne components need sophisticated tooling able to perform remote maintenance.

On 5 February, F4E's Remote Handling Project Team with its designated Procurement Officers, organised a one-day event for pre-selected candidate bidders in order to present the key aspects of the tendering process behind the multiple Framework contracts of the divertor remote handling system – the so-called “business case” that competing industries will have to perform. The meeting took place in Barcelona and brought together 30 representatives from the four candidate bidders, grouped in consortia led by: Assystem UK Ltd (UK); Astrium GmbH and Areva NP GmbH (Germany); Amec Nuclear UK Ltd (UK); Telstar Technologies S.L.U. (Spain).

Carlo Damiani, Project Team Leader for Remote Handling, explained that the procurement of remote handling systems for the divertor requires a novel combination of nuclear niche technologies with a considerable amount of engineering and foresees a major role for the European industry. “F4E is willing to define the best possible long-term partnership with industry. Therefore, we have devoted great attention in developing the business case that we are proposing today to the four industrial consortia that have responded to our call for expression of interest and have been selected for our tendering phase”.

Through this business case study F4E will ask the different consortia to demonstrate how their technical and managerial capabilities will be put to use concretely. The score of the business case study will



be one of the key elements of the tender evaluation procedure. By all means, this is a turning point for the different consortia because through this exercise they will be pushed to think out of the box, as well as demonstrate their competences and potential as big technology players. In order to support bidders in this competitive dialogue, F4E will offer financial support to those business case studies that receive a score above the evaluation threshold.

As far as the remaining three packages of remote handling are concerned, they will be carried out in the same way and it is expected that this area of technology will offer new opportunities to the different interested industries.

Carlo Damiani, Remote Handling Project Team Leader, presenting the business case study

POLAND'S INDUSTRY AND SMES DECLARE A STRONG INTEREST IN ITER



The business opportunities stemming from big science projects and the potential contribution of companies with their skills and expertise led Sylwia Wójtowicz, Poland's Industrial Liaison Officer (ILO), to organise a one-day seminar at Wrocław Technology Park in order to showcase the ITER project together with the European Spallation Source. This was the second awareness day organised in the last three years and it came at exactly the right time. Europe's ITER procurement strategy has been outlined and contactors are actively looking for suppliers at different levels. The event managed to attract the interest of 30 representatives coming from the fields of services, cabling and IT and offered them information about the upcoming Calls for tender.

The plenary session opened with a presentation from Professor Maciej Chorowski, who highlighted the benefits that large scientific collaborations can yield to the economy and its operators. In this context, the ITER project was described as a true opportunity for fast track learning in new niche technologies with clear financial benefits in the long term. Anthony Courtial, representing F4E's "Market policies, Analysis and Reporting" team, explained Europe's contribution to ITER and elaborated on the different procurement packages that were of interest to the audience.

An online guided tour of the Industry and Associations portal was given to all participants focusing mainly on how to register and how to search for other business partners. One of the novelties of the seminar was a session called "Meet the company", during which Polish companies presented their area of competence and capabilities to F4E in order to explore their potential contribution. The seminar concluded with meetings between different Polish companies exchanging contacts and understanding how they could complement each other's skills.

Sylwia Wójtowicz, Poland's Industrial Liaison Officer, delivering opening remarks at the seminar

F4E ENCOURAGES GERMAN YOUTH TO OPT FOR AN INTERNATIONAL CAREER



Braving sub-zero temperatures and a great deal of snow, young German students about to choose what university studies to pursue eagerly made their way to the F4E stand at the International Careers Fair in Berlin. There, they heard what it is like to work within an international project in a multi-cultural, polyglot environment and why this is a fruitful and interesting career option worth considering.

The event, organised by the German Foreign ministry, highlighted the possibilities of pursuing an international career and, apart from F4E, gathered international organisations such as the United Nations, CERN (the European Organization for Nuclear Research), EPSO (the European Personnel Selection Office), and the World Bank. The F4E stand, manned by Christine Konrath and Marcel Dolieslager from F4E's Human Resources team, attracted a high number of visitors who were all informed about F4E job profiles, recruitment procedures and career development. Interest was high – the aspiring university graduates had many questions about the ITER project and how to get a job at F4E once finished with their university studies. The coming years will show the fruits of this exercise and who knows, we will perhaps see an influx of job applicants who first heard about F4E thanks to this event?

Christine Konrath and Marcel Dolieslager informing German students about career possibilities at F4E.

HOW WILL THE ITER CONSTRUCTION SITE EVOLVE IN 2013?

The F4E clips reporting on the evolution of the ITER construction site and the manufacturing of components are back!

We have reworked their style and integrated interviews from different members of staff and contractors in order to give you more insight on the state of play.

Our aim is to keep you informed on the key developments, let you see the progress of the works and help you meet the people behind the biggest scientific international collaboration in the field of energy – ITER.

Our first clip introduces you to Laurent Schmieder, F4E's Project Manager for the ITER construction site, Buildings and Power Supplies, who gives us a guided tour on the site and shares with us the volume of works that it will undergo during this year.

You can watch our clips in the multimedia library of our website and on the F4E YouTube channel.



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01 Laurent Schmieder, F4E's Project Manager for the ITER construction site, buildings and power supplies, gives us a guided tour on the ITER platform.

02 Overview of the Assembly Hall of the Tokamak Complex Area. Concrete pouring planned until March 2013

Fusion for Energy

The European Joint Undertaking for ITER and Development of Fusion Energy

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