THEMATIC WORKSHOP

Plant installation program

Overview of Plant Installation progress & next opportunities

Bertrand ROQUES

ITER Plant Installation Program Manager

Since 2023, Bertrand Roques is responsible to plan, manage and execute assembly and installation works for the Tokamak Complex and the Balance of Plant buildings, up to commissioning readiness, in compliance with IO rules and regulations. It is supported by the development, within the mission scope, of a close relationship with the Domestic Agencies.

Previously, Bertrand Roques held several managerial positions in EDF within the Industrial Direction and the Nuclear Engineering Direction.

He began his career in the French Ministry of Economy and Industry, where he developed strategic visions and supported policy development for the General Directorate of Energy.

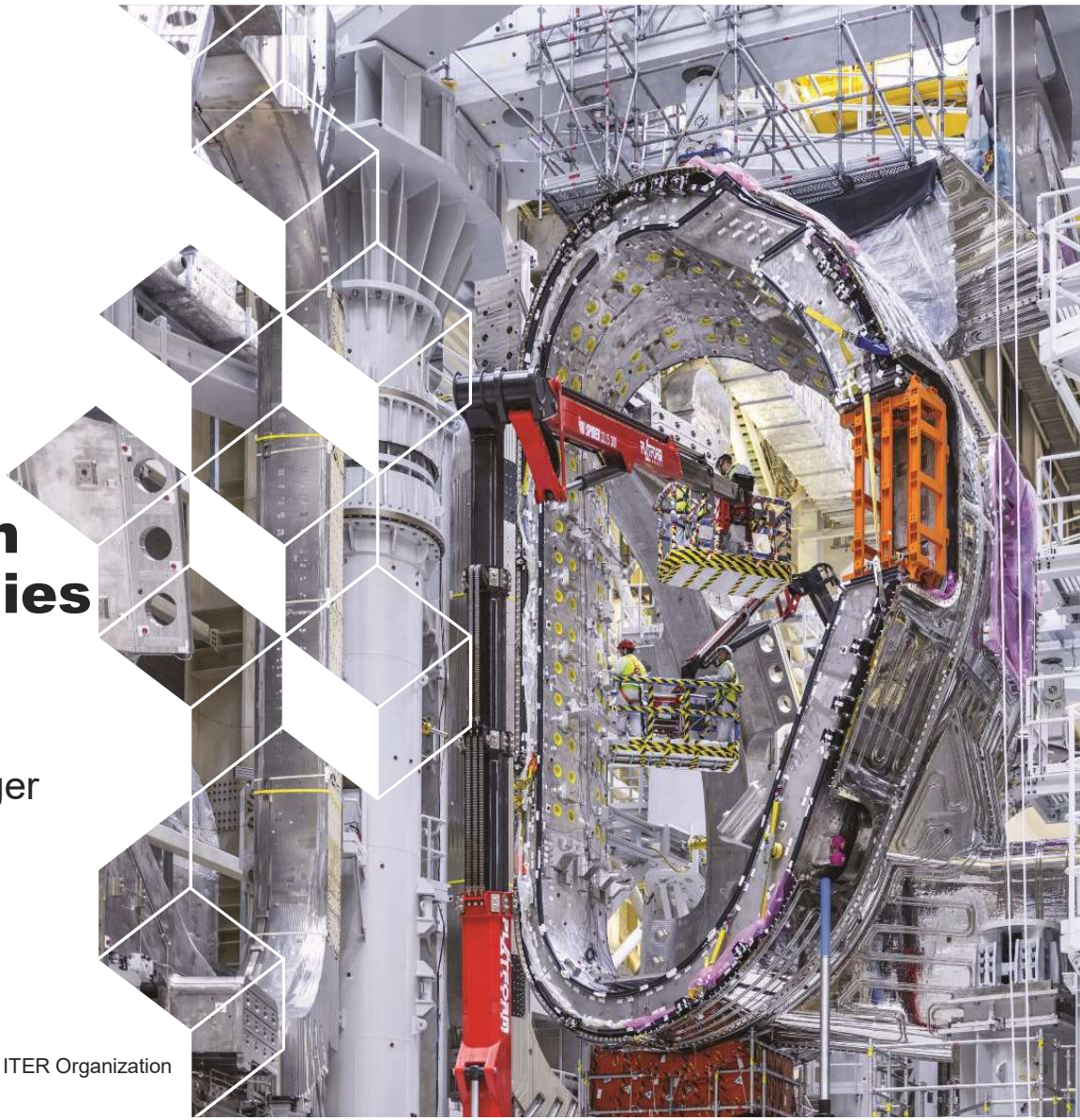
Chairperson:

Juan Knaster
EUDA Representative

IBF/25

INTERNATIONAL ITER BUSINESS FORUM

Overview of Plant Installation progress and next opportunities



Bertrand ROQUES

ITER Organization, Program Manager

FRIDAY APRIL 25th

AGENDA

1. **Where we are**
   - Introduction - Mission of the Program
   - Site overview
   - Examples of main works performed
2. **How we works**
   - Overall Process
   - Main challenges
3. **Next opportunities**
   - New tenders to come

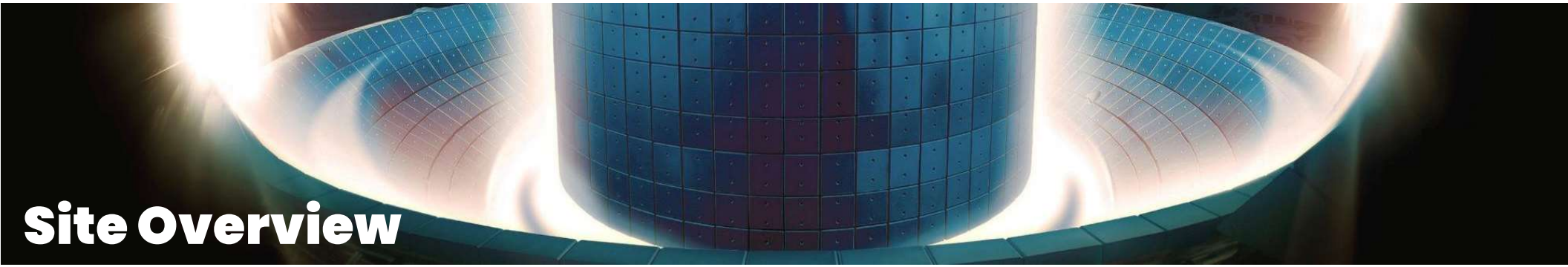
1. Where we are

Current status of works in Tokamak Complex and Balance of Plant Buildings

Introduction – Mission of the Program

The **Plant Installation Program**, under the leadership of DDG **Construction Project** Head, **shall plan, manage and execute assembly and installation works on the ITER work site for the Tokamak Complex and all the Balance of Plant buildings (Worksites 2, 3, 4 and 5)**, up to commissioning readiness, in compliance with IO rules and regulations, in order to meet the ITER Project objectives.

It works in close cooperation with the other Programs delivering items to be assembled and installed with a direct support from the Construction Management as Agent (CMA). It is supported by the development, within the mission scope, of a close relationship with the Domestic Agencies.



Site Overview

- Work Site 1 (Tokamak Assy.)
- Work Site 2
- Work Site 3
- Work Site 4
- Work Site 5 (SSEN)
- Work Site 5 (PPEN)

Plant Installation

Example of main works performed

Example of already completed facilities like the Cooling Water Plant.
The main purpose of this installation contract was to install the Cooling Water Systems (CWS) in the buildings of Cooling Water Plant (Buildings 64, 67, 68 A&B, 69). The installed systems were mainly Heat Rejection System (HRS) and Component Cooling Water Systems (CCWS-2D and CCWS-1 loops). This contract covered all installation works of mechanical equipment, piping, electrical and I&C. The components and equipment within this contract were delivered by India Domestic Agency (IN-DA).

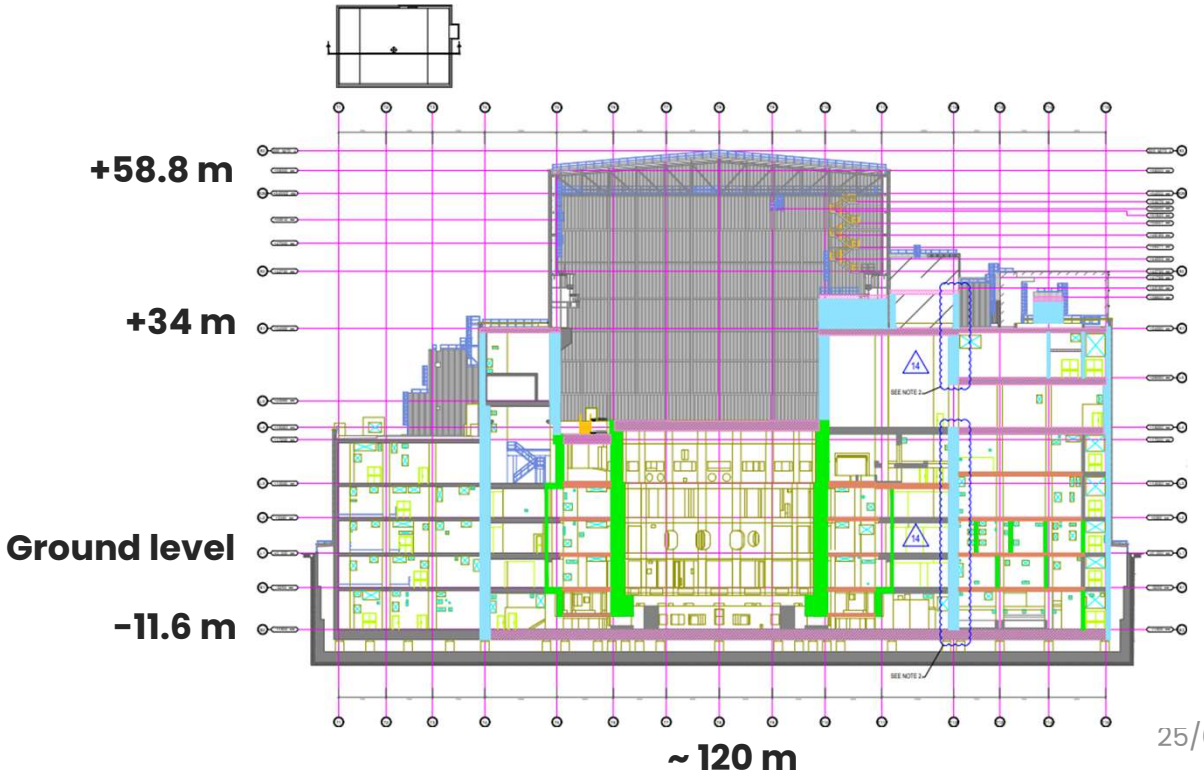

Cooling Tower


Vertical pumps in B67


Pump Stations (B68A)

Status of WS2 : typical dimensions of the buildings

Tokamak Complex
(B74/B11/B14)



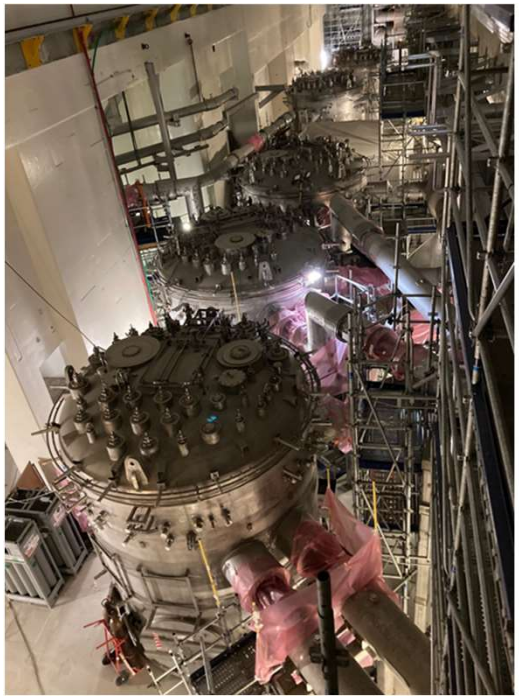
General status for WS2 – Tokamak Complex

With a number of workers of almost 400 people in Work Site 2 – Tokamak Complex, ITER Organization manages on daily basis several contractors performing different kinds of works :

- Civil works
- Mechanical installations
- Electrical and I&C installations

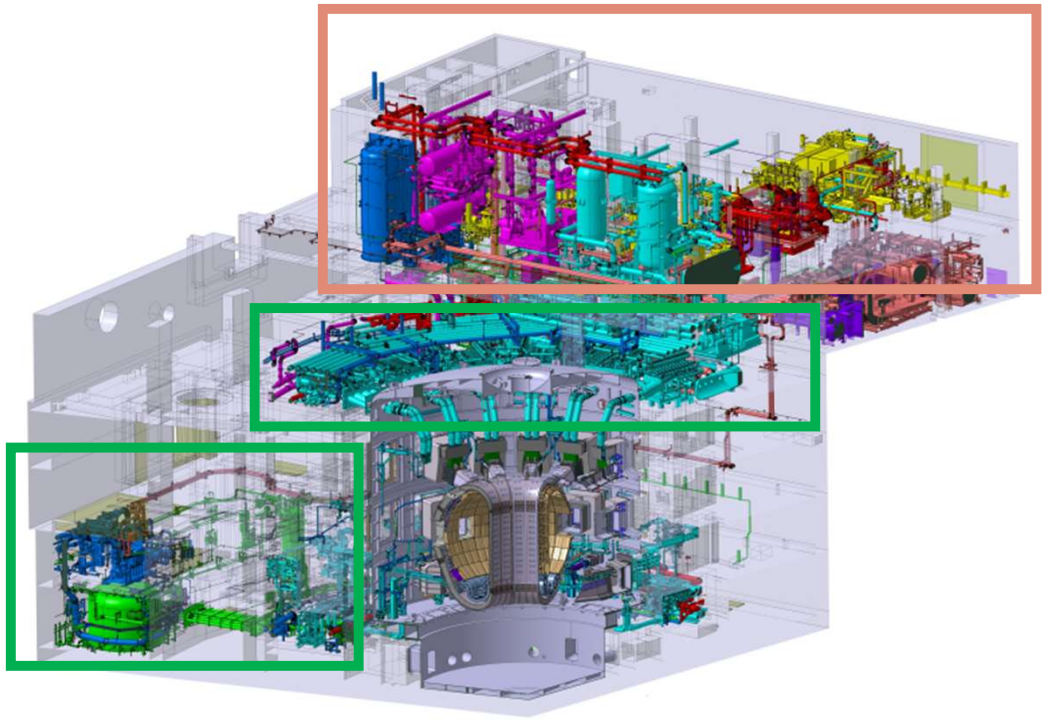
Some of these works are « First Of A Kind » with special requirements (technical, cleanliness, preservations etc.).

Example of main works performed



Auxiliary Cold Boxes installation in Tokamak Complex completed in beginning of 2025

Example of main works performed



Example of Tokamak Cooling Water System (TCWS):

- Done/On-going
- Future Contracts

Example of main works performed

Installation of bioshield openings (structure plus bundles) connecting Work Site 2 to the pit

Example of main works performed

Handling of the TCWS bundles inside a bioshield opening

Example of main works performed

Bioshield openings - view from PIT side:

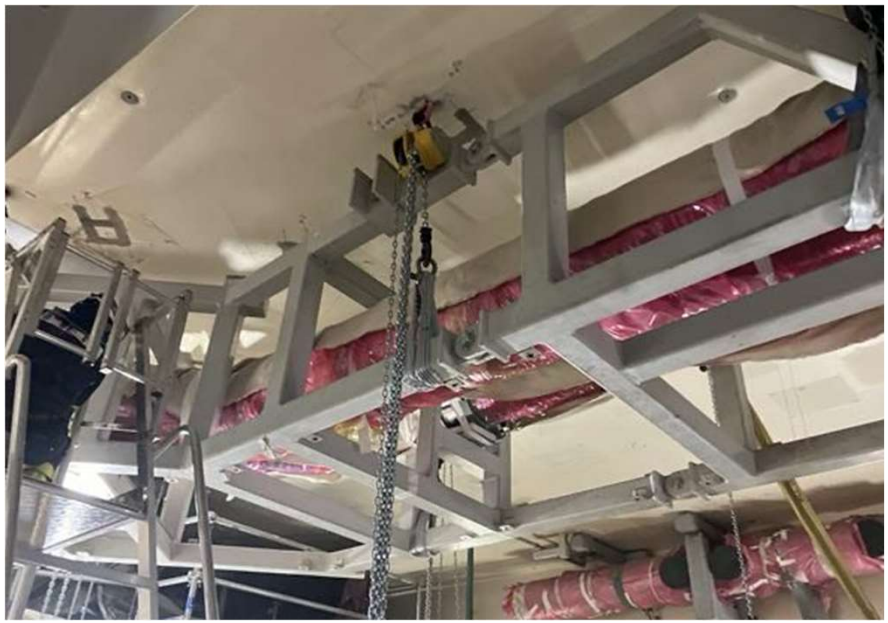
Mechanical parts:

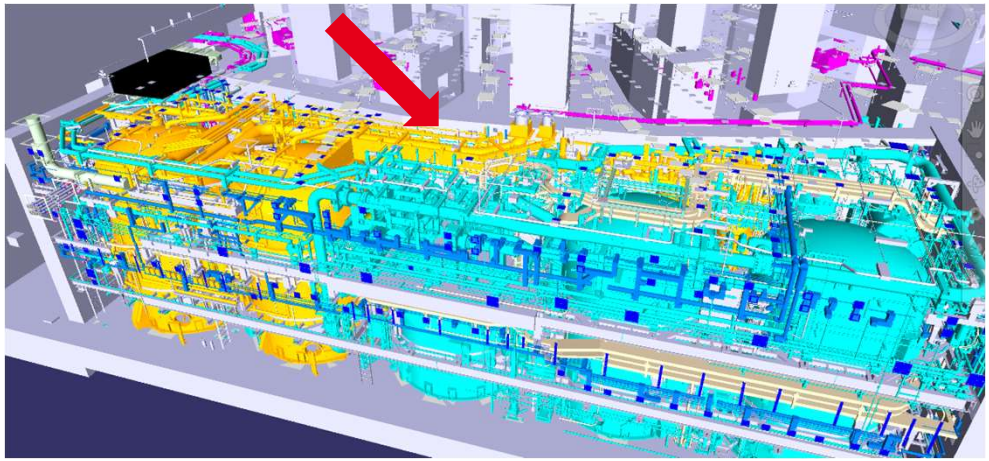
- Sleeves
- Pipe bundles

Civil parts:

- Backfilling (2nd phase concrete)
- Leak-tight coating

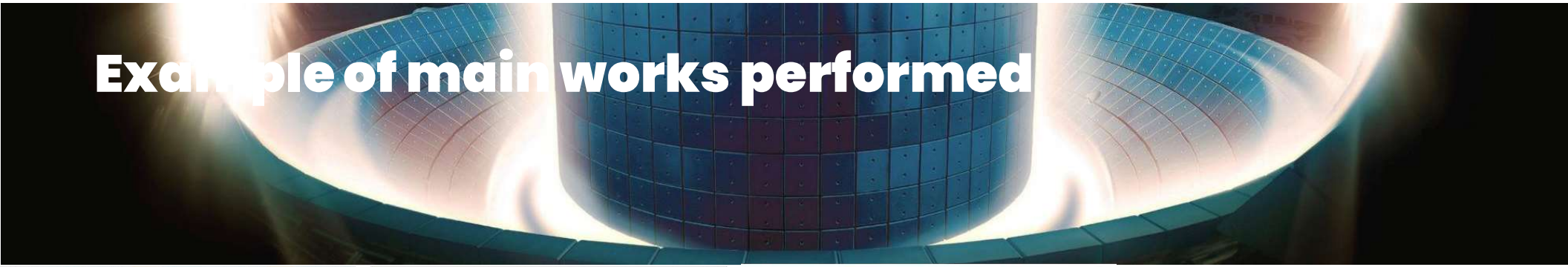
Example of main works performed

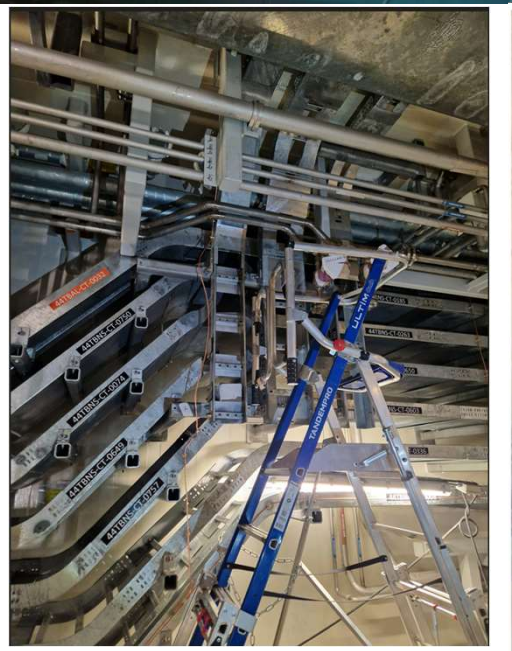




Vacuum-Vessel Pressure Suppression System in Drain Tank Room

Example of main works performed





LAC, Cables Trays, HVAC and Piping Installation in B11-B74

Example of main works performed

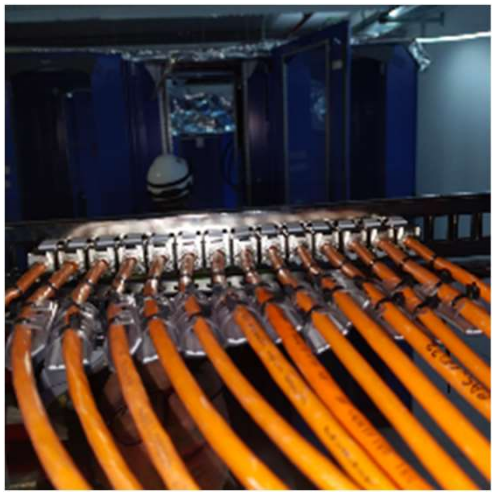
Busbars networks in Diagnostic and Tokamak buildings

Example of main works performed

Electrical and I&C installation in Control Building B71N

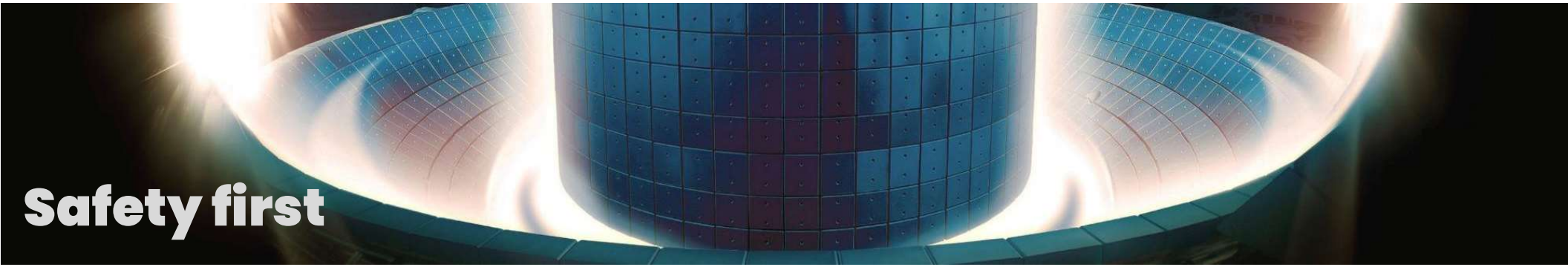
I&C Cubicles in Main Server Room

Terminations and Connecters for the Ethernet cables in Main Server Room



2. How we work

Main interfaces management



Safety first

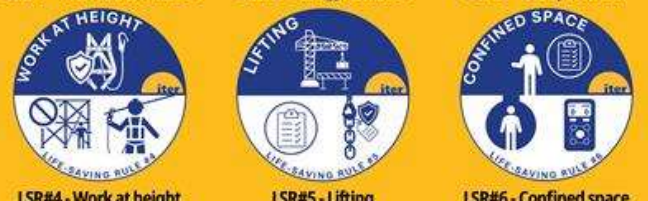
ITER Life-Saving Rules

Coming soon!

- **9 Life-Saving Rules** to prevent fatal accidents during hazardous activities
- **Simpler and clearer titles** that are easier to follow and remember
- **Re-designed icons** to make them self-explaining and ITER branded
- **Focus on activities with high potential risk** for injurious incidents or fatalities
- **Provide clear set of actions** expected from all individuals
- **Focus on actions that can be controlled** by individuals and traced if violated.
- **Aligned with OHS Safety Management Systems** and requirements in place

Scan me for more information about LSR

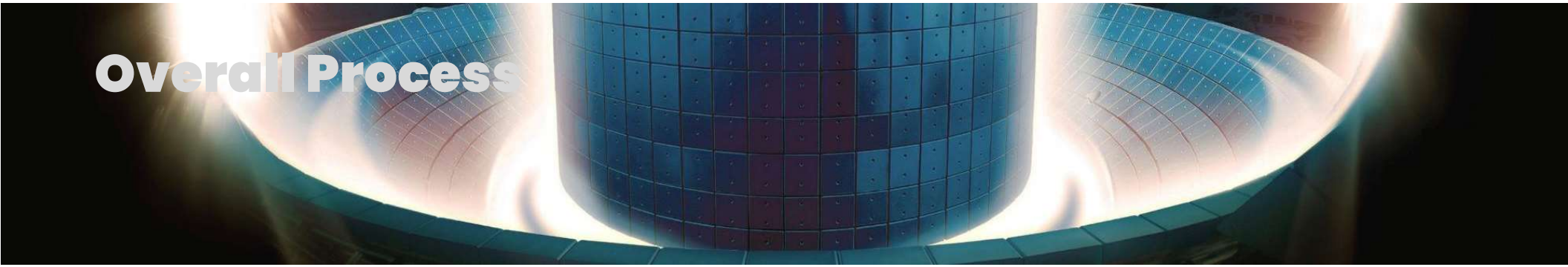
LSR#1 - Work authorization | LSR#2 - Energy isolation | LSR#3 - Safety controls



LSR#4 - Work at height | LSR#5 - Lifting | LSR#6 - Confined space

LSR#7 - Fire prevention | LSR#8 - Driving | LSR#9 - Line of fire

Overall Process



- Raw materials
- Domestic Agencies

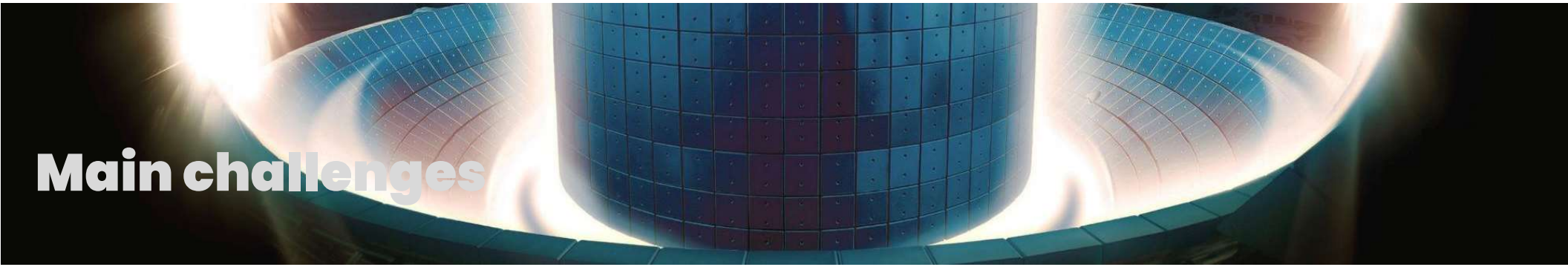
(on a case-by-case basis)

- Coordination activities
- Surveillance activities
- Quality Control

Installation / Assembly contracts

Design (EWPs) → Construction Package Preparation → Pre-Fabrication → Installation → Mechanical Completion Dossier → Hand-Over Package → Commissioning

- Procedures
- Qualifications
- MIP
- ITP
- NCR
- …



Main challenges

1. Ensure the continuity of the works for all the contractors
2. Provides general services needed for the performance of the works :
    - Electrical network
    - Water networks
    - Lifting devices (cargo lifts, tower cranes etc)
    - Temporary HVAC systems
    - Scaffolding
3. Manage the interfaces with WS1 – Machine Assembly
4. Shifts organization as per site needs
5. Restricted area/period versus Radiographic Test constraints management
6. Coactivity

H&S and Nuclear Safety

How we work

Construction team in ITER Organisation has the mission to complete the works withing the schedule and the cost, without any compromise on quality and safety.

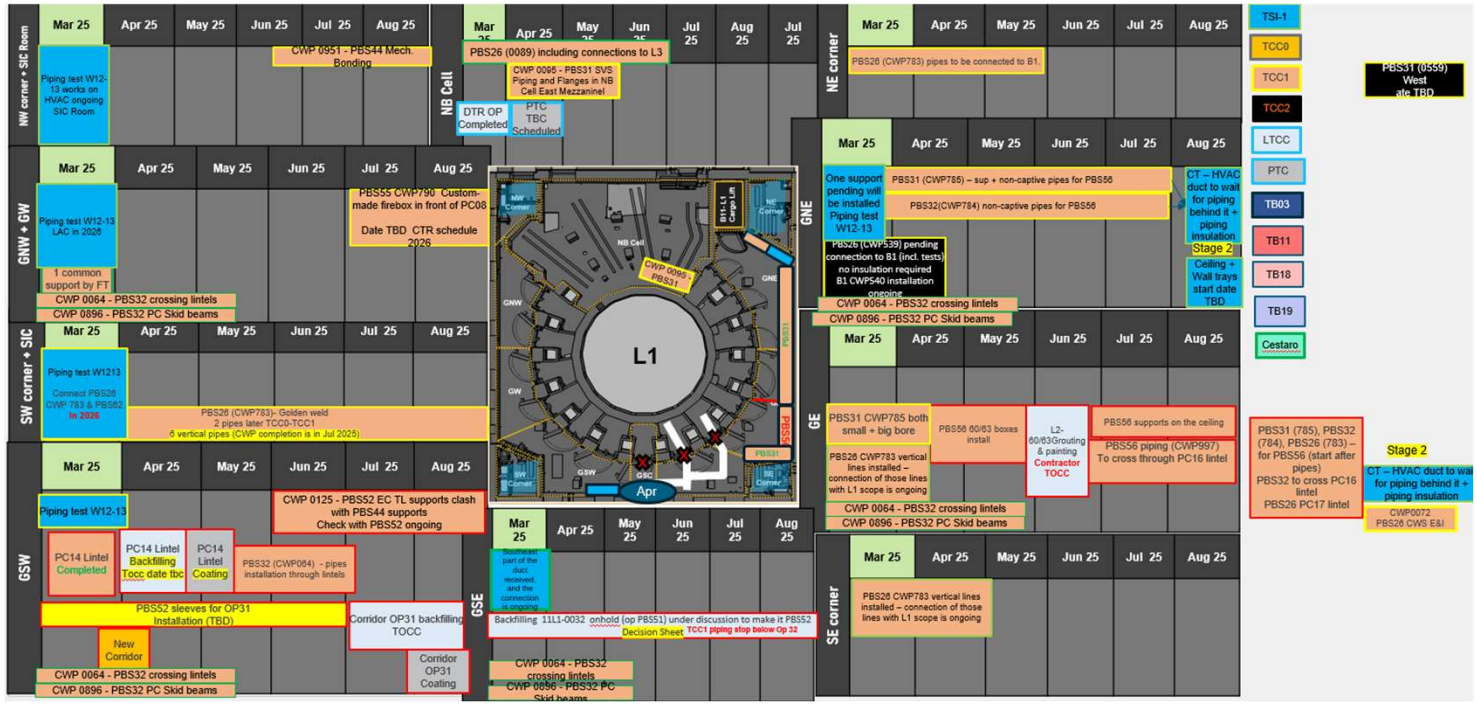
Main KPIs are constantly monitored the proper reactiveness from IO and from its industrial partners; e.g.:

- CPI, SPI
- NCR's
- H&S
- …

Management of the contractors is done by dedicated team through specific coordination plans.

Dedicated Framework Contracts are signed for transversal works.

Example of coordination plan



Example of coactivity management

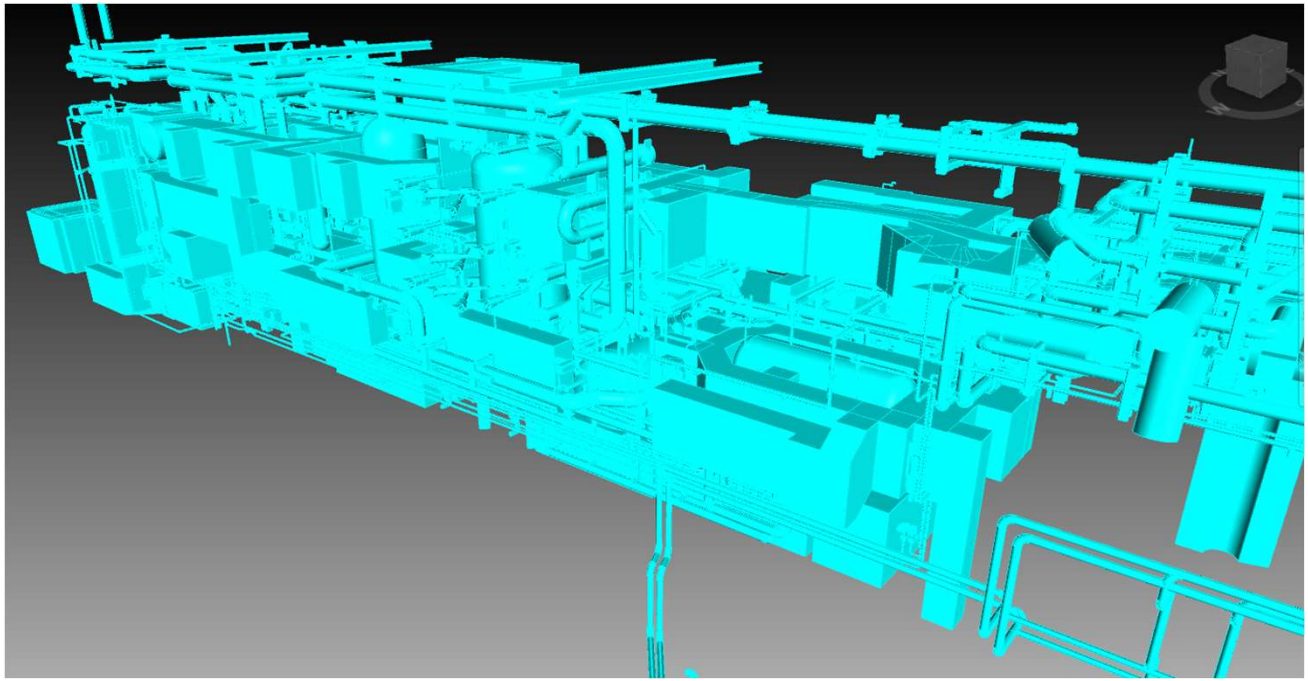
Transversal Contracts in place

1. Minor Mechanical Works
2. General Services Contract
3. Cleanness of the building
4. Lifting Works
5. Scaffoldings

3. Next opportunities

New tenders to come

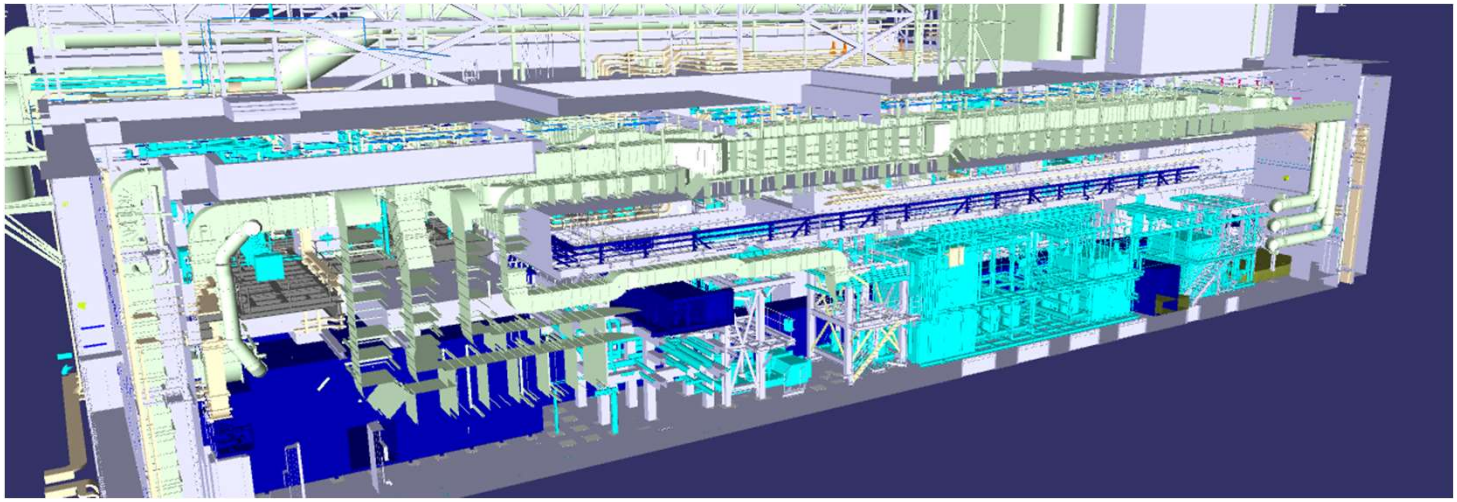
Installation activities to come



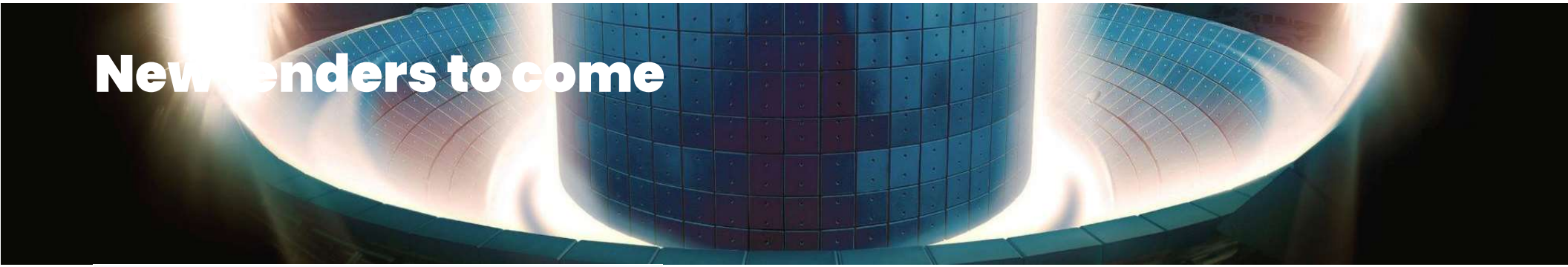
Example in B11-L4:

- Focus on TCWS piping and major equipment

Installation activities to come



Example in B11-L4:
- HVAC
- Cables
- TCWS piping and major equipment



New tenders to come

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

Tender Process	Cost Range	2025	2026		2027		2028		2029		2030		2031		2032	
		S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Tokamak Complex Contract #3 (mainly Electrical and I&C)	D															
Tokamak Complex Contract #4 (mainly Mechanical)	D															
Tokamak Services Installation #3 (Mechanical and Electrical)	D															
Tokamak Services Installation #4 (Mechanical and Electrical)	D															
Balance of Plant X (Mechanical, Electrical and I&C)	D															
High Neutral Beam Power Supply Components Installation Works (Electrical, Mechanical and I&C)	D															
LTOS (Infilling of openings)	D		#1				#2									
Shielding of Slab at L4 Final Design, Supply and Installation	C															

IBF/25
INTERNATIONAL ITER BUSINESS FORUM

THANKS

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

PLATINIUM SPONSOR SILVER SPONSOR SILVER SPONSOR BRONZE SPONSOR

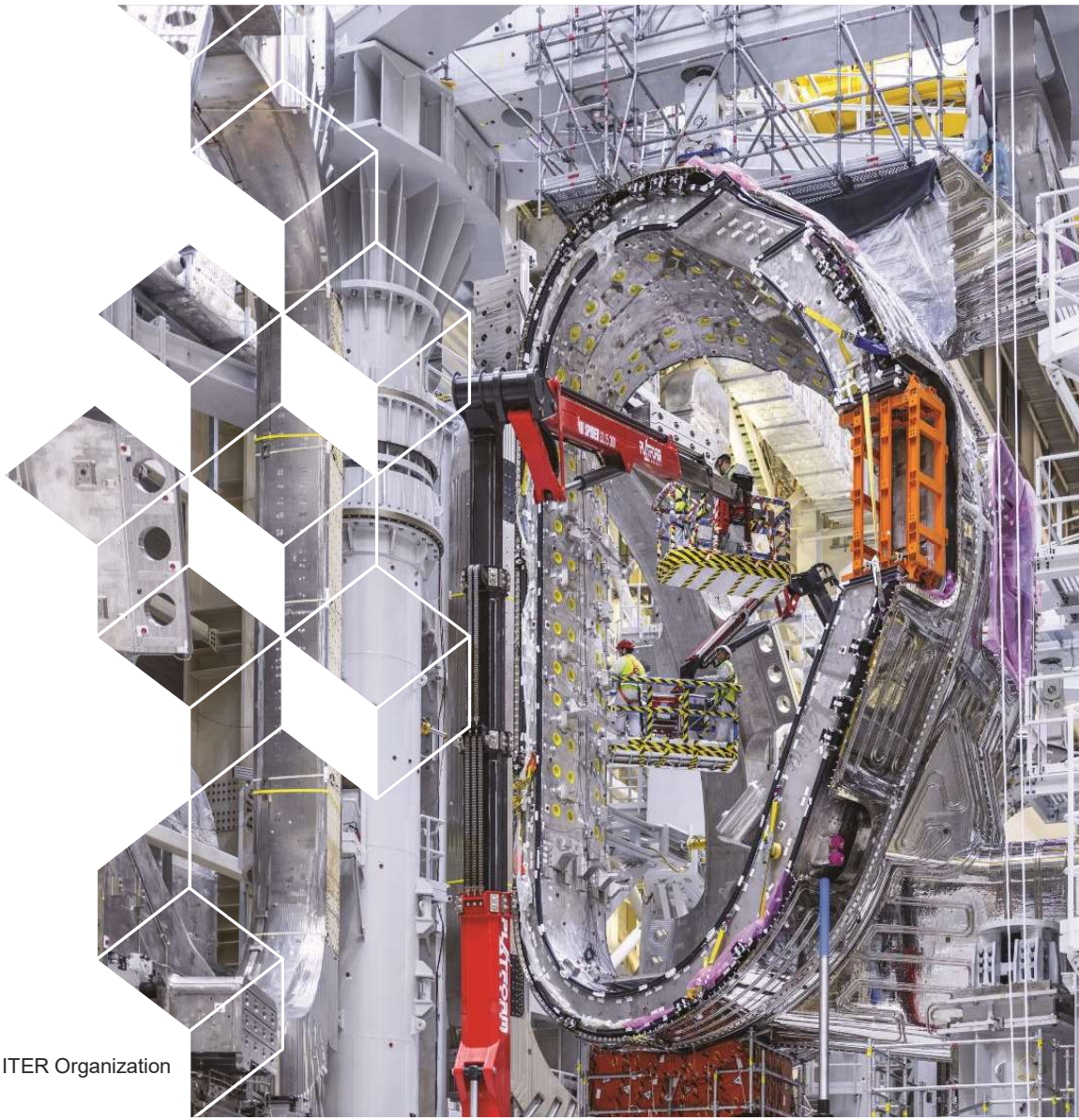
IBF/25

INTERNATIONAL ITER BUSINESS FORUM

Plant Installation Program

Pascal RAUNER

EQUANS – TSI Project Director &
MECANUC CEO



WEDNESDAY APRIL 23rd

Plant installation

1. **Current Status**
2. **How we work**
3. **Opportunities**

1. Current Status

Who we are

EQUANS
EMPOWERING TRANSITIONS

The specialist for nuclear activities from EQUANS (BOUYGUES Group) are working together to manage the site installation trough several contracts :

AXIMA AN EQUANS COMPANY

AXIMA Nuclear - Heat, Ventilation and Air conditioning specialist

INEO AN EQUANS COMPANY

INEO Nuclear – Electrical specialist

MECANUC AN EQUANS COMPANY

MECANUC – Piping and mechanical specialist

Our site Activities

Our main contract are the Tokamak Services Installation (TSI) that is the prolongation on IO side of the TB04 contract
TB04 contract started in July 2013, the content is :

DESIGN, CONSTRUCTION AND MAINTENANCE OF THE HVAC (HEATING, VENTILATION & AIR CONDITIONING), ELECTRICAL, I&C (INSTRUMENTATION AND CONTROL) HANDLING EQUIPMENT AND GAS AND LIQUID NETWORKS FOR THE TOKAMAK COMPLEX AND SURROUNDING BUILDINGS

Our site Activities

In 2018 : Novation of the TB04 contract to IO
Objective : To have all the main construction contract under IO on site management
The current contracts are Tokamak Services Installation **TSI 1 – TSI 2 and TSI 5**
Localisation : B74 – B11 and B74

- **PBS65 - Piping installation (BAS, CAS, NGD, HED, DWS, HWS, PWS, FPWS, Drainage : 200 000 mle**
- **PBS62 – HVAC systems - 20 000 m**
- **PBS44 – Cable trays installation – 80 000 m**
- **Supports for all system : 850 000 kg**
- **PBS43 – Distribution boards and Load Center**
- **Handling system**
- **Backfilling and infilling for our openings**

2. How we work

Our site Progress

TSI 1 : 80 %

- **B74 : 100 % finished since end of 2024**
- **B11 : Overall progress 70 % (B1and L1 finished)**

TSI 2 : 5 % started mid 2024

Decision have been taken during the past years to the benefit of the project :

- **Novation to have one organization for the tokamak installation works**
- **A construction managers meeting each Friday to manage the coordination issues with contractors' attendees**
- **Integrated team to manage the contracts : People are all on site and work closely together to manage, anticipate the issues**

Our site Progress

An industrial organization have been put in place by EQUANS to be able to face the schedule issues :

- Some main specialized subcontractors to be able to have adequate workforce
- Internal workforces to adapt the teams to the workload
- Weekly workload management with the client objectives

Contract management by anticipation – To warn in time and the earliest possible all the blocking points – To face them in order to ease the work but also to prevent from impacts (delay and costs)
"Early Warning" process

What could be better

- More accurate dates and reliable schedules for the daily, weekly coordination
- Better reactivity for IO services – Anticipation and availability on the day-to-day services

3. Opportunities

And tomorrow

Improve the partnership for other activities to be able to keep the workforces on site

To have enough workload for all workers and for the management to keep skilled and trained people in the project

IBF/25
INTERNATIONAL ITER BUSINESS FORUM

THANKS

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

PLATINIUM SPONSOR SILVER SPONSOR SILVER SPONSOR BRONZE SPONSOR

IBF/25

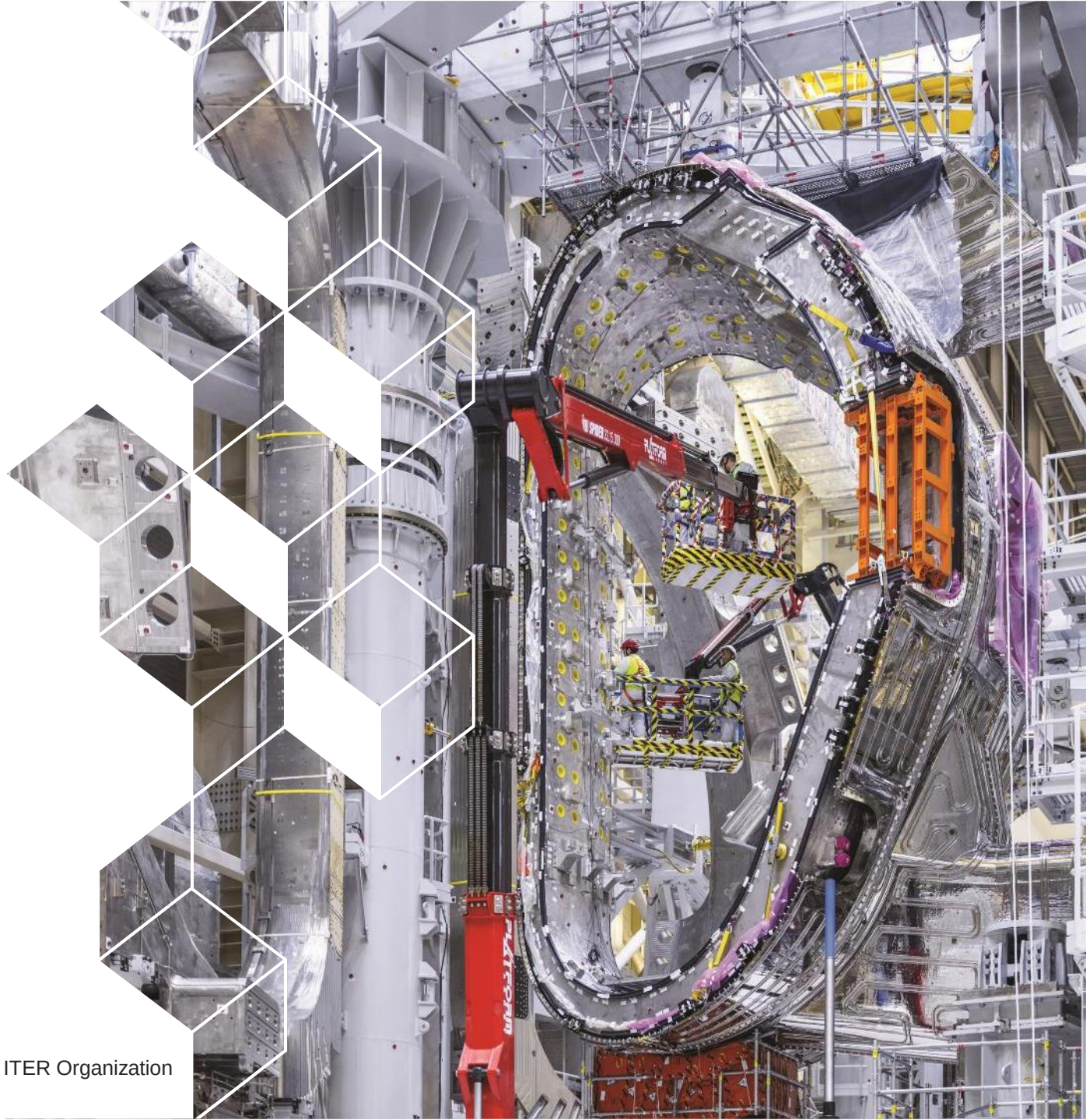
INTERNATIONAL ITER BUSINESS FORUM

FINCANTIERI CONSORTIUM

TB13 scarl · B3 scarl · TCC1 scarl · TB21 scarl · BUSBAR4F

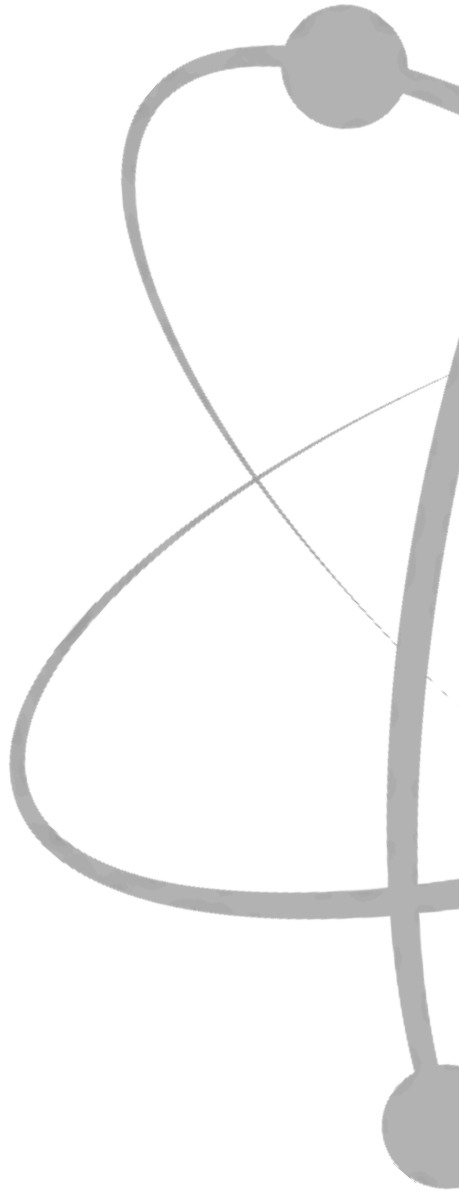
Return of experience

Vincenzo D'Ingianti
Projects Director



FRIDAY APRIL 25th

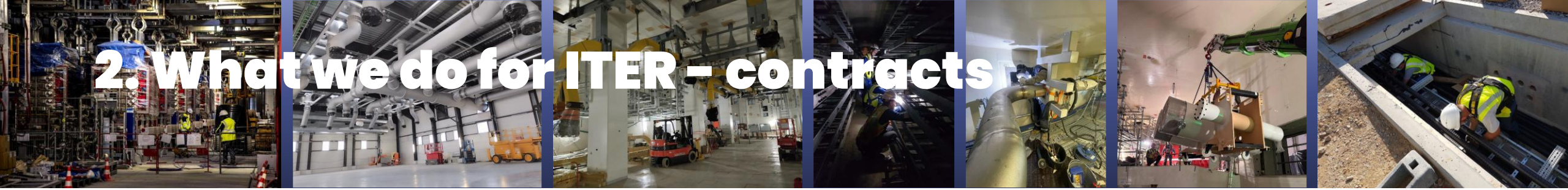
Index



1. Who we are

We are a group of European companies leaded by Fincantieri, that operate on several contracts with IO and F4E giving our contribution to the construction of this impressive and challenging plant. Our partners:

Strengthened, case by case, by leading engineering firms such as:



2. What we do for ITER – contracts

2018 2019 2020 2021 2022 2023 2024 2025 .....

BOP5 – Installation of DC busbar, Fast Discharge Resistors .....

BOP6 – Installation of AC/DC converters, reactors, filters .....

TCC1 – Process piping, heavy structures, E&I works

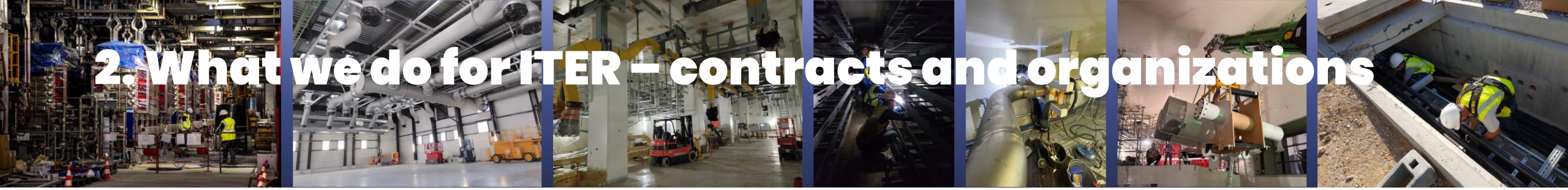
Temporary HVAC for WS1 .....

BOP3 – Piping, E&I works

TB13 – HVAC system for emergency buildings

TB21 – Lot 2: FWC mechanical (MED+PF+supply)

Several minor contracts such as: Lintels, Common supports, Shielding corners, PIC LAC etc...



2. What we do for ITER – contracts and organizations

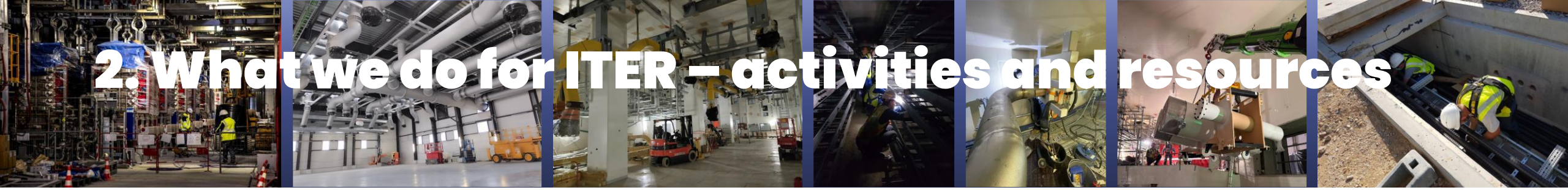
iter
china eu india japan korea russia usa

Overall progress (on the instructed works)**: ~70%**

FUSION FOR ENERGY

BUSBAR 4F	BOP 6 scarl	4 TCC1 scarl	TAC-HVAC	4 B3 scarl	4 TB13 scarl	4 TB21 scarl
A Fincantieri and PPA company	A Fincantieri Group company	A Fincantieri, Delta-ti and Comes company	Temporary HVAC	A Fincantieri and Cestarorossi company	A Fincantieri, Delta-ti and Cestarorossi company	A Fincantieri, Cestaro Rossi, Comes, Delta-TI and PPA company
FINCANTIERI FINCANTIERI SI evolving integration PPA CONTROLL PPA ENERGO	FINCANTIERI FINCANTIERI SI evolving integration + saet Padova ENERGY SOLUTIONS delivered	FINCANTIERI FINCANTIERI SI evolving integration Comes IndustrialConstructionPartner delta-ti impianti SpA	FINCANTIERI SI evolving integration CESTAROROSSI delivered	FINCANTIERI FINCANTIERI SI evolving integration CESTAROROSSI	FINCANTIERI SI evolving integration delta-ti impianti SpA CESTAROROSSI	FINCANTIERI CESTAROROSSI delta-ti impianti SpA PPA ENERGO Comes IndustrialConstructionPartner
D	D	D	C	D	C	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

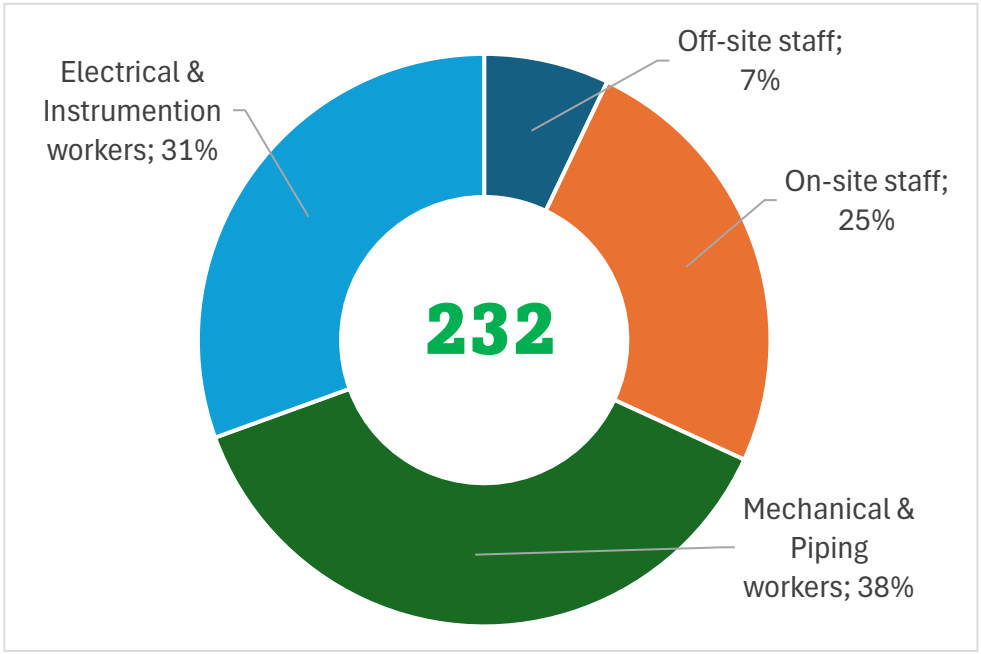


2. What we do for ITER – activities and resources

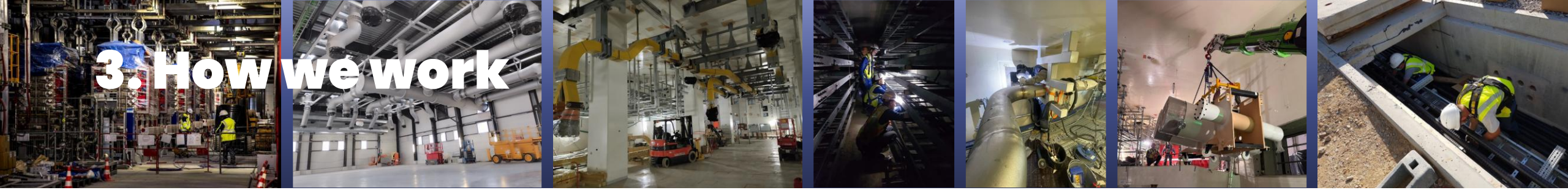
ACTIVITIES

	Equipment	Piping	Platforms	Supports	E & I
Field engineering	✓	✓	✓	✓	✓
Procurement (PARTIAL)	✓	✓	✓	✓	✓
Pre-fabrication	N/A	✓	✓	✓	N/A
Coating	N/A	✓	✓	✓	N/A
Handling	✓	✓	✓	✓	✓
Installation	✓	✓	✓	✓	N/A
Cable ways	N/A	N/A	N/A	N/A	✓
Cable pulling	N/A	N/A	N/A	N/A	✓
Cable termination	N/A	N/A	N/A	N/A	✓
Instruments installation	N/A	N/A	N/A	N/A	✓

RESOURCES



3. How we work

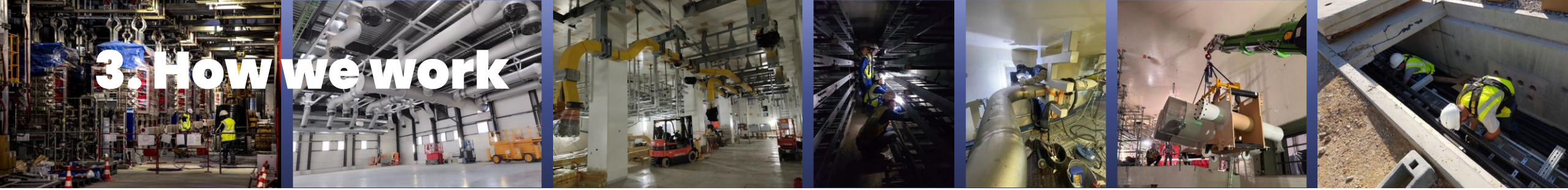


SHARE of RESPONSABILITIES

	IO	Contractor
Construction engineering	✓	
Supply of main equipment	✓	
Supply of components	✓	
Supply of raw material	✓	✓
Bulk material and consumables		✓
Surveillance	✓	
Coordination	✓	
Pre-fabrication	✓	✓
Delivery at site	✓	✓
Field engineering		✓
Construction management		✓
Installation		✓
NDT and testing		✓

MAIN CONTRACTUAL TERMS (typical)

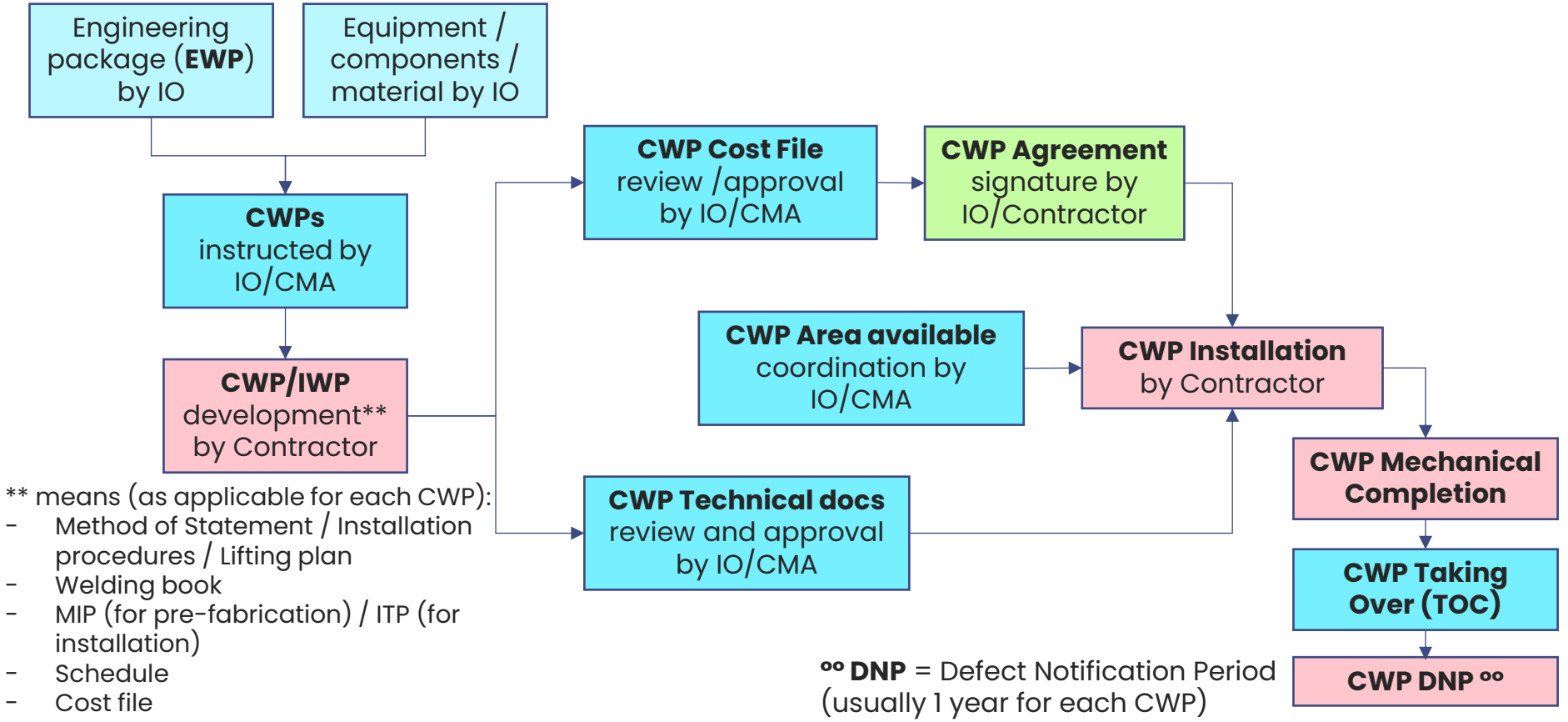
Basis of Contracts	FIDIC
Type of Contract	Lump-Sum (LS) and/or LS + remeasurable
Indirects	% time related % progress related
Perfomance guarantee	To be provided by the Contractor
Advance Payment guarantee	To be provided by the Contractor
Insurances	To be provided by the Contractor
Nuclear Operator	ITER Organization
Nuclear Liability	ITER Organization
Progress accounting	Monthly
Retention	Yes (typical 5%)
Delay damages	Yes (typical 0,1% of each CWP */ day)
Dispute resolution	DAB (Dispute Arbitration Board)
Assignment of the Works	through Construction Work Packages (CWPs)



3. How we work

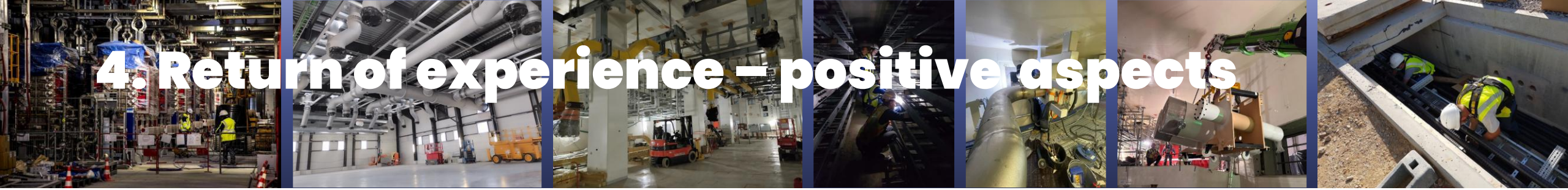
CWP (Construction Work Package) approach

A **CWP** is a construction deliverable that includes all information necessary to instruct the Contractor to proceed with detailed planning and preparations and produce one or more Installation Work Package(s)- **IWP** for the scope.



** means (as applicable for each CWP):
- Method of Statement / Installation procedures / Lifting plan
- Welding book
- MIP (for pre-fabrication) / ITP (for installation)
- Schedule
- Cost file

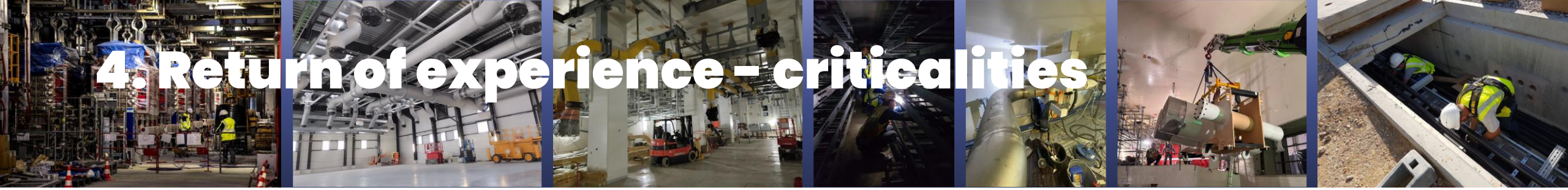
°° **DNP** = Defect Notification Period (usually 1 year for each CWP)



4. Return of experience – positive aspects

In over 6 years of continuous activity on various contracts in the ITER context we have been able to appreciate many positive aspects but also some critical issues on which we, contractors, have to pay the utmost care and attention (always keeping in mind that ITER is the world's most challenging construction project, a FOAK (First-of-a-kind) research center). **Positive aspects:**

- Employer and its consultants adequately structured, competent and fair.
- Great collaboration with contractors considered as industrial partners. Low conflict.
- Advanced construction techniques combined with very stringent requirements, for example in terms of tolerances, foster the professional growth of the teams involved.
- The multiple and continuous opportunities offered by the ITER project offers continuity in the medium/long term.
- Invoicing and payments terms and conditions allow for neutral cash flow.



4. Return of experience – criticalities

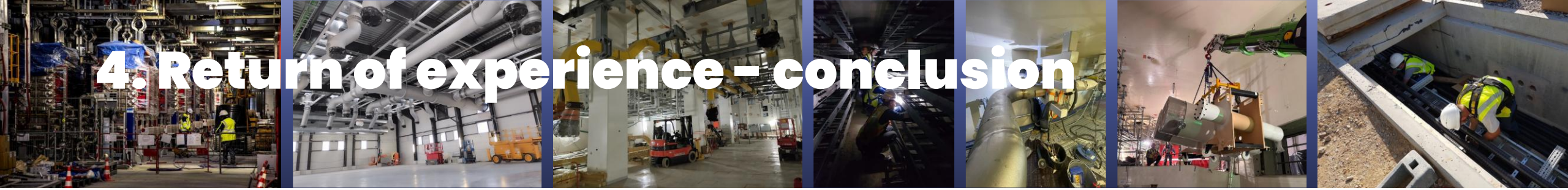
Fragmentation due to coactivity / interferences / too many CWPs also of small value.

Technical requirements often too stringent, even if not strictly necessary.

ITER project is organized into systems and subsystems managed by dedicated structures named PBS. Each PBS operates as an autonomous entity with its own requirements and reference standards (EN, ASME ecc.).

Design maturity sometime not suitable for construction, generating many changes in progress.

Although quality is organized into 4 levels (from QC-1 to QC-4), in practical application there is a tendency to standardize everything at the highest level.



4. Return of experience – conclusion

To get the most benefit by **mitigating the risks** arising from the criticalities above, experience teaches us that, on the Contractor side, a multi-skills organization is needed that can ensure:

- experience and competence;
- flexibility;
- adaptability;
- reactivity;
- creativity;
- short decision-making chain.

Thanks to our previous experiences in different research centres (CERN, Euratom, CIRA etc.), we realized since the beginning that the best organizational model could consist in aggregate several companies with different but complementary experiences and skills, all joint in a single operational entity, a **Project Company**.

After 6 years, with several projects completed and several more underway, we can confirm that it was the right choice.

IBF/25
INTERNATIONAL ITER BUSINESS FORUM

THANKS

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

PLATINIUM SPONSOR | SILVER SPONSOR | SILVER SPONSOR | BRONZE SPONSOR