

THEMATIC WORKSHOP

Diagnostics program & tools ■ ITER Business opportunities



Victor UDINTSEV

ITER Diagnostics Program Program Manager



From 2009, Victor Udintsev worked as engineer, section leader and Project Leader for ITER Diagnostic Engineering. He participated in the plasma physics studies and diagnostic developments on different tokamaks: RTP (The Netherlands), TEXTOR

(Germany), JET (UK), Tore Supra (France), TCV (Switzerland). He was the responsible engineer and scientist for the development and the operation of high and lower power microwave systems in tokamaks.



Glenn COUNSELL

F4E Program Manager for Diagnostics



Glenn Counsell is the Programme Manager for Diagnostics at F4E in Barcelona, where he has worked since 2008 guiding the design and delivery of European contributions to ITER in the field of plasma and first wall diagnostics.

Prior to that he was a research scientist and group leader for 10 years at the Culham Science Centre of UKAEA (CCFE) in Oxford UK, working on the science of fusion plasmas and their interactions with material surfaces.



Chairperson:

Søren Bang Korsholm

Senior Scientist,
Technical University of Denmark
DTU, ILO Denmark



Introduction to ITER Diagnostics and Business Opportunities

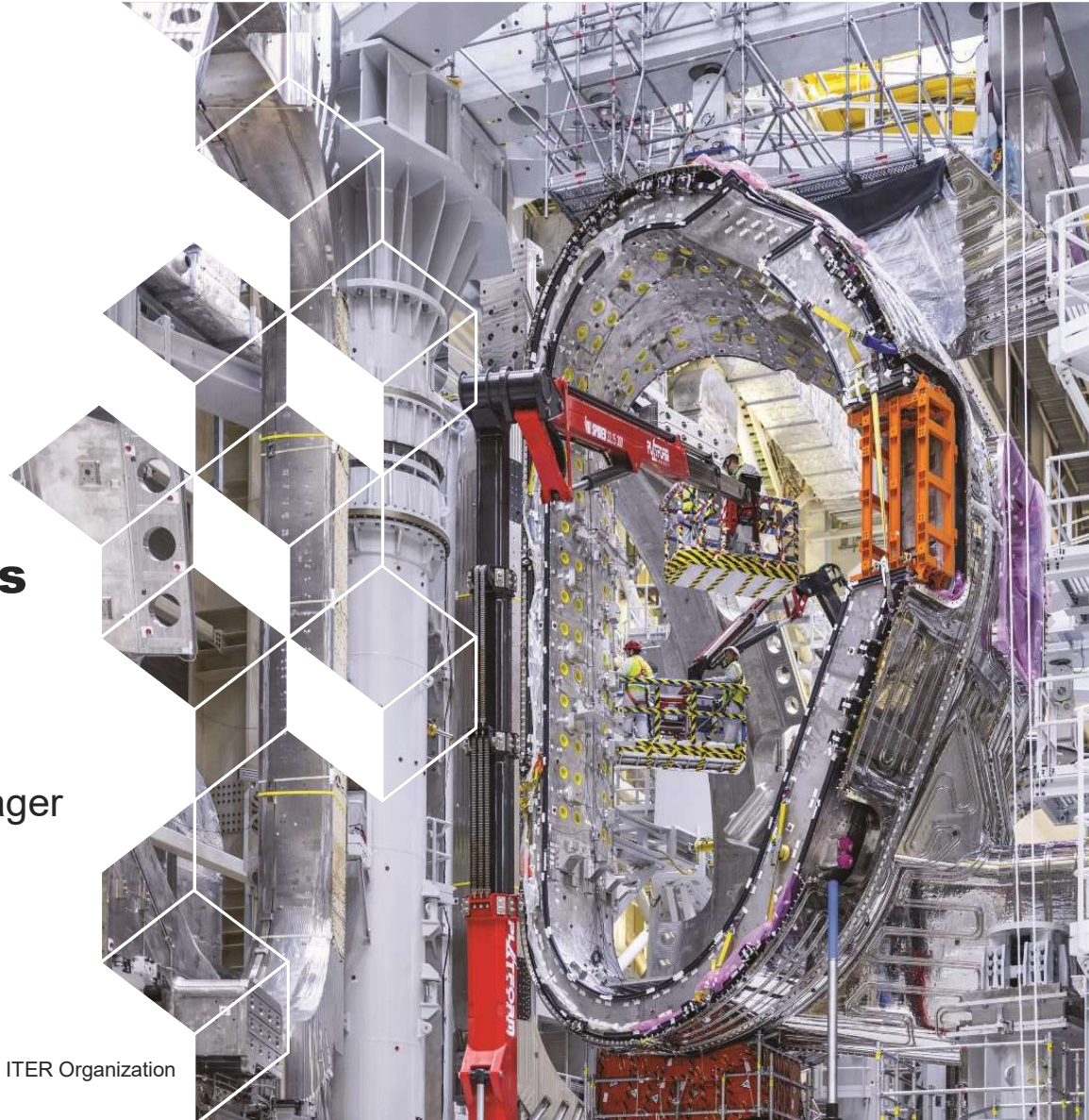


Victor Udintsev

ITER Organization, Program Manager

THURSDAY APRIL 24th

Disclaimer: the views and opinions expressed herein do not necessarily reflect those of the ITER Organization



Outline

1. Diagnostics in ITER

A quick reminder

2. Technical progress achieved

3. Lessons learned

4. Upcoming Contracting Opportunities





1. Diagnostics in ITER

A quick reminder

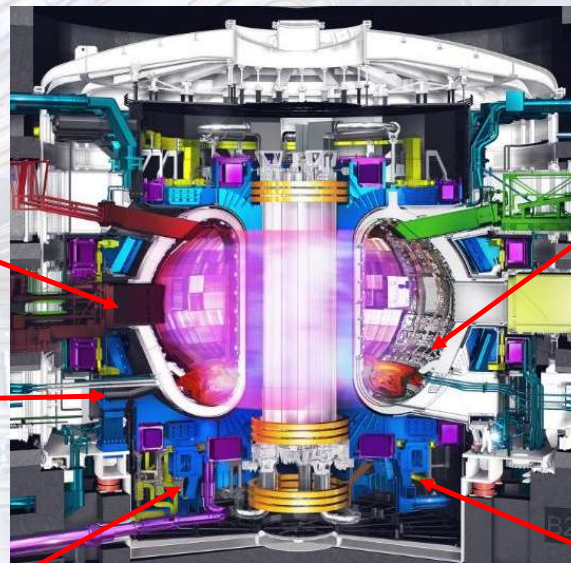
Controlling the plasma – ITER Diagnostics

ITER was authorized in 2012 as a Basic Nuclear Installation in France

UPPER PORTS
(14 used)

EQUATORIAL PORTS
(9 used-Equatorial)

DIVERTOR CASSETTES
(distributed diagnostics)

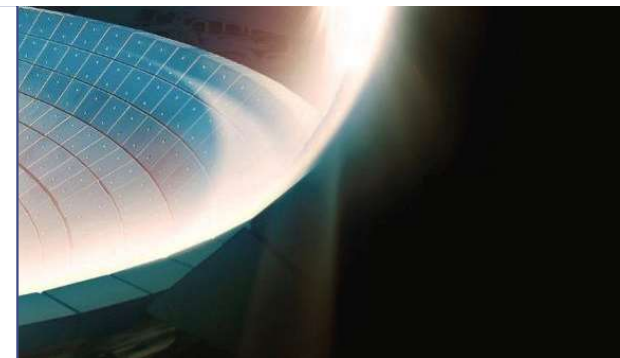
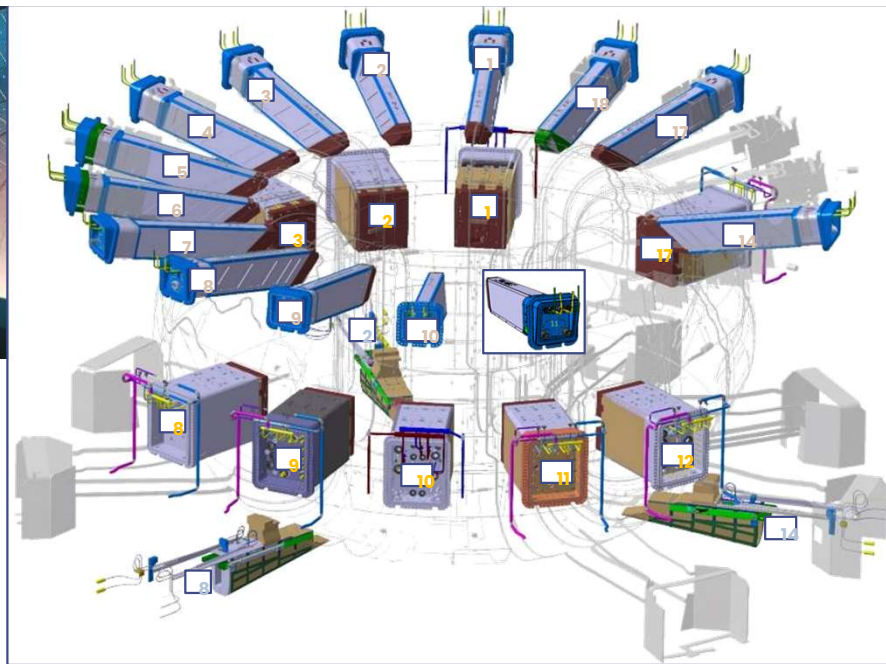
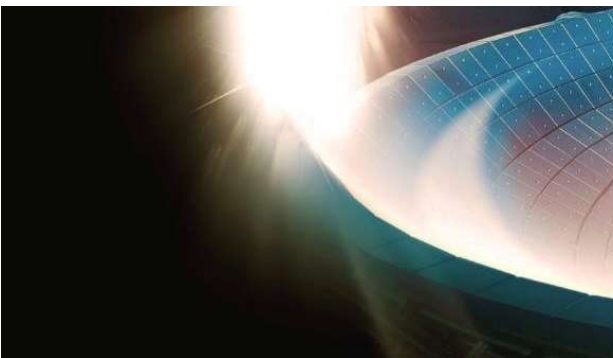


VESSEL WALL
(Distributed Systems)

DIVERTOR PORTS
(3 used)



- ~50 Diagnostics are required first for machine protection, then control and finally physics studies
- Measurements from DC to γ -rays, neutrons, α -particles, plasma species



- More than 100 Diagnostic products in total; over 50 Diagnostic systems distributed in 26 ports (many with **Domestic Agencies** – see *following presentations*)
- Several systems delivered and installed, many in manufacturing
- Other systems are either in the Final design stage or approaching it
- Priority to the Start of Research Operations (SRO) systems but others advancing too
- **Focus on hardware procurement, assembly and installation in upcoming years** – see *presentation later*



2. Technical Progress Achieved



Big picture

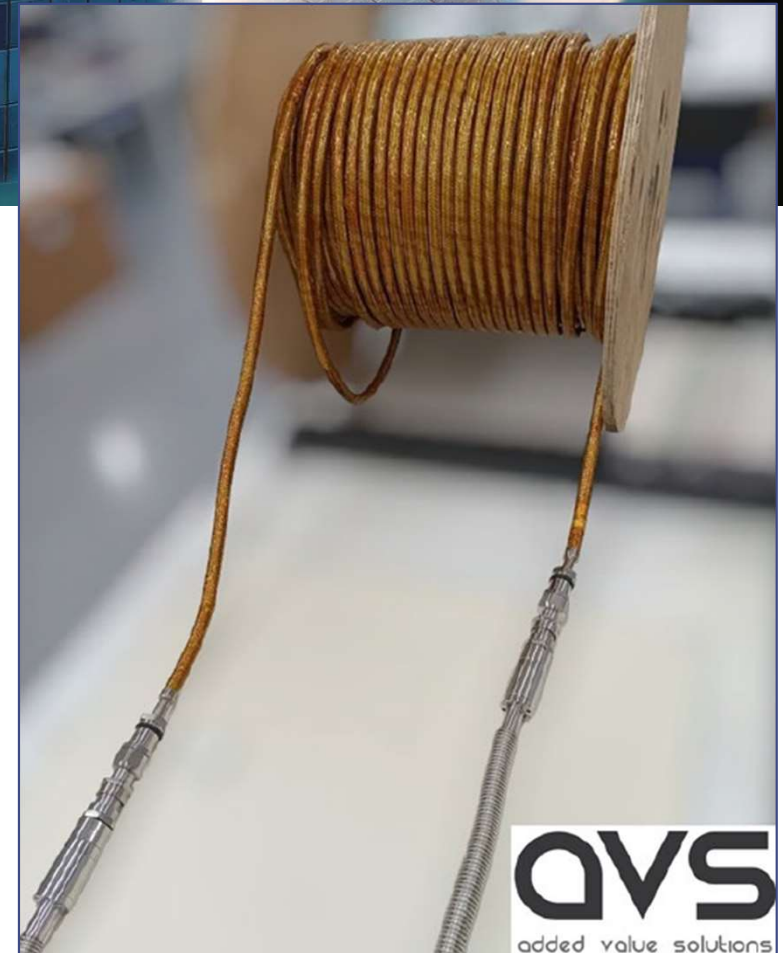
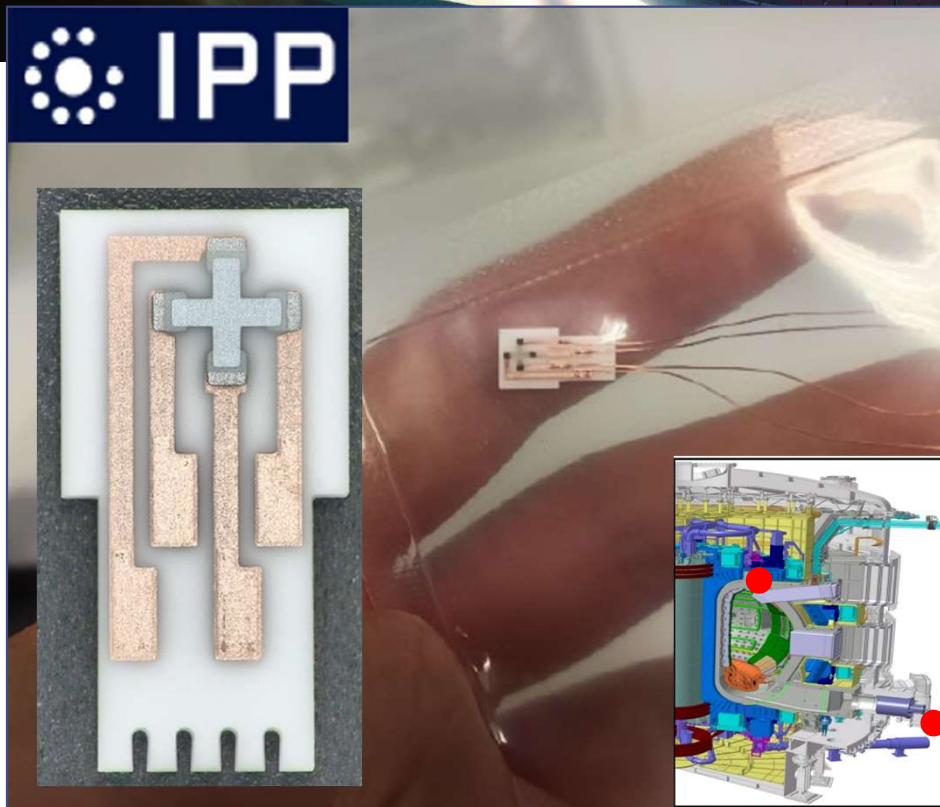
- **Close collaboration with Domestic Agencies and Industrial Partners**
- In-Vessel magnetics/ components procured by IO and DA; installation on Vacuum Vessel sectors ongoing
- Captive supports for diagnostics in buildings are procured and installed
- Big value contracts for Port Plug Structures (IO scope of supply) are placed
- Diagnostic First Walls manufacturing (IO scope of supply) is ongoing
- Diagnostic systems are in various stages of design and procurement – many in manufacturing **by IO and DA**
- **See next slides for specific examples and also presentations by suppliers during this session**



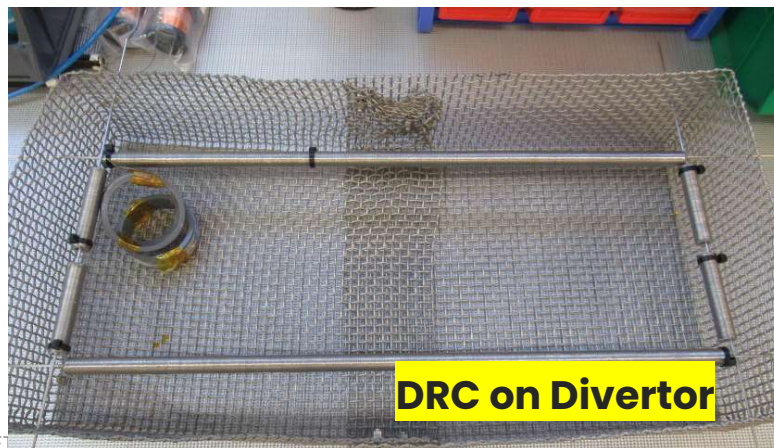
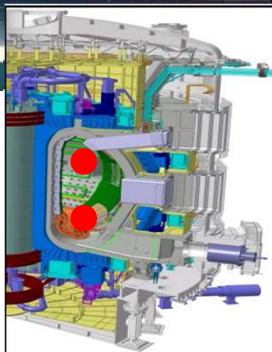
Status of ITER Magnetics Diagnostics

- **Finished installation, towards commissioning:** Magnet (Toroidal Field Coils) based Rogowski Coils
- **Finished manufacturing (fully delivered), installation underway:** Vacuum Vessel (In-vessel, Ex-vessel) based and Divertor based inductive sensors, Flux Loops, magnetics electronics (integrators) and electrical cabinets
- **Manufacture underway:** Non-inductive Hall effect sensors (finish in 2026), Divertor based Rogowski coils (finish in 2027), Blanket based Rogowski coils (finish in 2029)
- **In Final Design:** Fiber optical current sensor, Total Current Monitors

ITER Magnetic Sensors : Non-Inductive (Hall Probes, Fiber Optics Current Sensor)



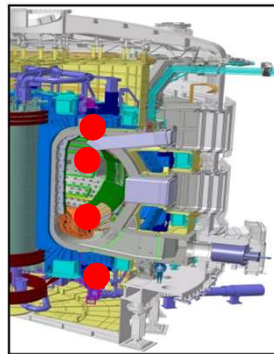
Brazed Mineral Insulate Cable Coil (Halo Rogowski)



ITER Magnetic Sensors: Inductive, In-Vessel and Divertor



Mineral insulated cable



Conventional Pickup Coil



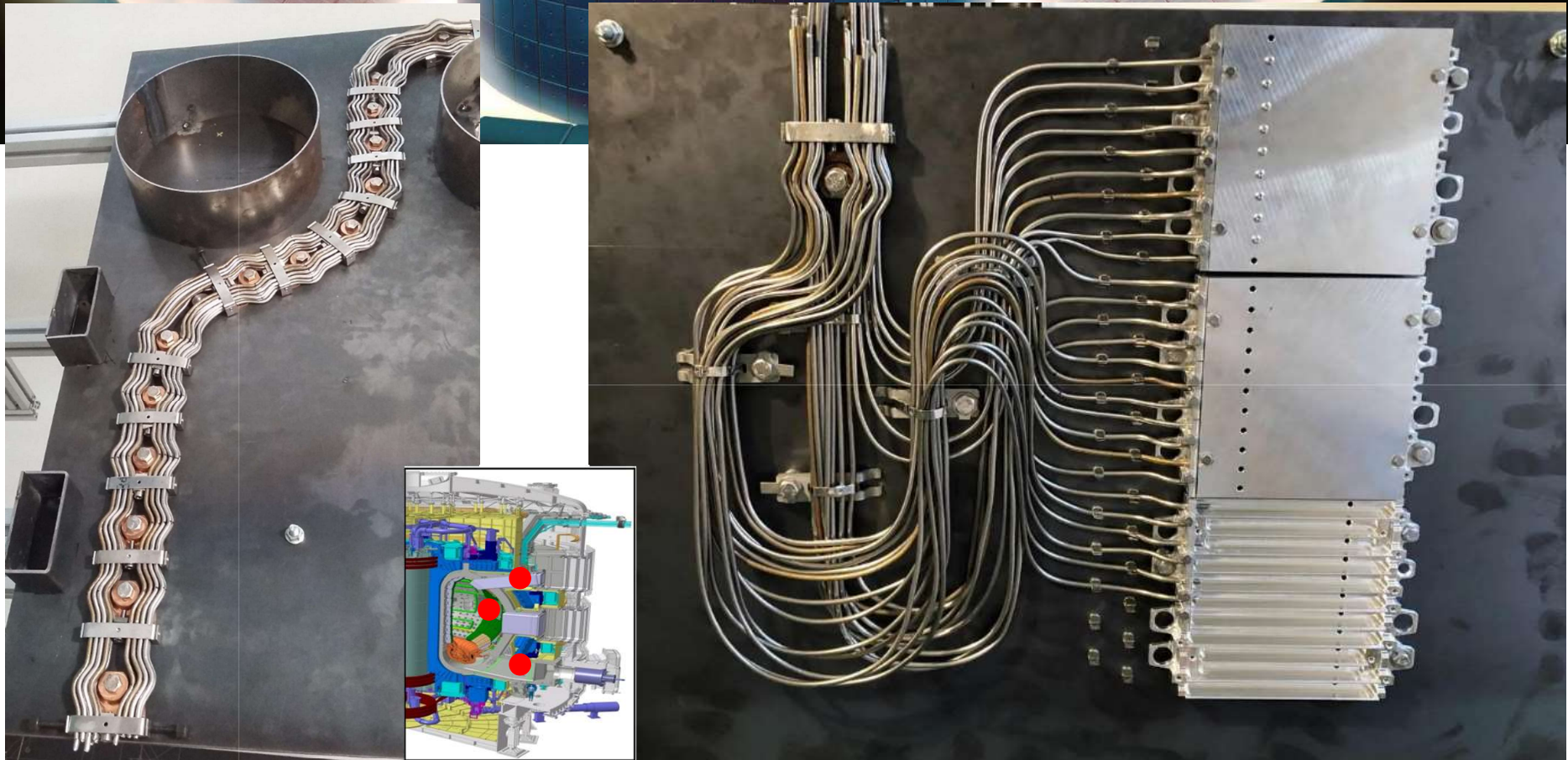
Continuous Ip Rogowski



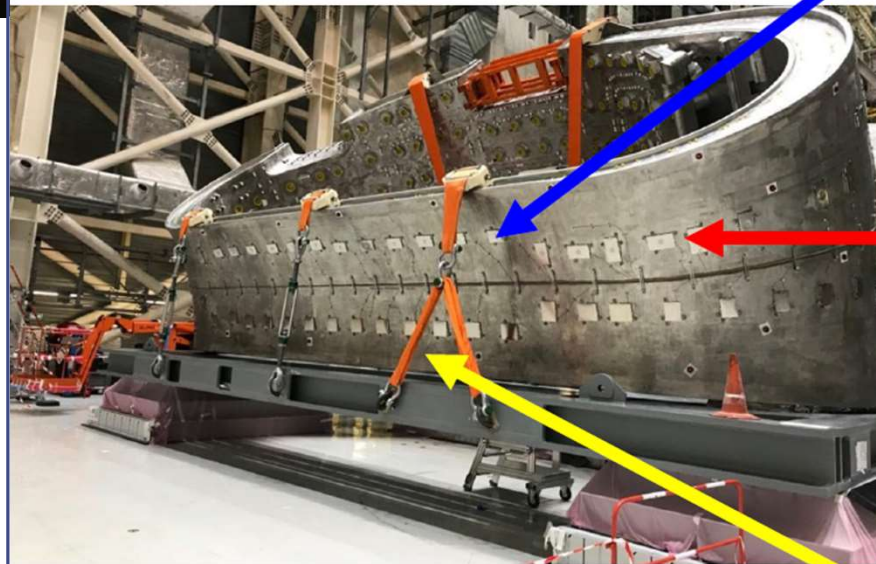
Status ITER In-Vessel and Divertor Electrical Services

- **Finished manufacturing (fully delivered):** Mechanical supports for in-vessel electrical services
- **Manufacture underway:** Mineral insulated cables (finish in 25/26)
- **Post-final design, manufacture in preparation:** In-vessel electrical feedthroughs (production to launch in 2026)
- **In Final Design:** Divertor electrical services

Assembly Demo – MI Cable Installation



Diagnostics Installation to VV are underway!



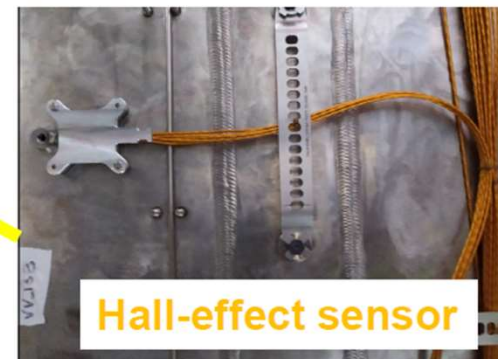
Ex-vessel magnetic sensors have been installed to 3 VV sectors



Flux Loops



Ex-vessel sensor



Hall-effect sensor

Magnetics Electronics, DAQ, cubicles



Cubicles assembly was done by IO; installation underway



Cubicles





Port Plug Structures

- **Change of supplier in 2024!**
- All materials are procured
- Equatorial #11 and Equatorial #12 partly finished frames are priority
- Delivery to the port integrators (IO and Domestic Agencies) is expected on schedule
- See also *Lessons Learned* in the following slides

Port Plug Structures



Port Plug Structure in progress



Port Plug Structures and materials delivered to ASIPP (China)



Diagnostic First Walls

- **Manufacturing ongoing with Vitzrotech in Korea**
- Close technical cooperation between supplier and IO experts
- Delivery will be in several batches matching port integrator's needs
- See also *Lessons Learned* in the following slides

Diagnostic First Walls



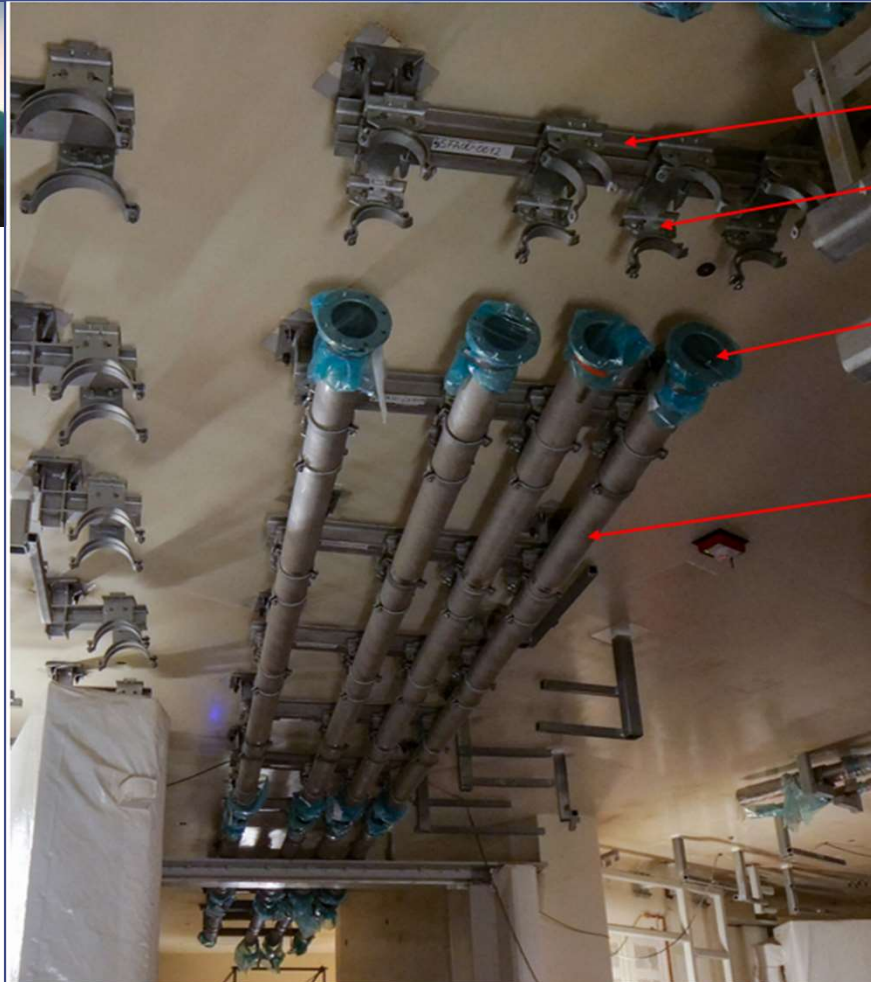
Manufacturing of
DFWs by Vitzrotech
(Korea)



Supports in buildings

- **Diagnostic waveguides and lines are supported on the ceiling by custom supports**
- For critical (captive) supports, procurement and installation has been performed
- Other supports are on their way to be procured

Supports in buildings



Support for 55.FA

Clamp

plastic dust cover

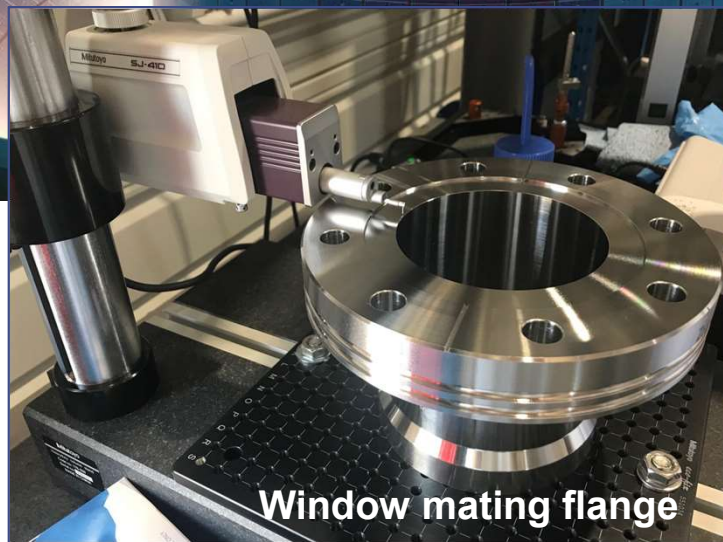
Pipe / laser duct



Specialized Diagnostic Procurement

- **Several specialized diagnostics are in procurement stage at IO and Domestic Agencies**
- Some are still in the design phase and we plan to accelerate
- Deliveries must match needs for installation in buildings, port plugs/ structures and machine assembly dates

Specialized Diagnostic Procurement



Window mating flange



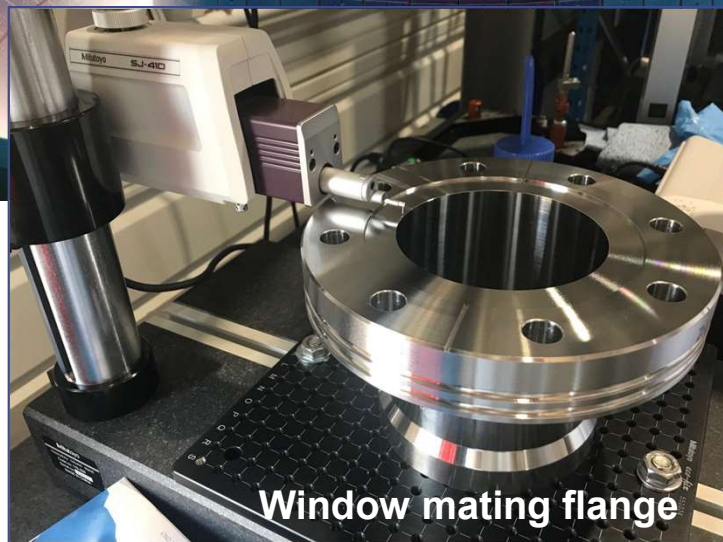
H-alpha shutter actuator (RF DA)



H-alpha "hot dog-leg" (KTO, Germany) – highlight at this Forum - booth #52!



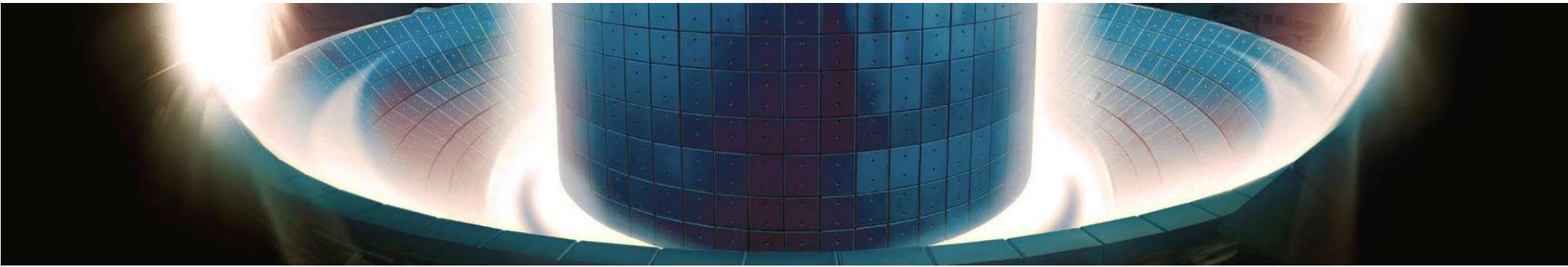
ZnSe window prototype for pre-qualification



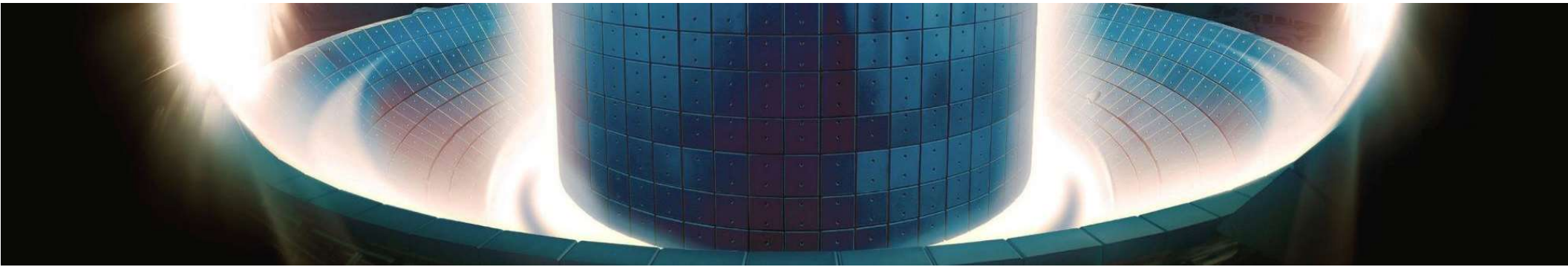
Manufacturing Visible Spectroscopy Reference System



3 ■ Lessons Learned

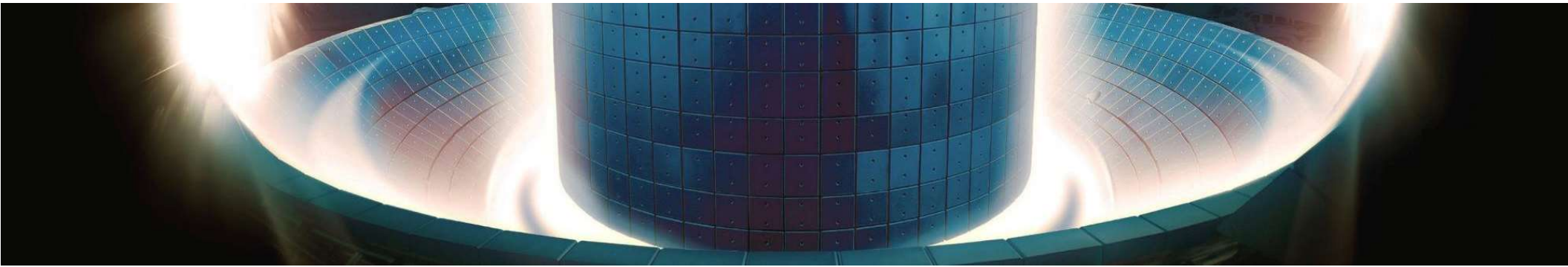


- **Based on in-vessel components components manufacturing (magnetics, probes, looms etc)**
- Virtuous synergy among ITER organization, ITER domestic agencies and suppliers (industries) is key to success
- Rigorous and consistent quality control scheme is essential for managing complex production / supply chain (in particular, when involving sub-contractors / sub-contracted activities)
- Training, practice and pre-qualifications are critical for joining techniques (welding, brazing, adhesives, etc.), and must be repeated when change of operator and/or start of a new production batch
- Prepare sufficient spare parts and trial pieces, in particular for small accessories and fasteners (bolts, nuts, clips, clamps, ties), to cope with installation losses / contingencies
- Plan and do not “forget” to install protection from subsequent operations and poor handling
- Quick (sometimes on-the-spot), strategic and pragmatic decision making is crucial in manufacturing and installation
- Reliable global logistics service and supply chain (hero during COVID pandemic)

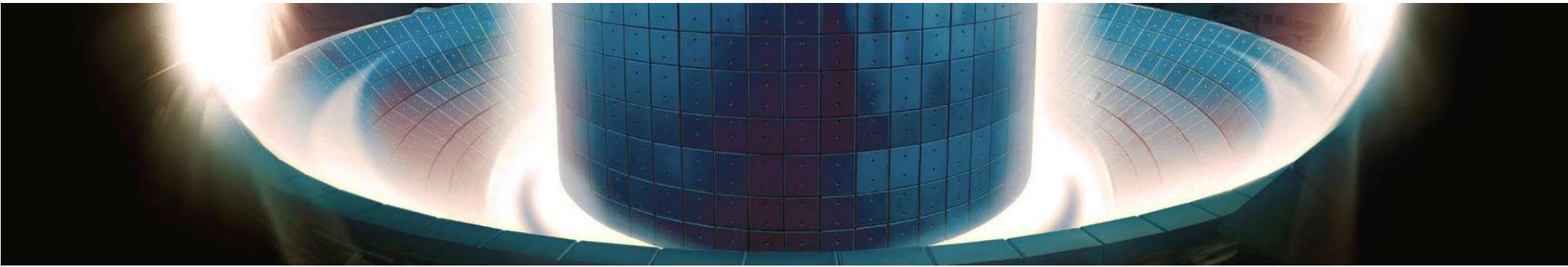


- **Based on In-vessel electrical services**

- Anticipate installation procedures while designing the items – ensure that the components have certain tolerance to external discrepancies
- Plan packing the items to simplify an inspection and management of components – put common components in common boxes rather than individually in the kits
- Nuclear-compliant materials with proper documentation are not easy to obtain in small quantities
- Outgassing tests take a long time and can be a major source of delays
- Paschen testing is essential
- Prototype and test all the items if a large series is planned, as potential replacement costs are large even in small items
- Do not allow the formation of monopolies, if feasible always have back-up suppliers even of sophisticated items
- Avoid designing individual, non-replaceable items, standardise or at least group the items to obtain mutual replaceability

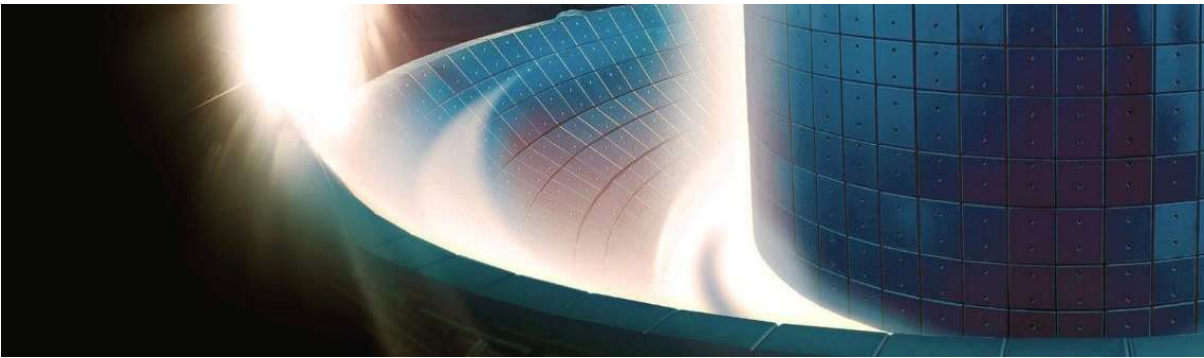


- **Based on Port Plugs major components manufacturing (Port Plug Structures, Diagnostic First Walls)**
 - Design to anticipate manufacturing complexity. A simpler and more manufacturing-oriented design greatly reduces the manufacturing risks
 - Sound and fair qualification replicating actual production conditions (means, sequence, etc.) is a critical aspect for success
 - Observance of cleaning and cleanliness preservation is paramount to ensure the quality of the component being manufactured
 - Relaxation or lack of rigor in welding operations (oxidation, purging, heat tint...) significantly complicates future activities. Production to be based on demonstrated and reliably qualified procedures
 - Continuous oversight with rigor and paying attention of all technical aspects is mandatory: skilled manufacturing experts and intense follow-up



- **Based on specialised diagnostic design and manufacturing**
 - Testing COTS beyond specifications can reveal they are better than expected and avoid expensive custom development. Simplify the design in early stage to avoid unrealistic demands on manufacturing and installation (note: even a simple diagnostic is demanding)
 - Application of innovative solution to simplify the design (e.g. use of electric shutter)
 - To factor the maintenance strategy early in the design of port and diagnostic systems. This corresponds to addressing through design issues of accessibility, complexity of the maintenance tasks, challenges with ORE, etc

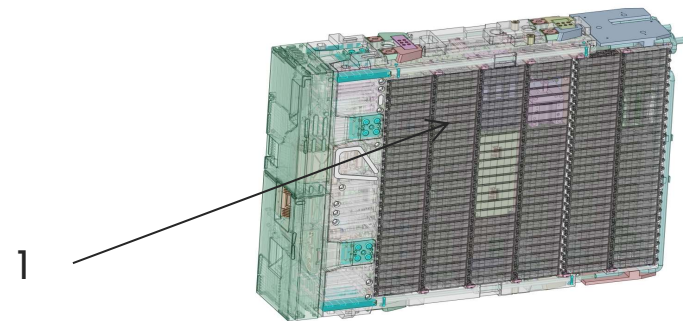
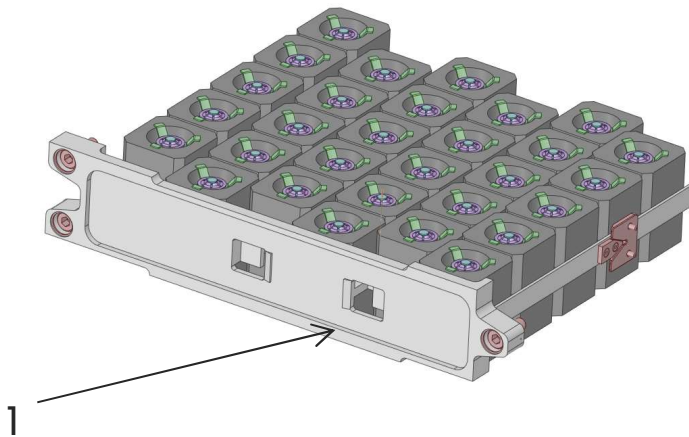
4. Upcoming Contracting Opportunities

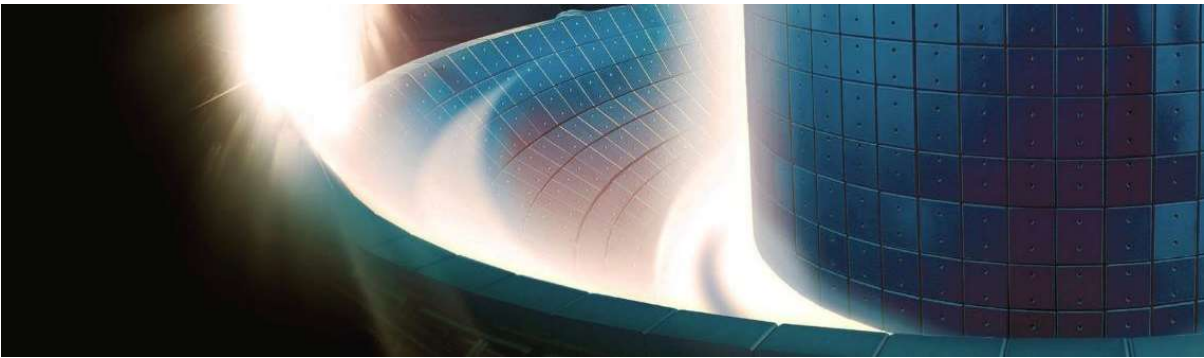


Approx. " Cost Range" (**indicative only!**)

- 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

- **IO Ports Plugs Procurement**
- **Shielding Trays Manufacturing and assembly (Q3-2025) [1] (C)**



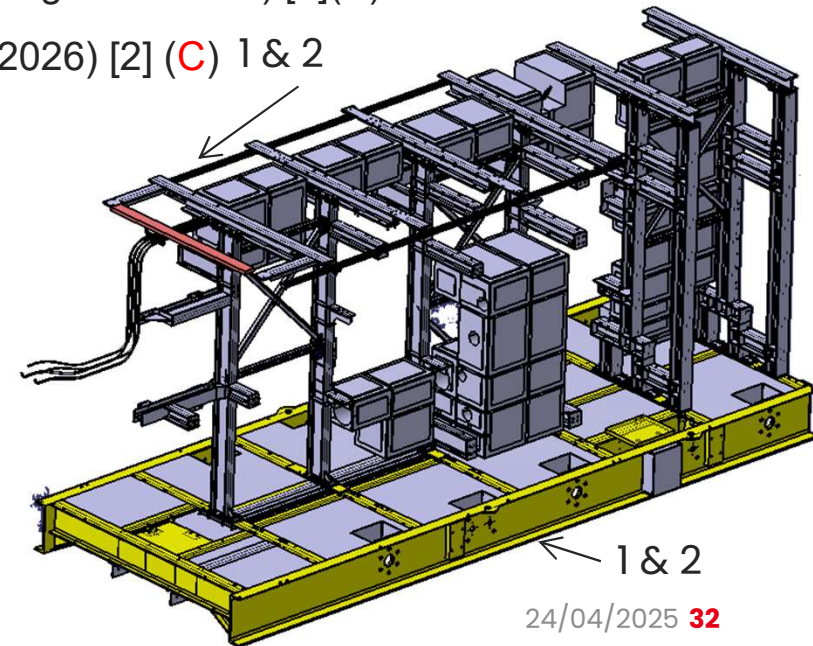
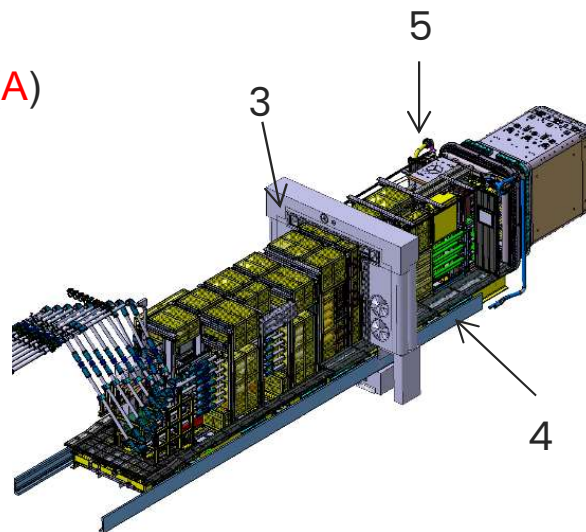


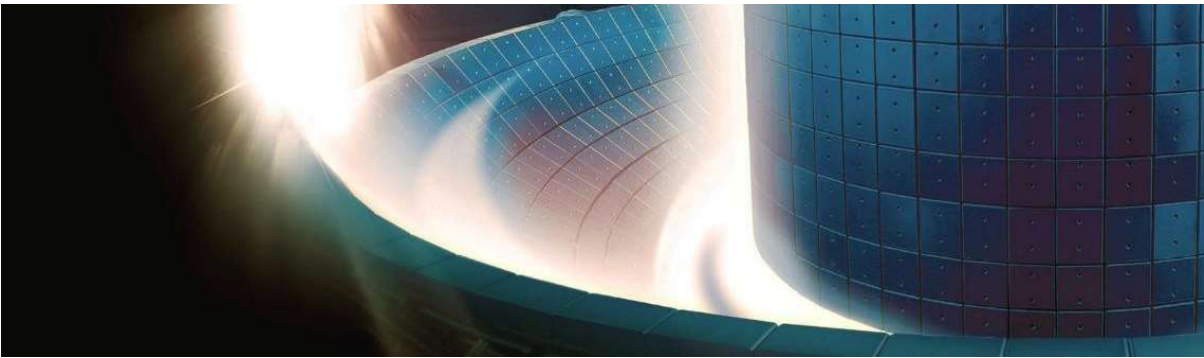
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• IO Ports Ex-vessel Procurement

- Equatorial and Upper ex-vessel structures material frames (signature target Q2-2026) [1](**A**)
- Equatorial and Upper ex-vessel structures frames manufacturing (Q2-2026) [2] (**C**) 1 & 2
- Ex-vessel shielding (2027) [3] (**B**)
- Port Cell Service Frames (2027) (**A**)

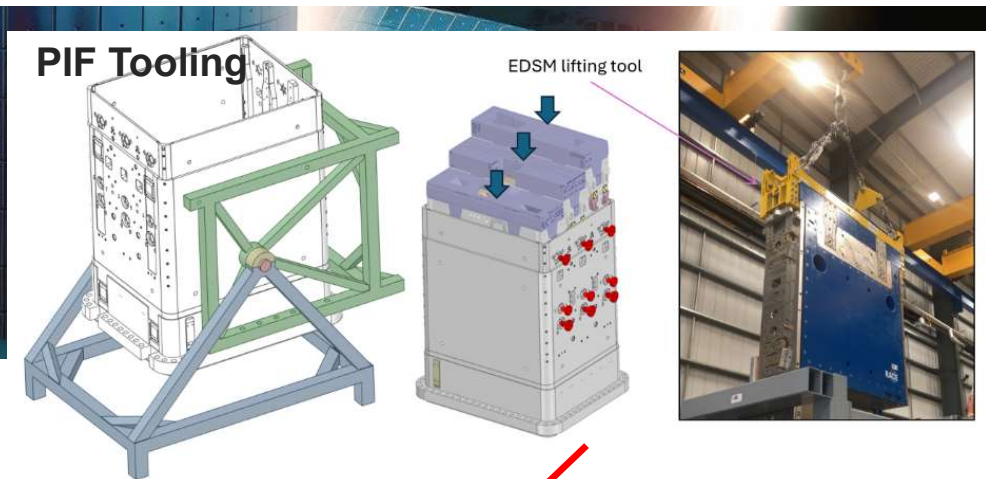
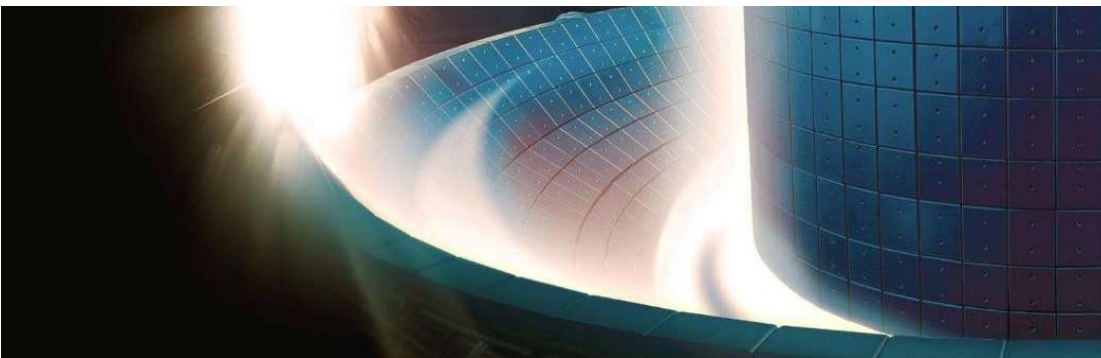




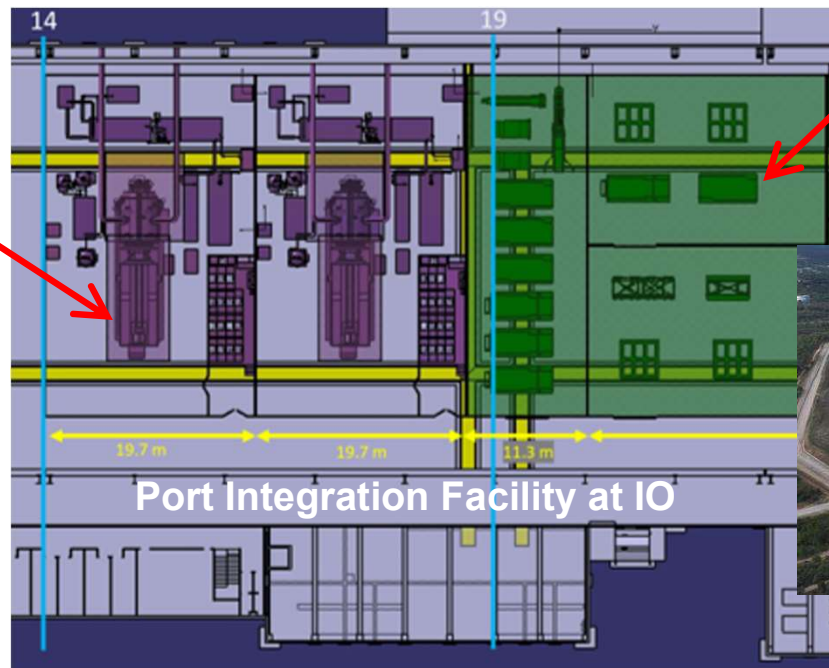
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- D** Item Range: above 10 000 000 EUR

- **IO Port Integration Facility (PIF) – see next slide**
- *Next to Port Plug Test Facility Area (procured by RF DA, installed by IO with RF DA team)*
- Ex-vessel integration PIF (tooling, installations, building adaptation) (**B**) (Q2-2026)
- In-vessel PIF Operation and Maintenance (Q4-2026) (**C**)
- Ex-vessel PIF Operation and Maintenance (2027) (**C**)

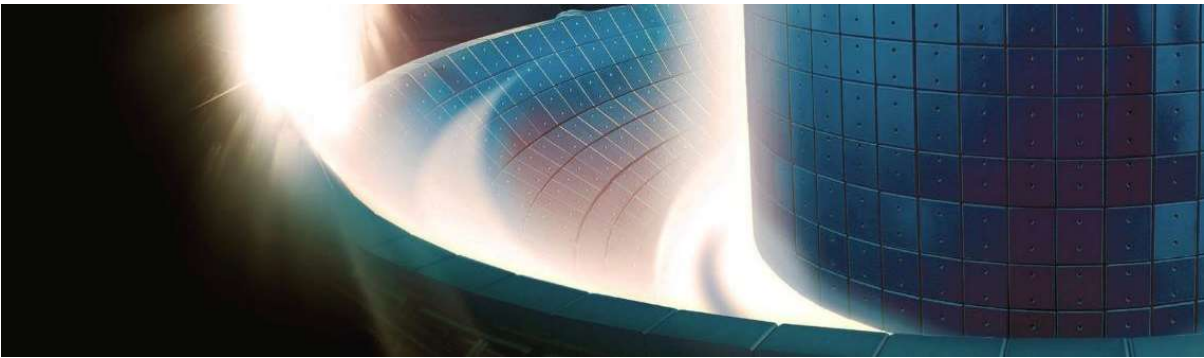


Port Plug Test Tank and auxiliaries (by RF DA/ GKMP)



PIF





Approx. " Cost Range" (**indicative only!**)

- 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
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- **Specialized Diagnostic Procurement needs – yet to come!**
- Prototyping and Manufacturing of 55.NE.X0 Port-cell connectors (signature target Q4-2025) (**D**)
- Framework contract for on-site specialized engineering interventions on PBS 55.NE.X0 electrical devices (Q4-2025) (**B**)
- Specialized coatings (metallic mirrors, insulation, low-friction, ...) (**A**)
- Custom back-end fibres (**A**)
- Narrow-band optical interference filters (**A**)
- Optical units comprising custom optical components (mirrors, lens assemblies), some water-cooled and motorized for alignment (**C**)
- Shielded enclosures (**B**)
- Optical table with cameras and other instruments (**A-B**)



THANKS

TO BE PART OF THE WORLDWIDE **FUSION** NETWORK



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PROCUREMENT OPPORTUNITIES AT F4E FOR PRIMES AND SUBCONTRACTORS

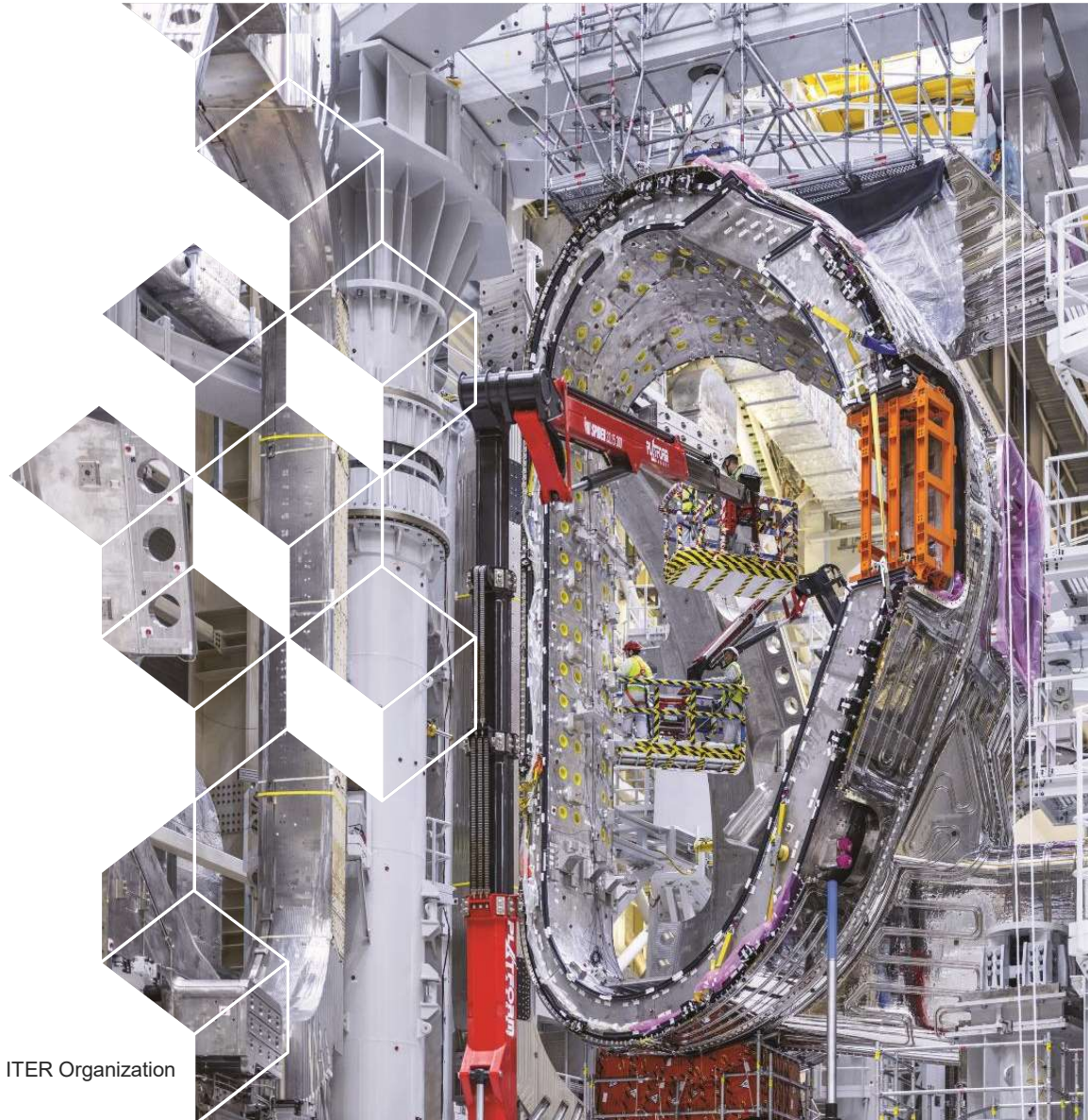


Glenn Counsell

Diagnostics Programme Manager
Fusion for Energy

TUESDAY APRIL 24th

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Outline

- 1. Status of F4E Procurements**
- 2. F4E-OFC-1183: Port Engineering**
- 3. Sub-contracting opportunities under existing frameworks**

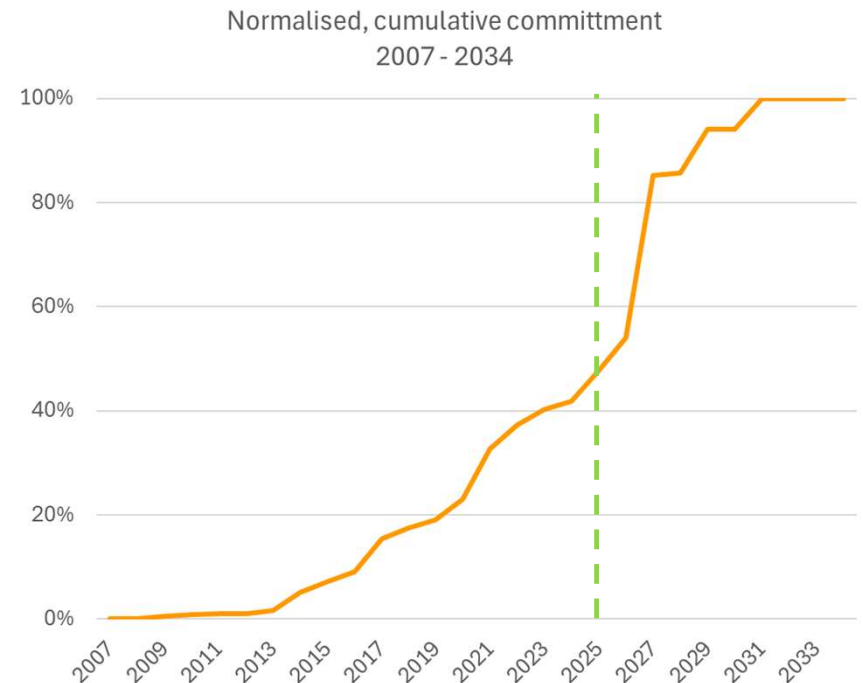
1. Status of F4E Procurements

Status of F4E Procurements (1/2)

- F4E is responsible for EURATOM in-kind contributions to the ITER Project
 - F4E supplies:
 - 8 Diagnostic systems providing more than 25% of the primary measurements needed for ITER Operations
 - In-vessel electrical services supporting all Diagnostics mounted in the ITER vacuum vessel
 - Diagnostics ports housing 21 diagnostic systems and 3 glow discharge electrodes
 - The Magnetics Diagnostic has been already completed and delivered, along with 50% of the in-vessel electrical services
 - 3 Diagnostic systems and the remaining in-vessel electrical services are in manufacture.
- Bolometers
 - Collective Thomson Scattering
 - Core plasma Charge Exchange Recombination Spectrometer
 - Core plasma Thomson Scattering
 - Diagnostic Pressure Gauges
 - Magnetics Sensors
 - Radial Neutron Camera
 - Visible/IR Wide Angle Viewing System
 - 2 Equatorial Ports
 - 4 Upper Ports
 - VV Electrical Feedthrough
 - In-vessel UHV-terminated MI cables, supports & junction boxes
 - Divertor remote handling electrical connector

Status of F4E Procurements (2/2)

- Business opportunities are for manufacturing, assembly, test and calibration. Average 35 M€ per year to end 2027 (and beyond)
- Wide scope, including many specialist components, technologies and processes
- Procurements mostly under existing framework contracts but many opportunities for SMEs to participate as sub-contractors
- 1 major framework still to be launched
- Specific contracts for 5 – 50 M€ per year over the period 2025 → 2030



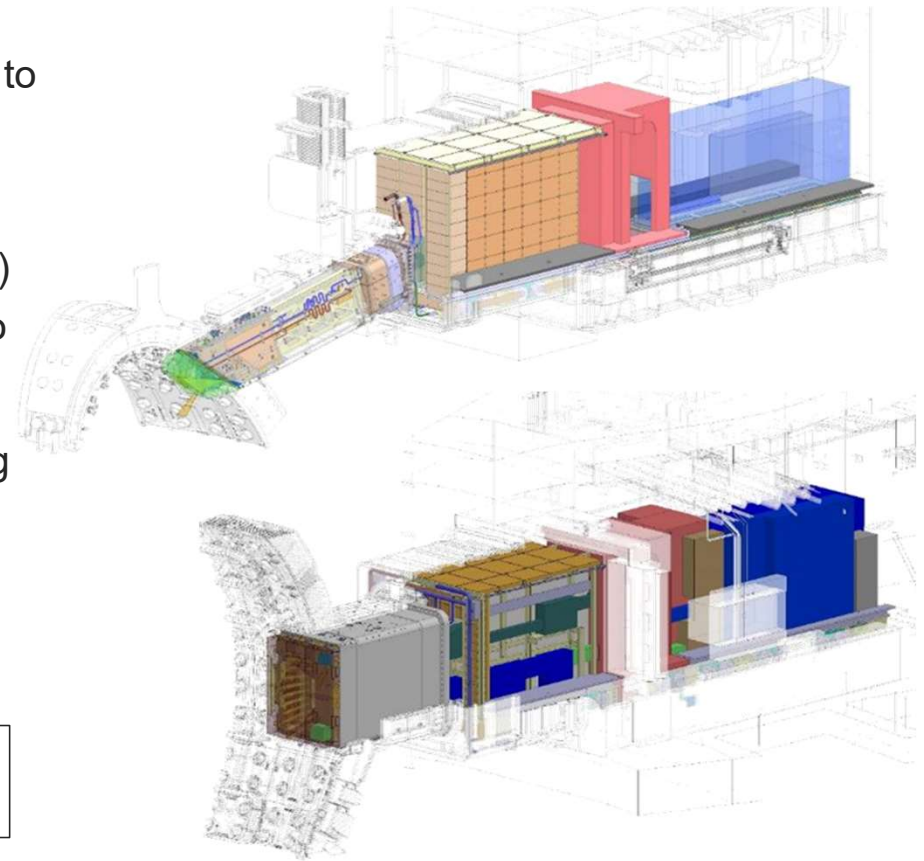
*44% of budget committed; 84% of which
for design contracts*

2. F4E-OFC-1183: Port Engineering

F4E-OFC-1183: Port Engineering (1/6)

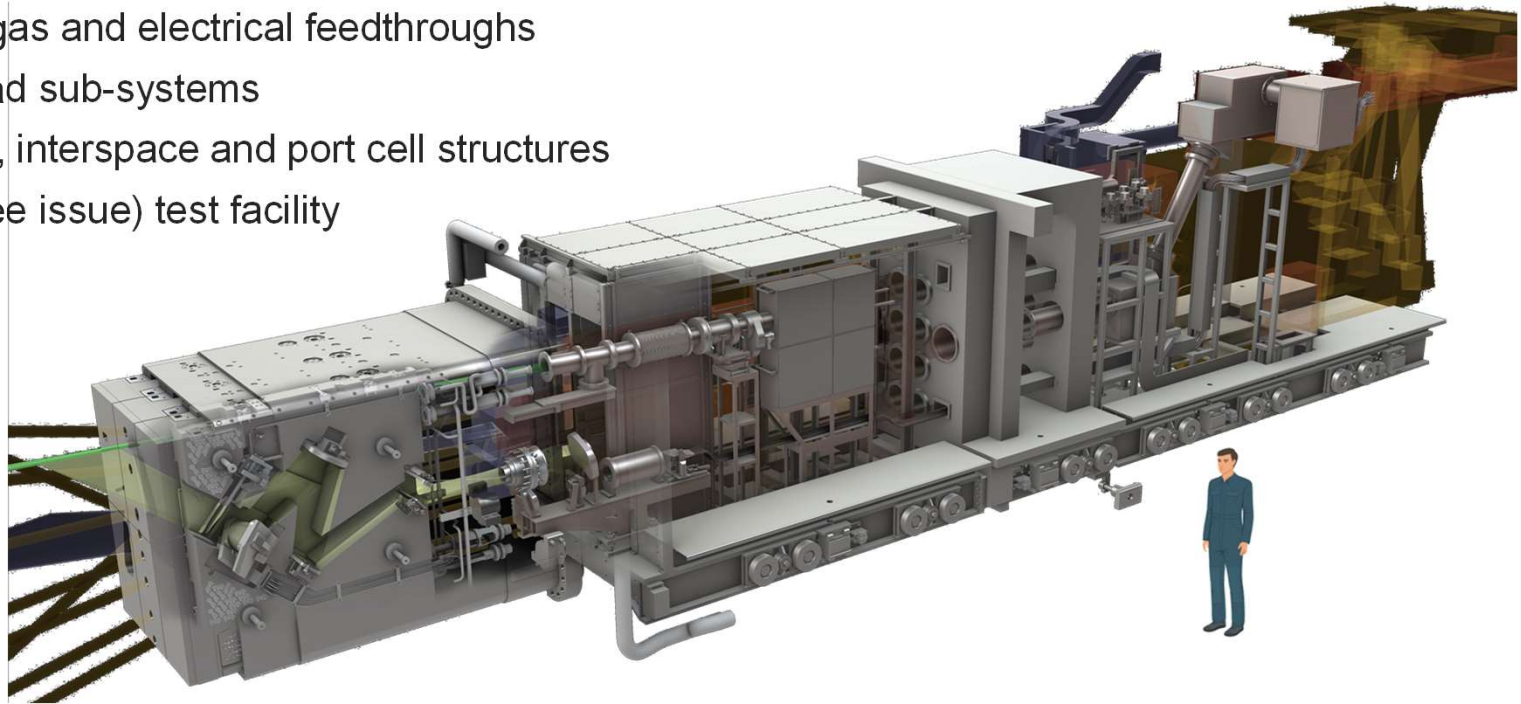
- **Competitive procedure with negotiation** for a framework to be awarded to **one** supplier
- 2 steps:
 - Selection phase (Call for Expression of Interest Q4/2025)
 - Call for Tenders (Q2/2026); selected candidates asked to submit technical, and price offers.
- Award for both framework and 3 specific contracts, covering
 - procurement of materials and tooling
 - port engineering of 4 ports
 - installation and operation of test facilities

Contact mehdi.daval@f4e.europa.eu (F4E's Market Analysis Group)

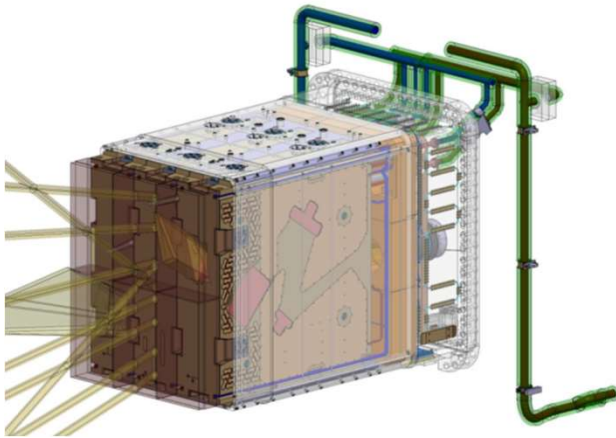


F4E-OFC-1183: Port Engineering (2/6)

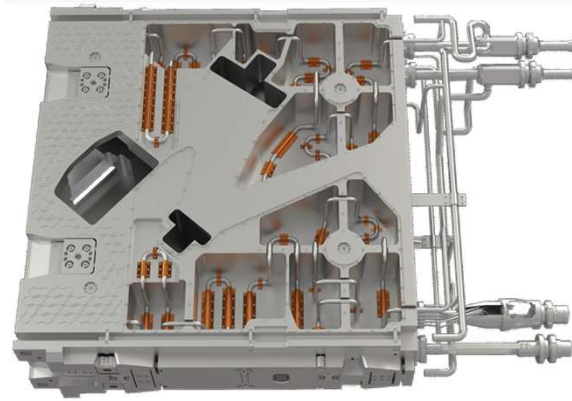
- Port Engineering for 6 ports:
 - Supply of special steel grades
 - manufacture of port structures
 - manufacture of water, gas and electrical feedthroughs
 - integration of 27 payload sub-systems
 - Assembly of port plugs, interspace and port cell structures
 - Extensive testing in (free issue) test facility



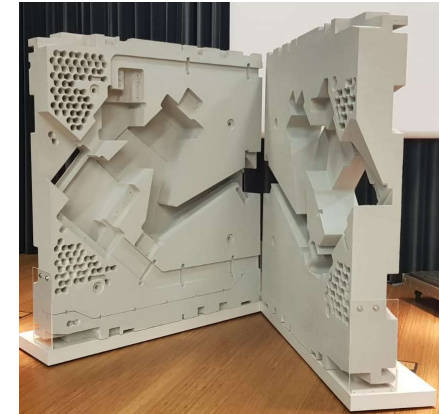
F4E-OFC-1183: Port Engineering (3/6)



Equatorial Port Plug with 3 Diagnostics Shielding Modules (DSM)

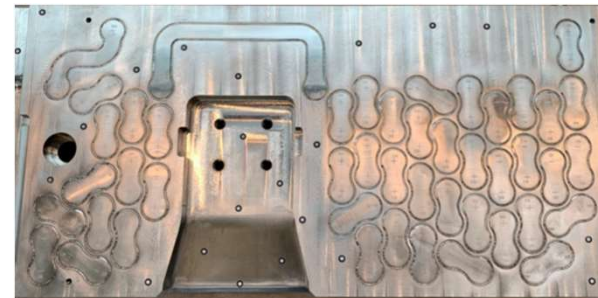


Each DSM houses one or several payloads (e.g. diagnostics)



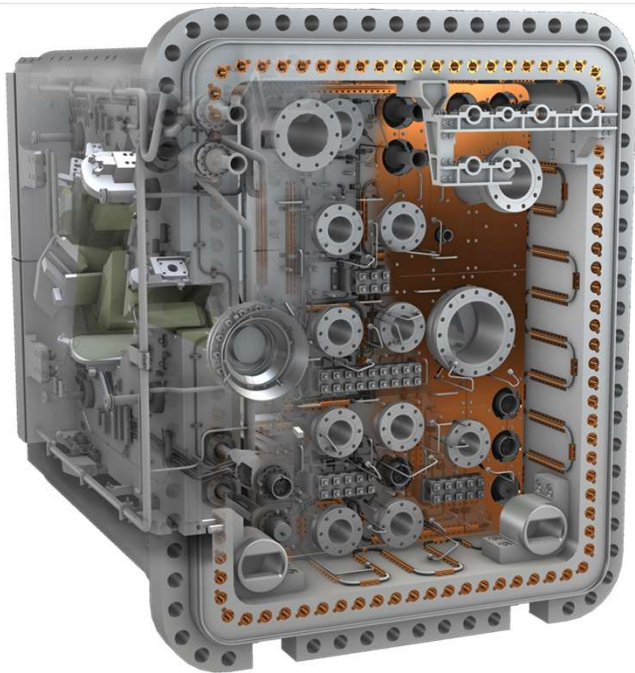
DSM mock-up

- Large steel structures (3 – 7t, 1-2 m dimensions)
- Some dimensions machined to high tolerance ($<50\mu\text{m}$)
- Copper coating of large steel components
- Machining and laser welding of water circuits
- Other zones filled with high purity B4C pellets
- Complex integration & assembly in clean conditions



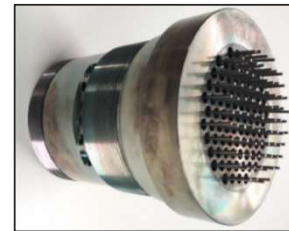
Laser welding of water circuit caps

F4E-OFC-1183: Port Engineering (4/6)

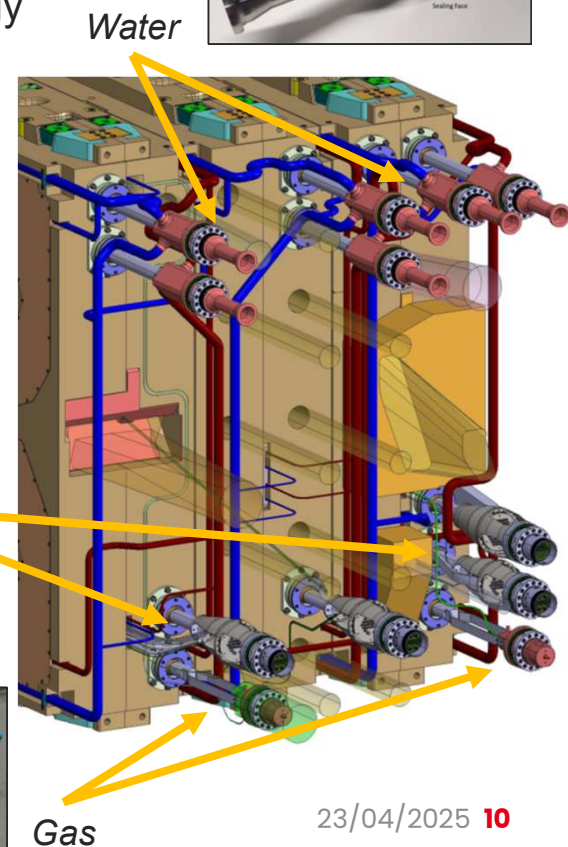


- Precision machining and welding of cut-outs in the Port Plug closure plate for feedthroughs
- Assembly of DSMs into Port Plugs (30 – 50 tonnes when assembled)

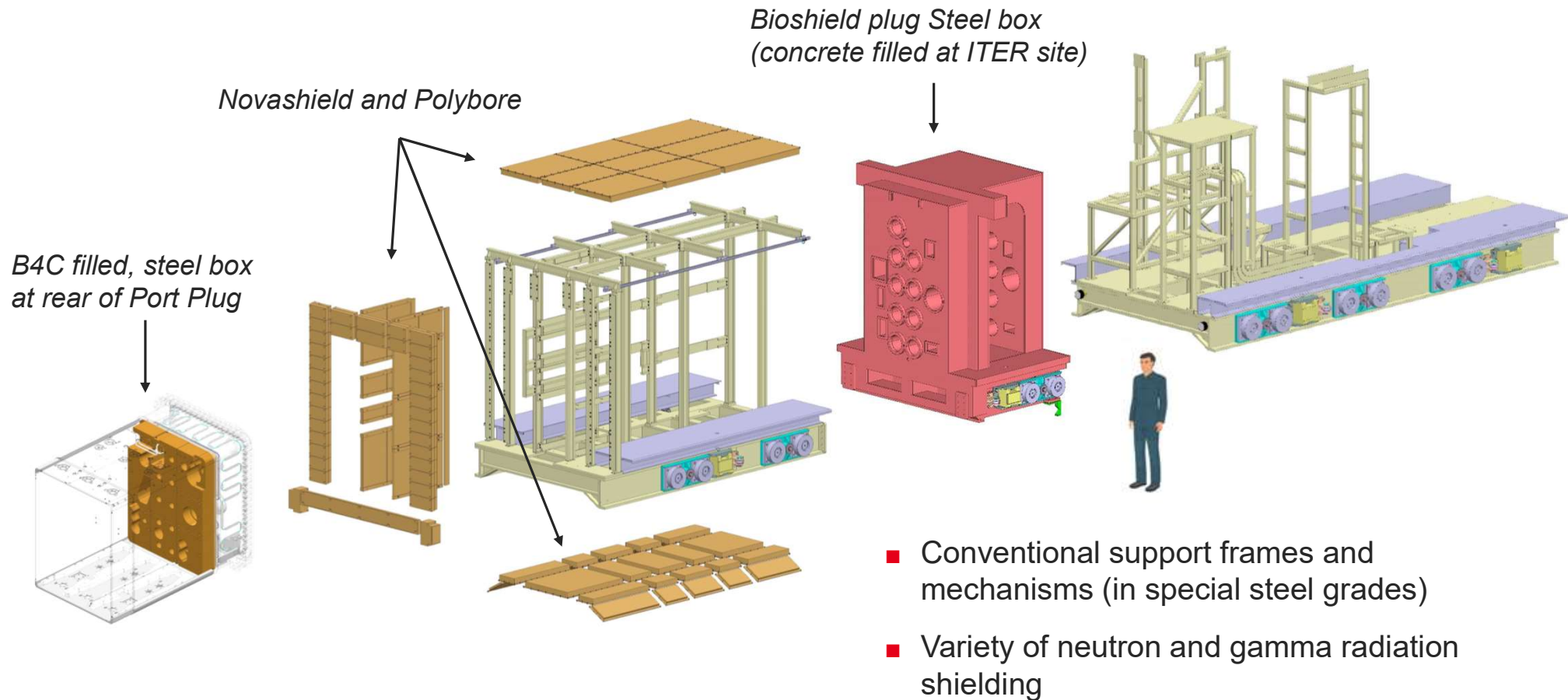
- Closure plate feedthroughs (tritium barrier, safety components)
- Glass-to-metal sealing technology
- UHV terminated MI cables
- Helicoflex seals



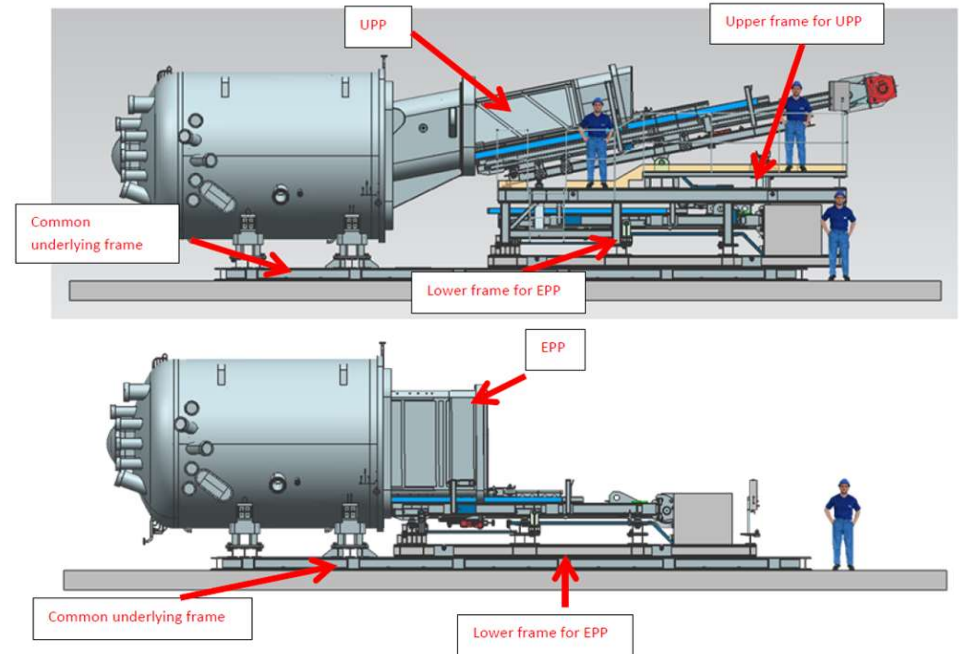
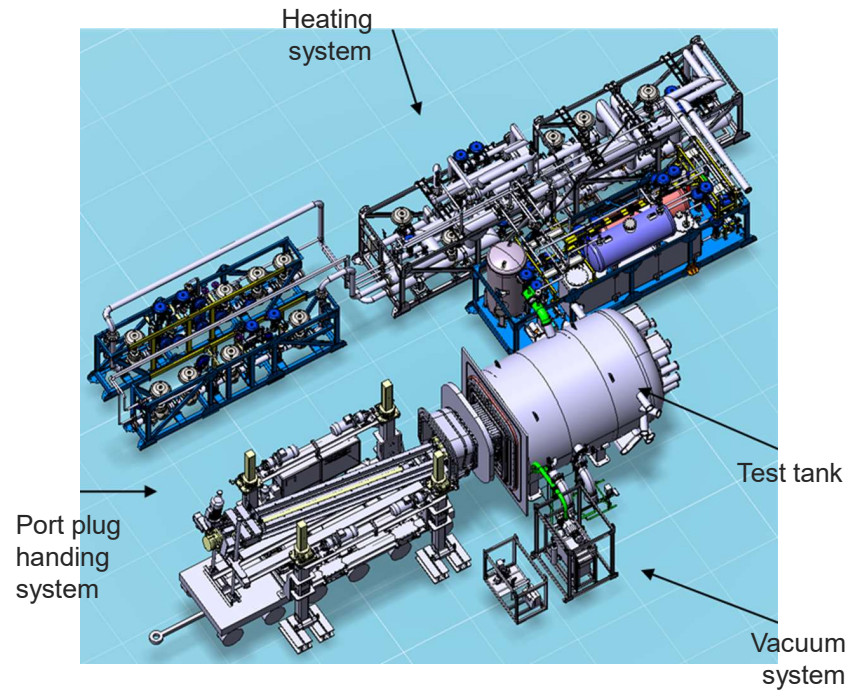
Electrical



F4E-OFC-1183: Port Engineering (5/6)



F4E-OFC-1183: Port Engineering (6/6)

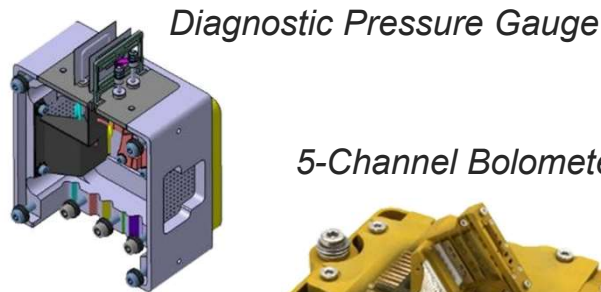


- Installation, operation, maintenance and disassembly of Port Plug Test Facility (free issue)
- Environmental testing of assembled plugs (part of FAT)
- Support for functional testing (alignment etc.) of installed diagnostics

3. Sub-contracting opportunities under existing frameworks

Sub-contracting opportunities

- Supply of 7 Diagnostic systems
- Around 100 main components or assemblies
- Many specialist technologies and processes:
 - Specialist materials and coatings
 - Precision joining techniques (e.g. laser welding, metal-ceramic brazing etc.)
 - Precision machining, including ceramics and free-form mirrors
 - Micro-machined, thin-film SiN sensors
 - Plastic scintillators
 - Single-crystal diamond substates
 - High power, short pulse near-IR lasers
 - Bespoke visible and near-IR Polychromators and spectrometers
 - UHV terminated MI cabling
 - Bespoke electronics, I&C & CODAC
 - supply of COTS or customised items, inc. lenses and optical coatings, piezo-actuators, RF sources, optical fibre bundles, IR Cameras
 - Calibration of sensors in dedicated facilities



Diagnostic Pressure Gauge

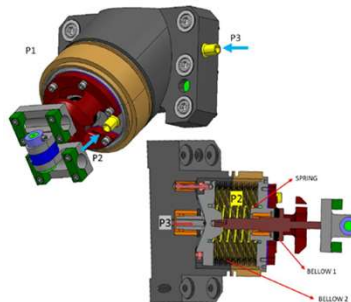


5-Channel Bolometer

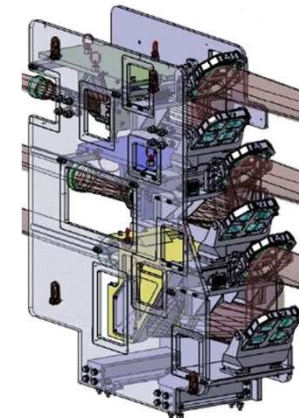
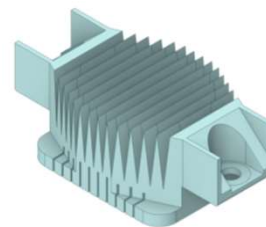


RNC He4 n-detector

CXRS bellows actuator



CPTS high power laser beam dump



WAVS opto-mech, piezo actuated alignment unit

Contact mehdi.daval@f4e.europa.eu (F4E's Market Analysis Group), who can put you in contact with existing framework suppliers



THANKS

TO BE PART OF THE WORLDWIDE **FUSION** NETWORK





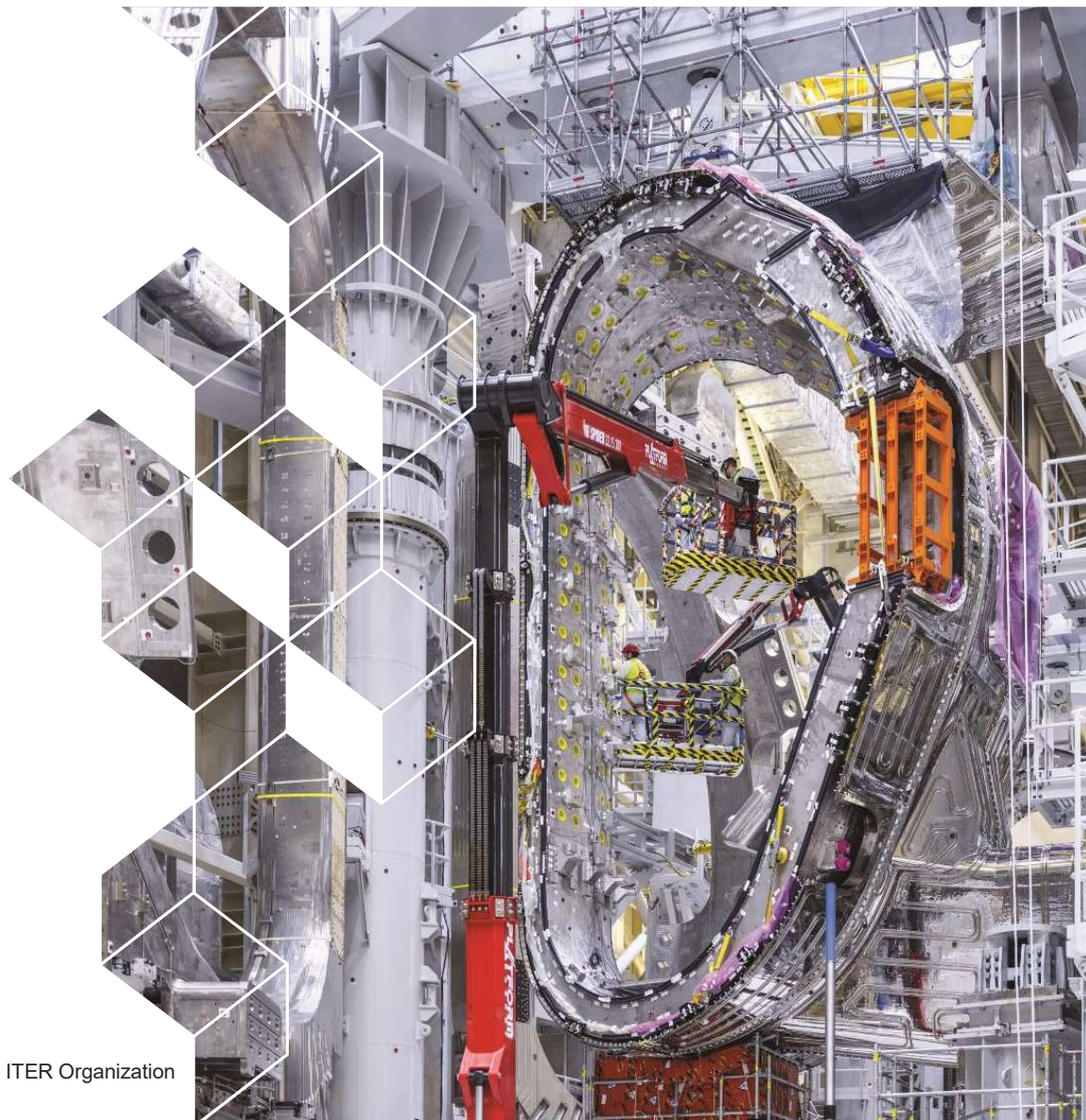
PRESENTATION TITLE 2 LINES

Speaker's Name

Company & position

WEDNESDAY APRIL 23rd

Disclaimer: the views and opinions expressed herein do not necessarily reflect those of the ITER Organization





4. INDUSTRY IN ITER DIAGNOSTICS

IDOM ADA experience. Present and future.

IDOM Advanced Design and Analysis

WHO WE ARE



Bilbao IDOM Headquarters

IDOM ADA (IDOM's Advanced Design & Analysis Division) is devoted to create and deliver bespoke advanced instruments and systems for Science and Technology.

5300 Professionals	Since 1957	979 Partners	125 Countries
-----------------------	---------------	-----------------	------------------

COMPETENCES

- Mechanical design
- Mechatronics
- Optical Design
- Opto-mechanics
- Singular Structures
- Analysis and simulation



Scientific facilities
Big Science



Scientific & medical
Instruments



Test Machines
and facilities



Singular structures
and engineering

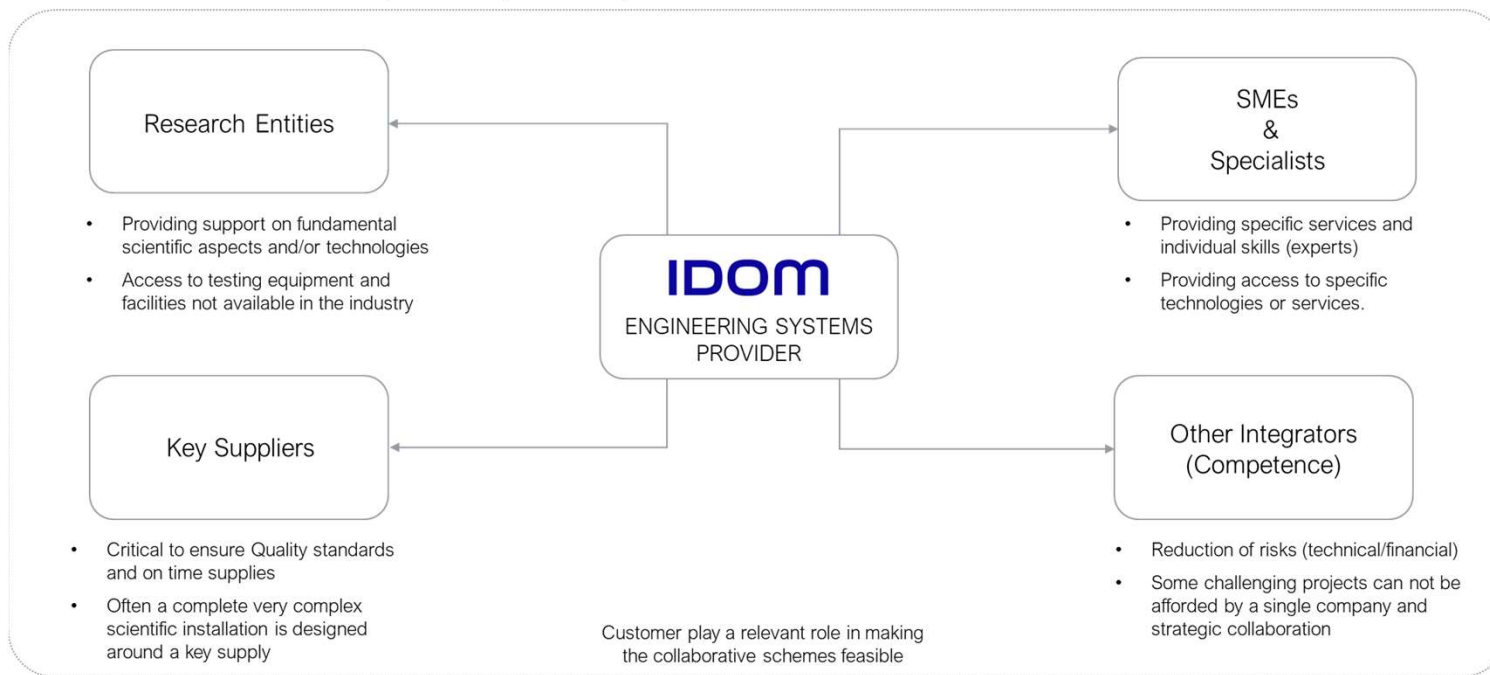
NETWORK

Deep collaboration over the years with the main fusion related actors.

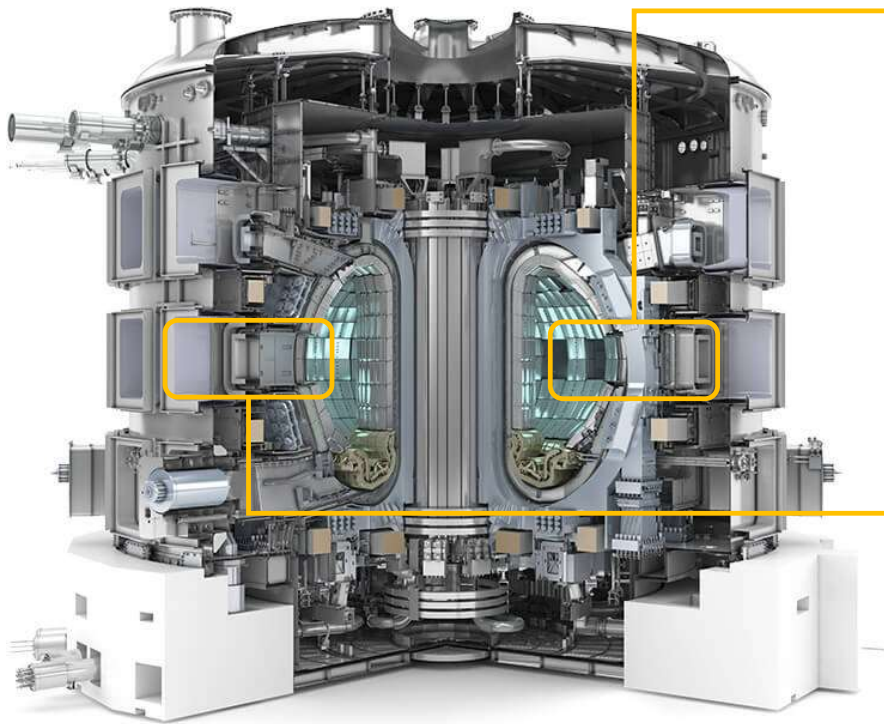


IDOM ADA NORMAL ROLE IN BIG SCIENCE

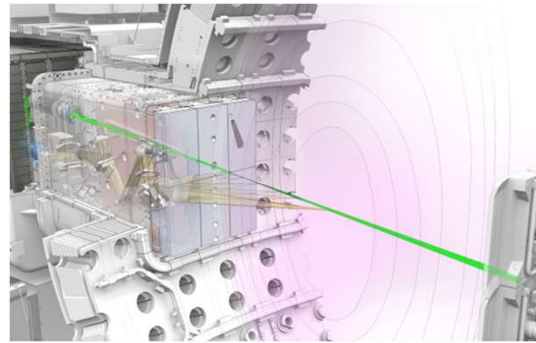
Collaboration and teaming is **essential** in our activity. Typically any of a large engineering system provided by us will require several of the above listed collaborations



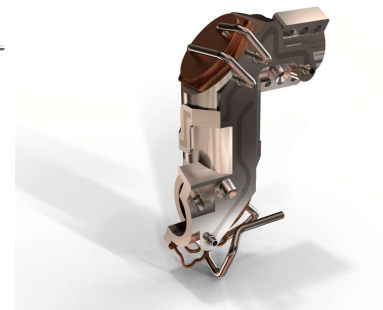
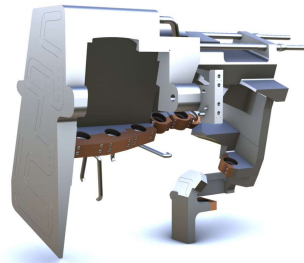
MAIN ACTIVITY IN ITER



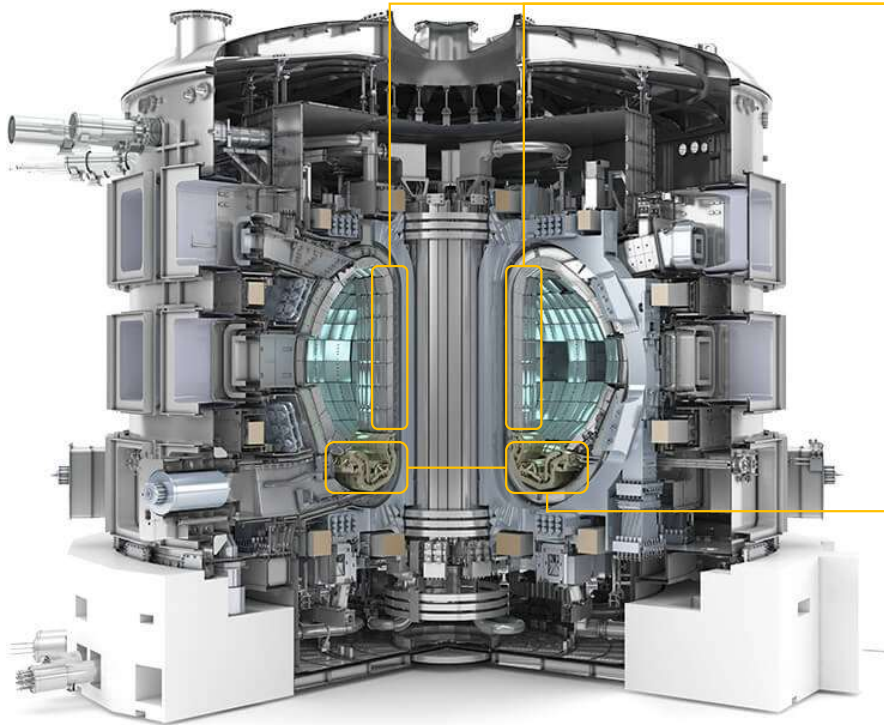
Core Plasma Thomson Scattering F4E-OMF-847 (Design and Testing)



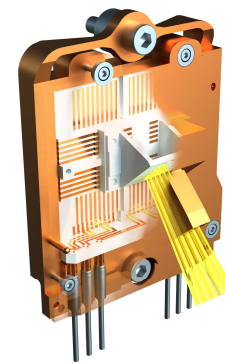
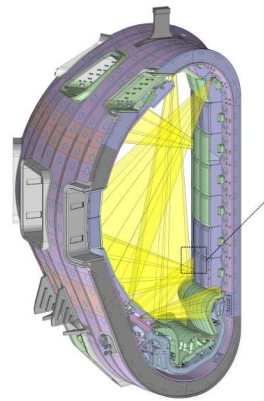
Collective Thomson Scattering F4E-OMF-1126 (Manufacturing and Qualification)



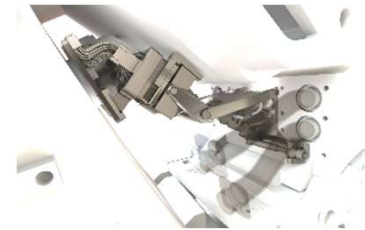
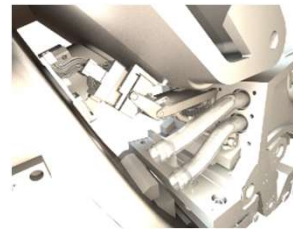
MAIN ACTIVITY IN ITER



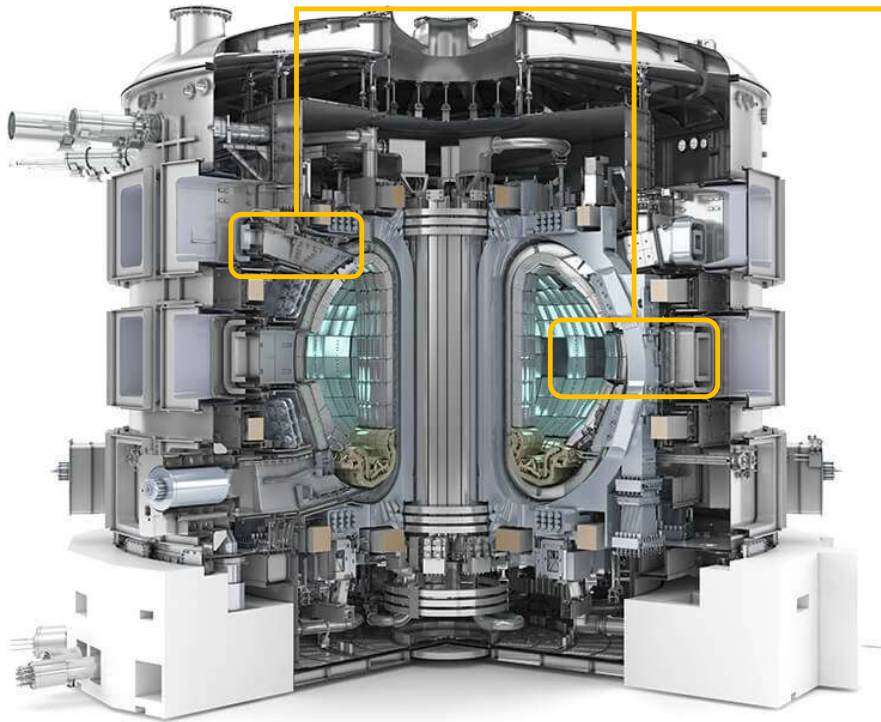
In-Vessel and Divertor Bolometer Cameras F4E-OMF-847 (Design)



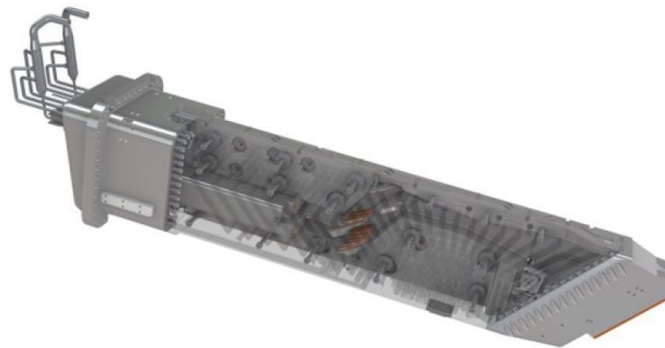
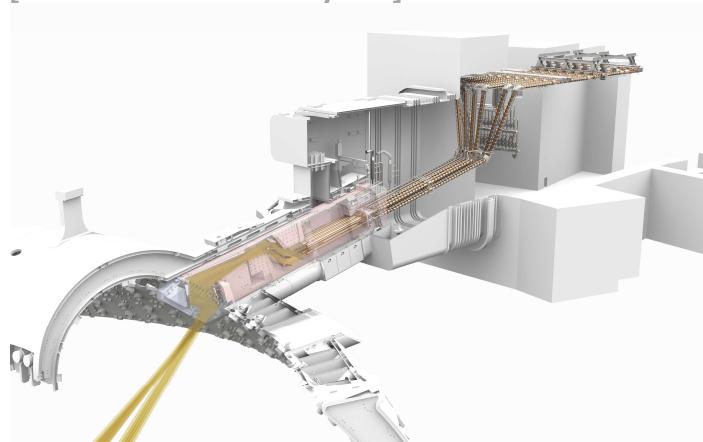
RH compatible connector F4E-OMF-1150 (Design and Testing)
Led by GUTMAR



MAIN ACTIVITY IN ITER

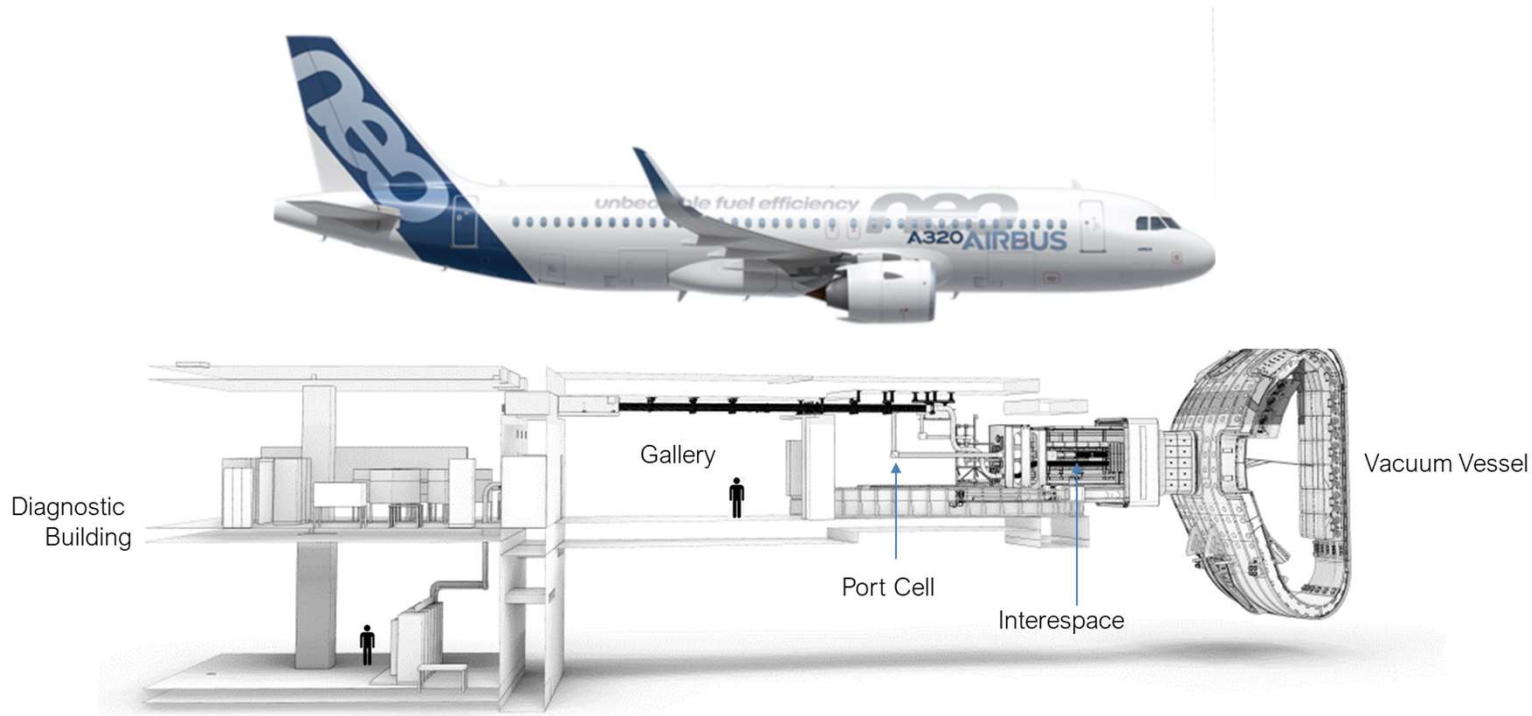


ITER Upper Launchers & EXVessel Waveguides. Design and procurement F4E-OMF-1120
[In collaboration with Alsymex]



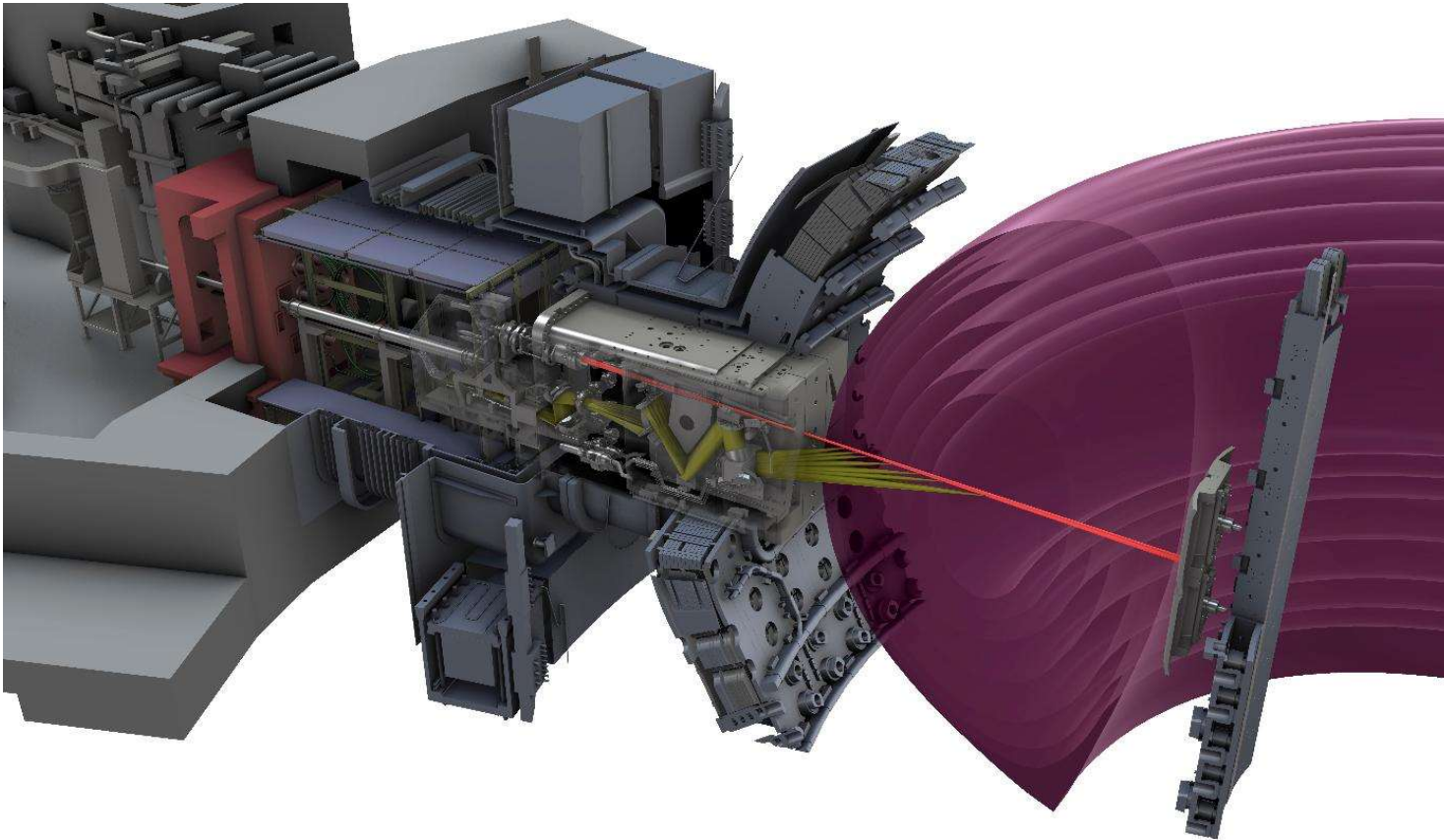
EXAMPLE. CPTS

ITER size represents a qualitative leap in the development of Diagnostics.



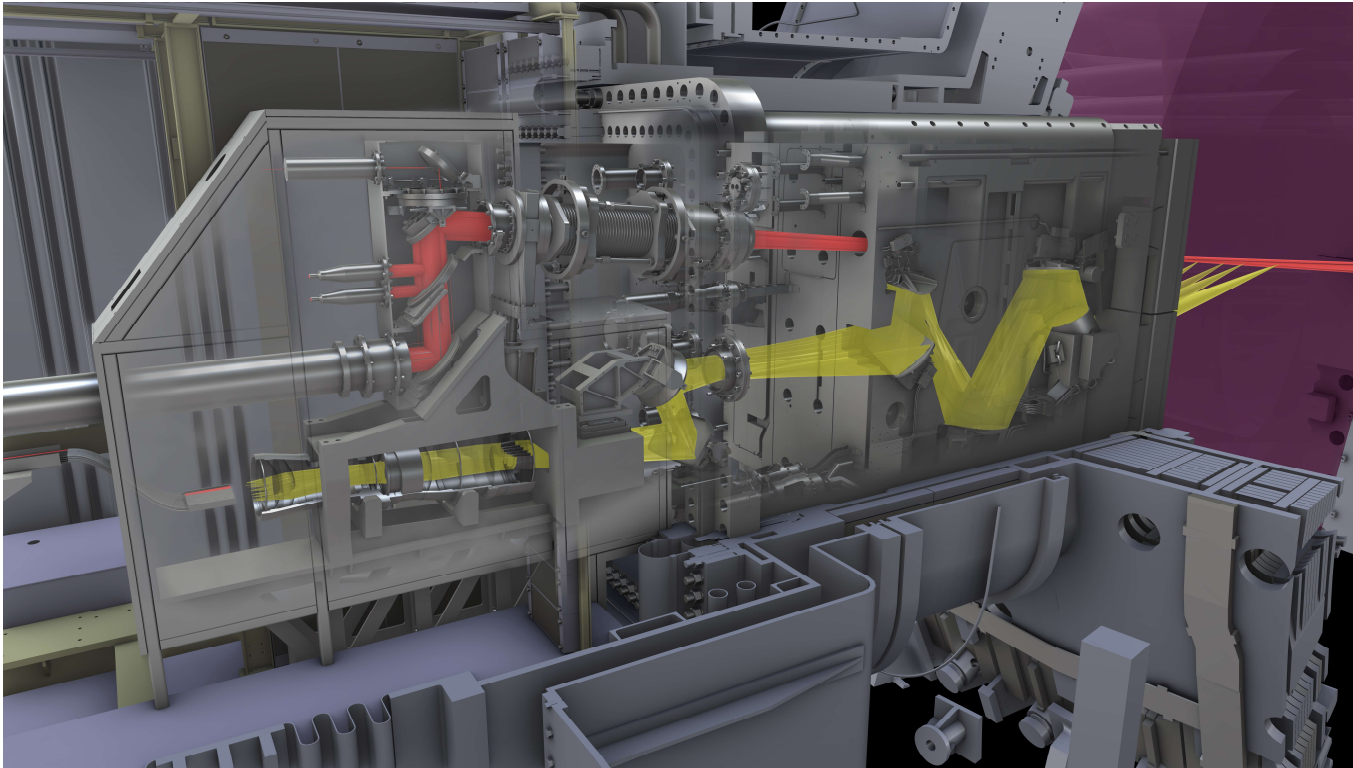
EXAMPLE. CPTS

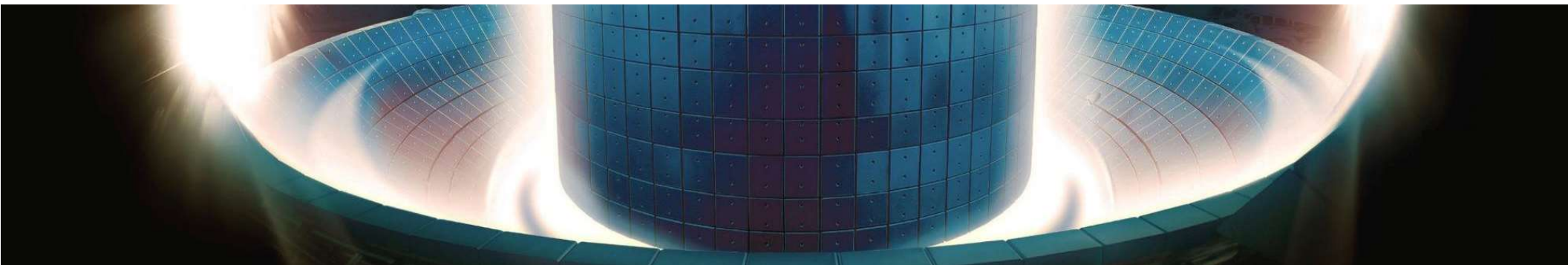
Complexity of the diagnostic itself is increased due to the harsh environment.



EXAMPLE. CPTS

Many of the technologies used are state of the art on their field.





THANK YOU

Iñigo Eletxigerra Aja

Responsible of Particle Physics and Nuclear Technologies at IDOM ADA

www.idom.com

Contact: eletxigerra@idom.com

Phone: +34 944797676



THANKS

TO BE PART OF THE WORLDWIDE **FUSION** NETWORK



PLATINIUM SPONSOR



SILVER SPONSOR



SILVER SPONSOR



BRONZE SPONSOR



Introduction of ASIPP's involvement in ITER Diagnostics

Qing Zang
zangq@ipp.ac.cn
2025.4.24



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Fusion Research at ASIPP

Diagnostics Development at ASIPP

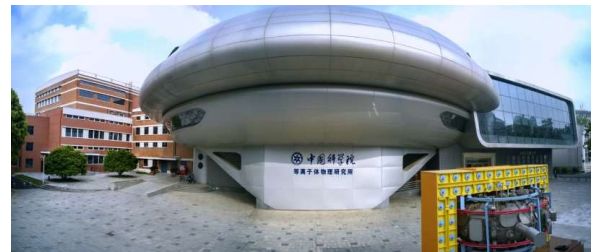
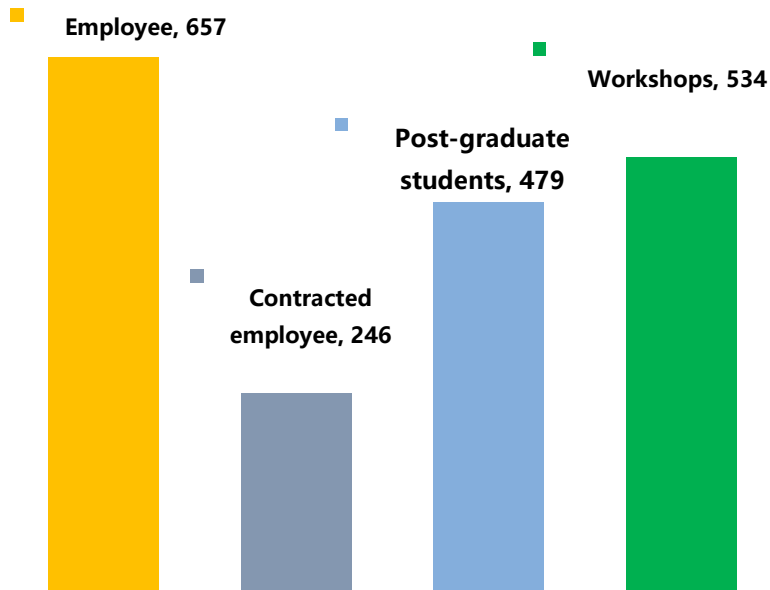
Summary



General information of ASIPP



- **ASIPP**: Institute of Plasma Physics, Chinese Academy of Sciences, founded in **Sept. 1978** in Hefei, Anhui Province.
- **Mission of ASIPP**: The research of **fusion energy** based on the **tokamak approach**.
- **ASIPP organization**: **13** Divisions, **3** Research Centers.
- **Human resource**: **> 1500**



Science island



New Energy Research Center



CRAFT

ASIPP Organization



1. Fusion Engineering Research Division

2. Power and Control Engineering

3. Applied Superconductor Engineering Technology Laboratory

4. Reactor Design Division

5. Theory and Simulation Division

6. Tokamak Division

7. Division of Control and Computer Application

8. Cryogenic Engineering and Technology Division

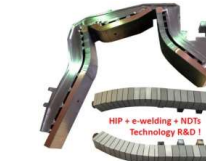
9. Division of Plasma Diagnostics

10. Division of Microwave Technology

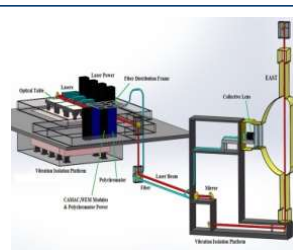
11. Division of Plasma Application

12. Fusion Reactor Materials

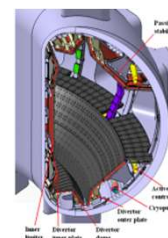
13. Neutral Beam Injection Division



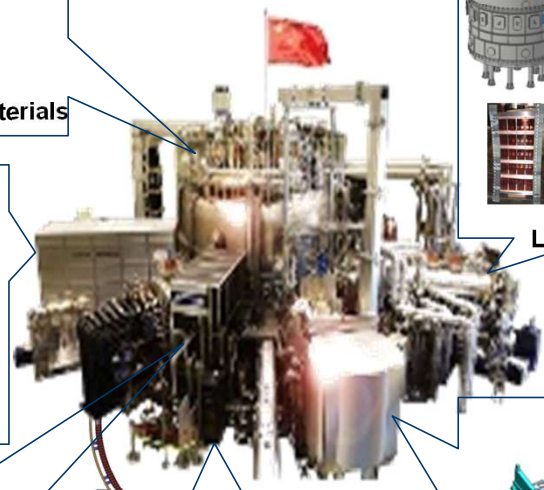
Fusion Reactor Materials



Advanced diagnostics



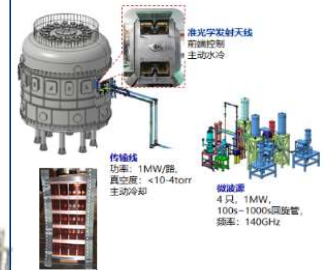
Fusion Engineering design & manufacturing



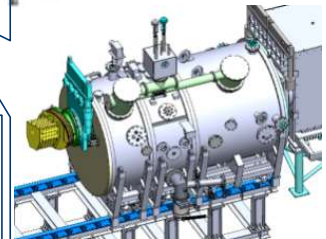
EAST Tokamak



Power and Control



LHW/ECRH/ICRF



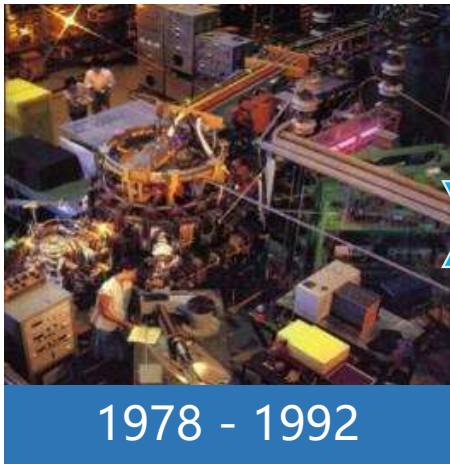
NBI

13 Divisions+ 2 Supportive Departments+ 3 Research Centers+ over 20 high-tech Companies

Four generations of Tokamak at ASIPP



HT-6B



HT-6M



HT-7



EAST



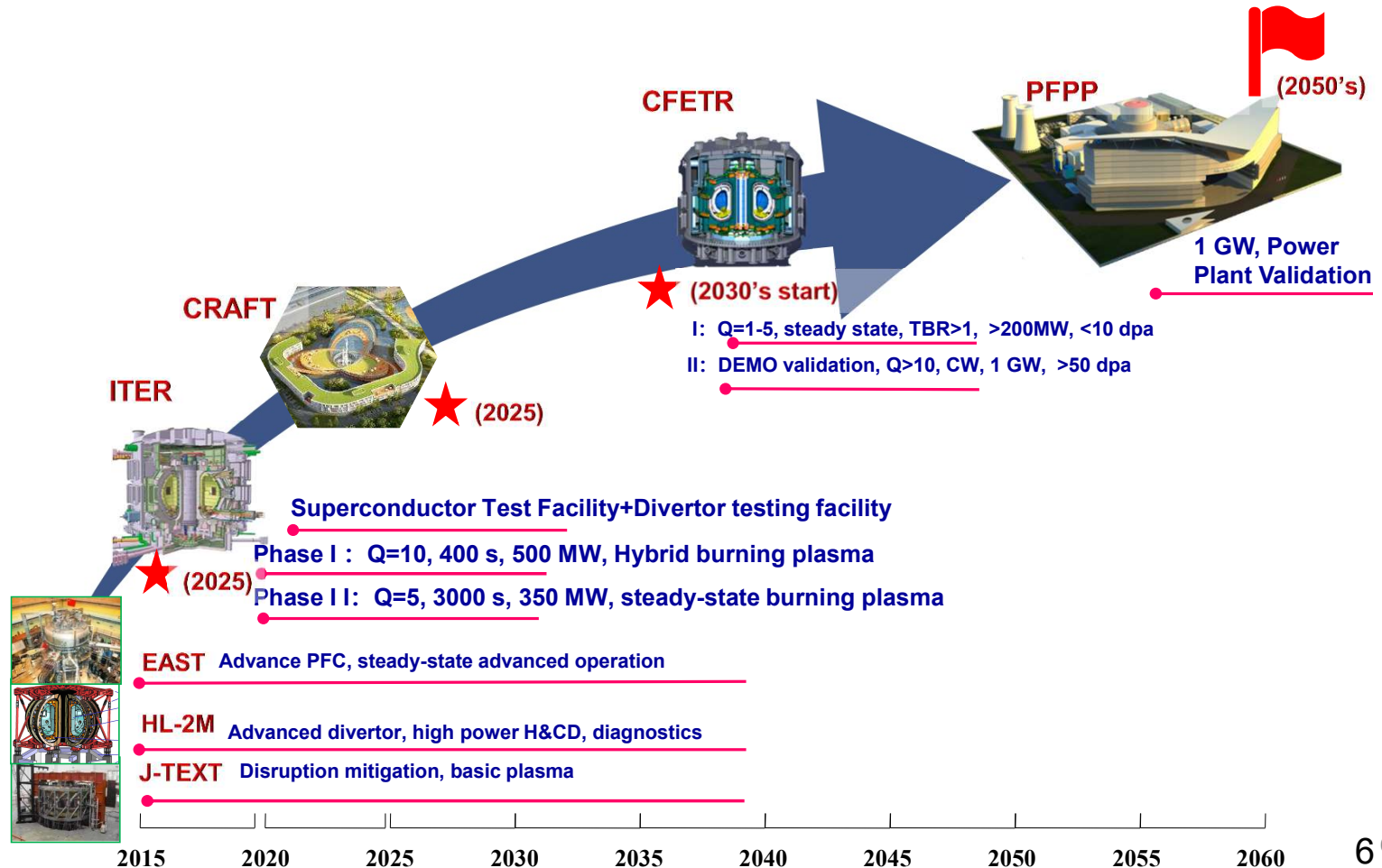
- **HT-6B & HT-6M:** Conventional non-superconducting tokamak
- **HT-7:** The **Chinese first superconducting** tokamak
- **EAST** (**Experimental Advanced Superconducting Tokamak**): The **world's first full superconducting** tokamak with a non-circle cross-section.

China MCF Roadmap



Solid Foundation

- **EAST**
Steady-state long-pulse physical operation
- **ITER**
Near 20 years' R&D experience
- **CFETR**
The engineering design completed
- **CRAFT**
The construction launched in 2019



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Plan of EAST upgrade: physics consideration

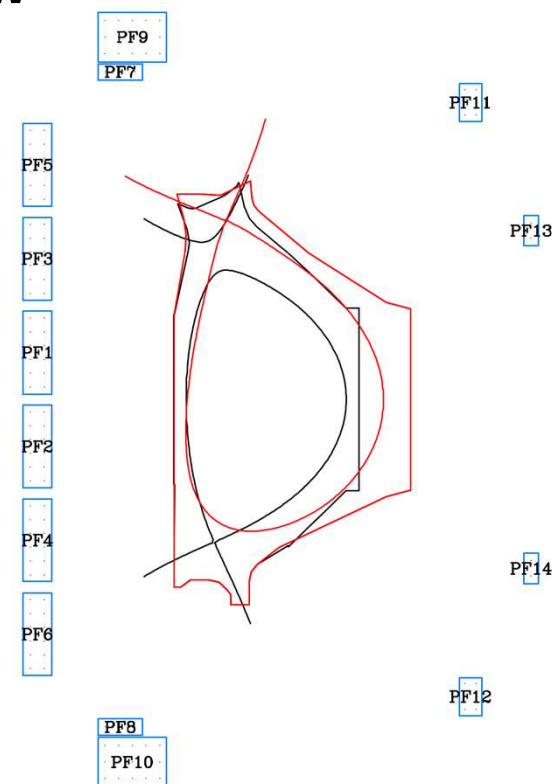


EAST upgrade aims to extend the operation window

- Close or reduce some gaps between EAST and BEST
- **Support the ITER new baseline scenario and other future devices**

EAST upgrade strategies

- Increase the plasma current up to 1 MA
- Increase plasma radius and cross section
- Increase the current limit of the PF coils by lowering the temperature of the helium coolant from 4.5 K to 3.8 K
- New BEST-like upper divertor
- Total injected power will increase from 12 MW to 18 MW
- Maximum betaN will be above the no-wall limit

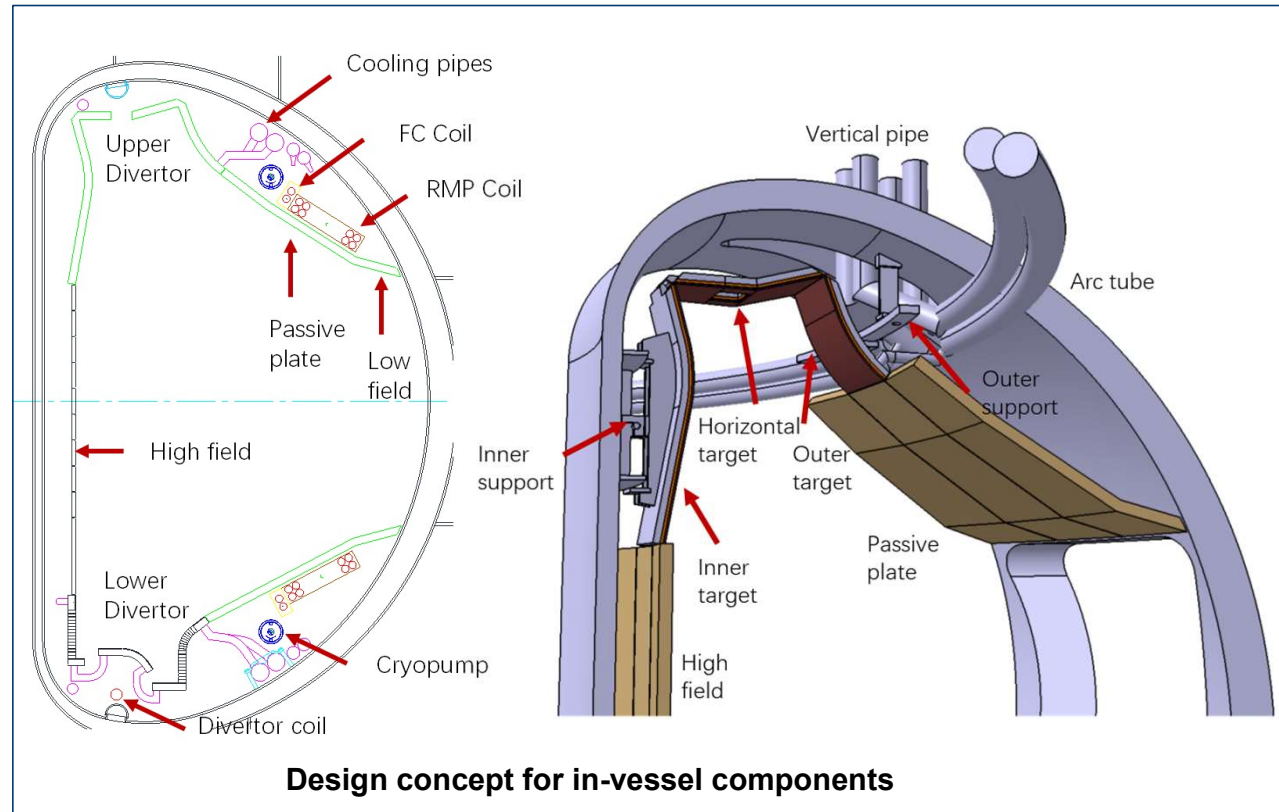


Plan of EAST upgrade: Engineering issues



Upgrade plan for different syst.

In-vessel components	<ul style="list-style-type: none"> ● Enlarged plasma volume, higher I_p ● BEST-like upper divertor ● Cooling system for 3MPa operation ● More efficient particle pumping ● diagnostics
Auxiliary heating systems	<ul style="list-style-type: none"> ❑ 120 keV ion sources for 80 keV reliable operation ❑ 4.6GHz LHCD in B port with two ECRH integrated, ❑ Reliable 3-4 MW ICRH power injection
Cryogenics	<ul style="list-style-type: none"> ➤ 3.5 K cryogenics supports 3.8 K PF coils operation



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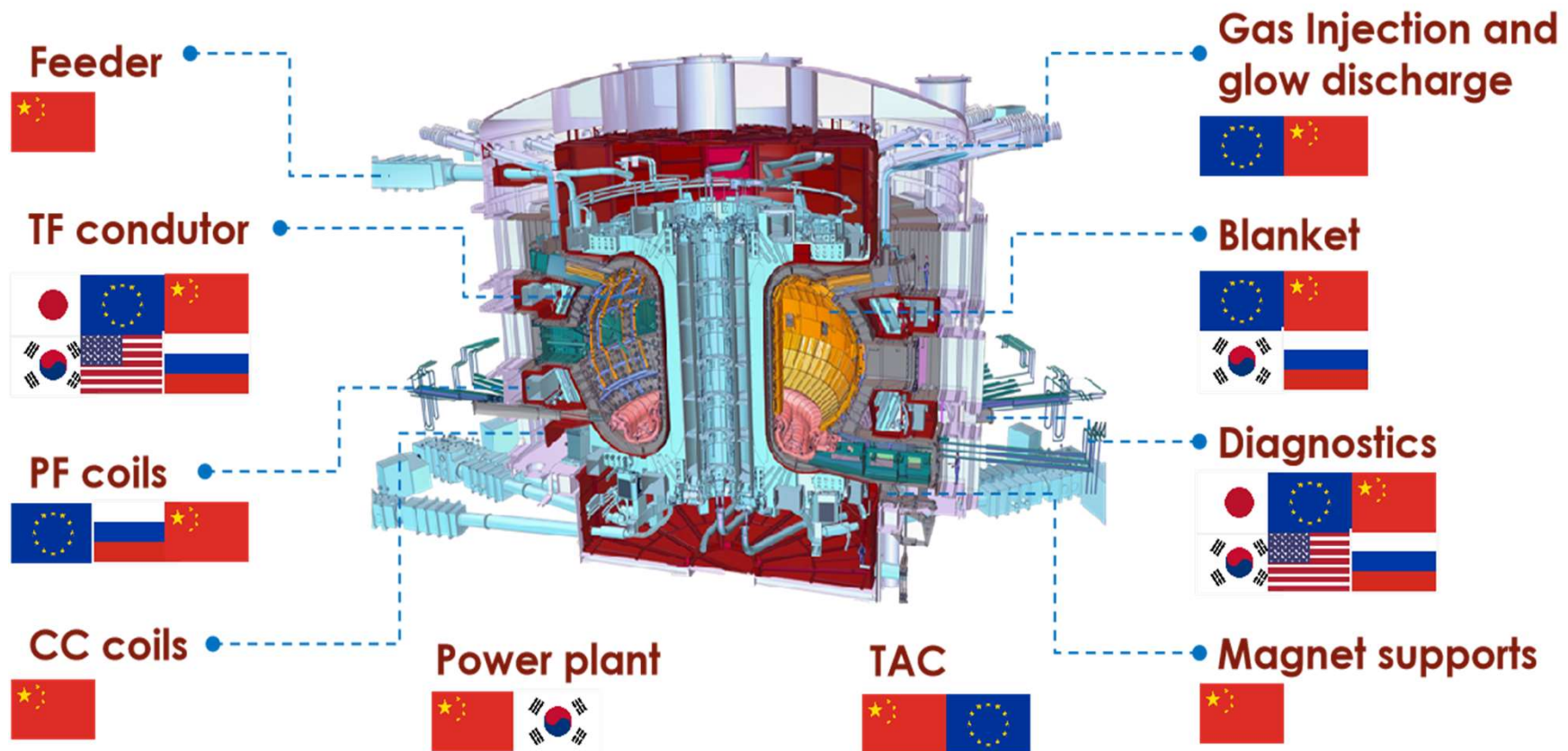
Summary



International cooperation project——ITER



ASIPP undertakes more than 70% of ITER Procurement Package in China

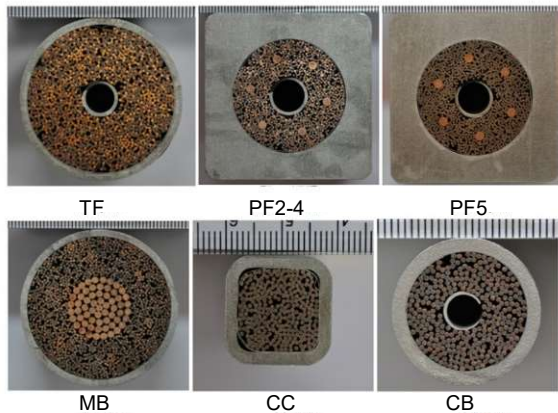


ITER superconductors



Conductors : **100% finished.**

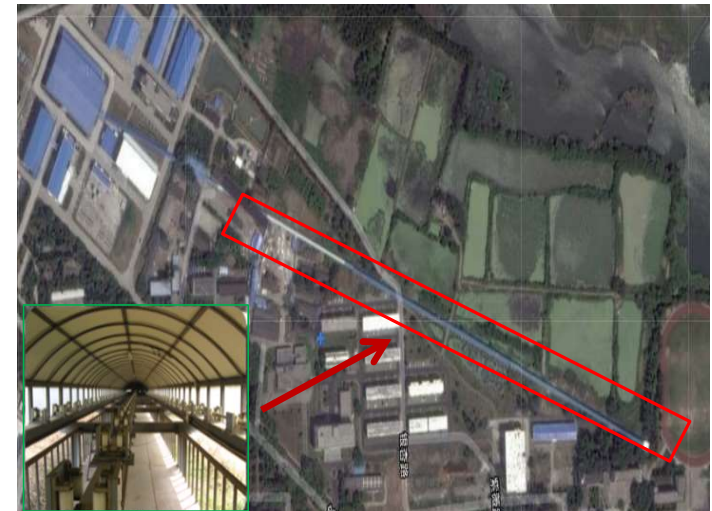
The performance has reached the highest level in ITER



First product delivered
First to arrive at ITER on site



TF conductors have been
delivered to ITER



Established 1000m conductor
production line in ASIPP

ITER power supply system



- Proposal for new power system design of ITER, **Lower risk** of grid over-voltage and ITER device damage
- Established **the largest DC test platform in China**
- AC/DC Converter: **95% completed**
- PPEN: on-site installation support is going on



PF3 & PF5 Installation and build the reparation platform in site



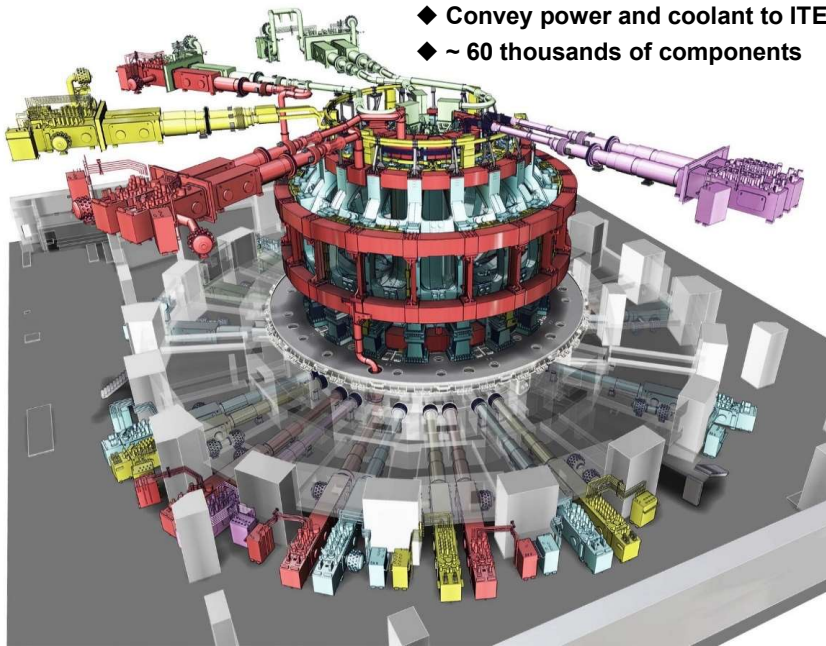
ITER On-site handover ceremony for PPEN

ITER magnet feeders

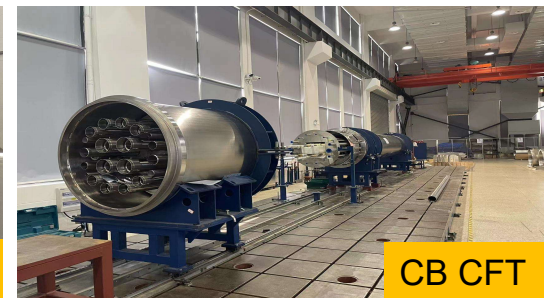


Feeder: **81% produced**, will finish in 2024
Internationally leading superconducting feeder technology

- ◆ 31 units, each ~50 ton, 30~50 m long
- ◆ Convey power and coolant to ITER magnets
- ◆ ~ 60 thousands of components



MB CTB



CB CFT

Consists of 31 units

Feeder system

TF feeder 9 units
PF feeder 6 units
CS feeder 6 units
CS/TF STR feeder 3 units
CC feeder 5 units
IF feeder 2 units



The highest steady-state operational current of HTS current lead reaches 68kA



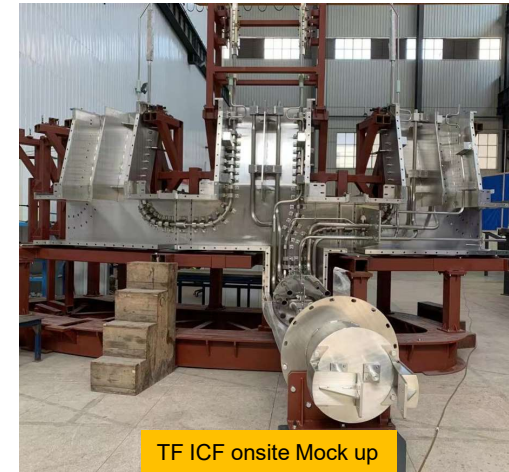
ICF Delivery

Feeder assembly joint Mock-ups



100% produced and delivered to ITER site

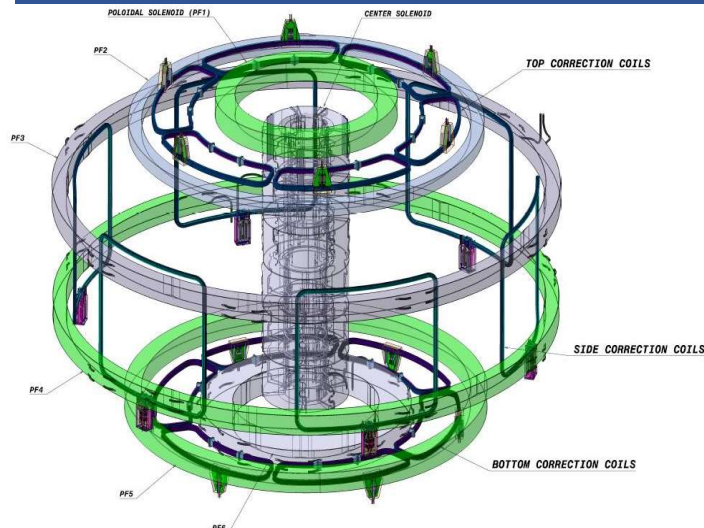
Batch	Contract number	Name	Status	Remark
Batch 1	TASK ORDER No 02 Reference 4200002463	MB joint Mock up	Delivered in 2019	40 sets
Batch 2	TASK ORDER No 10 Reference 4200002811	SCC25 ICF-Coil Mock up	Delivered in 2023	1 sets
		CTB-CFT-MB Mock up	Delivered in 2020	1 sets
	TASK ORDER No 08 Reference 4200002790	CTB-CFT-CB Mock up	Delivered in 2020	1 sets
		SEISMIC_BELLOWS Mock up	Delivered in 2020	1 sets
		CB joint Mock up	Delivered in 2020	40 sets
Batch 3	TASK ORDER No 12 Reference 4200003131	PF2 ICF-Coil Mock up	Delivered in 2023	1 sets
		PF5 CFT-ICF Mock up	Delivered in 2023	1 sets
		TF ICF onsite Mock up	Delivered in 2023	1 sets



ITER CC coil



- **CC coil: 96% manufactured** of BCC and TCC,
- **85% manufactured of SCC**, finish delivery to ITER in 2025
- **CCICF Finished** and delivered to ITER in 2025



◆ 3 sets of 6 coils each, distributed symmetrically around the tokamak and inserted between the Toroidal Field (TF) and the Poloidal Field (PF) coils.

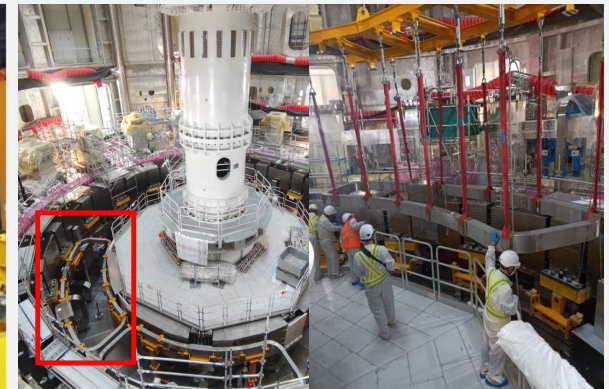
◆ The purpose of the correction field coil (CC) is to correct the effects of the asymmetries caused by coil manufacturing and assembly tolerances on the plasma.

Breakthroughs

- Laser welding technology for medium-thickness plates
- Thin-wall temperature-controlled welding technology
- Perfect insulation impregnation technology



CC coil fabrication

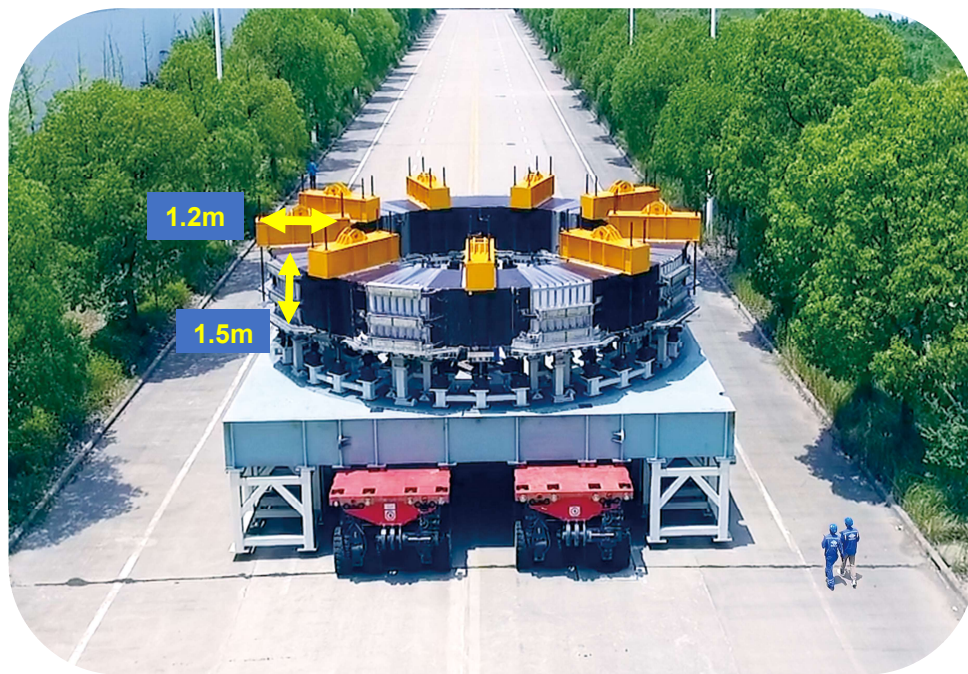


Correction coils successfully delivered and assembled in PIT

ITER PF6



PF6 : 100% completed
In cash procurement from EU F4E



PF6 magnet, 12 m in diameter, ~400 tons



ITER Project Director
Bernard Bigot

“ITER is a difficult and great exploration for human development and utilization of fusion energy, and the delivery of PF6 has taken a decisive step for the success of ITER.”



**PF6 was
successfully loaded
into ITER host as
the first coil
(2021.4.21)**

The Technical Support for TAC1 from ASIPP



- Superconducting joints connection for ITER Feeder and Coil system
- Onsite assembly of ITER Feeder system
- Lifting, transshipment and assembly of PF coil system
- Lifting, transshipment and assembly for Correction Coil system
- Electrical test (include HV DC, PD, Paschen) for onsite assembly insulation system
- Alignment measurement for large Superconducting TOKAMAK device assembly site



ITER CRYOSTAT RECTANGULAR BELLOWS

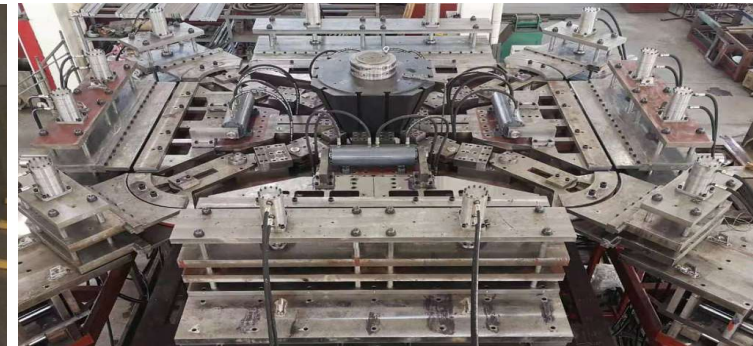


Design and fabrication of all 91 rectangular bellows for ITER

First 6 sets of rectangular bellows was successfully handovered in 2023



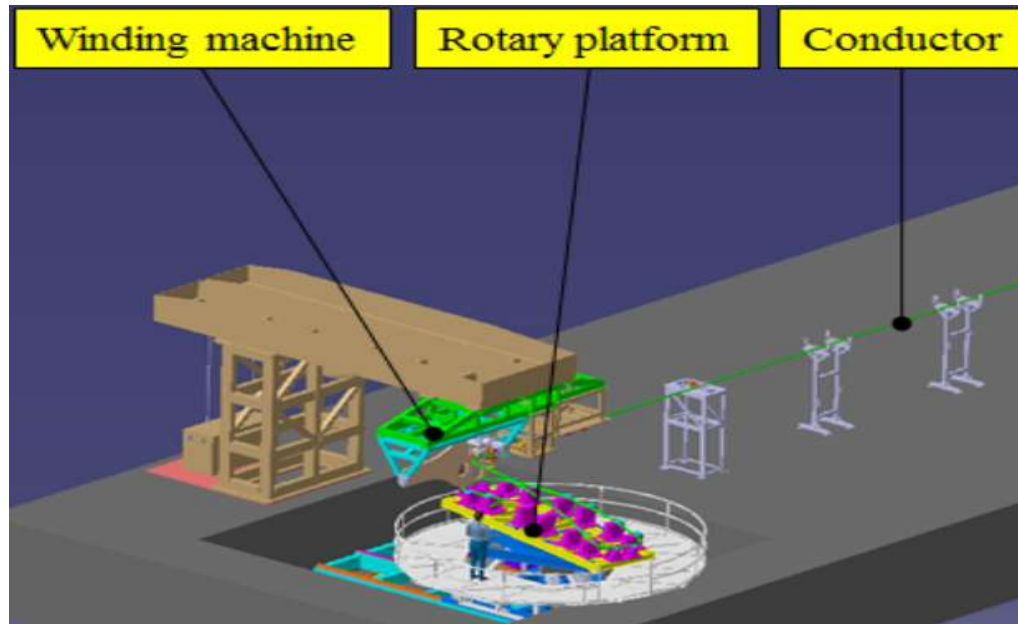
Large cross section (3m*4m) rectangular bellows



ITER In-Vessel ELM-IVCF Prototyping and Tooling



Completed the Manufacturing Design of First of a Kind ELM Coil and Feeder
Completed the manufacturing of Various necessary mock-ups



ELM Coil winding line

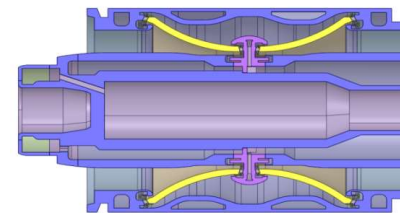
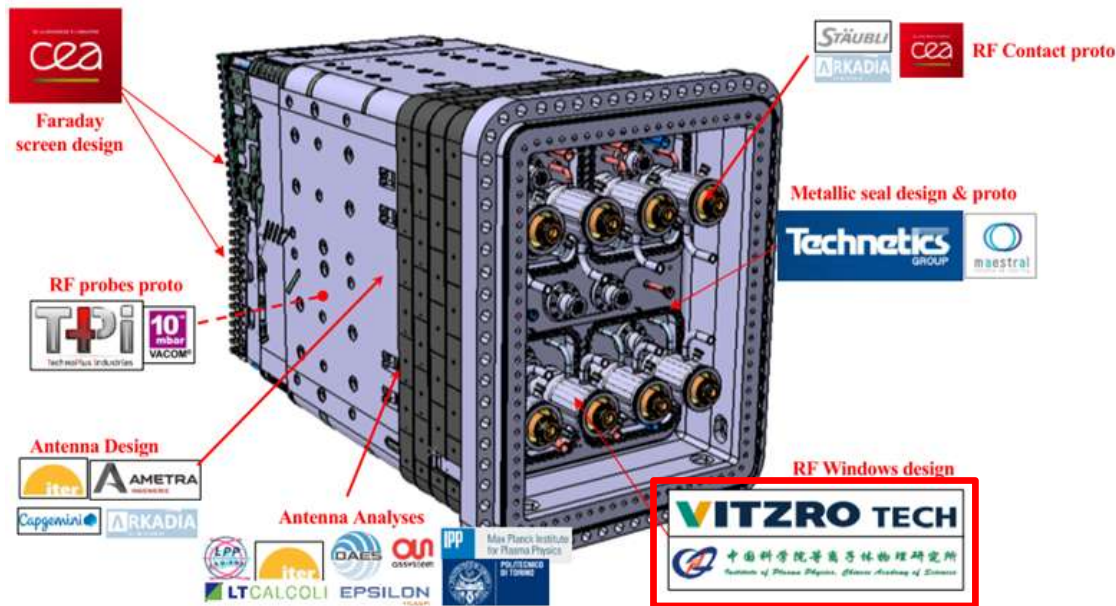


Mock-ups: Bracket, Coil corner, Inlet/Outlet

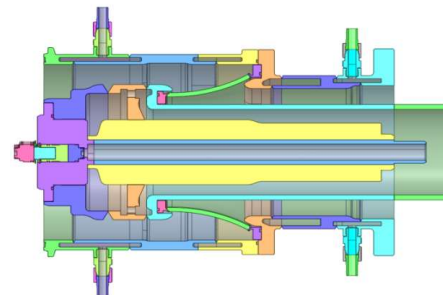
ITER IC H&CD RF WINDOW DEVELOPMENT



Completed the concept proposal and design, FEA analysis and optimization
Research to validate the design and manufacture feasibility



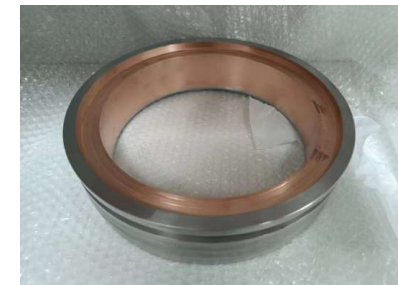
Front RF window_DM



Rear RF window_DM



Ceramic brazing component



Copper coating component

ITER IC H&CD ICRH International Cooperation Partner

Contribution to ITER staff & site construction



- ASIPP have sent **over 100 people** to support ITER On-site.
(Including IPA \ TAC1 personnel \ Visiting Scientists...)

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- Progress in CRAFT project

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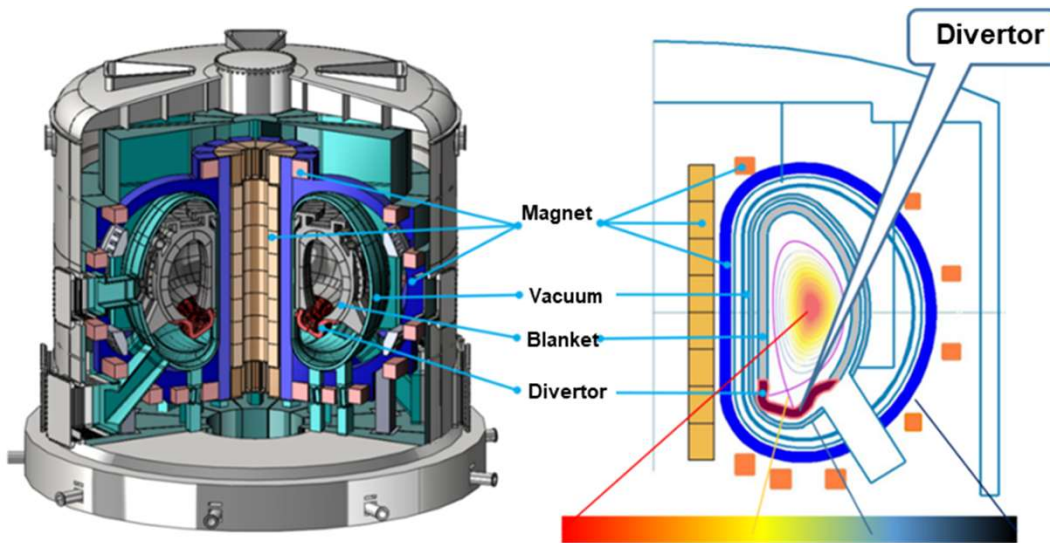


CRAFT: Comprehensive Research Facility for Fusion Technology



Explore and master fusion DEMO level key technologies

Establish the method and standard for manufacture the key material, components and system for CFETR



Large complex superconducting magnet system

Divertor system under extreme conditions



project durations 5 years and 8 months

Facilities of CRAFT



Two main Platforms and related R&D works, will be finished in 2025.

Superconducting magnet research system

- 1. SC Material testing facility
- 2. SC Conductor testing facility
- 3. SC magnets testing facility
- 4. CFETR CSMC and testing facility
- 5. CFETR HTS coil and testing
- 6. CFETR TF coil and testing
- 7. Cryogenic system
- 8. Power supply system

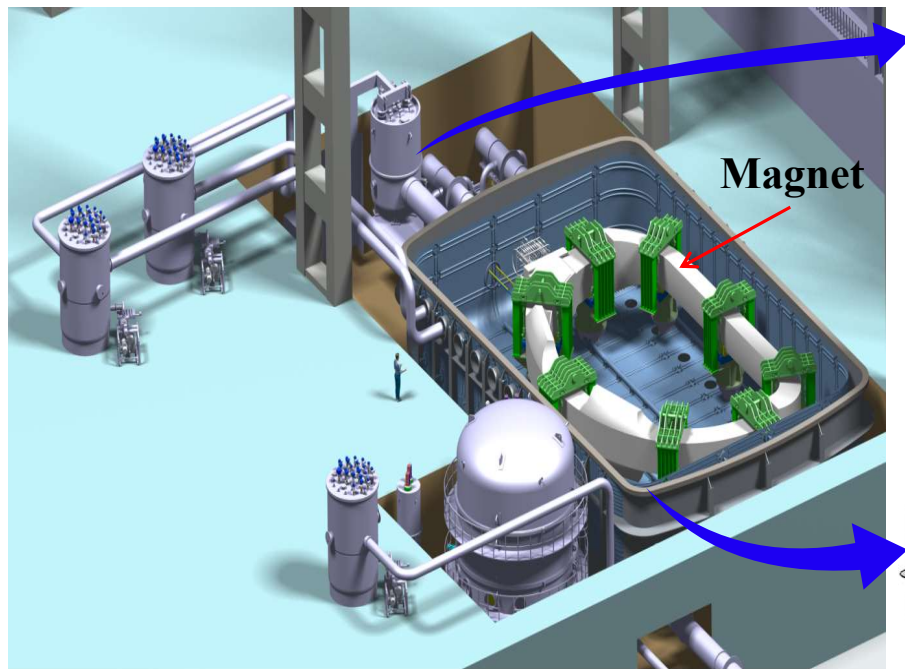
Divertor research system

- 9. Large Linear plasma testing facility
- 10. CFETR divertor development
- 11. CFETR divertor testing facility
- 12. EAST divertor upgrade
- 13. NNBI system
- 14. ECRH system
- 15. LHCD system
- 16. ICRF system
- 17. RH testing facility
- 18. VV and installing testing facility
- 19. Mater Control facility

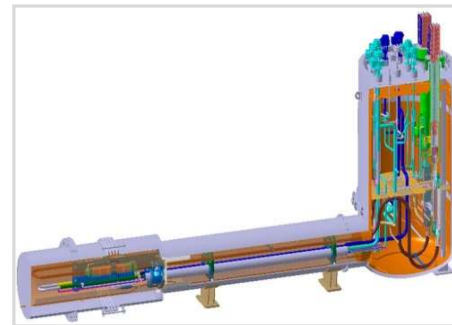
CRAFT: SC magnet test facility



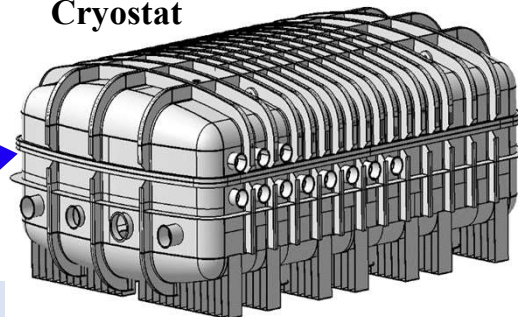
To master scientific and the intrinsic physical properties and service behavior of materials for superconducting magnets in complex and extreme environments, and to carry out engineering application research.



Large-scale Magnet Performance Research



Cryostat



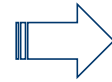
- Quench detection system
- Protection system
- Cryogenic system
- Fast discharge
- Vacuum system

Item	Description
Cryostat main dimension	Length~25.5m ; Width~15.5m ; Height~10m
Operation temperature	4.5K
Current leads operation current	100kA/60kA
SHe pressure	3-6 Bar
SHe massflow	>500 g/s

CRAFT: HTS coil development



- Develop automatic cabling machine
- low resistance HTS joint
- Long cable manufacturing



Insert coil:

Maximum field: 21.1T (back field 18.5T)
Operating current: 6.5kA



Cabling



Coil winding



Curing



Pre-loading



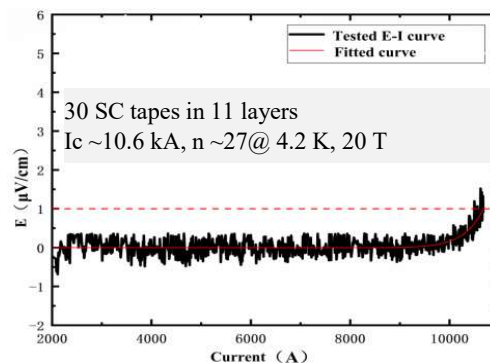
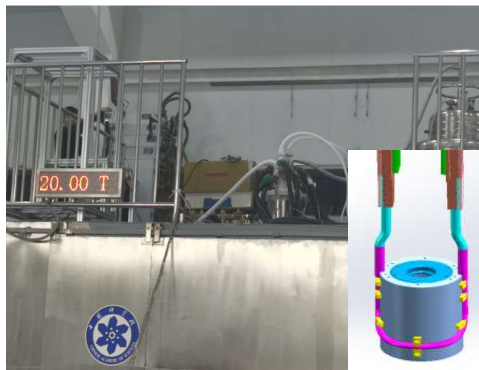
Testing

CRAFT: HTS magnet development



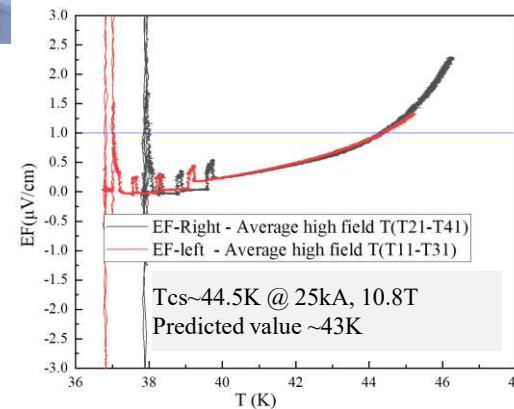
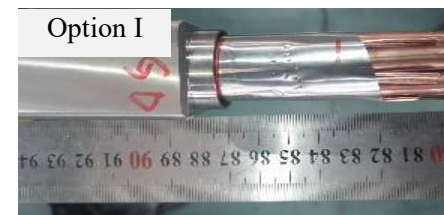
Sub-cable:

- Develop automatic cabling machine
- Sample performance → $I_c = 10.6 \text{ kA} @ 20 \text{ T}, 4.2 \text{ K}$
- Long cable manufacturing → $L = 110.6 \text{ m}$



Full size conductor:

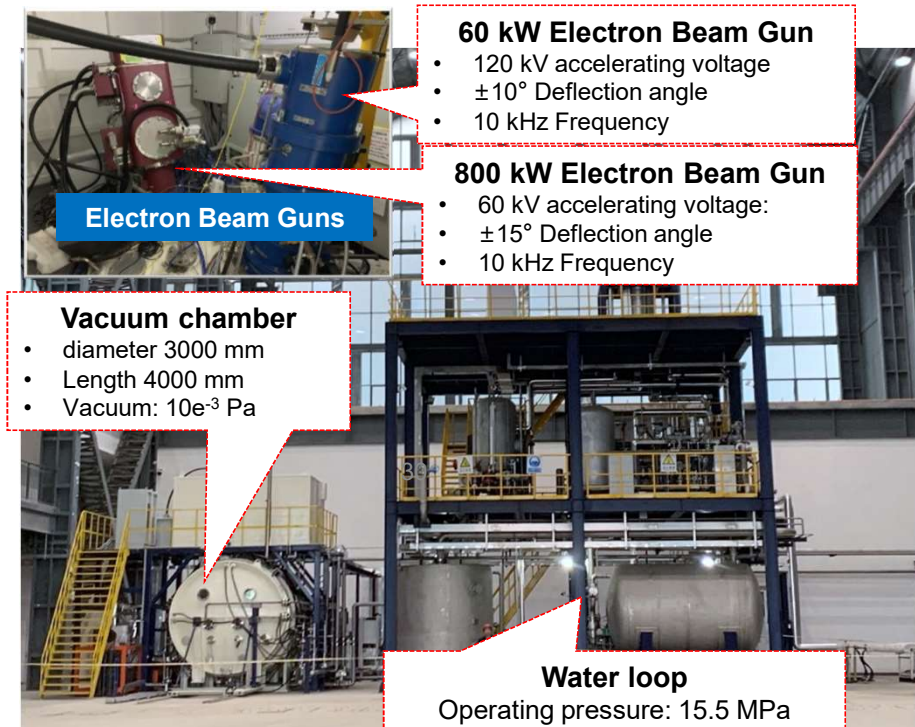
- Two samples were prepared → **2.7m per sample**
- Sample performance → **47kA @ 10.8T, 4.2K, stable**
- New optimized samples expected to finish in October



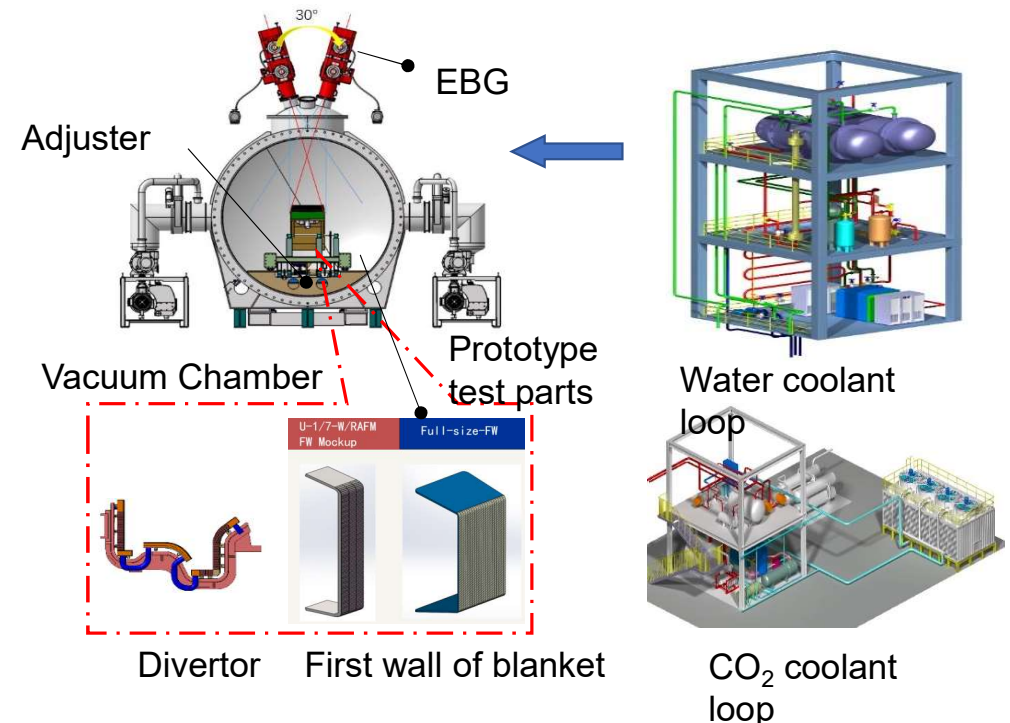
CRAFT: Divertor/Blanket test facility



The construction and commissioning of the main machine and water loop was finished
20MW/m² heat load, Water/CO₂ cooling, components acceptance test or accident test



Main device and water loop



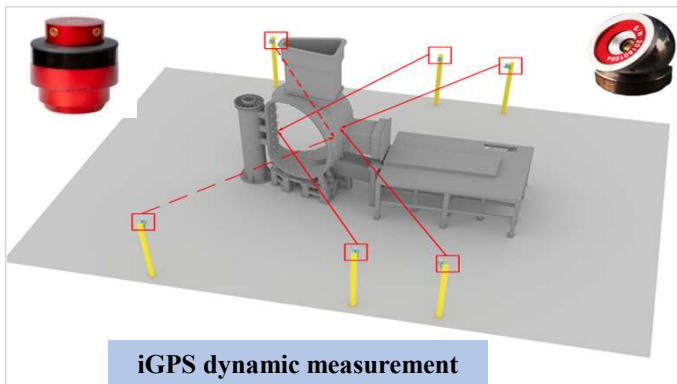
Testing scheme and gas cooling loop

CRAFT: 1/8 VV and Assembly Test Platform



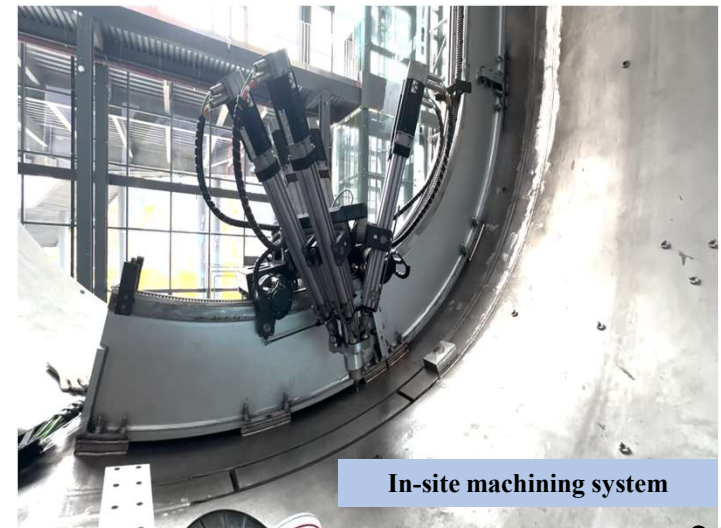
➤ Manufacturing completion

- ✓ Based on precision measurement and reverse engineering, Assembly accuracy $\leq 1\text{mm}$
- ✓ In-site weld length : $\sim 190\text{m}$
- ✓ Groove type: 50mm full penetration
- ✓ Welding quality: ISO-5817 level B
- ✓ Surface deviation $\leq \pm 8\text{mm}$



➤ Completion of automation system

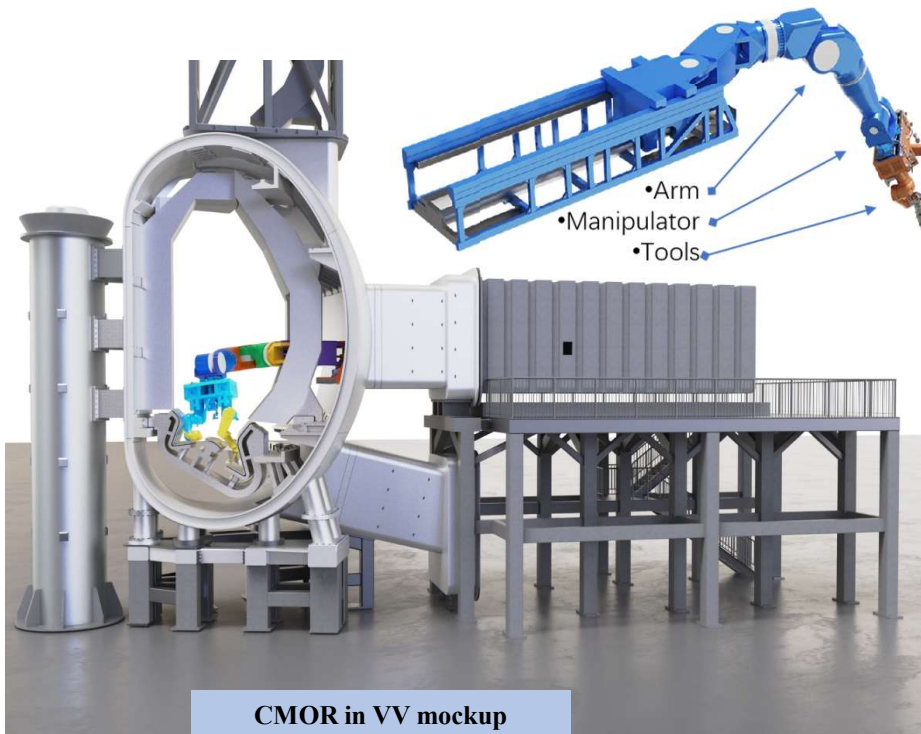
- In-site automatic machining, Narrow Gap Tungsten Inert Gas Welding, automatic Phased Array Ultrasonic Testing have been built and applied in the assembly process of sectors.



CRAFT: Remote handling system



CFETR Multipurpose Overload Robot would be used for maintenance the first wall components with **10 meters long and 2.5 tones capacity**.



- Dexterous manipulator being assembled
- 30kg per arm, 100kg for crane

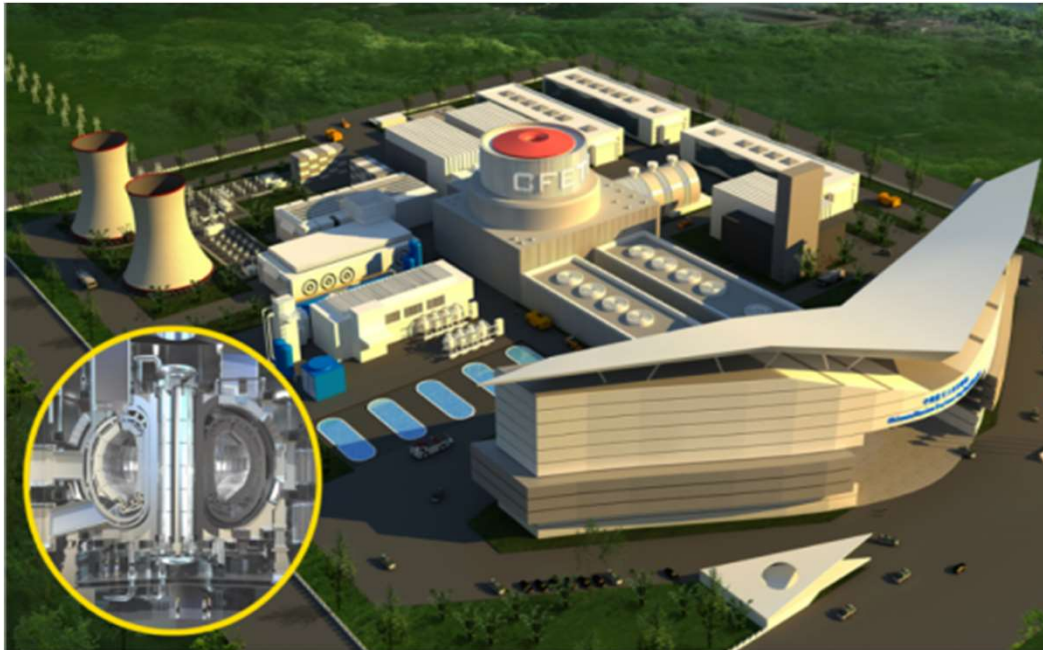


- Qualified in-bore cutting tool for divertor
- $\varnothing 51\text{mm}$ with 3mm thickness

CFETR: Chinese Fusion Engineering Test Reactor



Aiming to fusion energy production of **1000MW** and **steady-state burning plasma with a duty time of 50%**
Systematic R&D works for the Engineering Verification **based on CRAFT**



- ✓ R&D works are being carried out
 - TF magnet
 - Divertor
 - 1/8 vacuum vessel
 - NBI system
 - RH system
- ✓ Large-scale testing facility under constructed
 - Magnet Performance Research facility
 - Linear plasma testing facility

Quality Control & Management of Fusion Engineering



Certified Laboratory & Equipment Management:
Establish national certified **CNAS laboratory** with high capability of inspection & test;
Implement the **overall management** of instruments and equipment follow CNAS rules

Infrastructure management

- Equipment records
- Dedicated equipment manager
- Classified management

01

02

Equipment Management

Instrument management

- Traceability plan
- Traceability activity & Calibration
- Traceability results confirmed
- Marking/Identification

04

03

Condition management

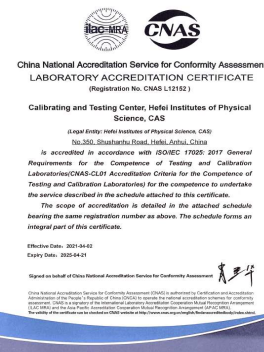
- Condition definition
- Intermediate check
- Equipment failure analysis & dispose

Maintenance

- Instructions
- Records;
- Regular maintenance;
- Spot inspection

equipment traceability table

序号	设备名称	型号/规格	生产厂家	出厂日期	首次检定日期	检定合格有效期	检定日期	下次检定日期	检定人
1	1-10005	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
2	1-10006	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
3	1-10007	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
4	1-10001	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
5	1-10002	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
6	1-10003	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
7	1-10004	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
8	1-10005	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
9	1-10006	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
10	1-10007	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
11	1-10001	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
12	1-10002	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
13	1-10003	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
14	1-10004	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
15	1-10005	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
16	1-10006	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
17	1-10007	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
18	1-10001	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
19	1-10002	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
20	1-10003	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
21	1-10004	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
22	1-10005	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新
23	1-10006	11432001T	华测检测	20200301	20200301	20200301	20200301	20200301	王新



CNAS/CMA laboratory

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-EAST diagnostic development

-ITER Project Support

-Close partner

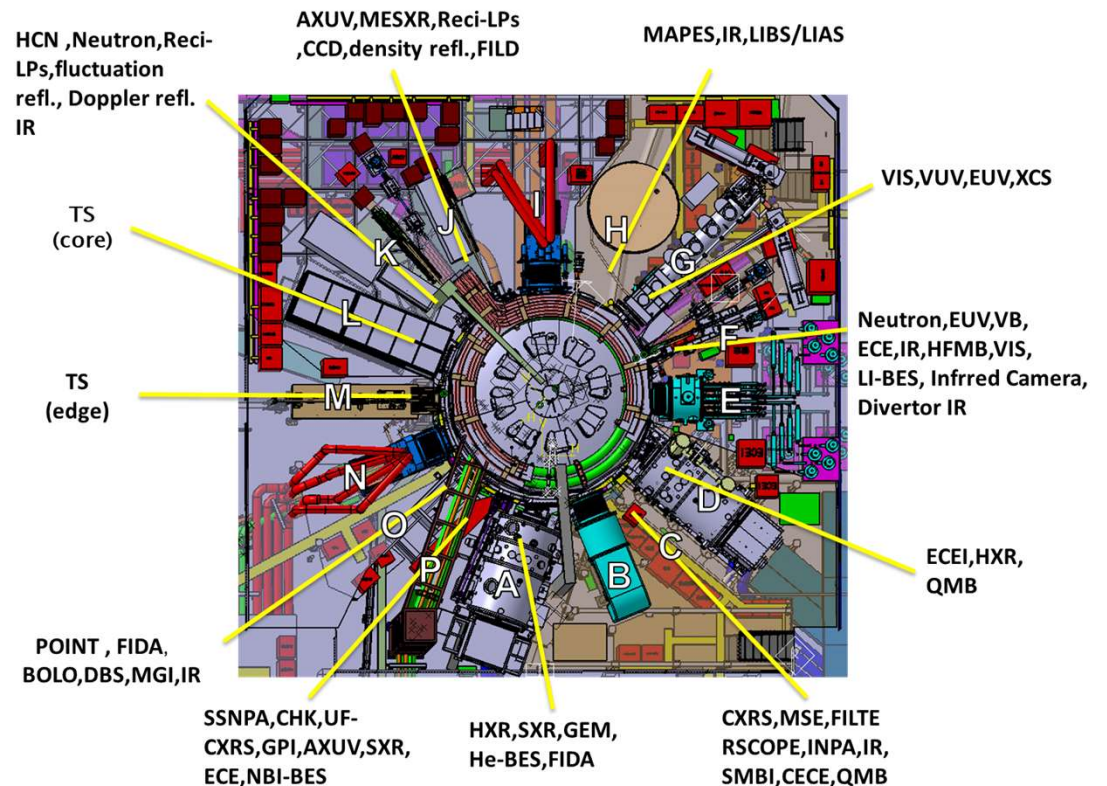
Summary



Diagnostics on EAST



- **Electromagnetic Measurements:**
Rogowski loops, Flux loops, Magnetic probes, Saddle loops, Mirnov coils, Diamagnetic loops
- **Operation Diagnostics:**
Visible/IR camera, thermocouples, LP, pressure gauges, RGA
- **Temperature and Density:**
TS, ECE, XCS, MESXR, HCN/POINT, Reflectometry, Recip.-LPs, He-BES, Li-BES, XCS, CXRS
- **Impurity: (Z_{eff} , C/W/Li...)**
Filterscope, Vis Spec, EUV, XEUV, SXPHA, Divertor W
Spec, Vis Brems., CXRS, XCS
- **Radiation:**
Bolometer, AXUV
- **Current density/q profiles:**
MSE, POINT
- **Energetic Particle:**
FIDA, FIELDS, ssNPA, neutron camera
- **Turbulence:**
magnetic probes, soft X-ray, ECE/ECEI, POINT, BES, DBS, ECEI, GPI, CO₂ laser collective scattering

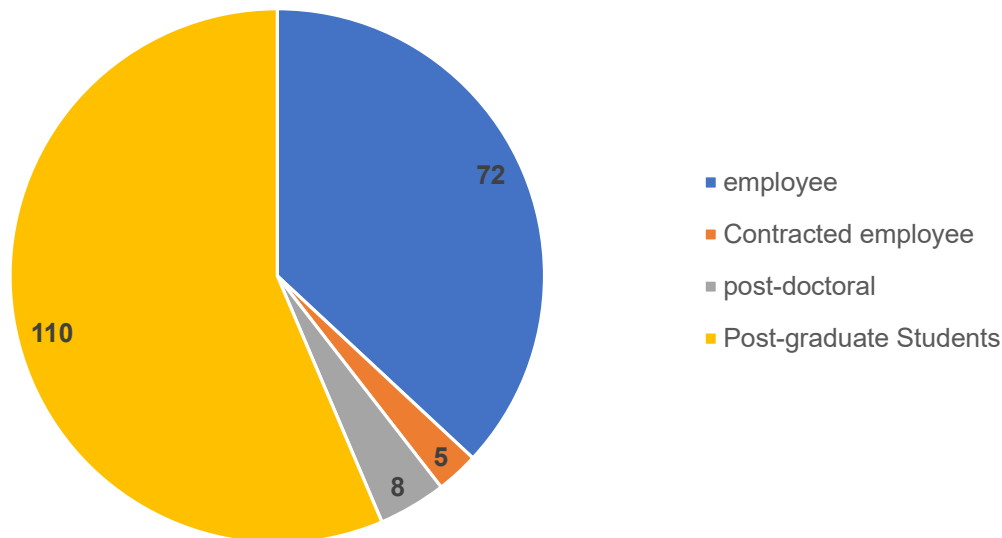


More than 80 diagnostics developed on EAST

EAST Diagnostic Group



- **Mission of EAST Diagnostic Group:** Diagnostic development and maintenance, ITER diagnostic, Diagnostic Research
- **Research Field:** Laser, Optics, nuclear electronics, spectroscopy, Electromagnetic analysis, microwave technology,
- **Human resource:** ~195, More than **70%** of the employees have a doctor's degree



	EAST	ITER	CFETR
2023	70%	12%	18%
2025	40%	30%	30%

Diagnostic Laboratory



Diagnostic Building

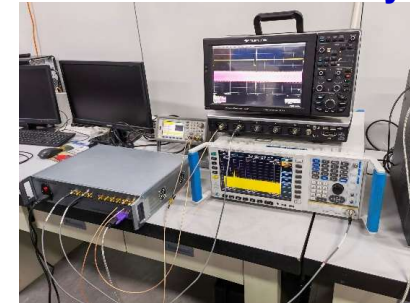
Electronics laboratory



Laser laboratory



Microwave laboratory



Optical laboratory



Spectrographic laboratory



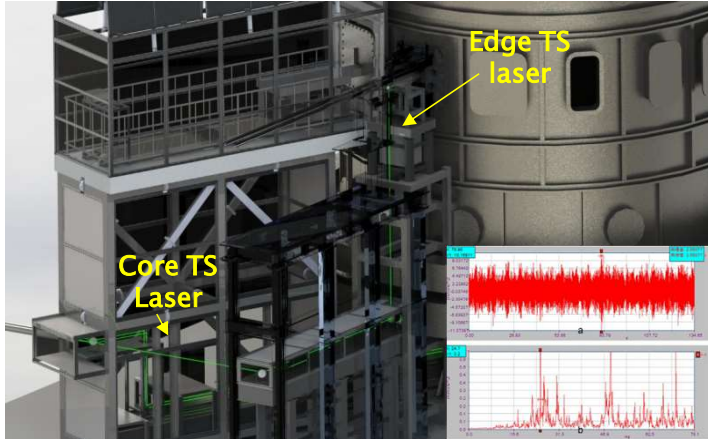
Nuclear electronics laboratory



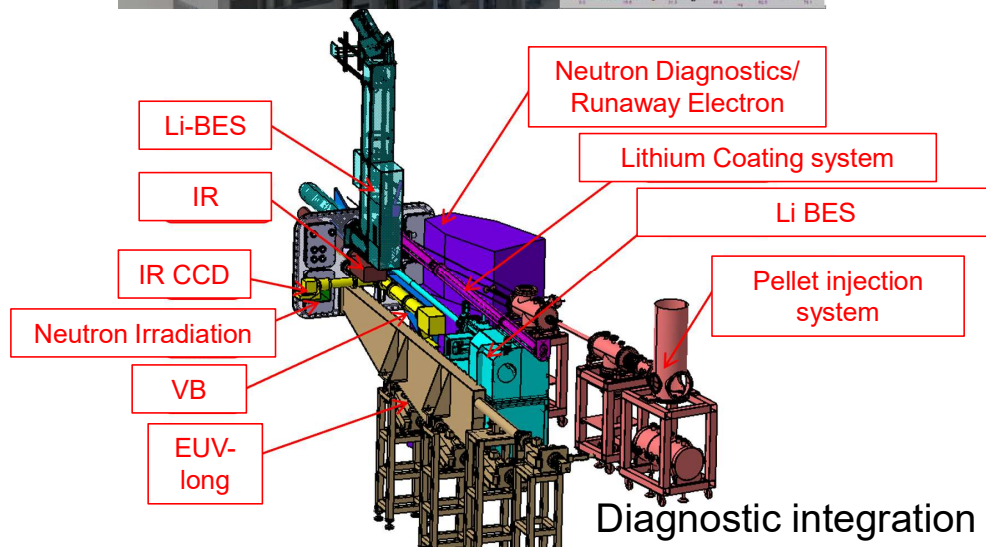
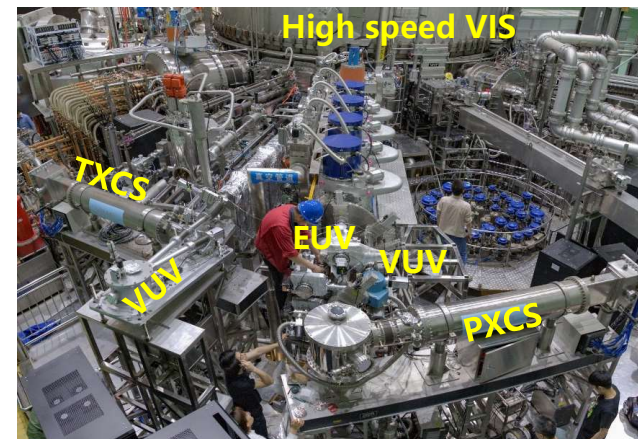
Diagnostics Developed on EAST



Vibration and electromagnetic analysis(Thomson scattering)



Engineering and Manufacturing (VUV&X-Ray)

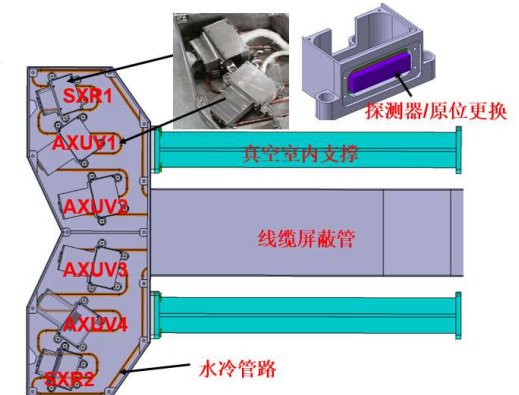


Dagnostic integration (Nuclear)

ECE



AXUV&SXR

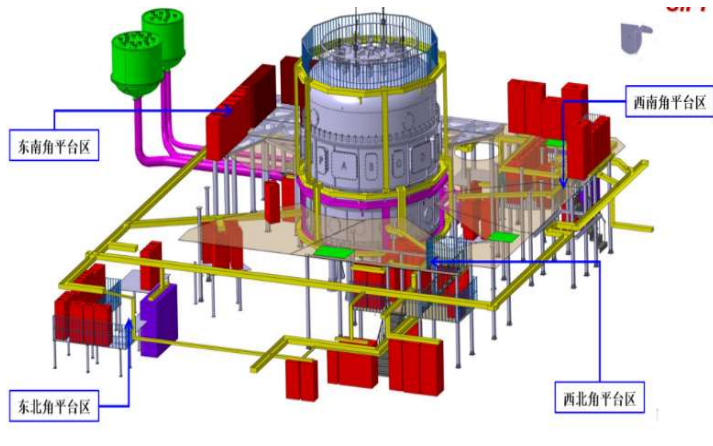


Dagnostic Test

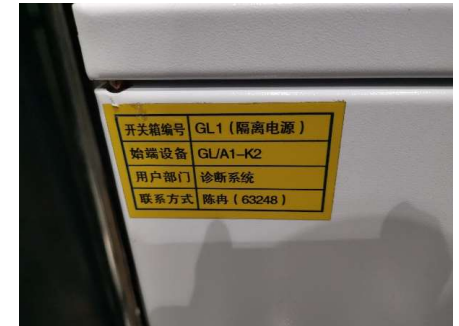
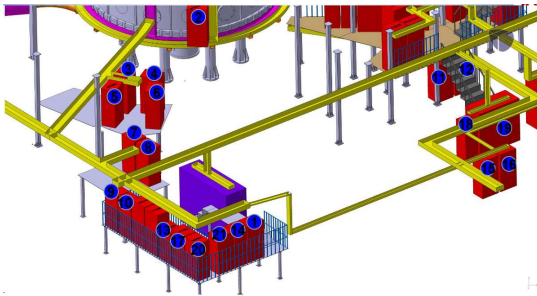
Diagnostic Installation and Infrastructure Development



Optical fiber and signal cable design and installation



Diagnostic power supply design and manufacturing



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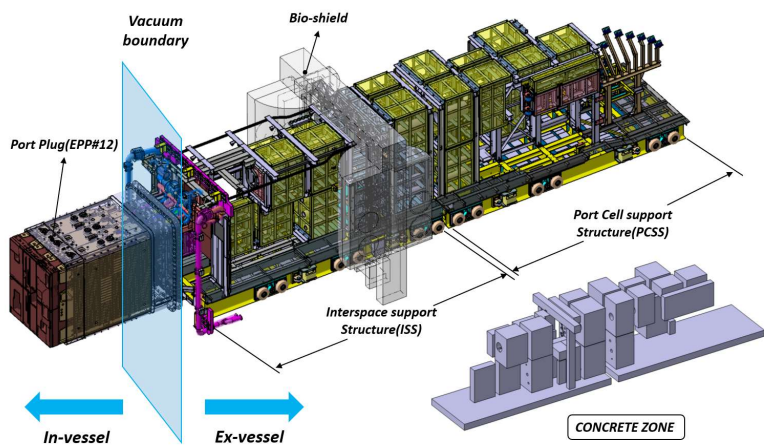
Summary



EQ#12 Port Integration Design and Manufacturing



- **MRRs are in preparing.** 316L(N)-IG Forging Procurement, MRR1-A (DSM rough machine), MRR-1B(DSM gun drilling),MRR-2(B₄C block manufacturing), MRR3-A(Shielding tray raw material) are **all closed**.
- **Key processes qualification** are in preparing.(Arg-tig welding for DSM, Electrical discharge machining, Laser welding for beams, Heavy borated concrete, Ceramic coating, etc.)
- **DSMs, B₄C, T-shape forgings are in manufacturing.**



design model of EQ#12



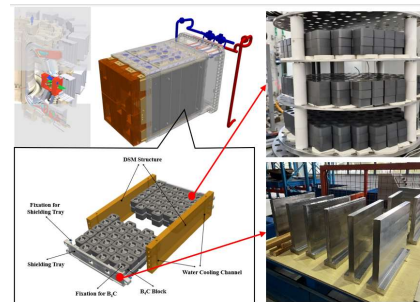
DSM rough machining



DSM gun drilling



Arc-tig welding sample



B4C and T-shape forging



qualification of beam Laser welding



EQ#12 Port Integration Design and Manufacturing



- Port Integration **dust-free** assembly building is in-preparing.
- **Test facilities and devices** are under- construction for port integration and tests.
 - ✓ Arc-tig welding system for water channel plug welding.
 - ✓ Outgassing testing system for vacuum component outgassing rate measuring.
 - ✓ Rotating device and Water testing platform for port plug integration.



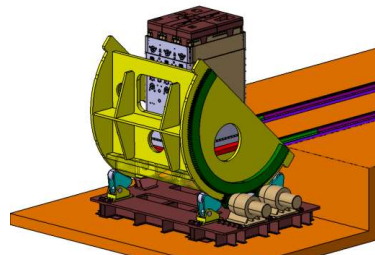
CNDA-PI assembly building
(Renders)



Arc-tig welding system



Outgassing testing system



Design of Rotating device

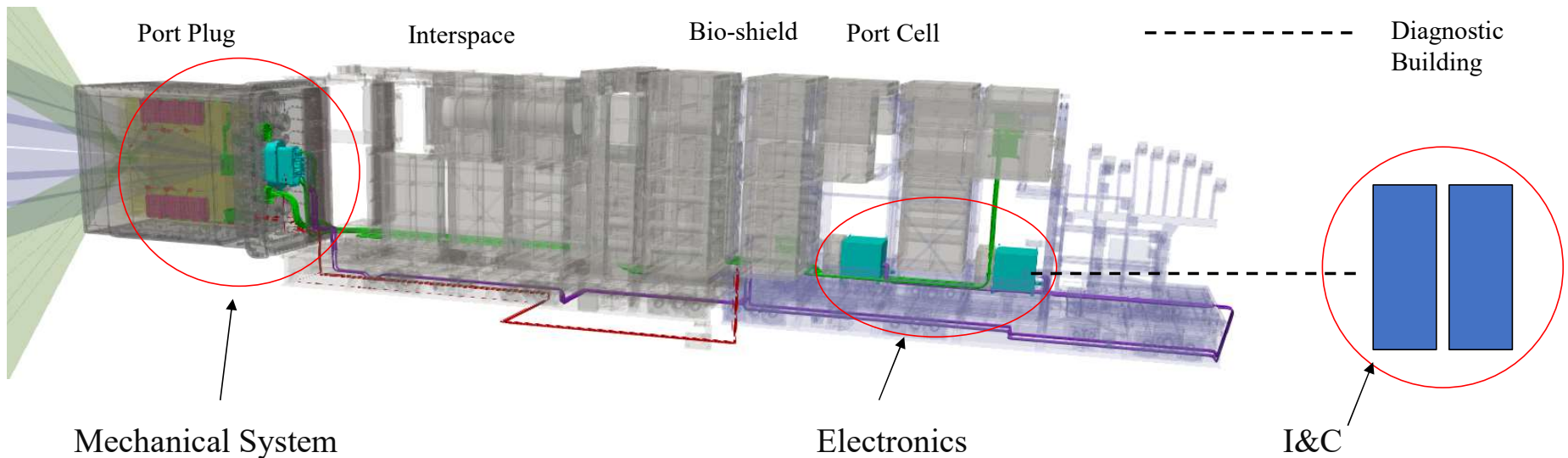


Water testing platform

EQ#12 Radial X-ray Camera Manufacture Study



- Radial X-ray Camera (RXC) including internal and external cameras will be installed in equatorial port 12 to measure primarily low (m, n) (MHD) modes, Edge-Localized Modes bursts, etc.
- RXC is divided into 3 subsystems of mechanical subsystem (including internal camera and external camera), PCSS electronics and data acquisition and control (I&C), distributed in areas of port plug (mechanical), port cell (electronics) and diagnostic building (I&C) .
- Mechanical system and I&C system have passed MRR. Electronics system is close to MRR closure. Many R&Ds were carried out for these MRRs.



Overall View of Radial X-ray Camera System

EQ#12 Radial X-ray Camera Manufacture Study

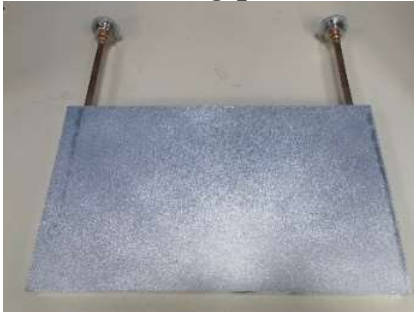


- Mockup of amplifier boards and chassis with improved design was manufactured and passed functional and cooling test. Besides, I&C hardware environment was built based on which software was developed.
- The electronics chassis and amplifier assembly was tested in a Magnetic Field Endurance Testing Device with doubled in-situ induction intensity, verifying the magnetic endurance.

Amplifier board



Cooling plate



Chassis



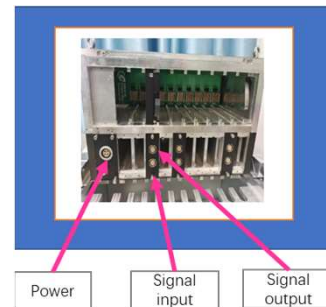
Integrated assembly



I&C hardware



Test facility



Tested chassis

ITER PPS manufacture



- Framework supply contract for the manufacturing of port plug structures(IO/24/CT/6000000508) was signed at 11^{st.} , Dec. 2024
- TO#01 Procurement of Diagnostic IO port plug structures EPP#11 and EPP#12 was signed at 14th, Dec. 2024, aiming for the delivery of the EPP#12 at the end of 2025 and EPP#11 at the beginning at 2026
- Raw material of EPP#11 and EPP#12 arrived to ASIPP at 21^{st.}, March, 2025, and acceptance tests mainly focused on the dimensional check and internal tunnel check while the former test have carried out



Fig a) Raw material of EPP#11 and EPP#12 Prior to the off-loading



Fig b) After off-loading

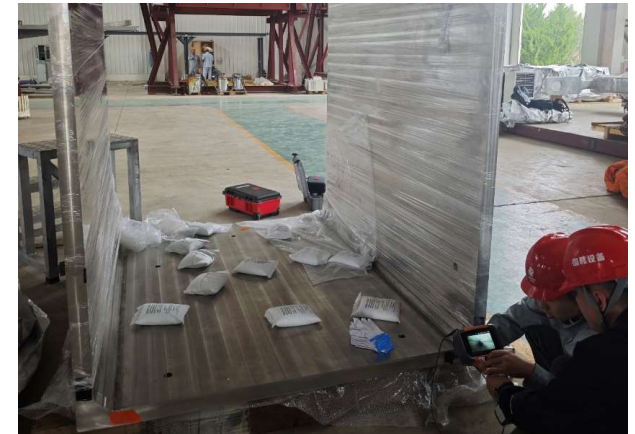


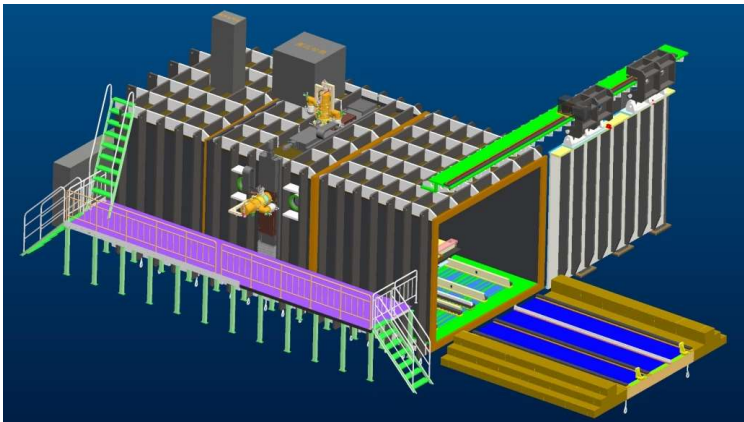
Fig c) PPS dimensional check based on laser tracker and internal tunnel check based on endoscope

ITER PPS manufacture



● TO#01 Preparation:

- ✓ Documentation: Raw material acceptance test procedure, Welding repair test plan for EPP#12, MIP for repair of EPP#12 have uploaded in IDM
- ✓ Key process trial tests: methods to removal the PPS internal tunnel oxidation areas are undergoing (see next page)
- ✓ Key machine: ASIPP EBW equipment modification dedicated for the welding between the box structure and front closure plate forging, is at tendering process



a) Overall layout of the modified EBW equipment

Main parameters of the EBW equipment

- Overall dimensional of the vacuum chamber:
11500mm×5000mm×3800mm
- Electron gun parameter:
150kV/60kW
- Pumping time (to 5×10^{-2} Pa):
≤45min
- Maximum load: > 20 Tons

招标信息

电子束焊接平台招标公告

2025-03-14 | 【大 中 小】 【打印】 【关闭】

一、项目基本情况

- 1.1. 招标编号: IPP-20250240314
- 1.2. 项目名称: 中国科学院合肥物质科学研究院等离子体物理研究所电子束焊接平台
- 1.3. 预算金额: 1050.00万元
- 1.4. 最高限价: 1050.00万元
- 1.5. 采购需求: 详见招标文件
- 1.6. 合同履行期限: 合同签订后4个月内完成并验收
- 1.7. 本项目不接受联合体投标。

b) Public bidding for the modification of EBW platform (modification shall be finished into 4 months after the signature of the contract, about middle of the August 2025)

TO#01 - Manufacture X-ray filter window Flanges and associated sealing gasket



- The objective of this Task Order is to supply X-ray filter window Flanges and associated sealing gasket for the ITER Organization
 - The manufacture of the test CF100 flanges and customized CF flange have finished
 - The qualification tests for both kinds of flanges have been finished
- Thermal cycling test for both flanges, three cycles from 35°C to 250°C and followed by leak test
- Pressure test for both flanges, three cycles with pressure differential $\pm 0.3\text{MPa}$ and followed by leak test
- Bending test for both flanges, moment 2.3 KNm and shear force 25 KN acted on the flange independently and followed by leak test



a) Test platform



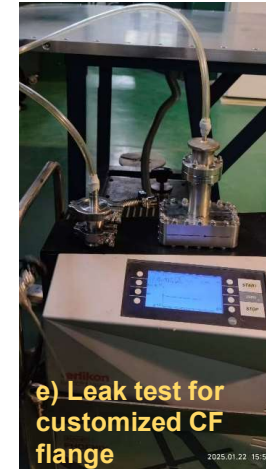
b) Leak test for CF100 flange



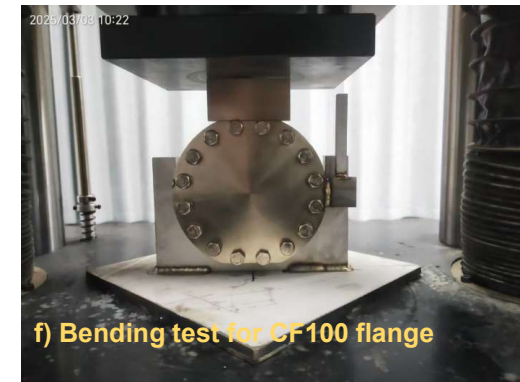
c) Leak test for customized CF flange



d) Leak test for CF100 flange



e) Leak test for customized CF flange

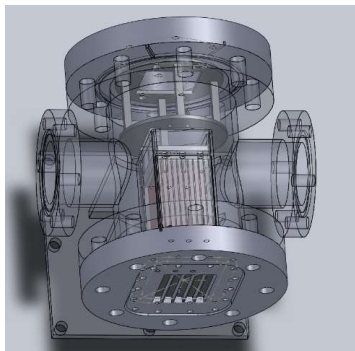


f) Bending test for CF100 flange

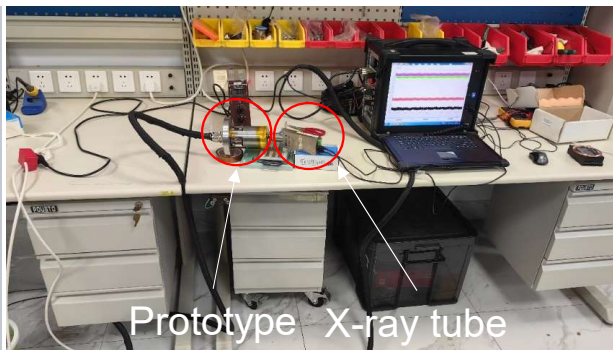
TO#02 - Low voltage Ionization Chamber prototype development for 55.E7.D0 internal camera PDR



- The task is aimed to investigate Low Voltage Ionization Chamber (LVIC) concept, in term to enrich the knowledge on system integration, signal transmission etc.
- The prototype was designed, manufactured and tested in lab and EAST tokamak. Effective signals have been observed, validating feasibility of using this kind of detector for x-ray detection.

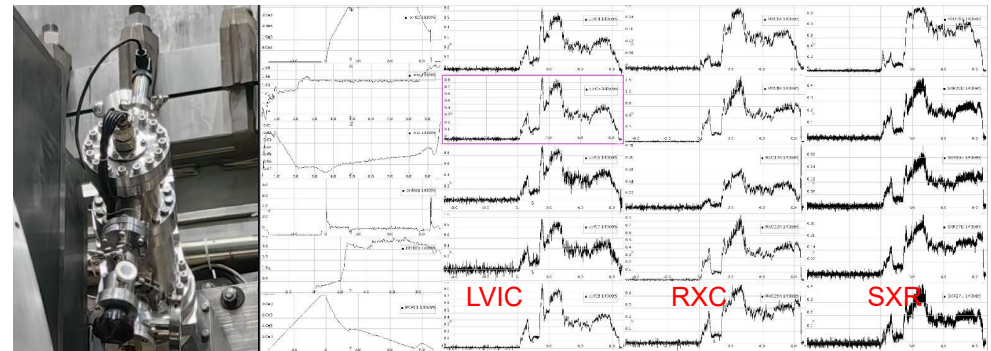


Prototype model



Prototype X-ray tube

Lab test

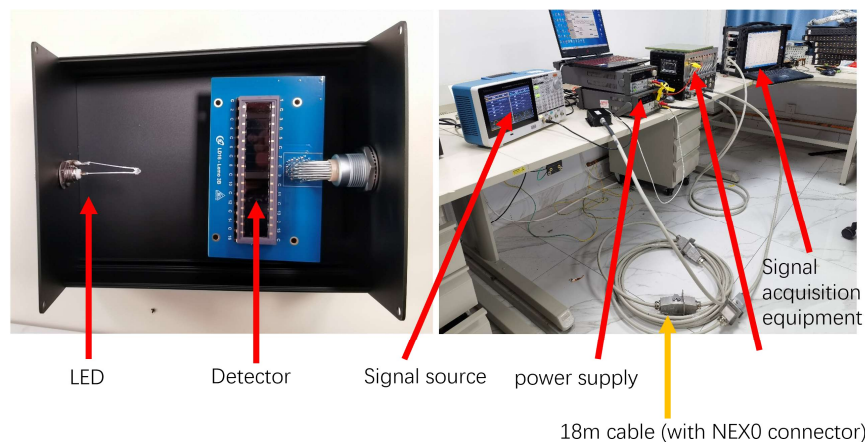


Tokamak test

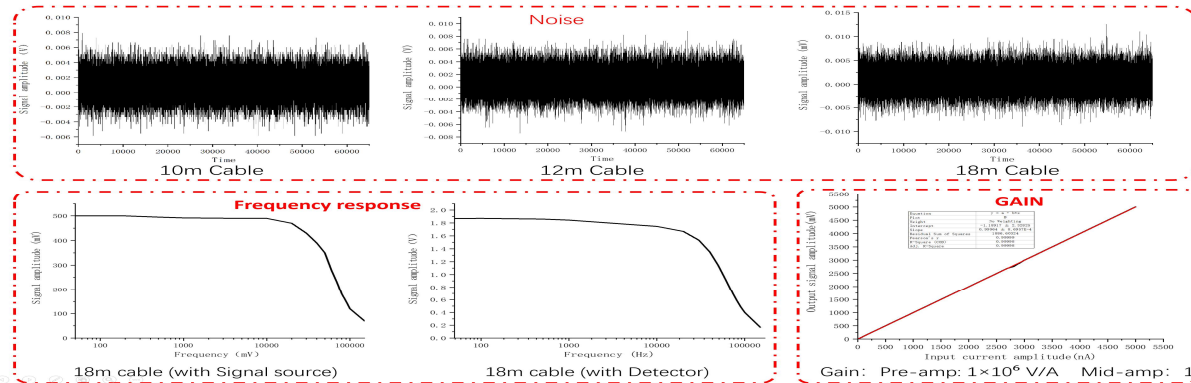


TO#03 - Verification test for 55.E7 electrical connection in PCSS

- The task is aimed to investigate impact resulting from using 55.NE. X0 cable routing scheme and consequently larger cable length on 55. E7 signal transmission performance.
- The test environment was built by procuring and integrating the cables/connector suggested by 55.NE.X0 to conduct the end-to-end.
- It is found in the test increasing cable length results in slight noise increase (noise amplitude ≤ 10 mV), slower frequency response (drop to ~ 40 -50 kHz), but transimpedance gain not impacted (test result consistent with design values).



Test Environment

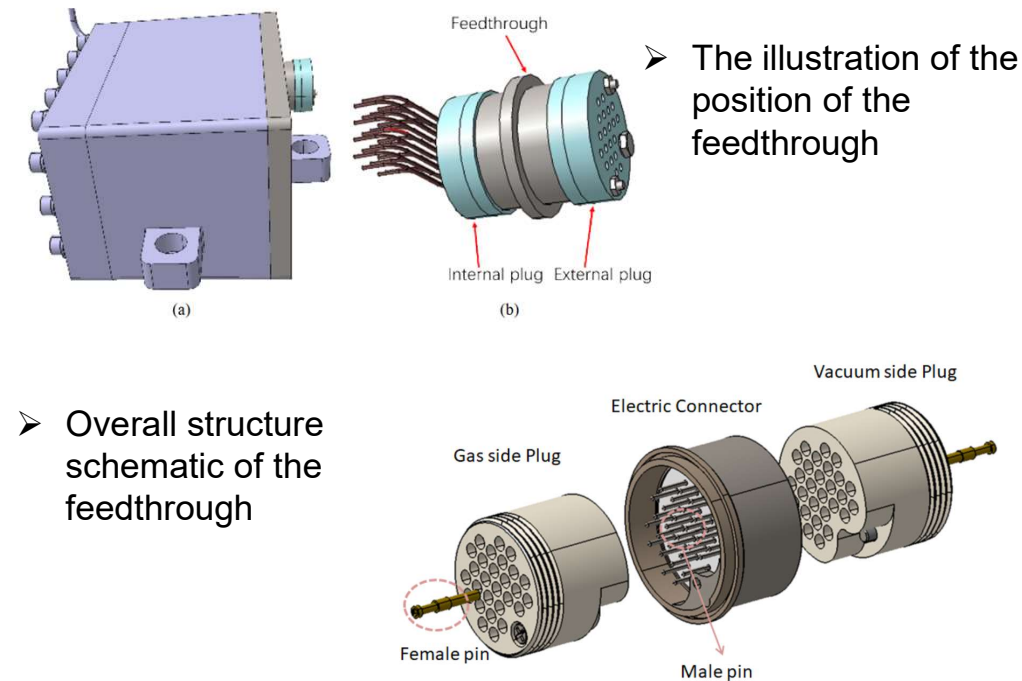


Noise, frequency and gain test results



TO#06 - Manufacturing and pre-qualifying an electrical feedthrough prototype for 55.E7.D0

- The objective of this Task Order is to manufacture an electrical feedthrough (EFT) prototype for 55.E7.D0 - Radial X-ray Camera Advanced Detectors for Nuclear Phase, and perform the tests to pre-qualify the EFT prototype
- The task order was signed at 14th., March, 2025 and KOM was held at 19th., March, 2025



➤ Project schedule

D#	Description	Due Dates	Main activities
D#01	Technical specification of electrical feedthroughs	T0 + 6 month	<ul style="list-style-type: none">➤ Creating the manufacture drawings and as built drawings(T0+2 month)➤ Manufacture of the prototypes(5 pieces, T0+6 month)
D#02	Testing plan for the prototype EFT assembly	T0 + 8 month	<ul style="list-style-type: none">➤ Feedthrough test plan uploaded and approved in IDM (T0+8 month)
D#03	Testing report for the prototype EFT assembly	T0 + 12 month	<ul style="list-style-type: none">➤ Performing the functional testing, assembly testing, thermal cycle testing, vibration testing, pressure testing and thermal aging testing➤ Feedthrough test report uploaded and approved in IDM (T0+8 month)

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Summary



Juneng company introduction



- Hefei Juneng Electric Physics High-tech Development Co., Ltd., founded in 2006, specializes in high-end equipment for scientific research.
- With extensive participation in major projects such as EAST, ITER, BEPC, SHINE, and other international collaborations, the company has built solid engineering and manufacturing capabilities.
- Equipped with CNC machining centers, advanced welding systems, non-destructive testing tools, and precision measurement equipment to ensure high-quality production.
- Main products include special magnets and coils, vacuum chambers, cryostats, plasma generators, and various experimental devices like current leads, magnet holders, and diagnostic tools.



Constant temperature CNC milling



NC Milling Machine



Measuring Equipment



Five axis CNC machining center



NDT Equipment



Special Welding Equipment



Hefei Keye Electrical Physical Equipment Manufacturing Co., Ltd.



- Hefei Keye Electrical Physical Equipment Manufacturing Co., Ltd. (Keye) was founded in January 2007. The company
- A comprehensive array of over 400 large and medium-sized machines, supporting high-precision and complex manufacturing tasks, has developed steadily through industry integration and innovation.
- Major equipment includes: EVER5 five-axis milling systems; Five-axis CNC high-pressure waterjet cutters; CNC machining centers, lathes, and milling machines; CNC micro-hole deep drilling and wire cutting machines; Vacuum brazing furnaces and hydrogen gas furnaces; Pipe bending and automatic argon arc welding machines.



JOBS (EVER5) 5-axis mobile gantry milling machine



High-Pressure Waterjet Cutting System



AQ750L Slow wire cutting equipment



XKAE2425*60 CNC gantry boring and milling machine



DVT630*31/50P-(NC) CNC gantry boring and milling machine



THDW-20 Electron beam welding equipment
(3m×2m×2m, 85kV/20kW)



KPC-4500J vacuum pressure impregnation equipment
(Φ4500mm)

Huainan New Energy Research Center



- The Huainan New Energy Research Center is a branch of the Institute of Plasma Physics, under the Hefei Institutes of Physical Science, Chinese Academy of Sciences. Established in March 2012.
- The center is dedicated to nuclear fusion new energy research, including technology development, application, academic exchange, and talent training.
- Has led and participated in national key projects, such as: ITER superconducting feeder system; CFETR 1/8 vacuum chamber; CFETR central solenoid model coil

• Main welding equipment



150kV/60kW/66m³ Electron beam welding system



60kV/15kW/18m³ Electron beam welding system



φ500×1500 Hot isostatic pressing system



260×260×350 Laser additive system

• Main non-destructive



Phased array ultrasonic nondestructive testing system



Creeping phased array ultrasonic testing system



Variable pitch adaptive X-ray fabric system



Robotic ultrasonic inspection system



Handheld ultrasonic inspection system

Chinese Academy of Sciences, Anhui Institute of Optics and Fine Mechanics



Since its founding in 1970, AIOFM has a 50-year history of mechanical component processing, optical component processing, aspheric surface development, and optical coating research and processing.

Atmospheric Optics Laboratory

1970

Key Laboratory of Atmospheric Optics

1995

Key Laboratory of Atmospheric Composition and Optics

2008

Key Laboratory of Atmospheric Optics

2016

OPTICAL WORKSHOP



MACHINING WORKSHOP



PROCESSING AND TESTING EQUIPMENT



ZYGO Interferometer



4D Technology Fizeau interferometer



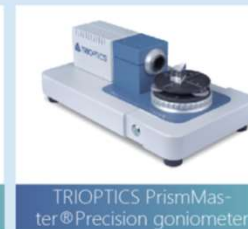
4D Technology Dynamic laser interferometer



Ion beam figuring machine

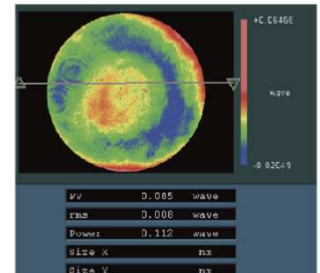


Six axis robotic arm polishing machine



TRIOPTICS PrismMaster Precision goniometer

ASPHERICAL SERIES





The Institute of Intelligent Machines focuses on sensor and intelligent technologies, including research in **sensitive materials, chemical sensors, microsystems, robot sensors, and intelligent sensor systems.**

❑ Seven research areas have been established:

intelligent sensing technology, bionic intelligence, advanced manufacturing, intelligent unmanned systems, ion beam biotechnology and green agriculture, smart agriculture, and smart health.



Introduction to Major Achievements of the Institute of Intelligent Machines



High-Throughput Soil Composition
Intelligent Detection Robot



Multispectral High-Speed Intelligent
Early Warning Sorting Machine



Autonomous Mining Vehicle



Ion Beam Biotechnology Device



High-Throughput Intelligent Single-Grain Quality
Detection and Sorting Instrument

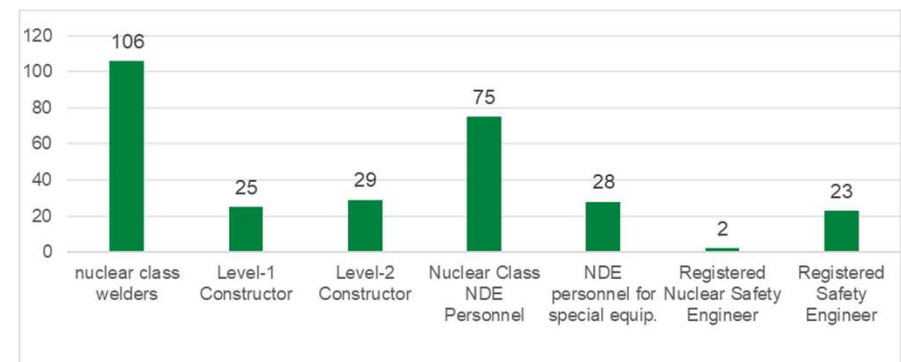
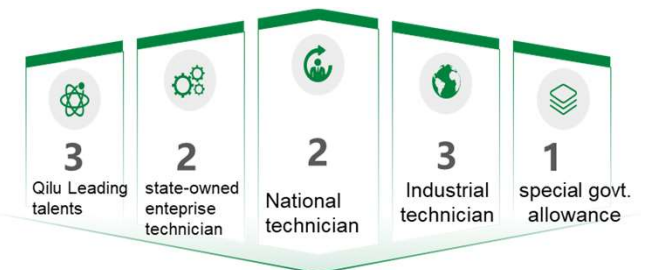
SNPEMC (Shandong Nuclear Power Equipment Manufacturing Company)



- Established in July 2007, SNPEMC is a subsidiary of the State Power Investment Corporation (SPIC).
- SNPEMC has fully mastered the manufacturing, on-site assembly, and welding technologies for 22 major categories of nuclear power equipment, and supplied more than 30 types of products for 29 nuclear power units of 11 different technologies, successfully supplied the first-of-kind AP1000 NPP products such as containment vessels, structural modules, mechanical modules, air baffles, etc.
- SNPEMC has a total personnel of 940 with average age of 36, 78.7% are with high level titled workers, and 47.3% are with medium-grade professional title or above.



Human Resources



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ASIPP Introduction and strategy

Fusion Research at ASIPP

Diagnostics Development at ASIPP

Summary

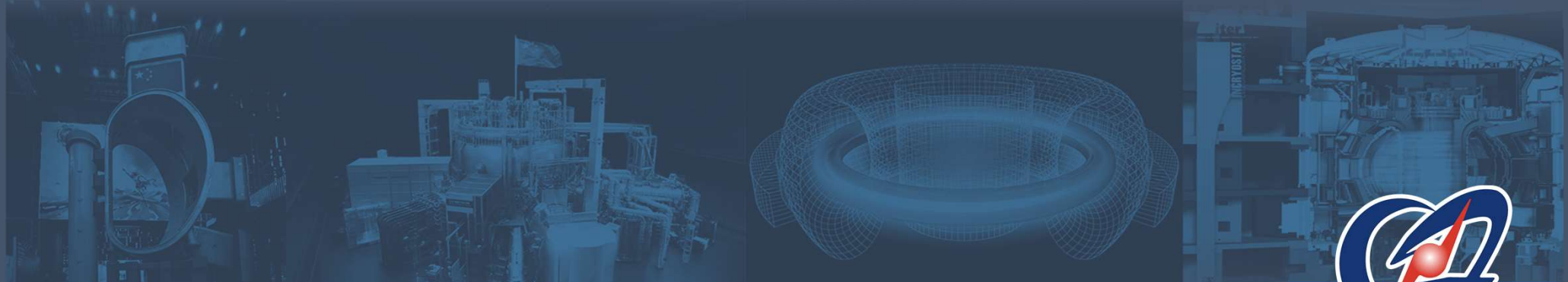


Summary and outlook



- ◆ ASIPP **dedicates to the fusion research and development** based on EAST-CRAFT-BEST-CFETR facilities.
- ◆ Strong efforts have been taken at ASIPP to **support ITER** progress.
- ◆ ASIPP diagnostic team **has the capability** of completing the tasks of the existing projects and **hopes to gain more service opportunities** for ITER.

Your comments and collaboration ideas with ASIPP will be highly appreciated!



Thanks for your attention!

ASIPP

