



**FUSION  
FOR  
ENERGY**

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

## ITER- F4E Forthcoming Business Opportunities

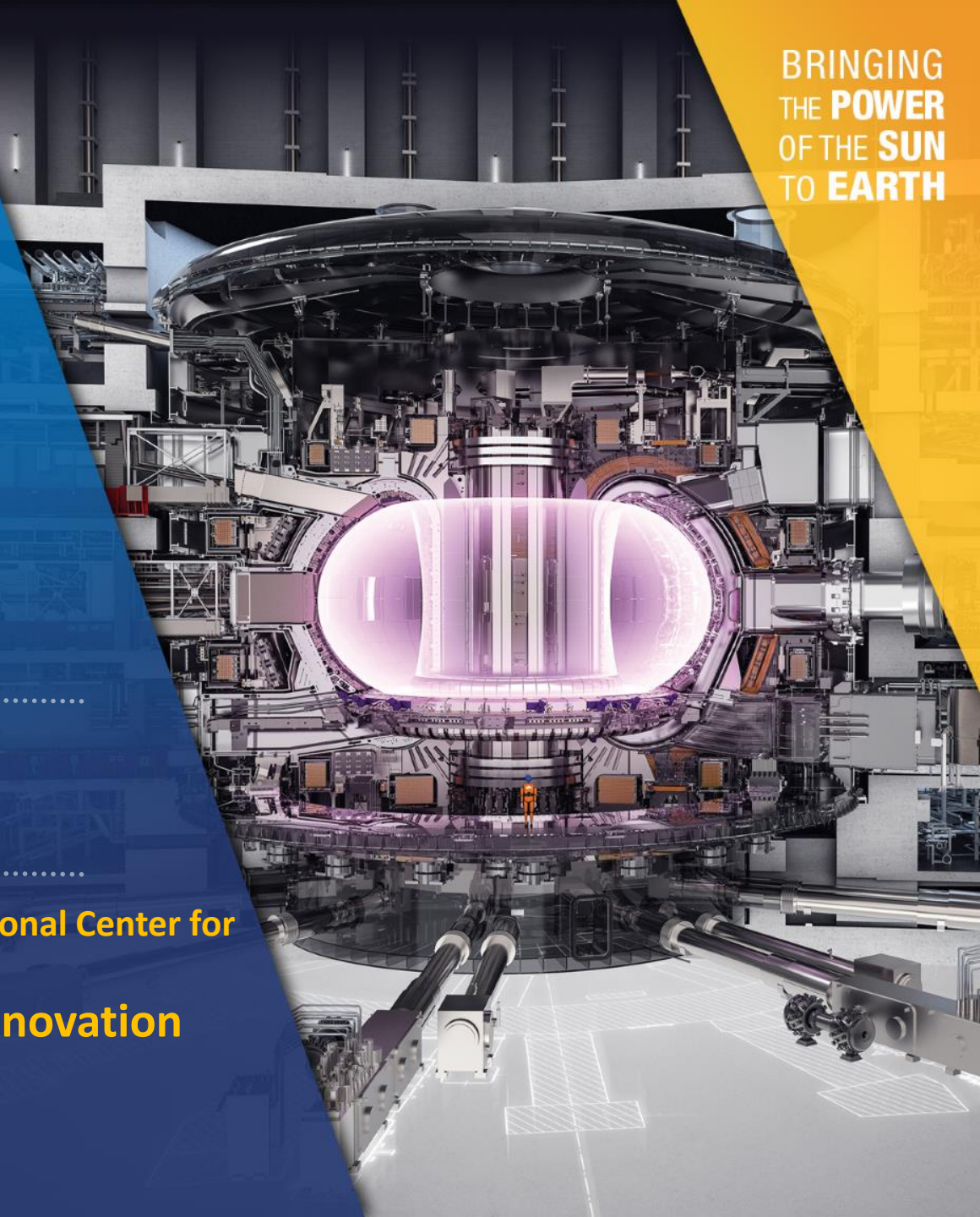
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**Mehdi DAVAL – F4E**

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19<sup>th</sup> November 2024 – OTWOCK National Center for  
Nuclear Research

**Big Science & NOMATEN Innovation  
Days 2024**



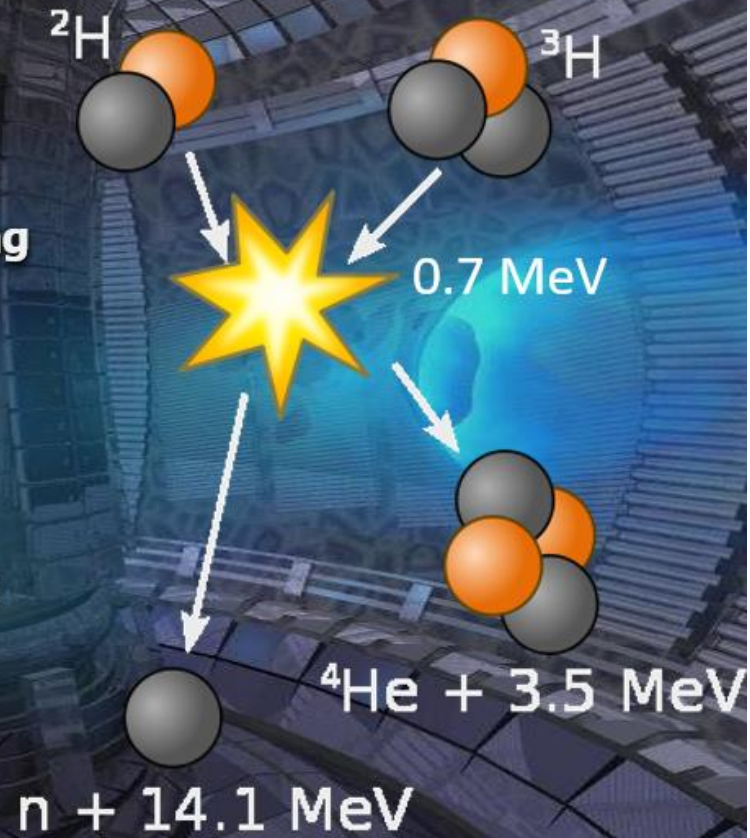
- **Fusion and ITER at a glance**
- How to access ITER opportunities (IO and F4E)
- Upcoming ITER opportunities (F4E)



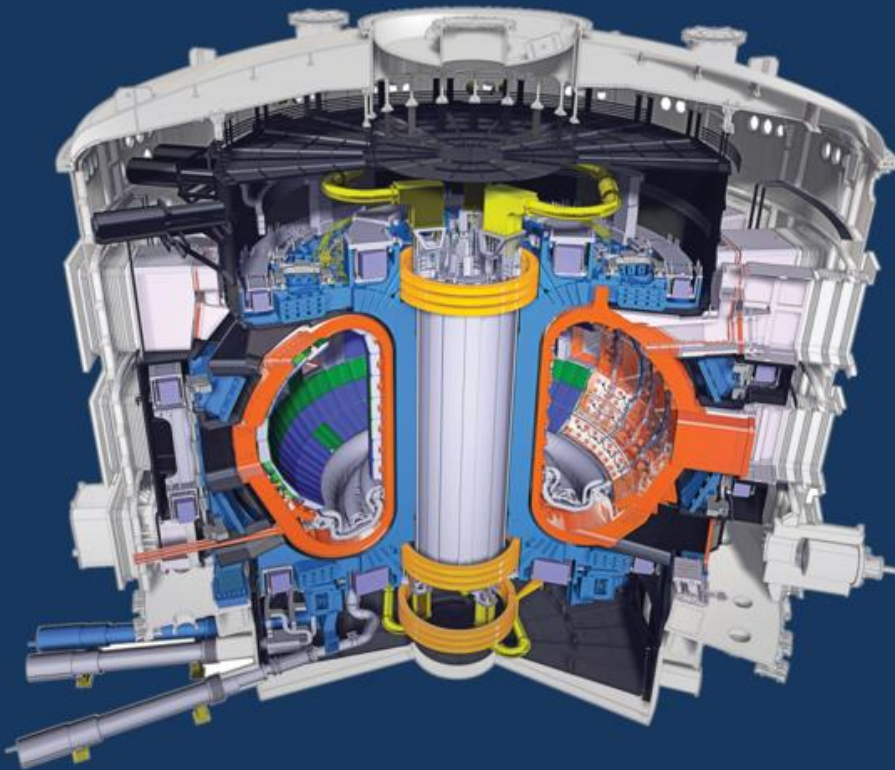
## Fusion on Earth

- A plasma of Deuterium + Tritium (hydrogen isotopes) is heated to more than 150 million °C.
- The hot plasma is shaped and confined by strong magnetic fields.
- Helium nuclei sustain burning plasma.
- Neutrons transfer their energy to the Blanket.
- In a fusion power plant, conventional steam generator, turbine and alternator will transform the heat into electricity.

**1 gram of fusion fuels = 8 tons of oil**



## The ITER Tokamak



**Vacuum Vessel: ~ 8 000 t.**  
**TF Coils: ~ 18 x 360 t.**  
**Central solenoid: ~ 1 000 t.**  
**Etc.**  
**Total ~ 23 000 t.**

**$R=6.2$  m,  $a=2.0$  m,**  
 **$I_p=15$  MA,  $B_T=5.3$  T,**  
**23,000 tonnes**



**3,5 times the weight of  
the Eiffel Tower!**

High Vacuum + Nuclear + Cryogenics = (Very) High precision



# ITER at a glance



Bird view of ITER Site – Cadarache, France. 06/2024



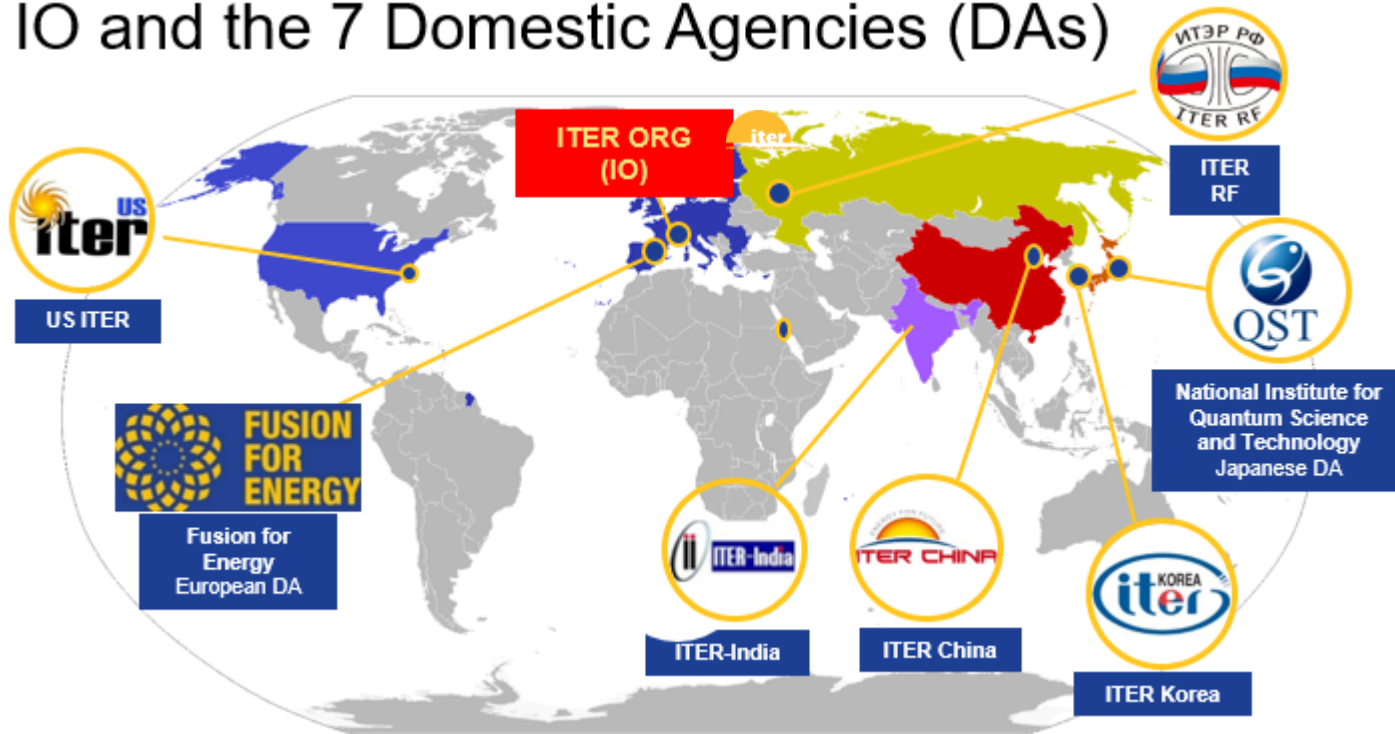
Tokamak and Assembly buildings



European Vacuum Vessel sector -09/2024

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## IO and the 7 Domestic Agencies (DAs)



## ITER ORGANISATION (IO)

### International Public Procurement Rules

Competition, fair treatment, transparency  
Ultimate authority with ITER Council

Geographical scope: **all ITER parties**

Threshold for publication: **100 k€ (services)**

Publication: website and through DAs  
<http://www.iter.org/proc/overview>

Types of contract: commercial procurement, ITER Project Associates, expertise.

Contact: [ITER-Procurement@iter.org](mailto:ITER-Procurement@iter.org)

Tendering: Mandatory registration on IPROC  
[www.iter.org/proc/overview](http://www.iter.org/proc/overview)

Procurement procedures: open call, restricted call, negotiation, competitive dialogue, etc.

Support to locate staff and facilities near ITER site is provided through **Agence ITER France** and *Welcome Around ITER* partnership <http://welcome-around-iter.com>

## FUSION FOR ENERGY (F4E)

### EU General Financial Regulation

(based on Public Procurement Directive 2014/24/EU)  
Wide competition, fair treatment, transparency, proportionality, non-discrimination  
Ultimate authority with European Parliament

Geographical scope: **EU (sometimes Worldwide)**

Threshold for publication: **144 k€ (services)**

Publication: website and TED  
<https://industryportal.f4e.europa.eu>

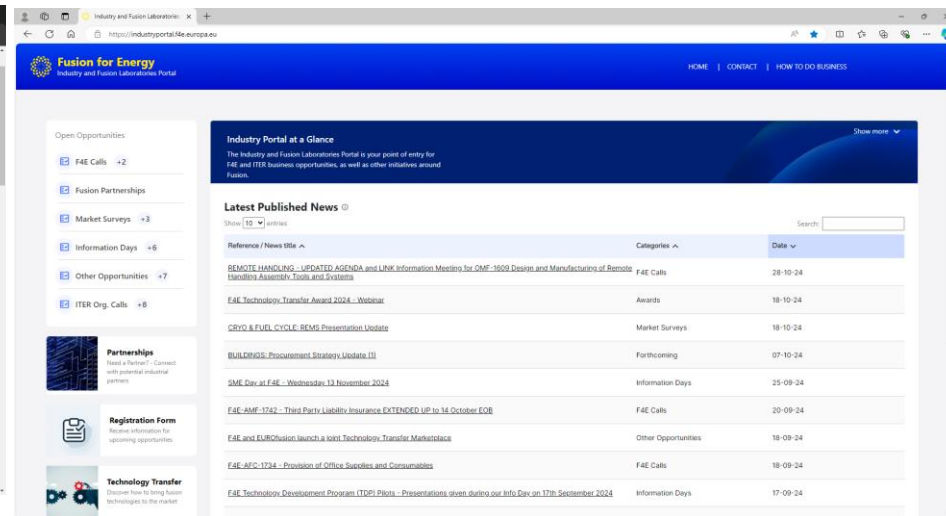
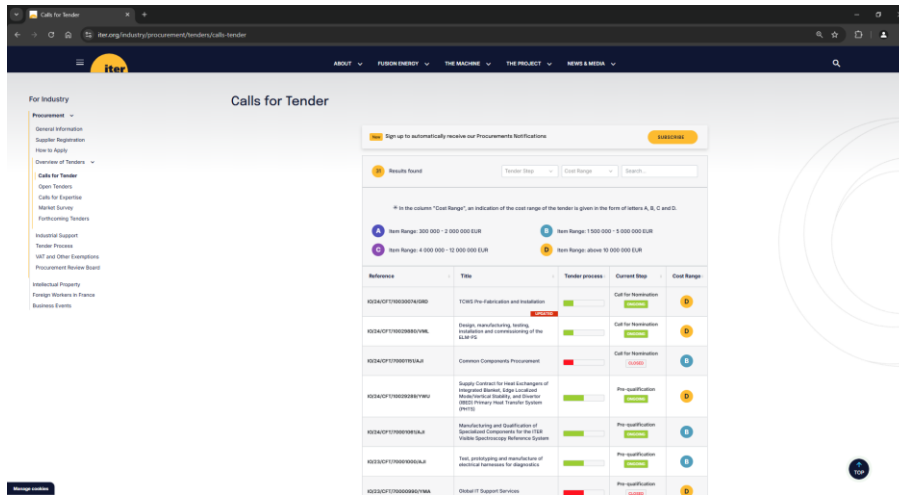
Types of contract: commercial procurement, research grants, innovation partnerships, framework partnerships, expertise.

Contact: [mehdi.daval@f4e.europa.eu](mailto:mehdi.daval@f4e.europa.eu)

Tendering: Mandatory upload of tenders on EU Supply  
<https://eu.eu-supply.com/login.asp?B=>



# IO and F4E Calls For tender webpages



<https://www.iter.org/industry/procurement/tenders/calls-tender>

<https://industryportal.f4e.europa.eu/>

\* In the column "Cost Range", an indication of the cost range of the tender is given in the form of letters A, B, C and D.

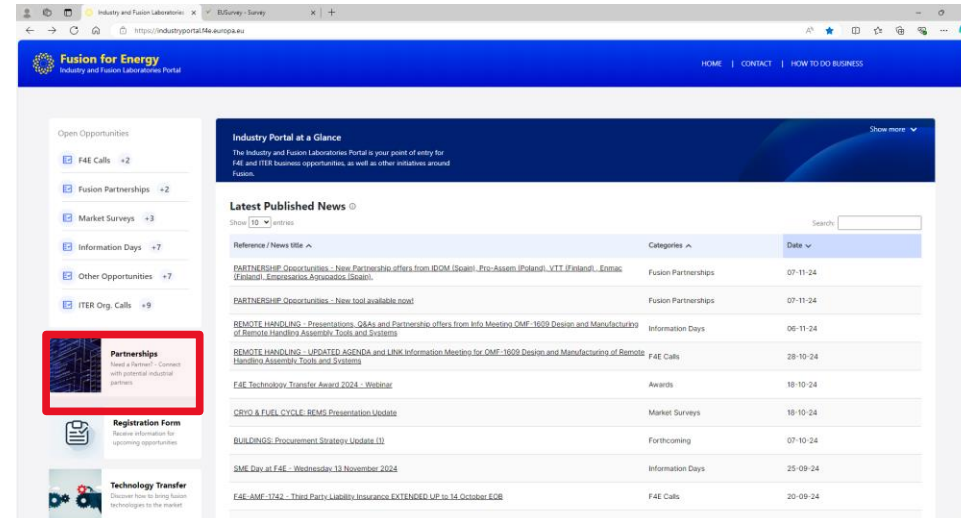
- A** Item range 300 000 – 2 000 000 EUR
- C** Item range 4 000 000 – 12 000 000 EUR

- B** Item range 1 500 000 – 5 000 000 EUR
- D** Item range above 10 000 000 EUR

# F4E Partnership tools



New feature available for companies/SMEs to increase their visibility and offer/request partnership on the F4E Industry Portal  
[F4E Partnership marketplace](#)



## [F4E-EUROFusion Techno Transfer Marketplace](#)

=> 10.000 € prize in 2024

Registration available for companies/SMEs, requires selection of relevant Technologies

[Register in the internal F4E Supply Chain database](#)



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- **Upcoming ITER opportunities (F4E)**



## Just published: OPE-1776 Tungsten-CuCrZr bonding.

- 3 contracts in parallel of about 300 k€
- Gradient Joint of W to CuCrZr. 3 stages:

### Stage 1:

- Development of **manufacturing process** to produce 12x22x22 mm **tungsten tiles**.
- **Characterization of the W-tiles**. Chemical composition, density (ASTM B311-17 or equivalent) and hardness HV30 (ASTM E92 or EN ISO 6507).
- **Microstructural characterization** of the W-tiles (surface conditions, grain sizes (ASTM E112-13 or equivalent) and microstructure morphology).

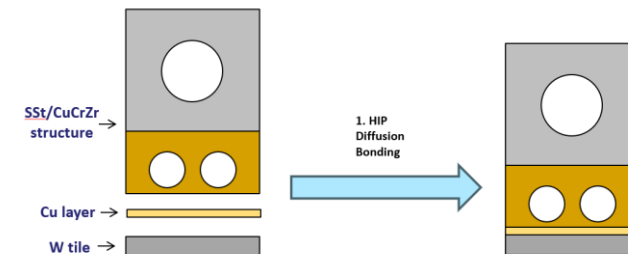
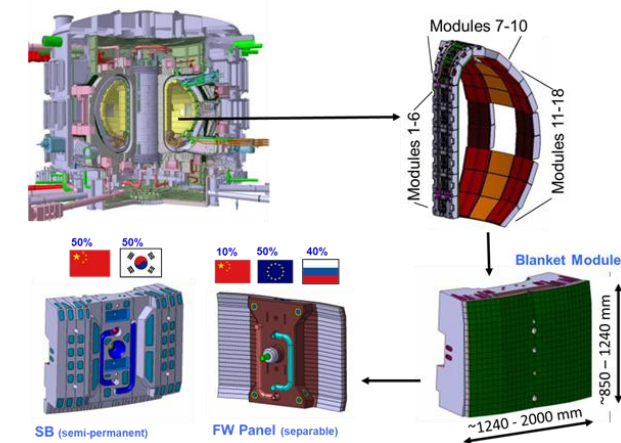
### Stage 2:

- Development of **manufacturing process** to produce 12 (+gradient thickness) x22x22 mm **W/CuCrZr gradient tiles**.
- **Mechanical characterization** of the W-to-CuCrZr **bonding**. Technique for characterization to be proposed by Supplier and approved by F4E (e.g. tensile, shear, torsion, bending tests).
- **Microstructural characterization** of the gradient W-tiles. Grain sizes (ASTM E112-13 or equivalent), microstructure and density (ASTM B311-17 or equivalent).

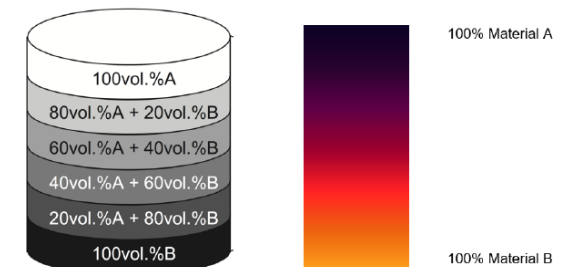
### Stage 3:

- Manufacturing of W to CuCrZr gradient joints.
- Supply 40 specimens of 12 (+gradient thickness) x22x22 mm W/CuCrZr gradient tiles manufactured after successfully passing stage 2.

=> Preliminary activity before manuf. of up to 1 million tiles.



A: Material A  
B: Material B

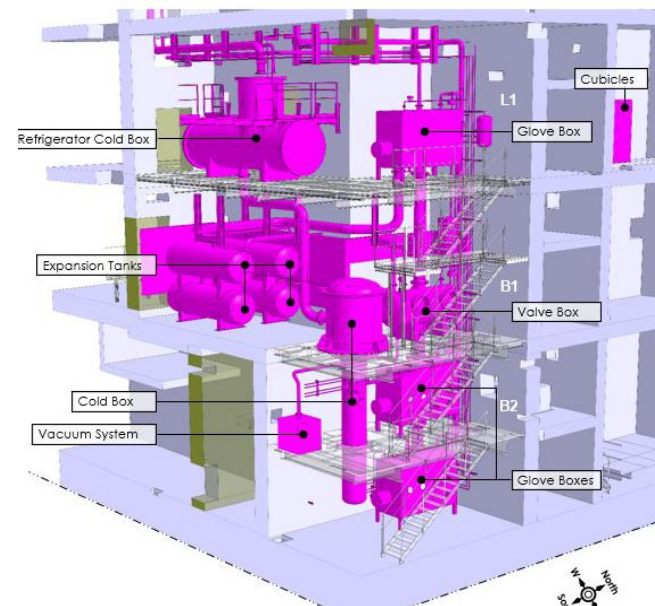


"Linear" composition changes for gradient joint.

## TRITIUM=> Stainless Steel components

- **Isotope Separation System Cryosystem (cat D) Final Design and Supply**

- Nuclear system, 6 cryogenic distillation columns (H/D/T). 3-7 m high
- Column height of 7.5 m, cooling power of 1kW @ 16K.
- Tight tolerances.
- Target CFT: Q1 2026. Market Survey ongoing
- 2 main contracts: Cryogenic refrigeration & Process plant.

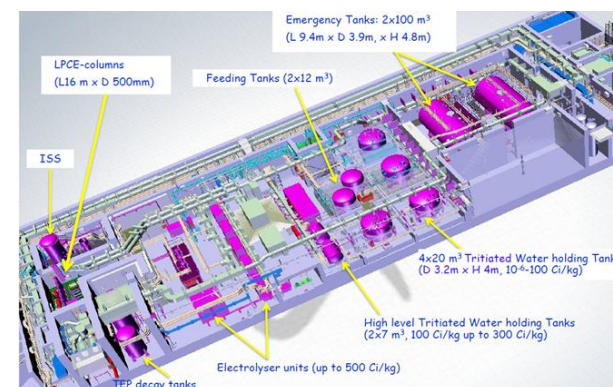


⇒ + TURBO-BRAYTON CRYOFREEZERS STUDY (OPE-1794)

- **Water Detritiation System (cat D) Final Design and Supply**

- Reception and Purification System: Target CFT Q2-3 2025.
- Distillation columns (2 x 28 m)
- Protection Important Component.
- Target CFT Q1 2026. Market survey Ongoing

- **F4E-IO Tritium Workshop** (online) 13<sup>th</sup> February (registration: [https://ec.europa.eu/eusurvey/runner/F4E\\_Fuel\\_Cycle\\_Workshop](https://ec.europa.eu/eusurvey/runner/F4E_Fuel_Cycle_Workshop))

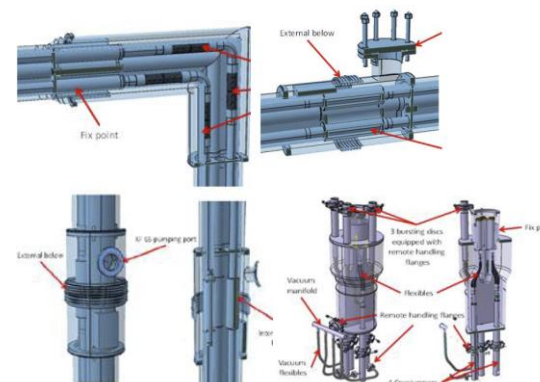


- **OPE-1592 CRYOLINES DN25** (cat **A**).

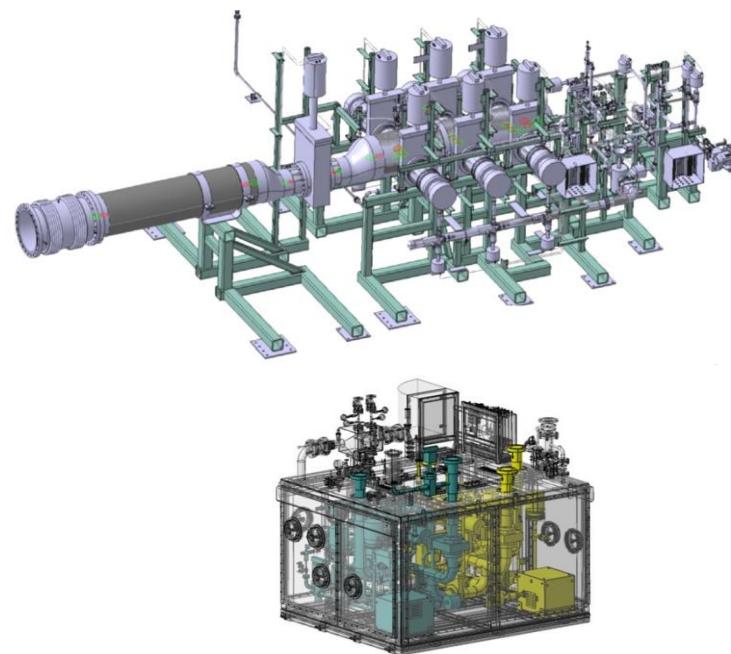
Target CFT Q1 2025 (contract signature August 2025). About 200 meters.

- **OPE-17XY Leak Detection (ex-OPE-0982):** Cat. **B**  
Market Survey Q1 2025; CFT Q3-4 2025.

- 7 skids with leak detection equipment
  - Manufacturing and preparation of vacuum pipes spools;
  - Vacuum welding (1.000 welds);
  - Machining process for 300 vacuum flanges (ITER flange);
  - Vacuum assembly and clean area availability;
  - FAT Factory Acceptance integrated with I&C;
- => High leak tightness



Examples of some of the rigid cryolines subcomponents





- **TDP: Portable Tritium Detector**
  - 2 contracts for the detector.
  - 24 months activity starting Q1-2 2025.
  - **3 stages:**
    - Market status survey (patents?)
    - Then Design;
    - then Manufacturing and testing and a plan for industrialisation (by any actor).
  - If patent, we can negotiate, (we did not find a patent on it.)
- 
- REMS: Engineering Support: Q3 2025.



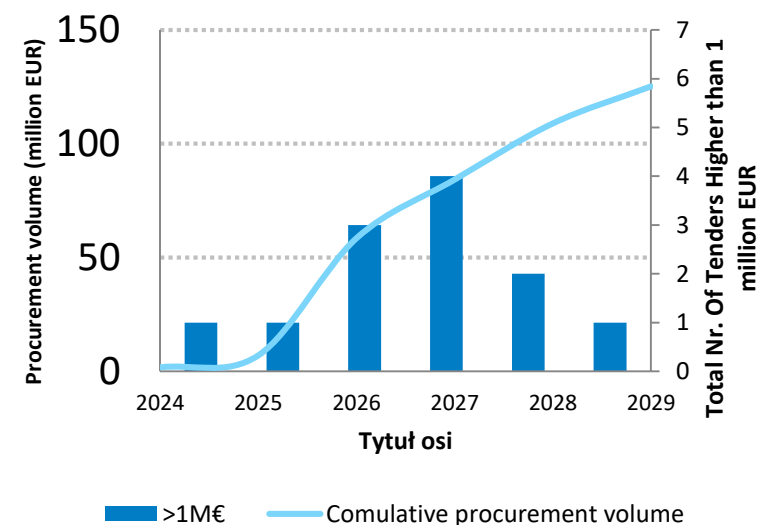
- **NB Cryopumps** (3 units, cat **D**)
    - 1000 cryopanel ; >1000 m<sup>2</sup> pumping surface.
    - Build-to-Print.
    - Tight tolerances.
    - 1000s of radiographies.
    - >500 leak tests.
    - (Protection Important Component)
- ⇒ Target CFT Q2-3 2025

## All Vacuum, Cryogenics and Leak detection technologies:

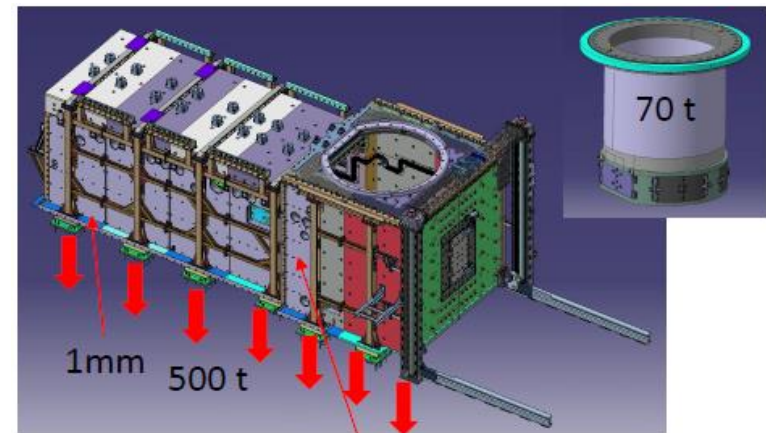
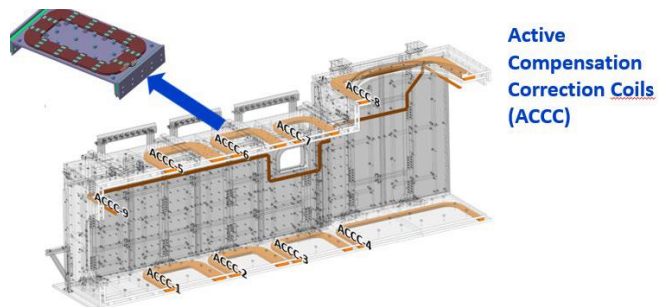
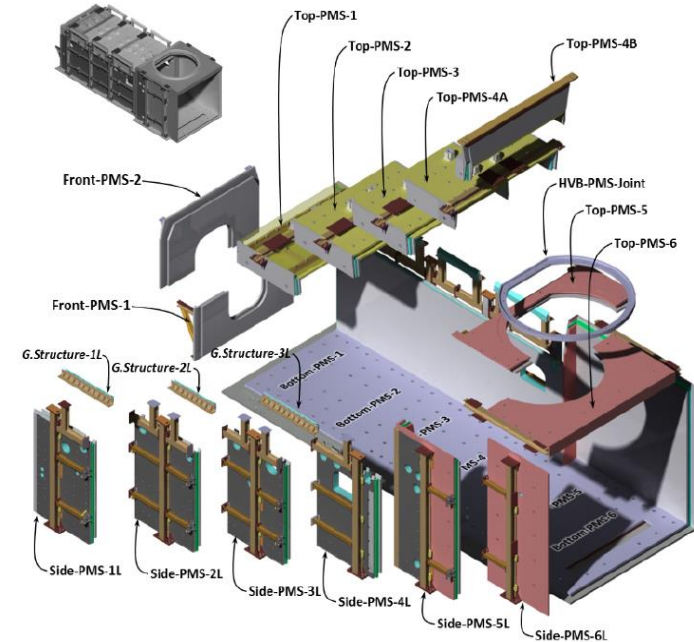
About 120 M€ of Procurement from 2025 to 2029.



Mitica cryopump prototype



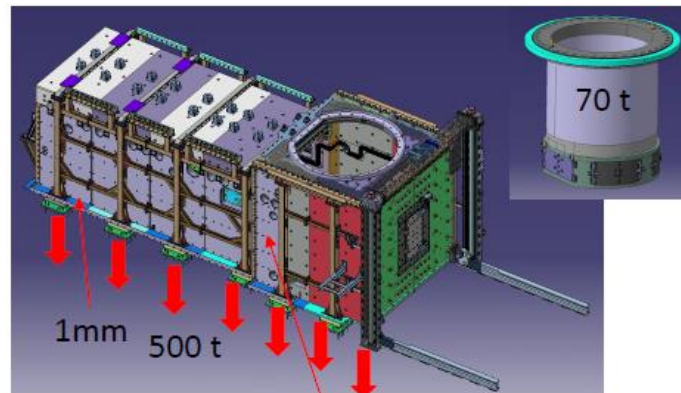
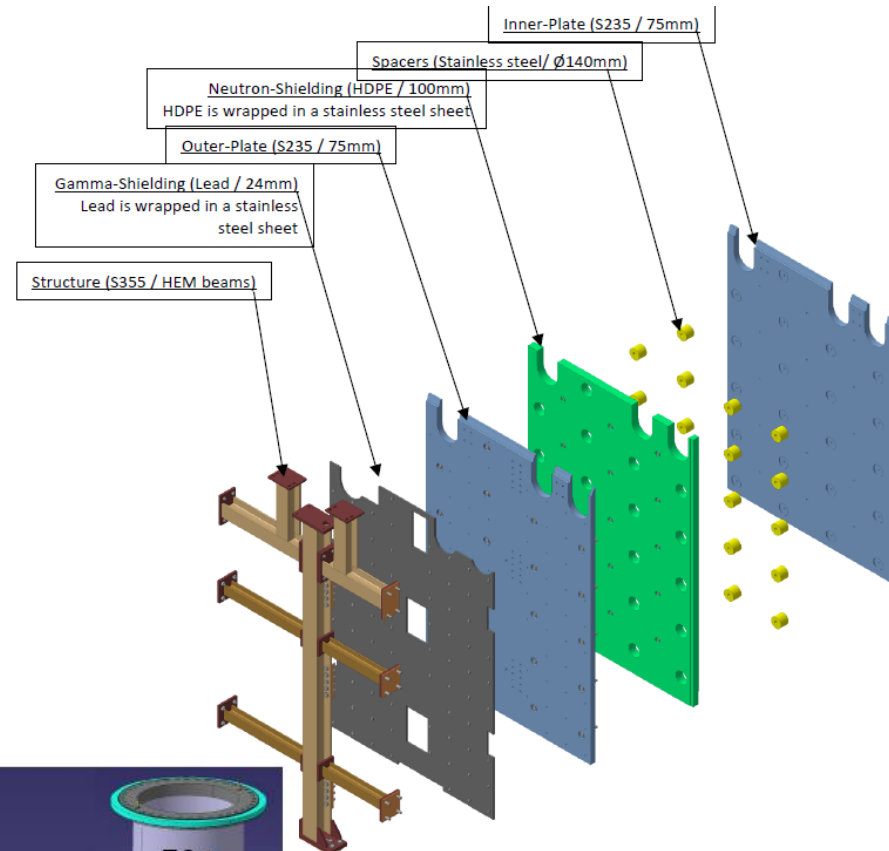
- **Neutral Beam Magnetic Shielding (NBMS)**  
Cat. **D.** (2 units)
    - Active Compensation Correction Coils (ACCC): 2 x 8 units.
    - Passive Shielding with plates (see next slide)
    - Skills: Machining and precise Assembly (1mm gaps/0.1 mm tolerances) of heavy components (500t) nuclear classified (RCC-MR) + coil design and manufacturing).
- => Target CFT: Q3 2025.



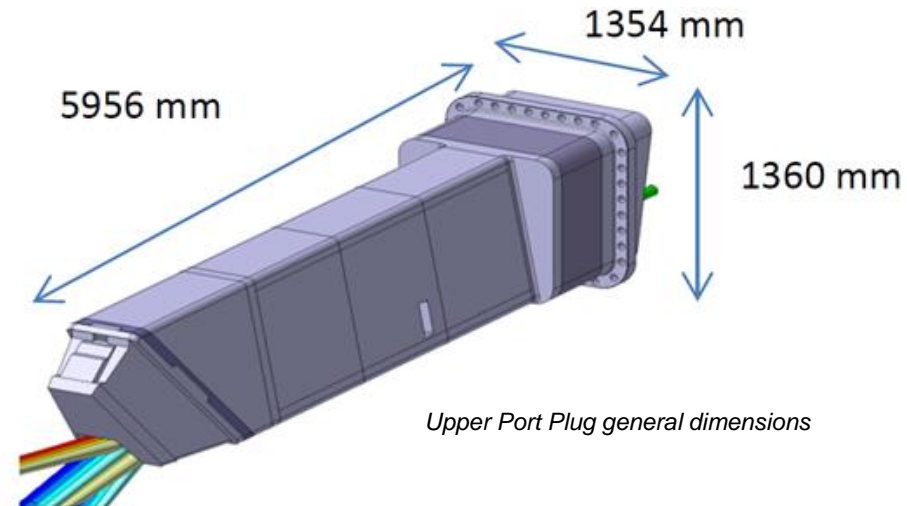


- **Neutral Beam  
Magnetic Shielding-  
FOCUS on Materials**

- **Steel S235** plates (EN 10025-2) (2 x 400 tons). 80 mm thick about 5 meters. Annealing needed.
- **Pure iron** plates
- **LEAD** plates
- **HDPE** polymer plates
- **Bumax BOLTS**

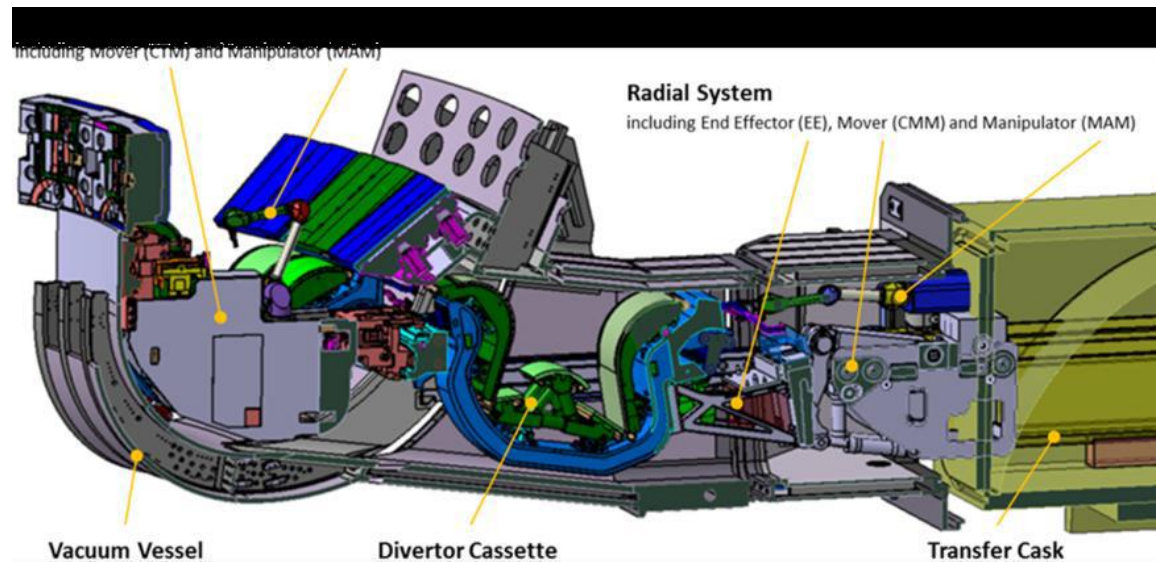


- **6 Diag PORTS Manufacturing and Assembly.**  
Cat. **D.** (OFC-1183)
- Target => CFT: Q3 2025.
- **316L(N)-IG) Austenitic stainless steel**  
“X2CrNiMo17-12-2 controlled nitrogen”  
with a concentration of Cobalt, Niobium  
and Tantalum not exceeding 0.05%, 0.01%  
and 0.01% weight respectively
- **Polybore** HE 430, as neutron shielding  
blankets for ISS (TBC).
- **B<sub>4</sub>C (Boron Carbide) pellets:** sintered B<sub>4</sub>C  
pellets used to fill the DSMs B<sub>4</sub>C Shielding  
Chambers, as neutron shielding (about 15  
tons).
- **Commercial Off-The-Shelf (COTS) items:**  
bogie wheels, fasteners, flexible metal  
seals, piping fittings, connectors, etc.
- **Glass To Metal Process** with 99% purity N<sub>2</sub>  
atmosphere.



- **B<sub>4</sub>C plates for WAVS:** about 3 tons (1.250 plates of 250 x 250 x 20 mm) (Then 3 other batches in future) => CFT in 2026.
- **Feedthroughs** (Tritium barrier)

- Just published:  
**OMF-1609** Design  
& Manufacturing of  
Remote Handling  
System for  
Machine  
Assembly.
- See on F4E  
Industry portal  
offers of  
partnership.





## Final Design and Supply of Ancillary Systems

- **1<sup>st</sup> System** - Final Design and Manufacturing of Tritium Extraction & Accountancy Systems + Gloveboxes in Tritium Room.

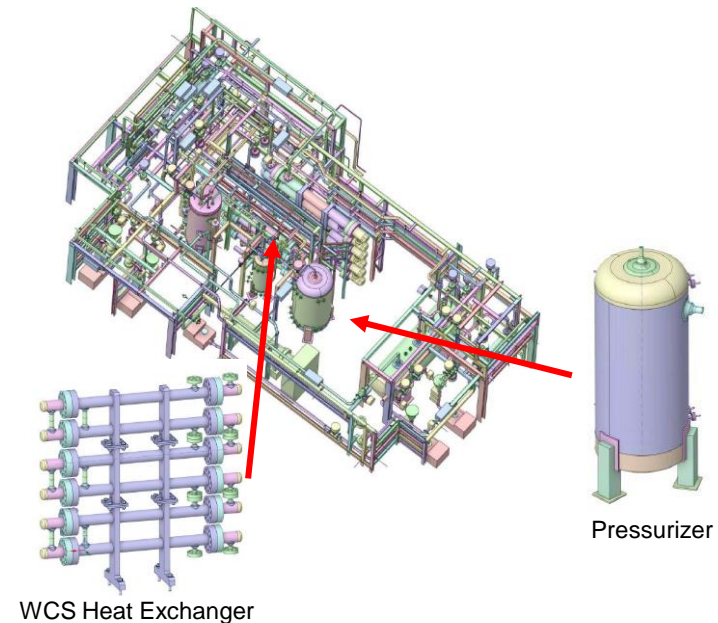
Market Survey closed – **CFT Q3 2025** Cat **C**

- **2<sup>nd</sup> System** – Water Cooling System, Coolant Purification System

Market Survey Closed – **CFT Q3 2025** Cat **D**

- **3<sup>rd</sup> System** – Water Cooled Lead Lithium loop - Cat **B**

=> **Market Survey soon.**



- **Destructive and ND Testing of Material and Mock-ups:** (ex-OMF-1082). Cat. **B**. Target CFT: Q1 2025.



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**See you during our next CFTs!**

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