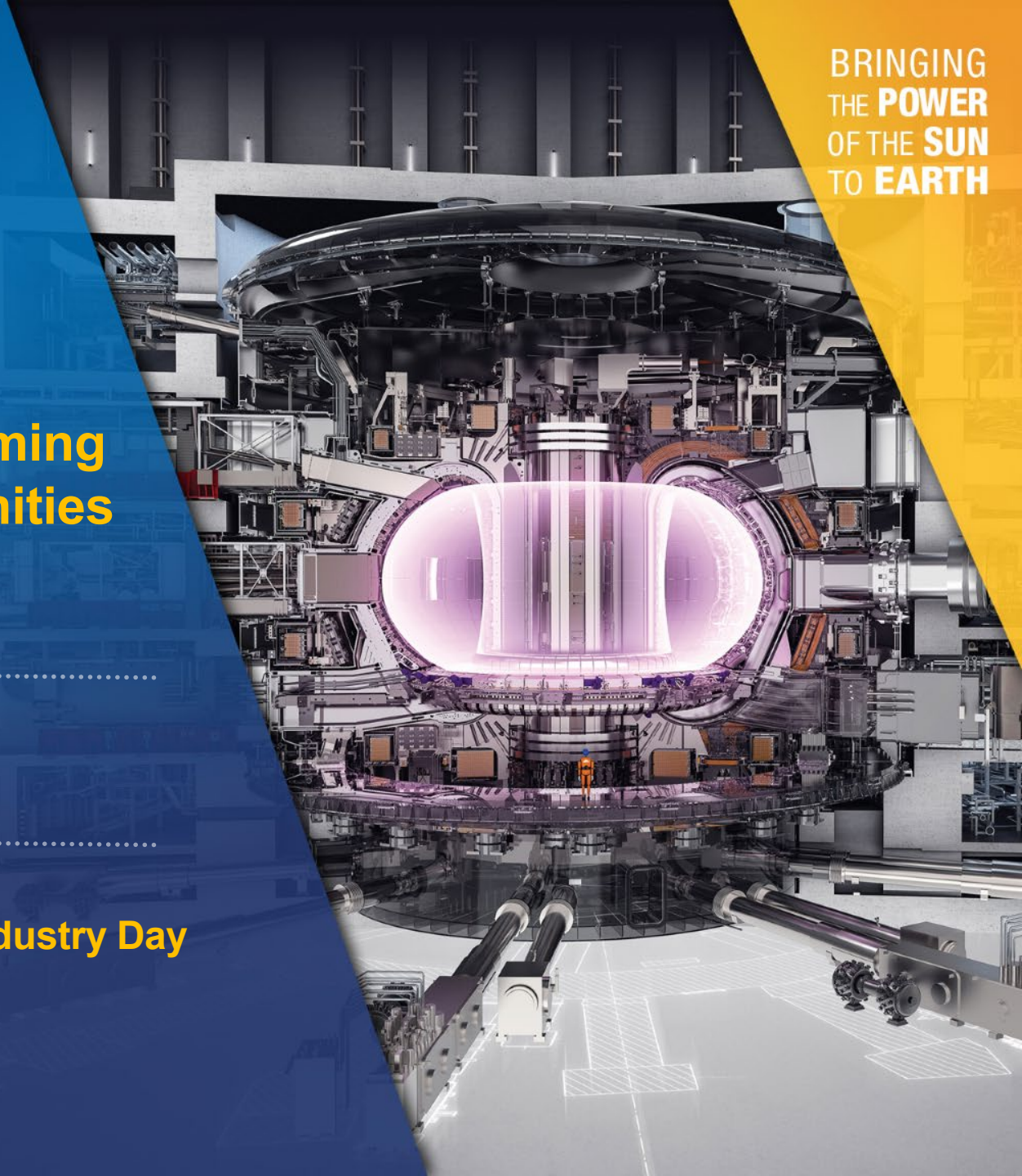
FUSION FOR ENERGY



BRINGING THE POWER OF THE SUN TO EARTH

ITER: F4E Forthcoming Business Opportunities

Mehdi DAVAL – F4E

Big Science Partner & Industry Day

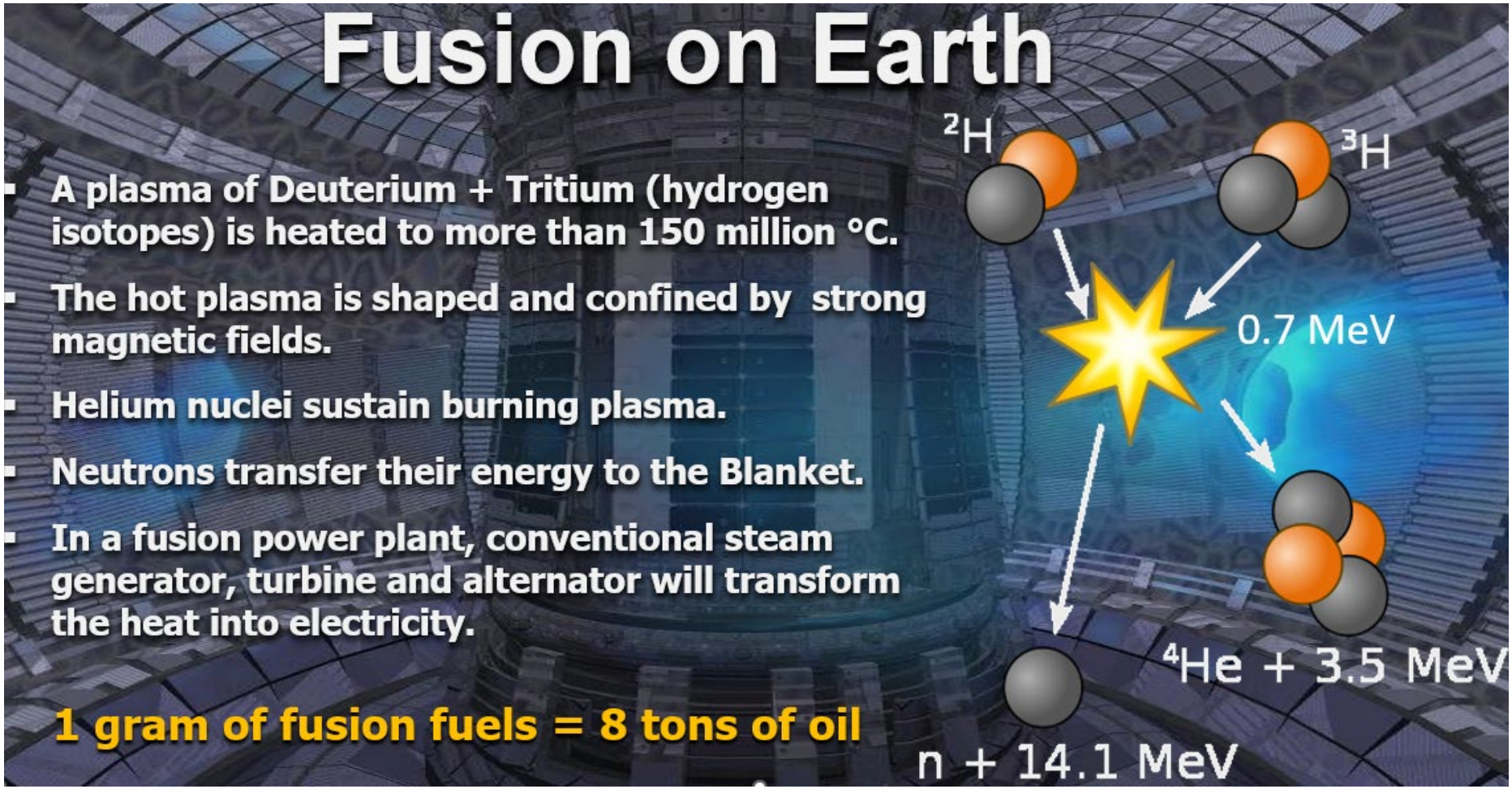
12th January 2024 Kraków

Instytut Fizyki Jądrowej

Outline

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

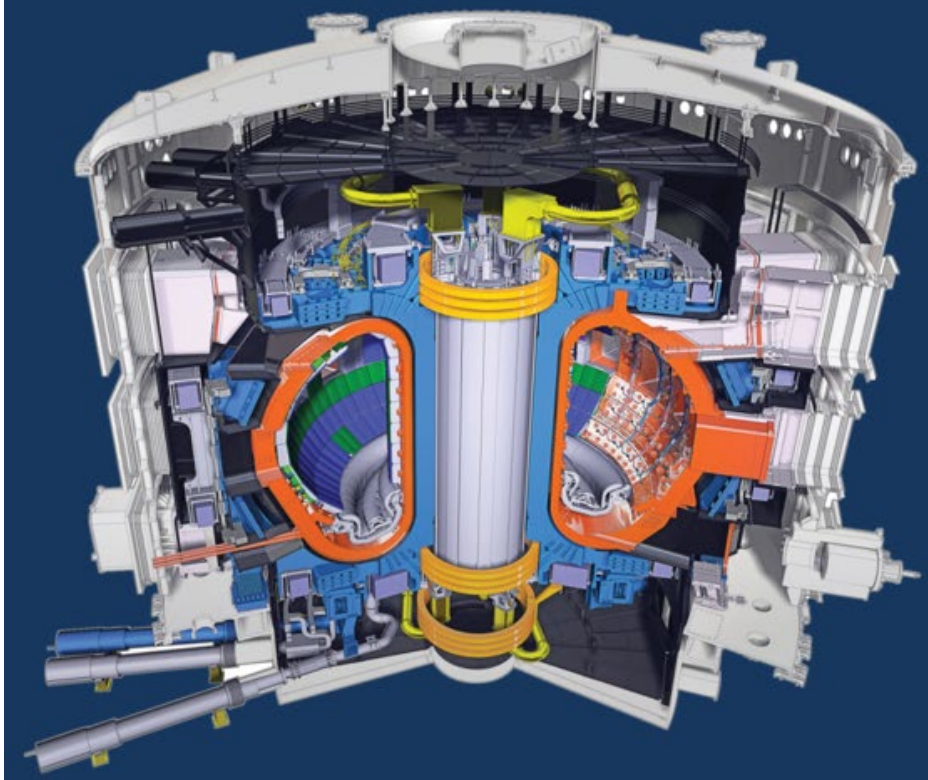
ITER at a glance



ITER at a glance

FUSION FOR ENERGY

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

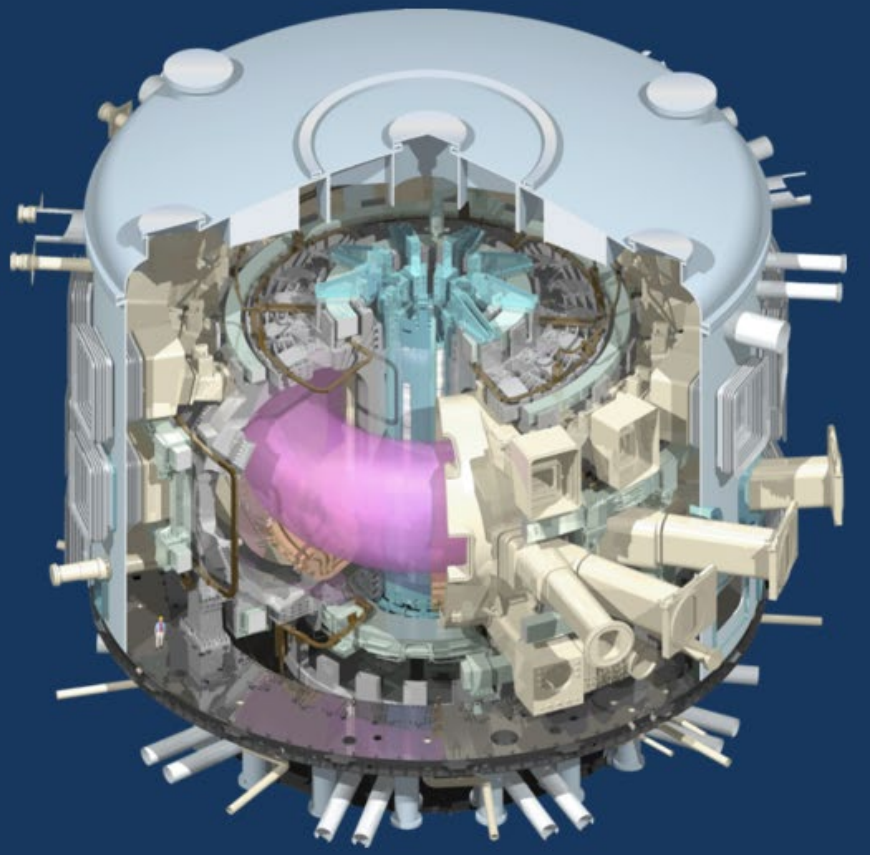
ITER mission

To demonstrate the scientific and technological feasibility of fusion power for peaceful purposes

ITER is the only magnetic fusion device under construction aimed to produce a burning plasma.

Input (heating power): 50 MW

Output (fusion power): 500 MW



ITER at a glance

FUSION FOR ENERGY

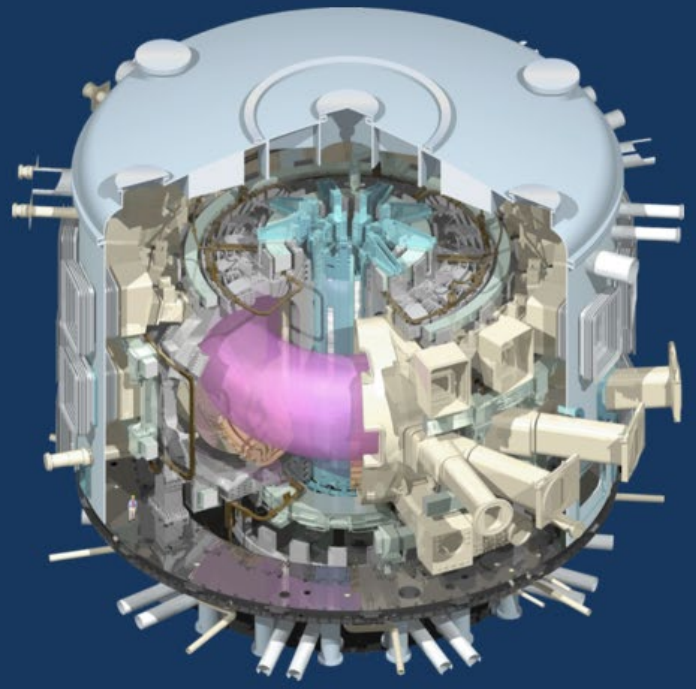
How does it work?

Run a strong electrical current in the DT gas to create a plasma.

Continue heating by way of electromagnetic waves.

Inject high-energy neutral particles.

By combining these different heating techniques, you reach the requested temperature for fusion reactions to occur.



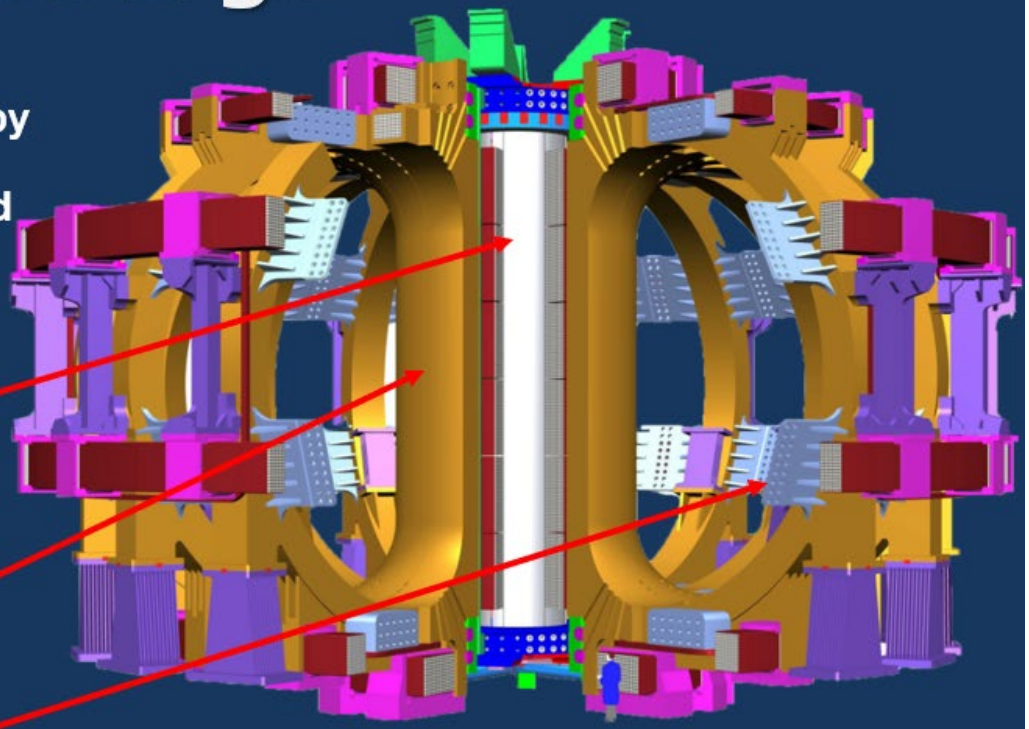
But what can contain something that is 10 times hotter than the core of the Sun?

ITER at a glance

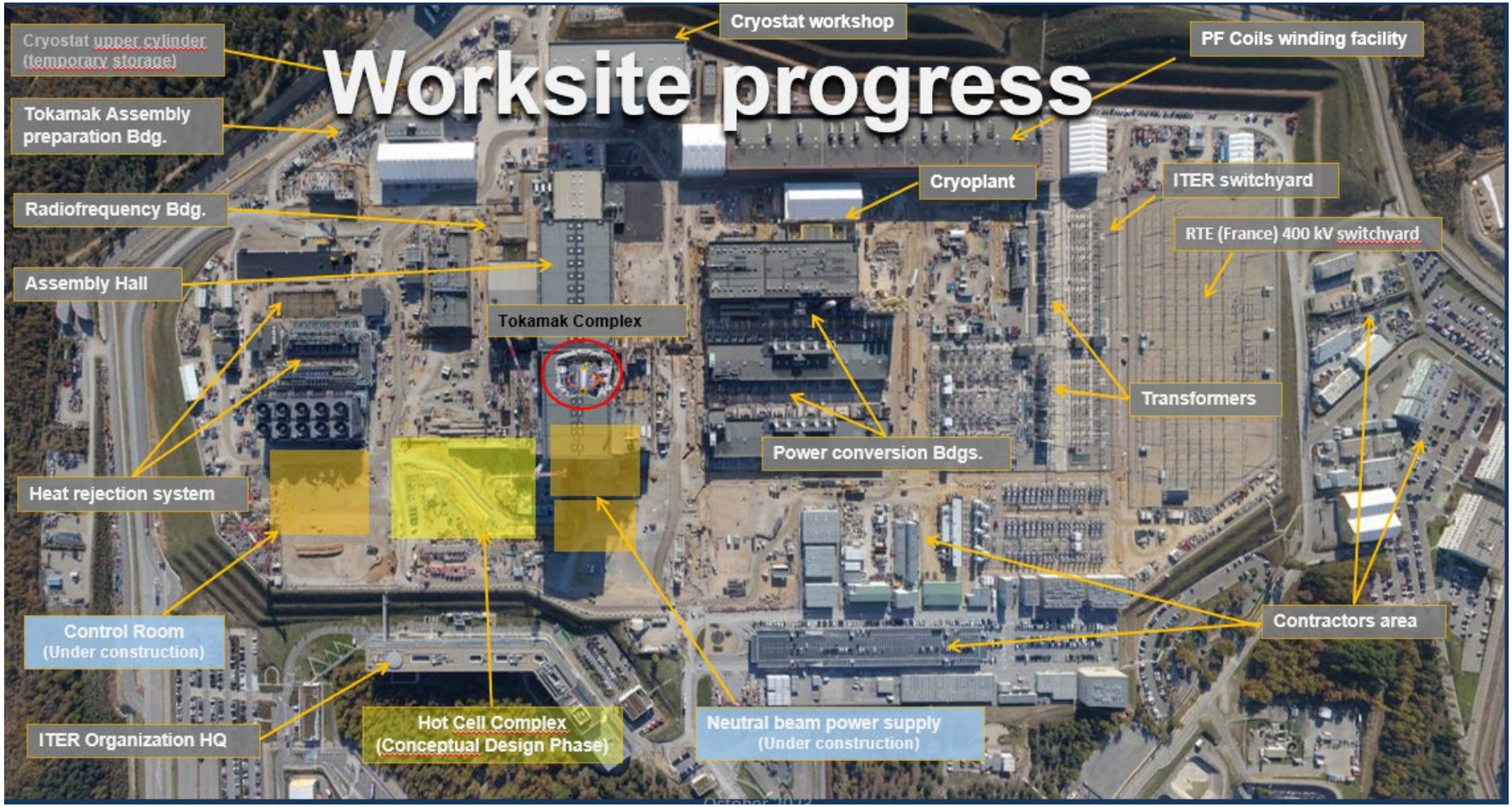
A large magnetic cage

An intense magnetic field, generated by powerful superconducting magnets shape and confine the hot plasma, and keep it away from the vacuum vessel wall.

- 1 central solenoid, 13 m high, 1,000 tons, powerful enough to lift an aircraft-carrier out of the water
- 18 Toroidal Field Coils, 17-metre high, 360 tons each.
- 6 Poloidal Field Coils, 8 to 24 m. in diametre, 200 to 400 tons.



ITER at a glance

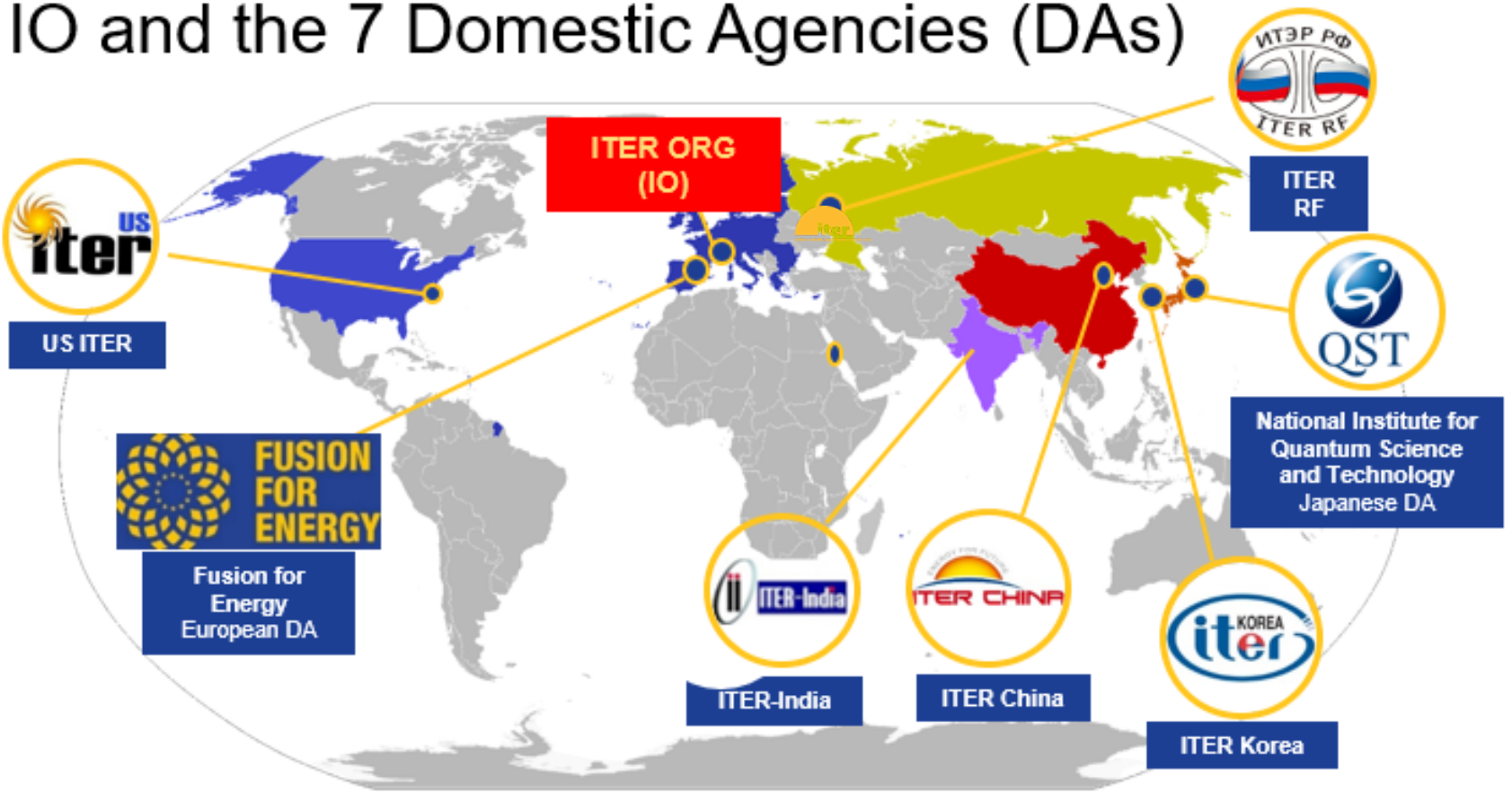


Outline

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

IO and F4E Domestic Agency

IO and the 7 Domestic Agencies (DAs)



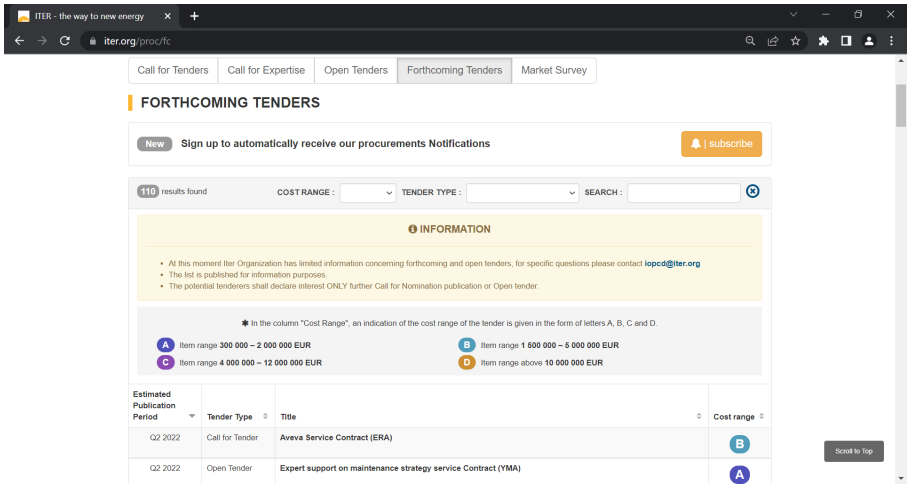
IO and F4E ways to engage with Industry

ITER ORGANISATION (IO)	FUSION FOR ENERGY (F4E)
International Public Procurement Rules Competition, fair treatment, transparency Ultimate authority with ITER Council	**EU General Financial Regulation** (based on Public Procurement Directive 2014/24/EU) Competition, fair treatment, transparency, proportionality, non-discrimination Ultimate authority with European Parliament
Geographical scope: **all ITER parties**	Geographical scope: **EU (sometimes Worldwide)**
Threshold for publication: **144 k€ (services)**	Threshold for publication: **144 k€ (services)**
Publication: website and through DAs http://www.iter.org/proc/overview	Publication: website and TED https://industryportal.f4e.europa.eu
Contact: ITER-Procurement@iter.org	Contact: mehdi.daval@f4e.Europa.eu
Tendering: Mandatory registration on IPROC www.iter.org/proc/overview	Tendering: Mandatory upload of tenders on EU Supply https://eu.eu-supply.com/login.asp?B=

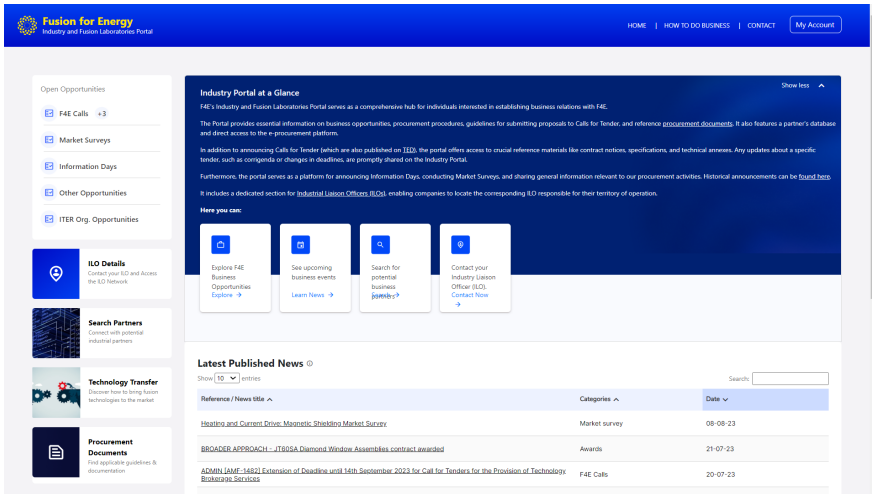
Procurement procedures: open call, restricted call, negotiation, competitive dialogue, etc.

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

ITER ORG and FUSION FOR ENERGY



https://www.iter.org/proc/fc



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**

B Item range **1 500 000 – 5 000 000 EUR**

C Item range **4 000 000 – 12 000 000 EUR**

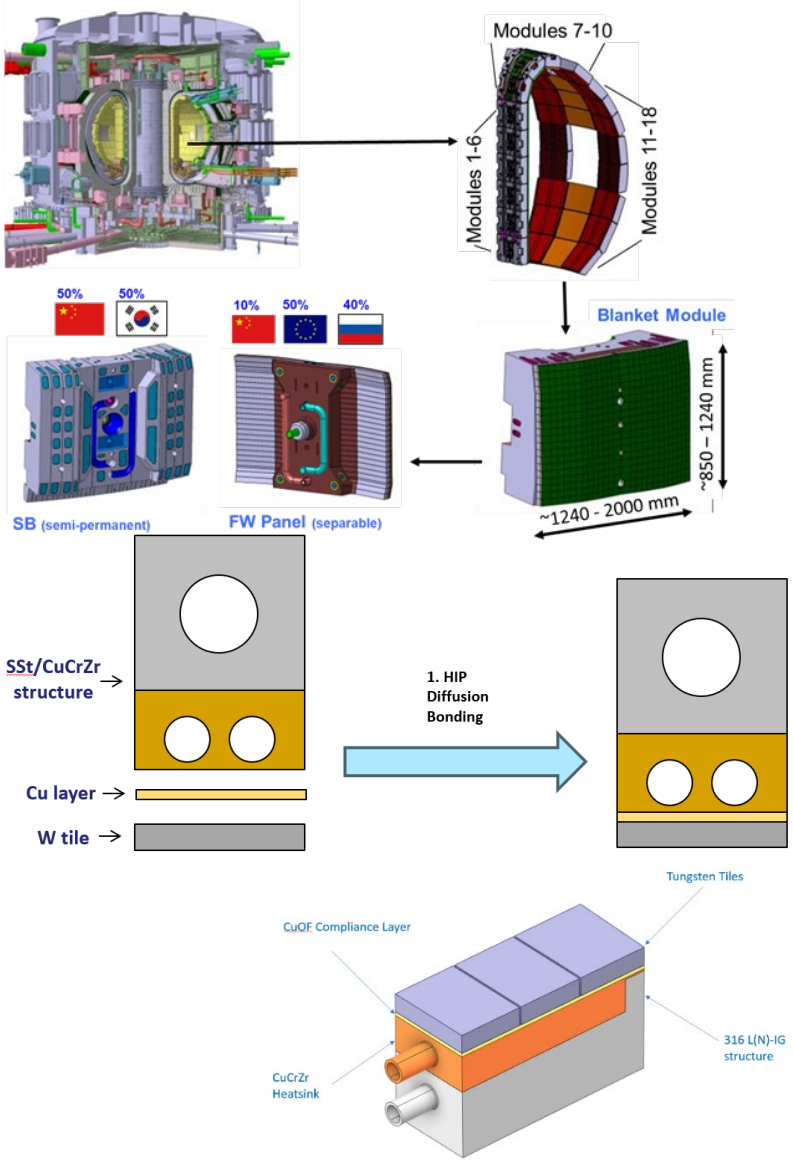
D Item range above **10 000 000 EUR**

Outline

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

Tungsten Tiles. Cat D.

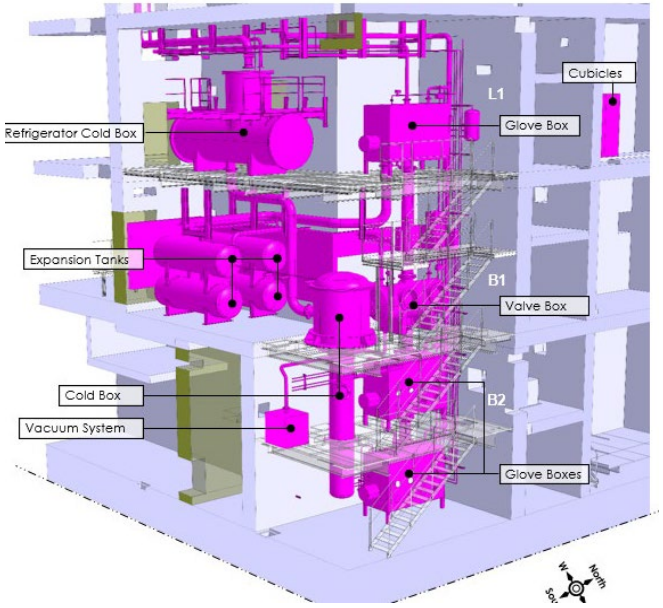
- W tiles supply, machining, Joining, and assembly.
- About 600 m^2=> 200-500 k pcs.
- Market Survey ongoing. See F4E Industry Portal.
- CFT in Q3 2024.
- Contract signature: Q3 2025.



ITER Cryoplant & Fuel cycle

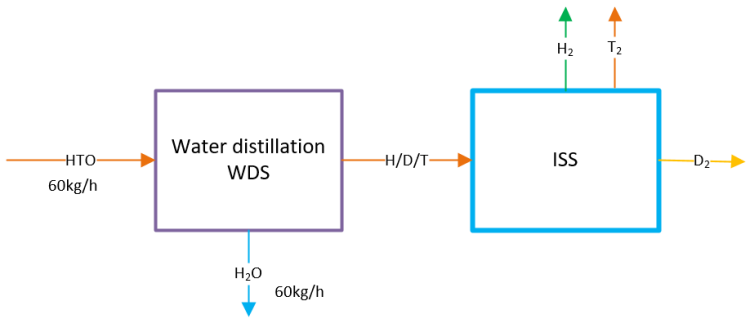
TRITIUM=> Stainless Steel components

- **Isotope Separation System (cat D)**
  - Cryogenic distillation of >650 thermal shield panels
  - Cold boxes, Gas Handling System, Tanks, Valve Box, helium refrigerator components, Glove box, Heat exchanger, Metal Bellows pumps, cryogenic lines, etc…



- **Water Detritiation System (cat D)**
  - Water Distillation columns, or Combined Electrolysis Catalytic Exchange solutions.

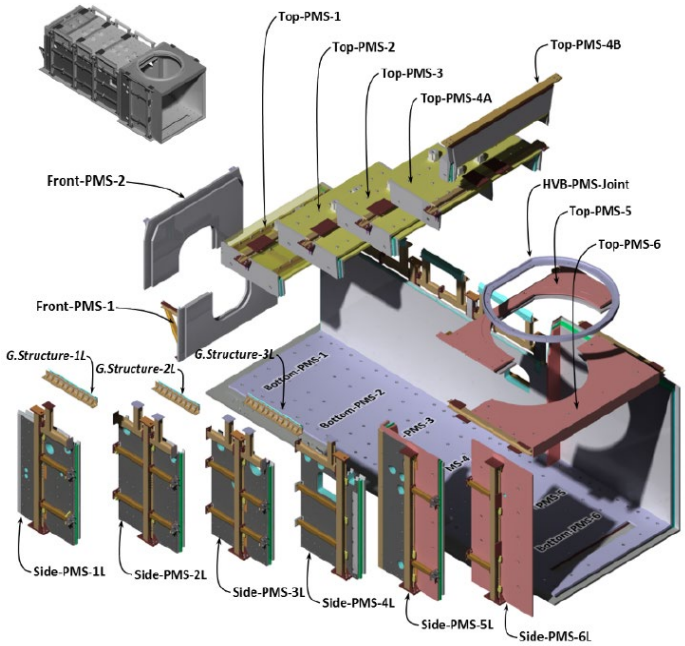
Ask F4E for Technical Description. Market Surveys ongoing.

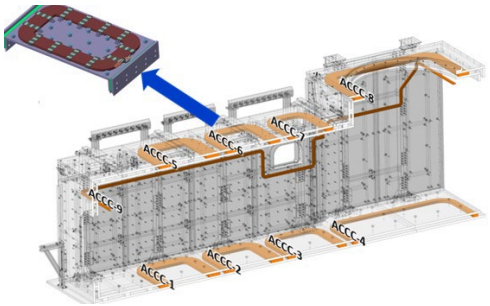


ITER Heating and Current Drive

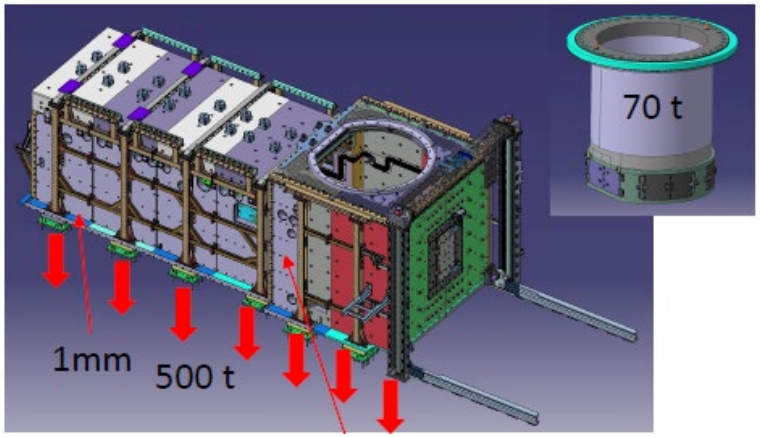
- **Neutral Beam Magnetic Shielding** (NBMS) Cat. D. (2 units)
  - Active Compensation Correction Coils (ACCC): 2 x 8 units.
  - Passive Shielding with plates (see next slide)
  - Skills: Machining and precise Assembly (1mm gaps/0.1 mm tolerances) of heavy components (500t) nuclear classified (RCC-MR)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

=> Target CFT: Q3 2024. Market Survey online.

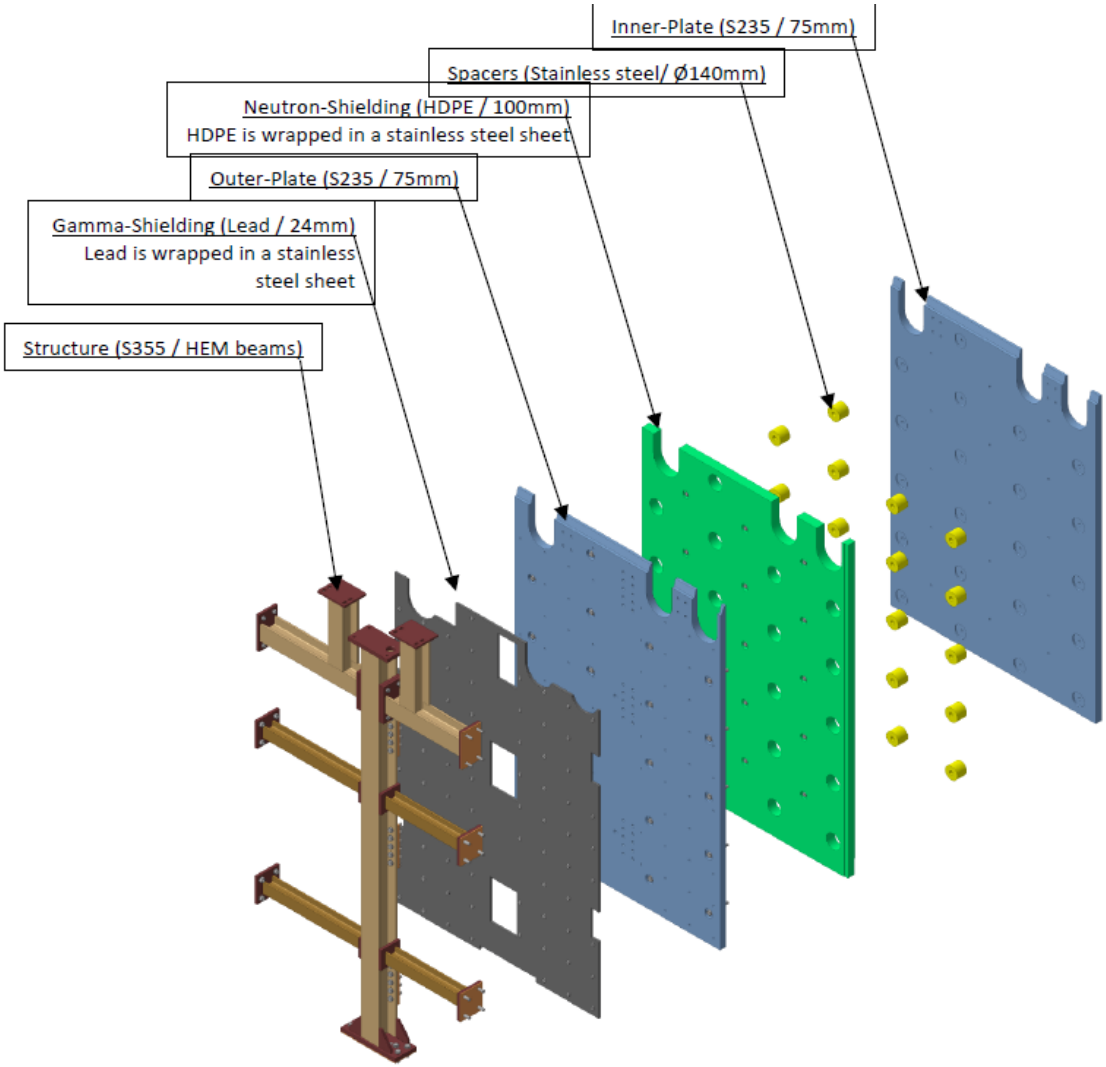




Active Compensation Correction Coils (ACCC)



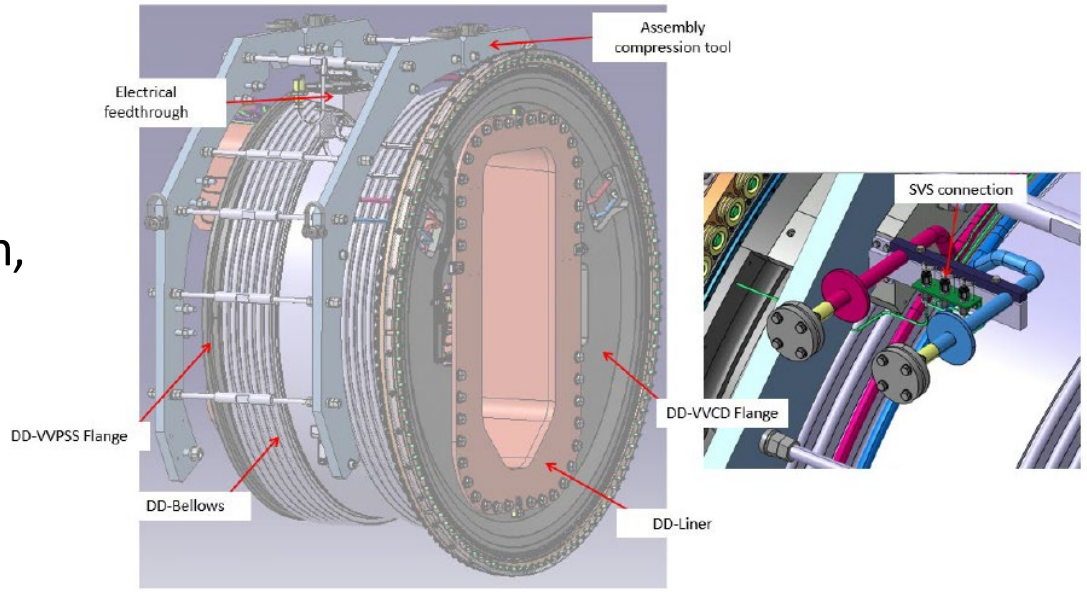
- **NBMS- FOCUS on Materials**
  - **Steel S235** plates (EN 10025-2) (2 x 400 tons): 1 or 2 additional sample(s) still welcome nowadays for characterization.
  - **LEAD** plates
  - **HDPE** plates
  - **Inconel** or special **316L Stainless Steel** BOLTS (High content in molybdenum)



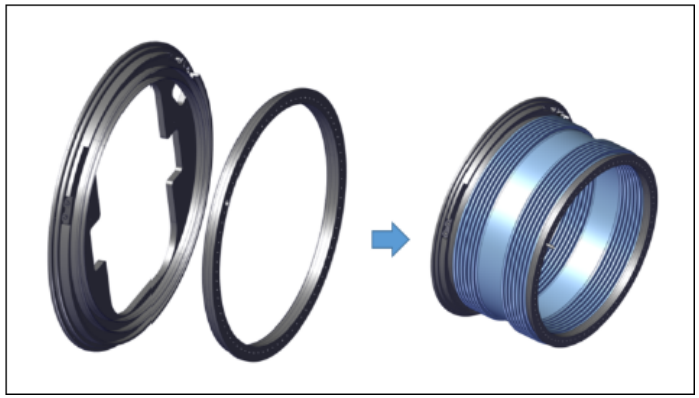
ITER Heating and Current Drive

- Drift Duct. Cat. C. (2 units)
  - Skills: Nuclear component manufacturing, High Vacuum, Stainless Steel welding, Brazing of S.S pipes over the CuCrZr plates, NDTs, EBW of CuCrZr.
  - S. Steel SIC-1 Bellows and flanges.

=> Target CFT: Q2-Q3 2024.



L1.4 m x W3.2 x H3 m -Weight ~ 5.7 t



View of the flanges

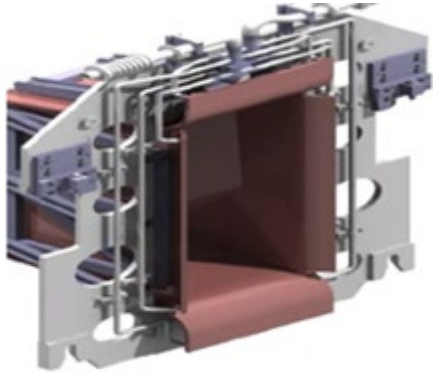
ITER Heating and Current Drive

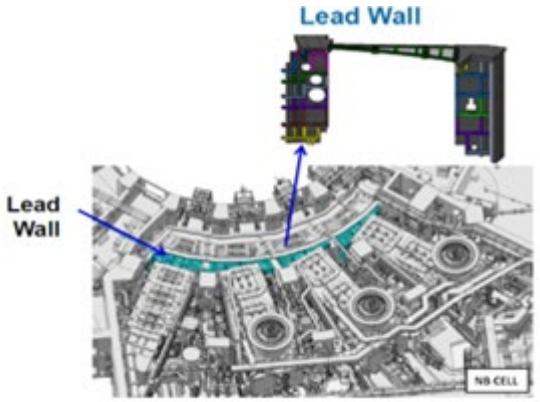
Longer-term (up from 2026):

- **2 Fast Shutters** (extension of the primary vacuum barrier, Nuclear Safety Relevant)

- **2 Exit Scrapers** (High Vacuum, non-safety relevant): Stainless Steel support + Deep drilled water cooled Panels in CuCrZr, Electron Beam Welding (vacuum tight) of CuCrZr.

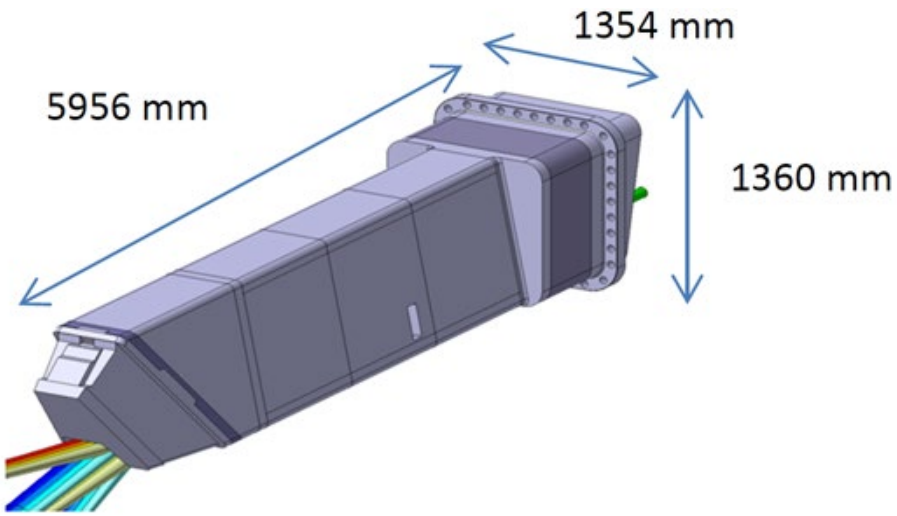
- **2 Lead Walls** (Gamma protection): Panels of lead and Steel structure.





ITER Diagnostics

- 6 Diag **PORTS Manufacturing and Assembly**. Cat. D. (OFC-1183)
- Target => CFT: Q3 2024.
- **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_4C pellets:** sintered B_4C pellets used to fill the DSMs B_4C 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_2 atmosphere.
- **Feedthroughs** etc. + **TESTING FACILTY**



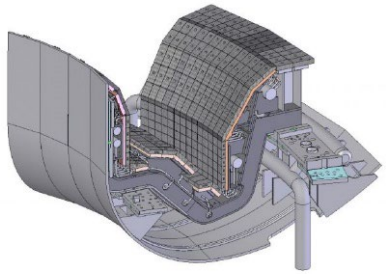
Upper Port Plug general dimensions

Technical Support

- **CAD Design, Dimensional Variation Analysis, General Mechanical and Plant Design** Support: (including scope OMF-1058) Cat. B. Target CFT: Q1 2024.
- **Qualification testing:** Cat B Target CFT: Q1 2024.
- **Seismic, Dynamic and Structural** Analyses of ITER Buildings and Mechanical Components Support. (renewal of OMF-1023) Cat. A. Target CFT: Q1 2024.
- **Nuclear Analysis Support** (renewal of OMF-0882): CFT: Q1 2024. Cat. A.
- **Destructive and ND Testing of Material and Mock-ups:** (renewal of OMF-1082). Cat. B. Target CFT: Q2 2024.
- **I&C** Integration Services (renewal of OMF-0989). Target CFT Q2 2024. Cat D.

Broader Approach

- **OPE-1405: Integration and testing of Actively Cooled Divertors of JT-60SA**, estimated contract value: C D, Annex B under preparation, planned launch Q1/Q2 2024 (Competitive with Negotiation).



Source: JT60SA.org

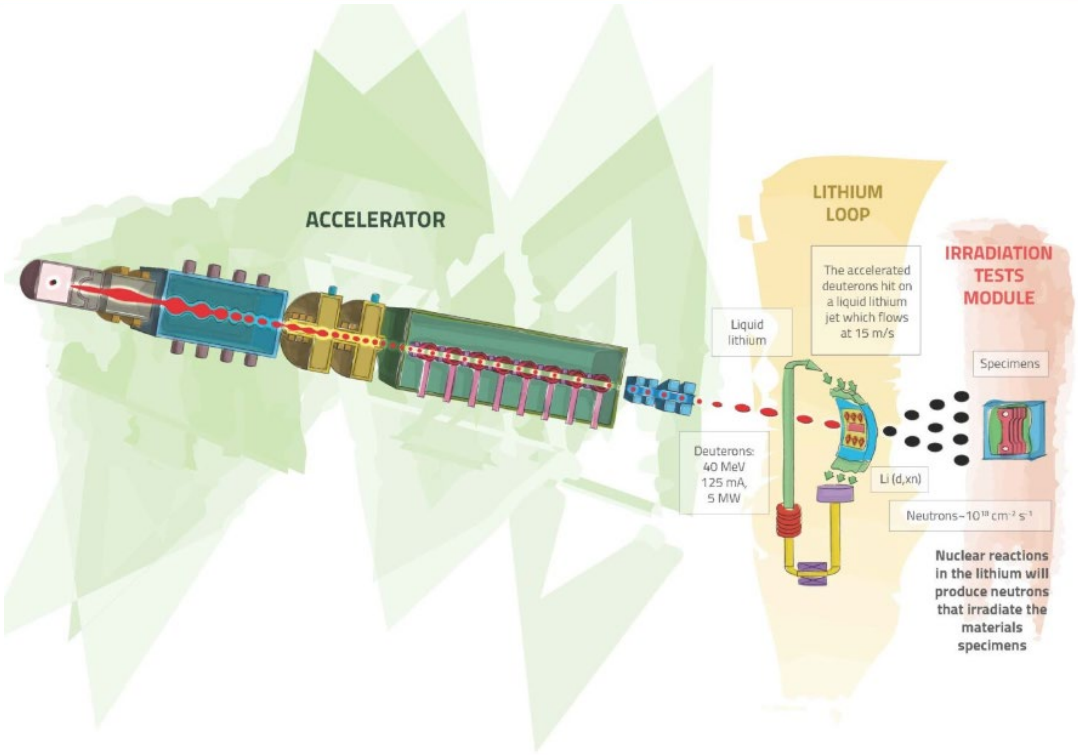
- **OPE-1407: LIPAc Injector Upgrade,** estimated contract value A, Q1/Q2 2024 (Competitive with Negotiation).

Source: IFMIF-DONES.es

- **OPE-1XXX: JT60SA Pellet Injectors (re-issue):** Pre-information notice will be done with overview of technical scope and commercial way forward + dissemination to target companies and ILO network**.** Value A, planned Q1 2024.

DONES (Granada, Spain)

DONES Program: see https://ifmif-dones.es/es/ (Irradiation facility for the development of fusion-like neutron effects database).

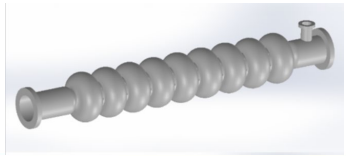


- **Superconducting Radio Frequency Power Coupler.**

- **Design and Supply of a superconductive Cavity.**

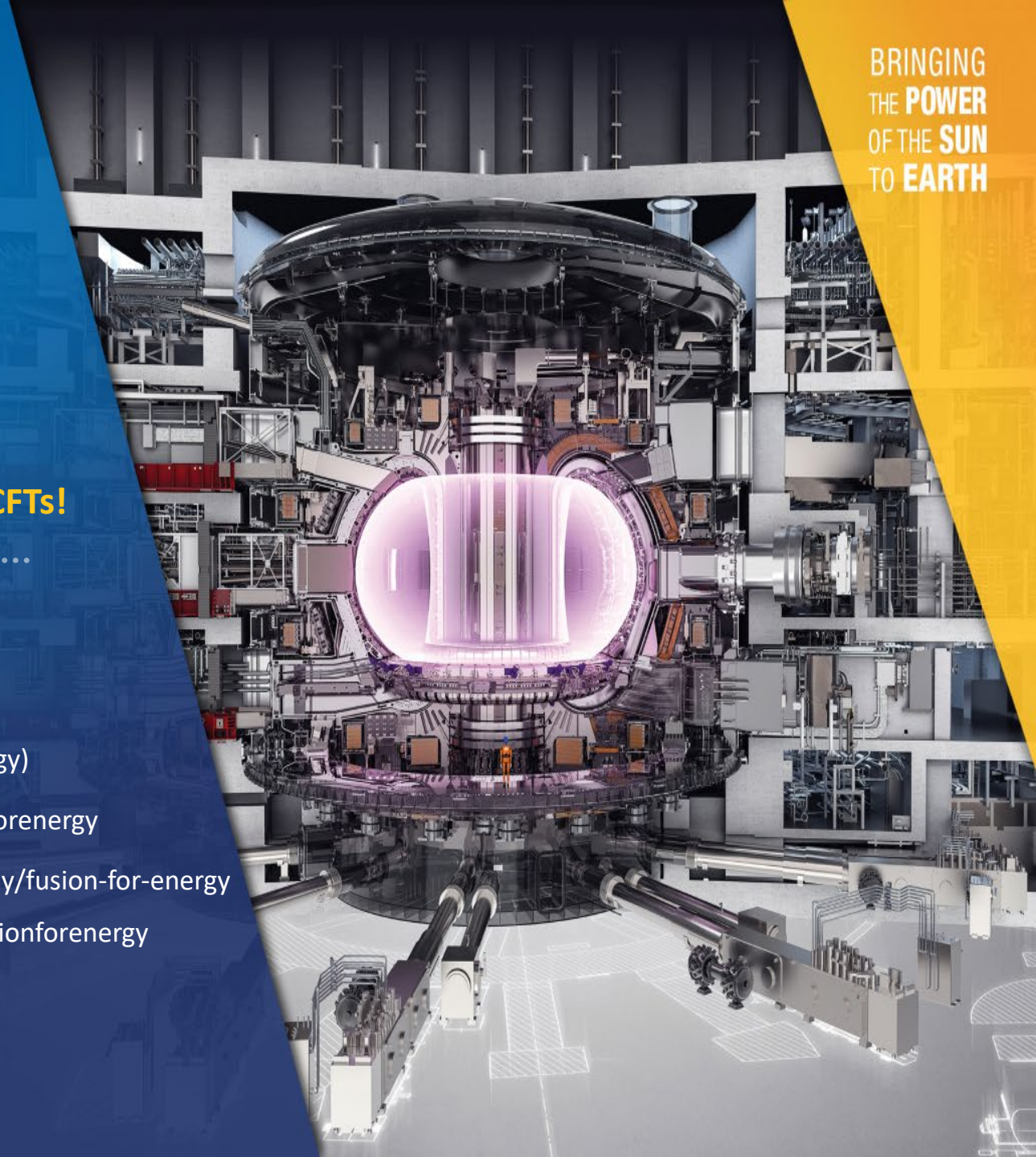
IFMIF-DONES – Functioning Scheme

Source: CERN



Source: Wikipedia

FUSION FOR ENERGY



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

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