



**FUSION
FOR
ENERGY**

BRINGING
THE **POWER**
OF THE **SUN**
TO **EARTH**

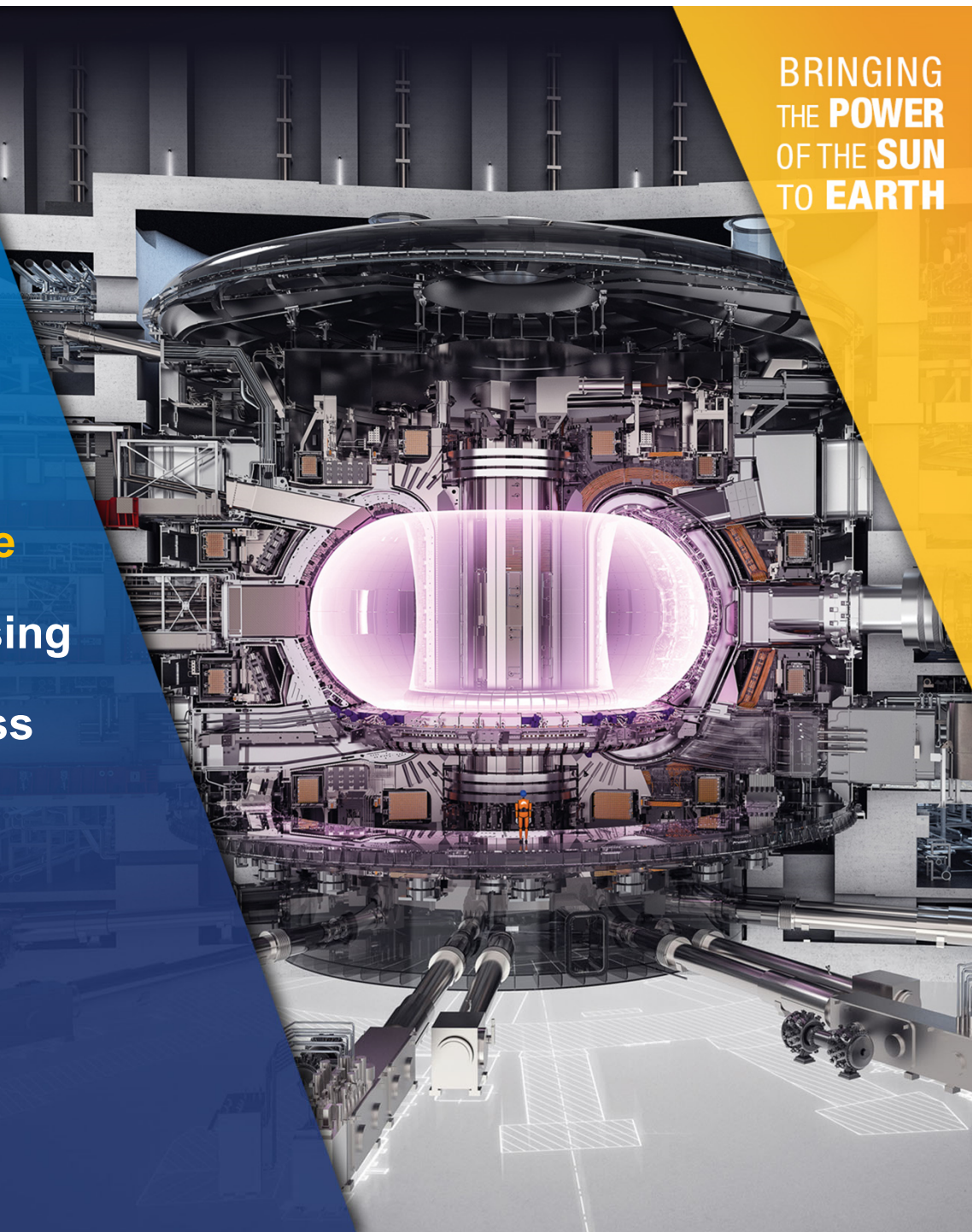
Innovate with Big Science

**The ITER project: increasing
European competitiveness**

Carmen Casteras

IP and Technology Transfer Officer
Fusion for Energy

Barcelona, 2nd December 2021



The ITER project

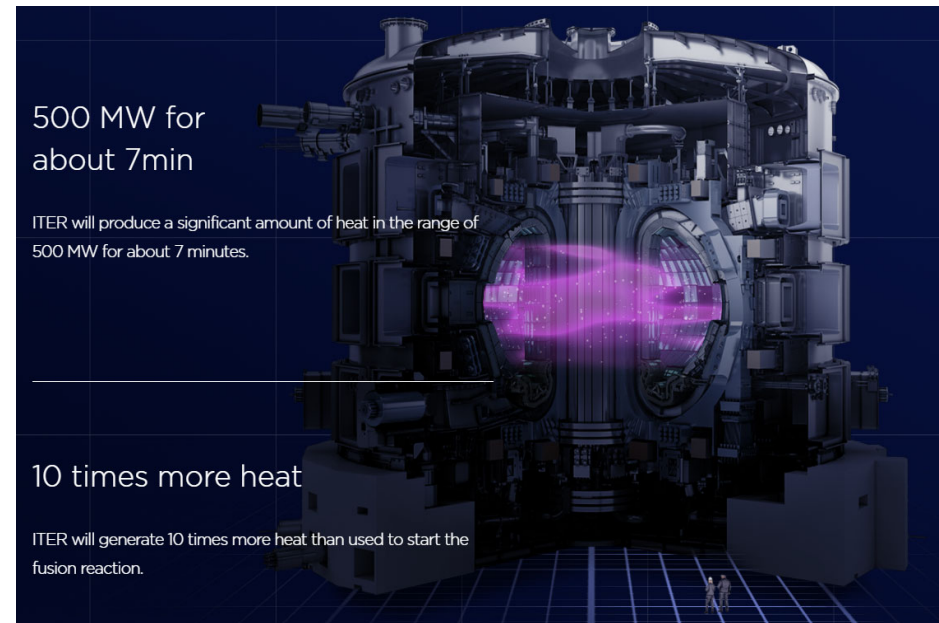


The world's biggest experiment on the path to fusion energy

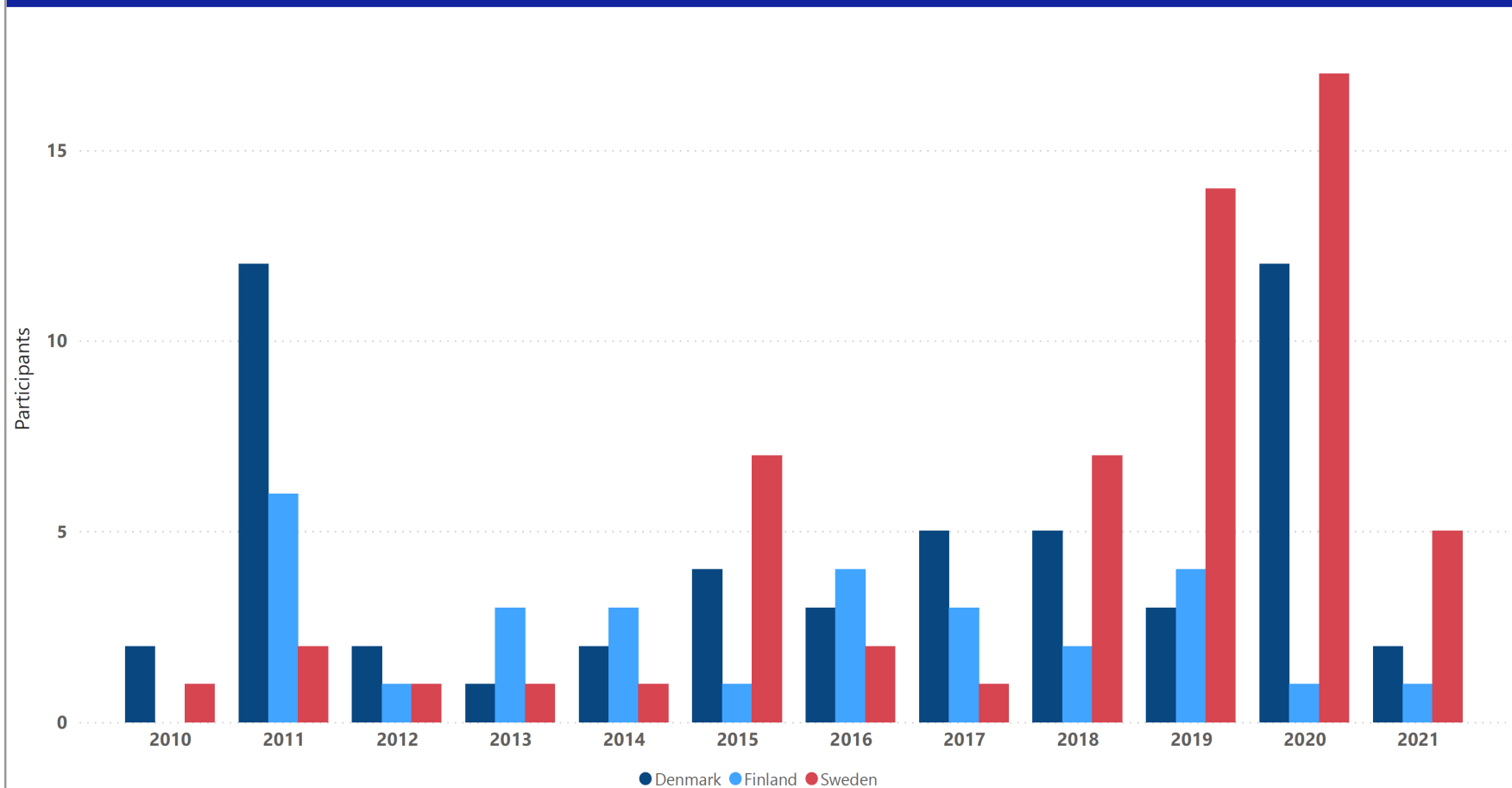
ITER is a global scientific partnership: China, Europe, Japan, India, the Republic of Korea, the Russian Federation and the United States.

The largest Tokamak device to test magnetic confinement to produce fusion energy.

Millions of components, operated by cutting-edge systems.



Industry's interest: Participation in pre-procurement activities*



*Pre-procurement activities stands for Market Surveys, Info Days and outreach activities

Swedish industry in F4E contracts



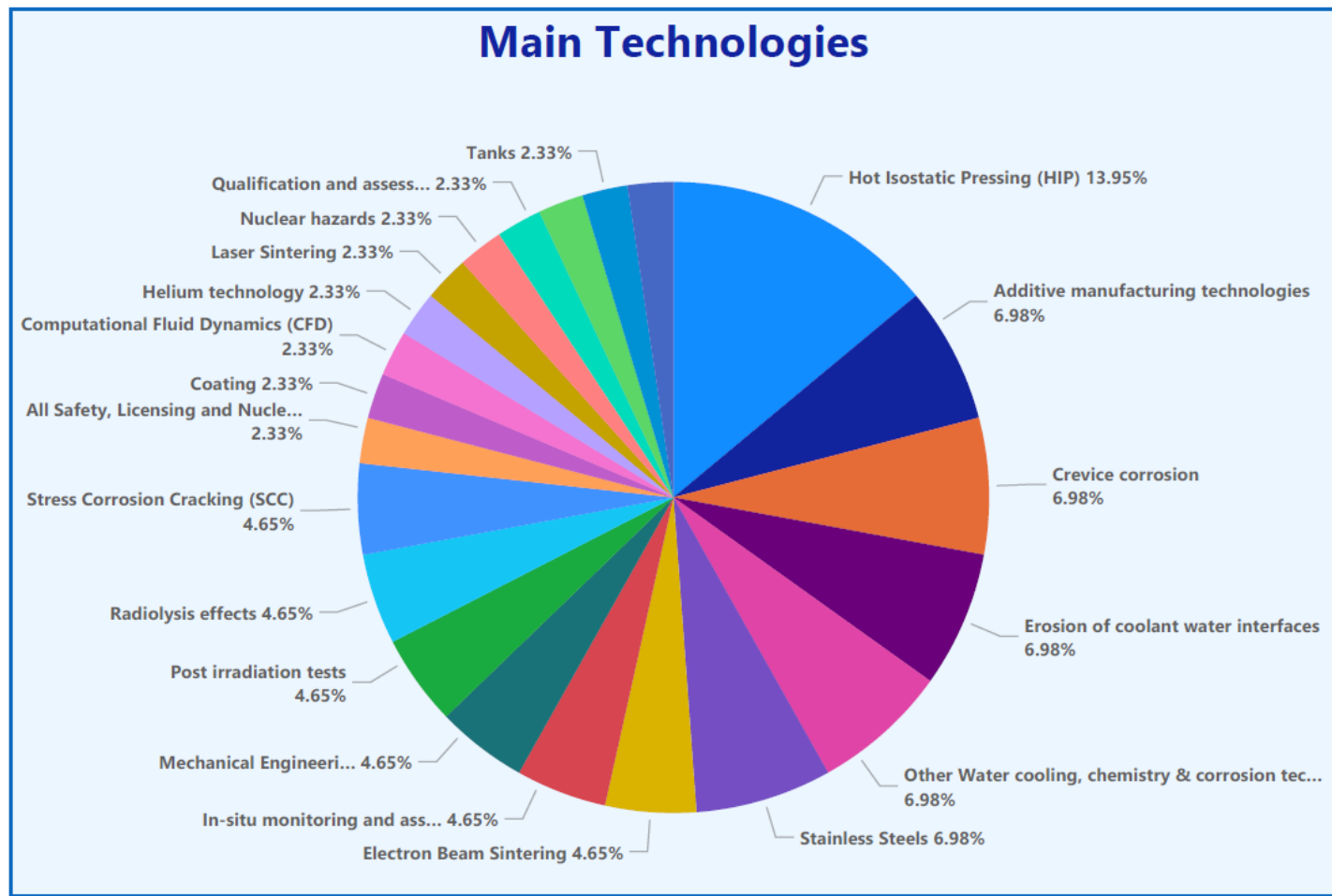
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Contracts

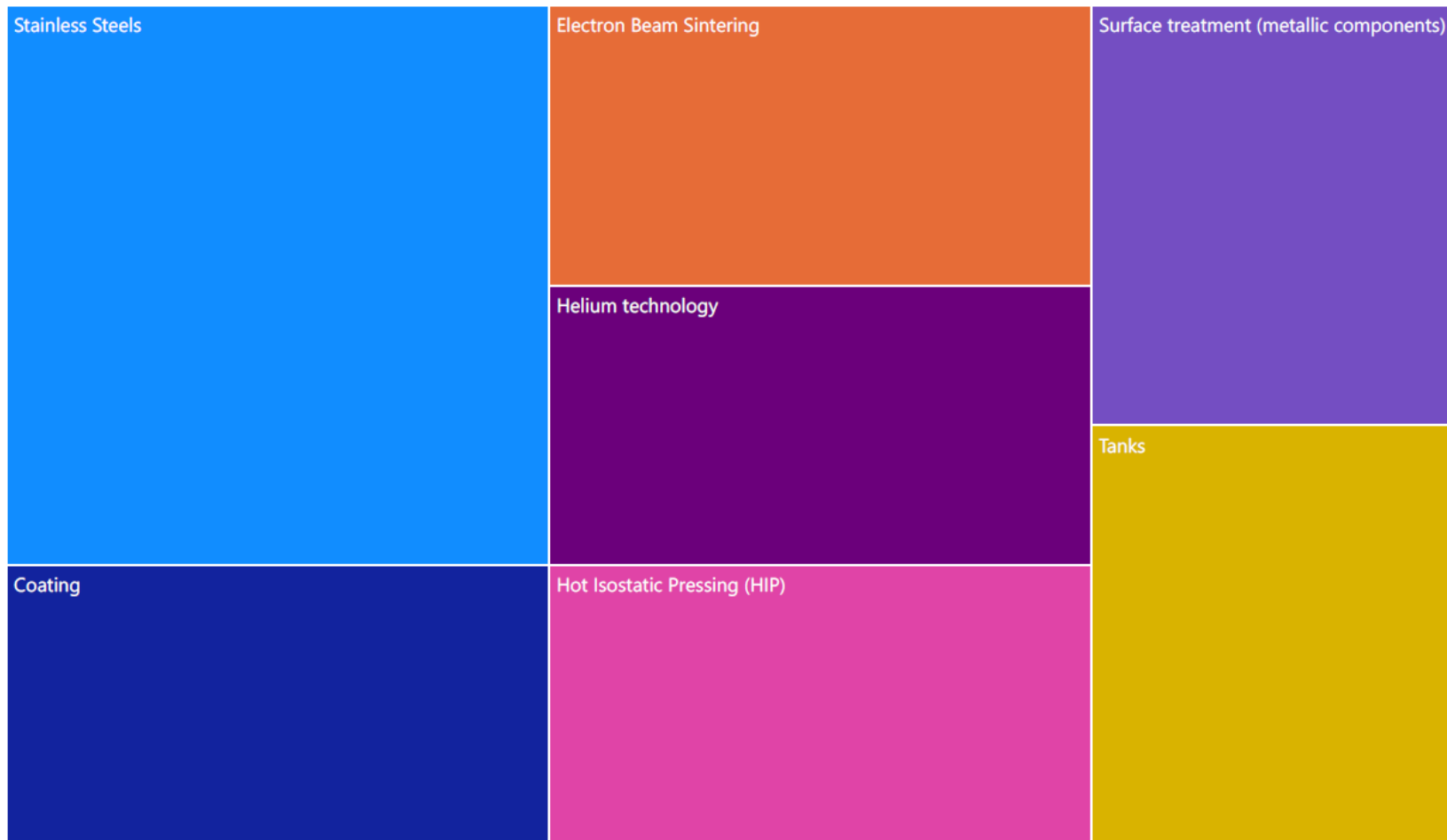
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Contractors

Which technologies do Swedish contractors perform?



What do other countries subcontract in Sweden?

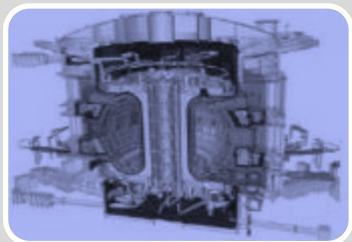


Who we are



- ▶ **Fusion for Energy (F4E) is the European Union organisation managing Europe's contribution to ITER.**
- ▶ **F4E is placing contracts and working closely with industry to provide the infrastructure and the components of ITER, the biggest fusion device.**
- ▶ **Headquarters: Barcelona, Spain**
Offices: Cadarache, France
Garching, Germany
Rokkasho, Japan
- ▶ **Budget**
 - ▶ **2007-2020 ~€6.8bn (2008 values)**
 - ▶ **2021-2027 ~€5bn (2019 values)**





Contribution to ITER through contracts placed with Industry



Broadening the industrial base for future fusion market



Fostering innovation and competitiveness

F4E Industrial Policy - Objective # 3

Foster European innovation and competitiveness in key emerging technologies to further the development of the Innovation Union and its impact at the international level.

F4E Technology Transfer Program is a tool to achieve such objective.

- Goals:
 - Identification of **Success stories** portraying the increase of competitiveness, growth, business and employment resulting from the ITER project.
 - To nurture a Technology Transfer Culture.
 - To increase the motivation of companies to work with F4E.
 - To manage the **IP to create value** to Industry. Licensing practice at F4E.

Portfolio of technologies



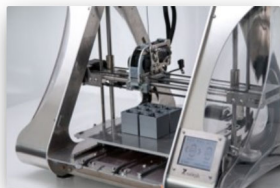
Technology portfolio



TECHNOLOGY OFFER

High-resolution Fiber optic Encoder

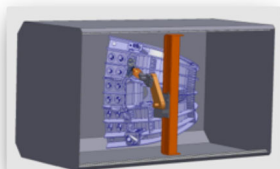
F4E and Micronor have developed a high-resolution fiber optic incremental encoder system which can function in a high magnetic environment. The all electronically passive design enables many potential applications where electronic based position encoders cannot be used. Micronor and F4E are currently working to achieve radiation resistance encoders that meet [Read more...](#)



TECHNOLOGY OFFER

3D printing know-how for stainless steel components

F4E, Stockholm University and Mid Sweden University have investigated two methods of 3D printing in order to evaluate their feasibility of manufacturing ITER's First Wall Beam. Providing high density and stress tolerances with the possibility to design and manufacture complex components, these AM technologies can find many applications in healthcare. [Read more...](#)



TECHNOLOGY OFFER

New electron beam welding technology for very large structures assembly

PRO-BEAM and F4E have developed a new electron beam welding solution dedicated to the manufacturing of huge and complex structures. Its combination of high accuracy, productivity and ability to weld very large structures, is a complete breakthrough and show promising applications in nuclear, maritime, railway or wind power. Technology assets [Read more...](#)

Search Results for: measure



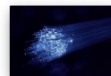
TECHNOLOGY OFFER

Target Reflectivity Measurement System for large objects and hazardous environments

F4E and OES Systems have developed an innovative optical prototype system dedicated to the measurement of the target reflectivity of objects which are too large or dangerous to be used in traditional RDP measurement instrumentation. Promising applications in target identification are now considered. Technology assets [Read more...](#)

ITER electrical connectors open a new market for VAC-TRON in the Oil and Gas industry

ITER requires an extensive diagnostic system to monitor the experiment. Remote will be located in the vacuum vessel to measure the temperature, radiation, composition of the plasma. Remote will carry the signals provided by the sensors through the walls of the vacuum vessel so that signals can analyse the data. [Read more...](#)



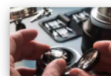
TECHNOLOGY OFFER

High-resolution Fiber optic Encoder

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Success stories

New fusion brings concrete benefits to the European industry through our success stories of spin-offs, increased competitiveness, and innovation from industry diagnosis of fusion plasma to an active control system using real-time data. Plasma [Read more...](#)



TECHNOLOGY OFFER

High-precision dimensional inspections

F4E and OES Systems have developed an innovative optical prototype system to scan and to 3D reconstruct high precision components at large distance and high accuracy for inspection and quality control. Applications in dimensional analysis of large scale manufacturing parts and industrial products (metal inspection) are considered. Technology assets [Read more...](#)



TECHNOLOGY OFFER

A revolutionary Beam Position Monitoring system

Seven Solutions, in association with F4E, brings a complete solution for Beam Position Monitoring (BPM) used to provide information on the position, current and phase of the beam. An accurate and fully programmable system powered by White Rabbit synchronization and including high bandwidth communication links provides a precise beam position measurement. [Read more...](#)



TECHNOLOGY OFFER

A margin of error 25 times thinner than an A4 page for component inspection

F4E and Teramir have developed an innovative portable technology equipment able to measure the thickness of structural rings with 25 microns of tolerance. An innovation in the field of industrial dimensional metrology that will avoid the existing applications in quality control and R&D to inspect parts and valve manufacturing [Read more...](#)

Search Results for: remote

Fusion remote handling innovation conducts tele-operation technology enhancement for robot companion services

The Remote Handling System (RHS) will be designed for the maintenance of plasma facing components of the plasma fusion reactor. During operation, these components will get activated and contaminated with radioactive and toxic materials. Remote handling operations are performed by remote close proximity techniques. Remote [Read more...](#)

TECHNOLOGY OFFER

Adaptable Remote Handling Diagnostics Tool

ITER will have developed, with the support of F4E, Remote Handling Diagnostics (RHD) a software processing and off-line tool for diagnosis of Remote Handling System and allowing measurement of plasma diagnostic functions. This technology could be used in any application that needs remote data acquisition such as medical research in [Read more...](#)

Success stories

New fusion brings concrete benefits to the European industry through our success stories of spin-offs, increased competitiveness, and innovation from industry diagnosis of fusion plasma to an active control system using real-time data. Plasma [Read more...](#)

Webinars



TECHNOLOGY OFFER

Simple vision software for harsh environments

Remote handling in fusion reactors with F4E and Teramir have developed a vision software that can handle the complex and demanding of a harsh environment. This technology could be used in any application that needs remote data acquisition such as medical research in [Read more...](#)



TECHNOLOGY OFFER

Cost effective robot system ready for the market

F4E and OES Systems have developed a high quality remote handling system which is being integrated in order for spin and process control of components. The technology could be used in any application that needs remote data acquisition such as medical research in [Read more...](#)



TECHNOLOGY OFFER

New integrated circuits to withstand high ionising dose radiation and high energy particles

F4E and Teramir have developed a new generation remote handling system for plasma facing components. This technology could be used in any application that needs remote data acquisition such as medical research in [Read more...](#)



TECHNOLOGY OFFER

Light & compact image sensors resistant to radiation

Development of new light CMOS image sensor able to handle a dose of radiation up to 1 Mrad without sensitivity, high temperature operating capability or image processing. In the meantime, the device is a new generation of very low light cameras in nuclear applications. This technology could be used in any application that needs remote data acquisition such as medical research in [Read more...](#)

Specialised in manufacturing diamond discs with similar or even better properties than natural diamond, Diamond Materials improves the transmission of high-power beams. Such an innovation shows great potential for application in a wide variety of fields of interest. Technology assets natural diamond-like properties: low absorption, hardness, thickness, extremely high thermal conductivity, [...]

The Remote Handling Systems of ITER will be designed for the maintenance of plasma facing components of the plasma fusion reactor. During operation, those components will get activated and contaminated with radioactive and toxic materials. Remote Handling (RH) maintenance is performed by master-slave telemanipulation techniques, therefore, proper visual and haptic [...]

CECOM heritage in nuclear fusion market started in early 2010s when the company changed its strategy to address the Big-Science market and when first manufactured the oil extraction grids for JET (Joint European Torus). Based on copper deposition, this industrial method has then been implemented with F4E during the Spider [...]

The French company Axor Cable designs and manufactures innovative cabling, interconnect solutions, cable assemblies, connectors and mini systems for high tech applications. To tackle the challenges of the quench detection system of the ITER magnets, especially on the voltage tap wires and leader cables, Axor developed a process allowing the use [...]

ITER requires an extensive diagnostics system to monitor the experiment. Sensors will be located in its vacuum vessel to measure the temperature, ionisation, composition of the plasma. Cables will carry the signals produced by the sensors through the walls of the vacuum vessel so that experts can analyse the data. [...]

GEORAT and F4E have improved and pre-qualified a MSPA piezo motor, based on a secret material and able to operate in vacuum, non-magnetic or high temperature and sustain radiations. Its high reliability, precision and operating lifetime makes this new piezo motor perfectly suitable for space, healthcare and nuclear applications. Technology [...]

Success stories

3D printing know-how for stainless steel components

F4E, Stockholm University and Mid Sweden University have investigated two methods of 3D printing in order to evaluate their feasibility of manufacturing ITER's First Wall Beam. Providing high density and stress tolerances with the possibility to design and manufacture complex components, these AM technologies can find many applications in healthcare, automotive, nuclear or space industries.

Technology assets

- a fast, one-step building process for resistant and complex components;
- high component density and resistance to stress;
- skipping manufacturing complexity and exploring new solutions in many spin-off applications: surgical implants, powerplant, space, car engines components.

[DOWNLOAD OUR TECHNOLOGY OFFER](#)

Categories: [TECHNOLOGY OFFER](#)



Interested in this technology?

Contact

Nicolas Louée

Technology broker

[EMAIL](#)

Who?



F4E Technology Transfer Brokers



- 7 technology transfer and market experts with European presence
- Business mindset and strong interface with non-fusion industries (big science, aerospace, energy, automotive, electronics, agrifood, healthcare....)
- Same network of brokers implemented by the European Space Agency and EUROfusion

How?



I. Brokerage services:

- New applications in non-fusion markets, business opportunities.
- Adoption of F4E technologies in companies' innovation processes.
- Adoption of F4E technologies to address technical needs.

II. Funding initiatives:

- Technology transfer award.
- Demonstrator project.

III. Webinars:

Focused on specific technical fields. 'Sales pitch' format.

1. Radiation resistant electronics
2. Inspection and quality control
3. Advanced Manufacturing
4. Simulation and modeling
5. Remote handling and motion control

Contact us

In Extenso Innovation Croissance and our network of brokers in Europe are fully mobilised to guarantee the success of your project!

For further information about the technologies and the programme, please contact the coordinator of the programme :

 **Nicolas Louée**
[EMAIL](#)

About the team

This initiative is led by F4E and managed in collaboration with In Extenso Innovation Croissance.

We work with a network of European business experts to guarantee the qualification of cutting-edge fusion technologies, identify industrial needs and the successful technology transfer through projects and agreements. Our network of partners and brokers in Europe will help you capitalise on the fusion technology transfers.

RTC
Inspiring growth
Broker in **Italy**

VERHAERT
WATER MANAGEMENT
Broker in **Belgium**

EurA
European Atomic Research Community
cesah
Centrum voor Samenwerking en Innovatie
Brokers in **Germany** & **France**

RINA
Broker in **Italy**

In Extenso
Innovation Croissance
Broker in **France**

Kim
Knowledge innovation market
Broker in **Spain**

F4E's network of brokers in Europe

Other contacts

For communication enquiries
Sophie Gouleyron Maestroni
[EMAIL](#)

To reach Fusion for Energy
Carmen Castoras
[EMAIL](#)

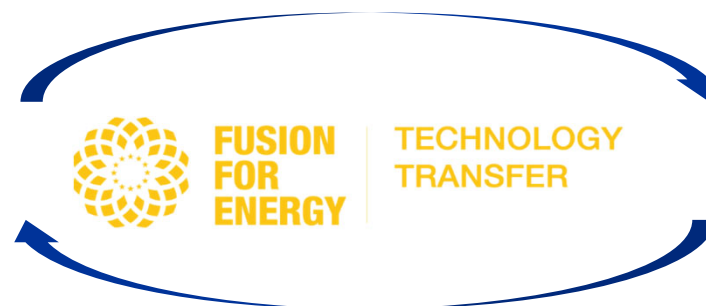
Finding new applications for fusion technologies

Fusion for Energy (F4E) Technology Transfer Program is promoting the transfer of fusion technologies within the European Industry.



Developer of innovative fusion technologies

Looking for new markets and business opportunities



Connecting fusion and non-fusion ecosystems

Access to a Technology Marketplace

Operational Support from Technology Transfer Brokers (European network, mediation with new customers/suppliers)

Communication support / Funding opportunities

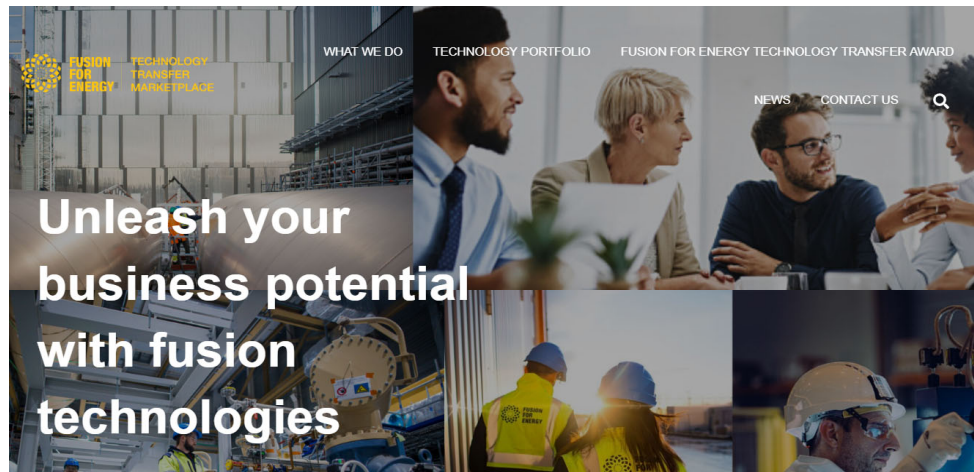


Industry or entrepreneurs willing to tackle R&D challenge and/or add value to their products and services

Looking for new technologies

Adoption of fusion technologies

Marketplace of technologies



Key information for companies on the [F4E Marketplace of technologies](#) and funding opportunities:

- Portfolio of technologies with their corresponding 'Product data sheet'
- Webinars: repository of past webinars (replay)
- B2B meetings.
- Technology Transfer Award 2021
- Demonstrator project 2021
- Contact details of the brokers

Technology Transfer Award



In Extenso
Innovation Croissance

2021

PAY TO THE
ORDER OF

VAC-TRON

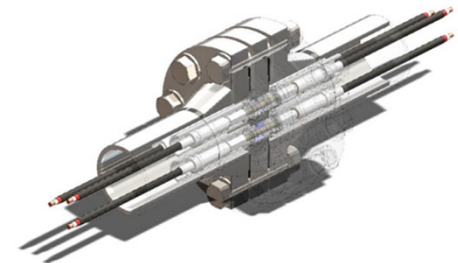
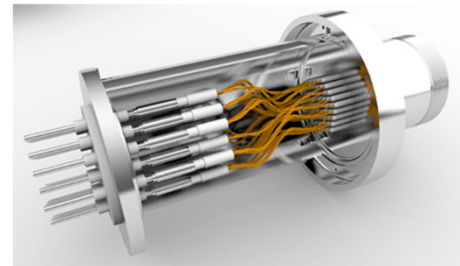
ten thousand EUROS



10,000.00€

Fusion for Energy Technology Transfer Award

Technology Transfer Award



Electrical Feedthrough for fusion and now for Oil and Gas applications

Innovative Glass-to-Metal Sealing (GTMS) technology for ITER electrical connectors

Safer energy supply for pumps and compressors in gas industry

Increased value and scope of VAC-TRON products

- **Objective:** This funding aims at financially supporting a demonstrator project where a fusion technology or know-how is planned to be used in a non-fusion environment
- **Value:** a project will be funded with 35 000€ (VAT exempt)

Evaluation criteria	Note
Project Feasibility	30%
Innovation potential	40%
Socio-economic impact	30%



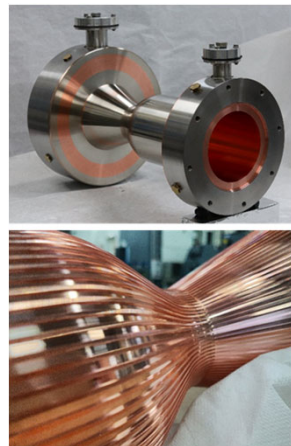
Doing business out of fusion



Fusion inspires...



Robust and safe remote-control system for elderly people assistance (Heemskerk Innovative Technology)



Cooling channels for space thrust chambers (CECOM)



Automated sorting of fruits and vegetables (CHROMODYNAMICS)



Large and complex components for Ariane and Solar Orbiter (pro-beam)

Doing business out of fusion



Participate in the technology transfer track

Big Science Business Forum 2022

BSBF 2022 is a business oriented congress which congregates all the European Research Infrastructures, focused on technology and with the aim to be the main meeting point between Research Infrastructures and industry.

This will be the second edition of the event after the success of the previous edition in Copenhagen, where more than 1,000 participants from more than 500 organisations and 29 countries gathered together to discuss the future prospects of the Big Science Market.

[Programme](#) [Registration](#) [New calendar](#) [Procurement handbook](#) [New BSBF Webinar Miniseries](#)

October 4 Starts: 09:00 AM

October 7 Ends: 04:00 PM

Get the most out of BSBF2022!

The event will start in: 31D 14H 48M

[Add to calendar](#)

Meet Europe's largest Big Science organisations:





**FUSION
FOR
ENERGY**

Thank you

carmen.casteras@f4e.europa.eu

