ITER Core Machine Assembly Progress

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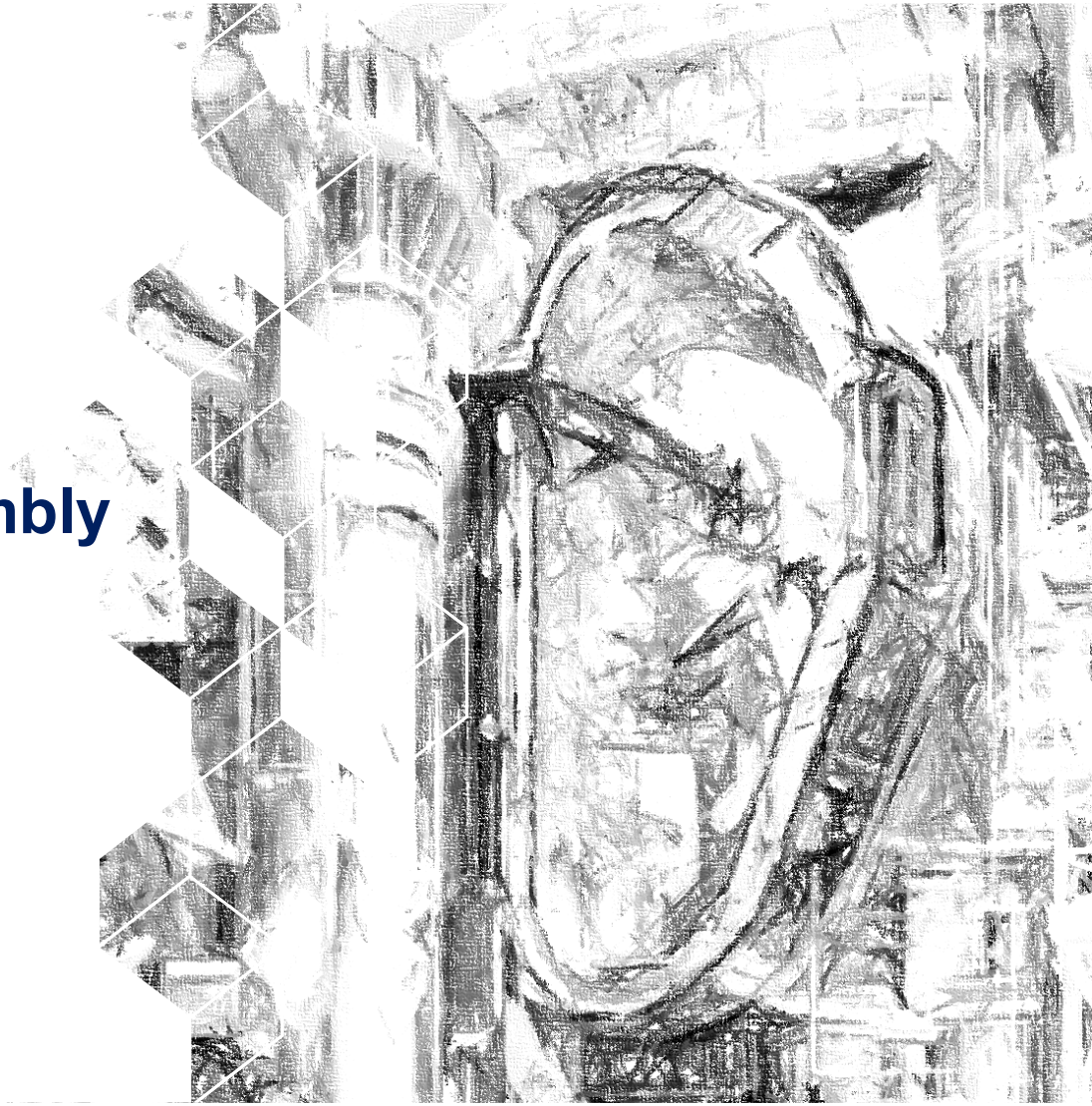
Disclaimer: The views and opinions expressed herein do not necessarily reflect those of the ITER Organization

Outline

1. The ITER Machine - Progress to Date
2. Challenges & Opportunities during Assembly
3. Collaboration in Partnership



1. The ITER Machine

Progress to Date

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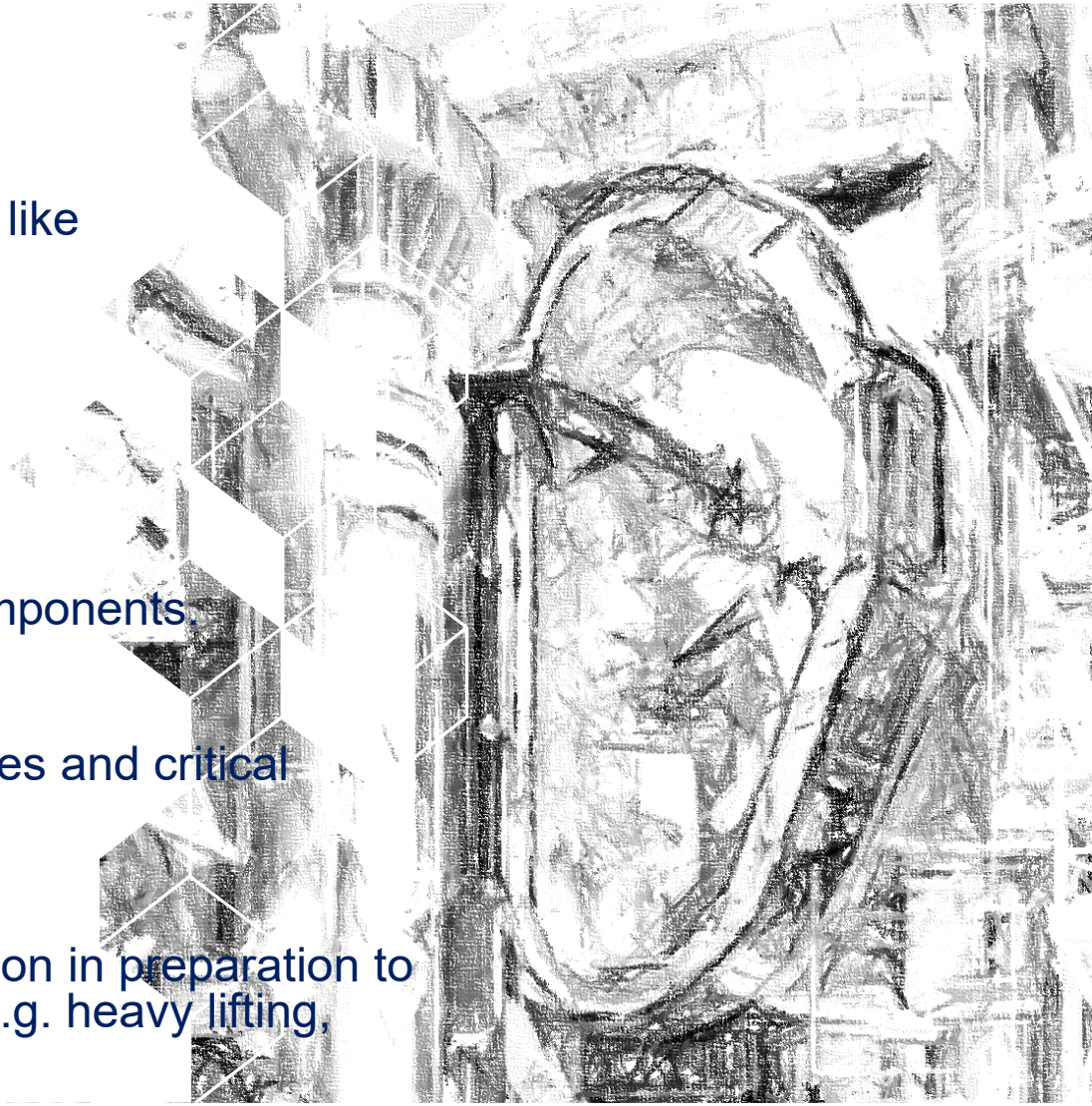
Progress to Date

Installation works started in **2019** with Machine core components like

- Cryostat Base,
- Poloidal Field Coils,
- Lower Cryostat Thermal Shield elements,
- Toroidal Field coils gravity supports,
- Bottom Correction Coils and many other important captive components.

In parallel Magnet (supply) Feeders have been installed in galleries and critical superconducting busbar connections are made.

Valuable experiences has been built in relation to work organization in preparation to the movements of components with physical installation works (e.g. heavy lifting, instrumentation).



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Progress to Date

[Tokamak Pit, top-down view]

The Cryostat Base, ~30 metres in diameter, was positioned with a final tolerance under 3 mm at all metrology points.

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Progress to Date

The docking of a spaceship – the Cryostat base is being lowered into the Tokamak pit.

May 2020

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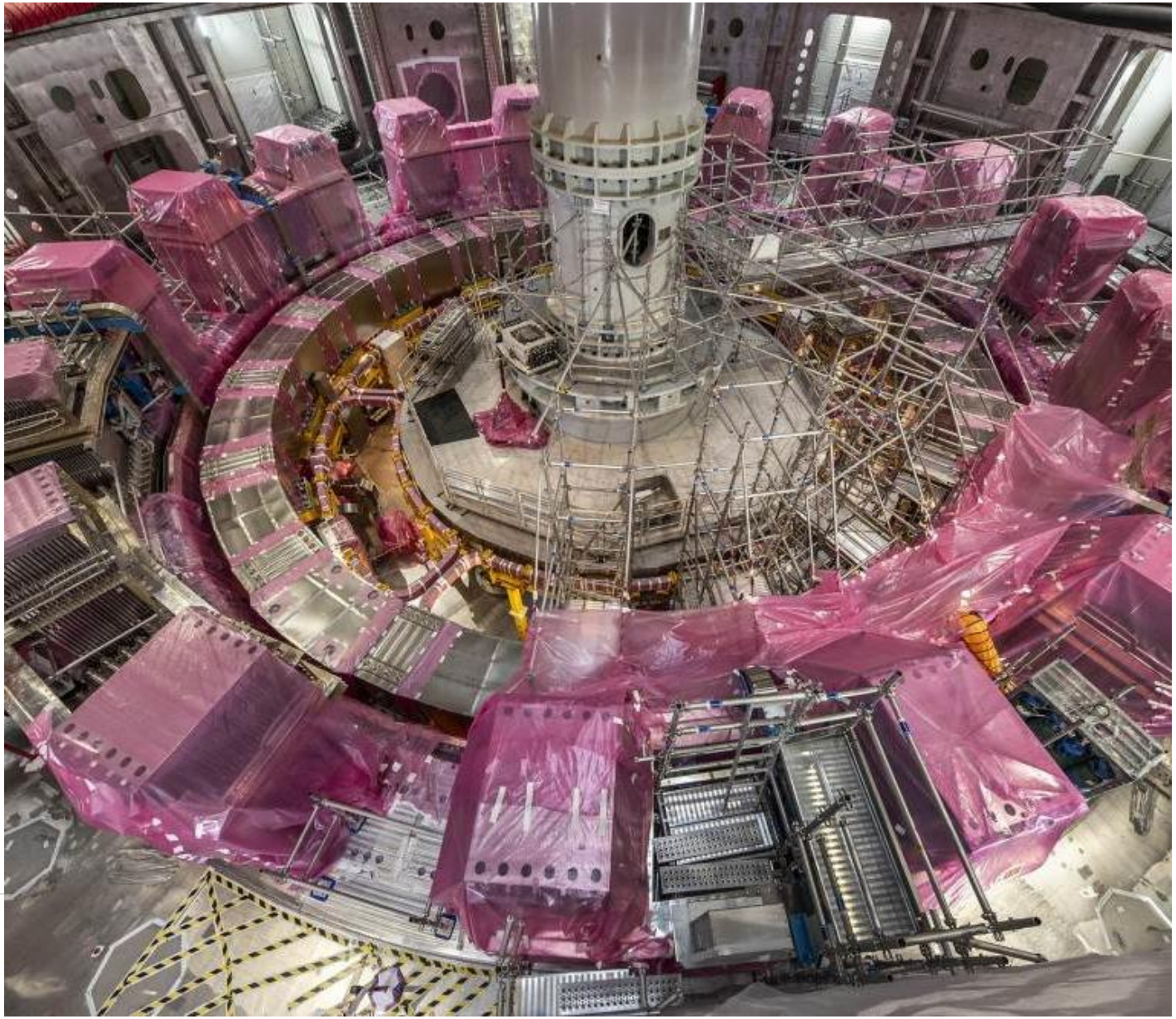
Progress to Date

Preparation of Pit prior to Vacuum Vessel Sector Landing

November 2021



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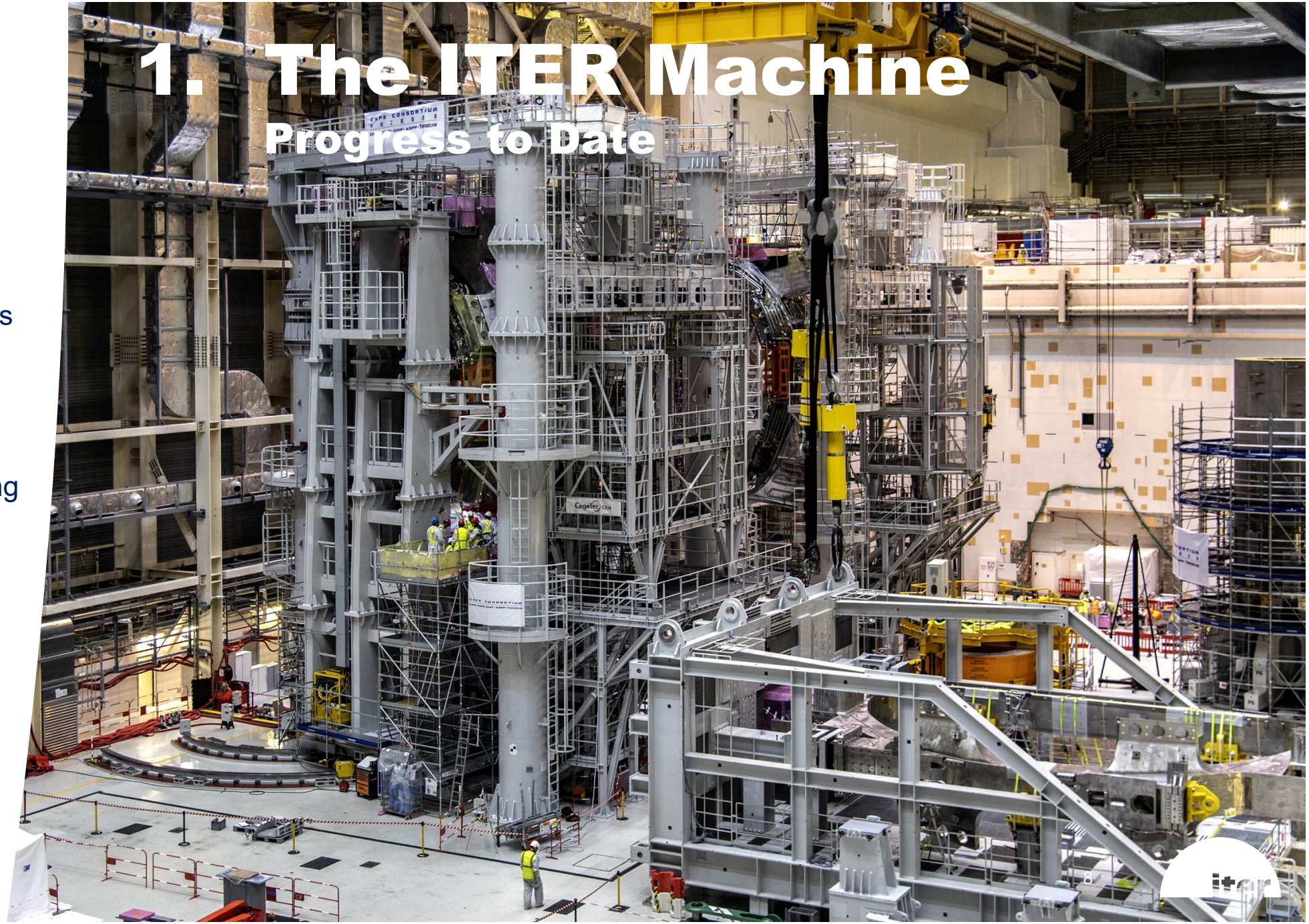
Progress to Date

Sector Module Assembly restarted after repair of Vacuum Vessel bevels and Thermal Shield components in September 2024

Two Sector Sub-Assembly Tools (SSAT) in use allowing for parallel preparation

January 2025



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Progress to Date

Declaration of first Sector Readiness- end –March 2025

Sector Module #7: Assembled in Record Time

In just 6 months and 10 days, teams at ITER assembled a massive 440-tonne vacuum vessel, two 330-tonne toroidal field coils, and thermal shields into Sector Module #7—a key “building block” of the ITER machine.

1. The ITER Machine

Progress to Date

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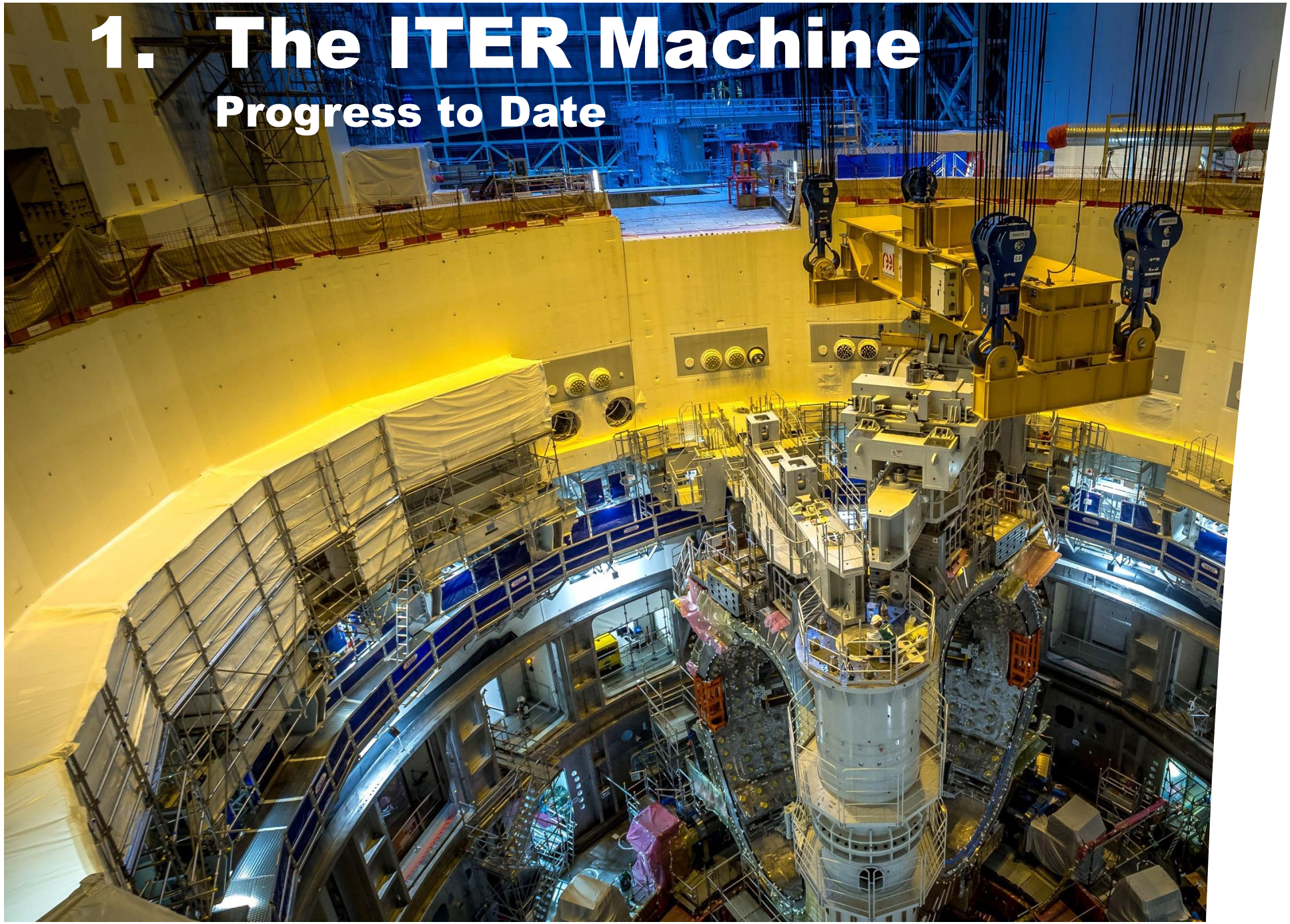

Currently two modules positioned in pit

18th June 2025

Forecast up to end this year:

3rd Module lift foreseen in November

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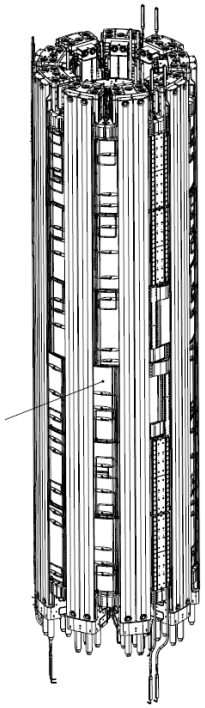
Challenges and Opportunities during Assembly

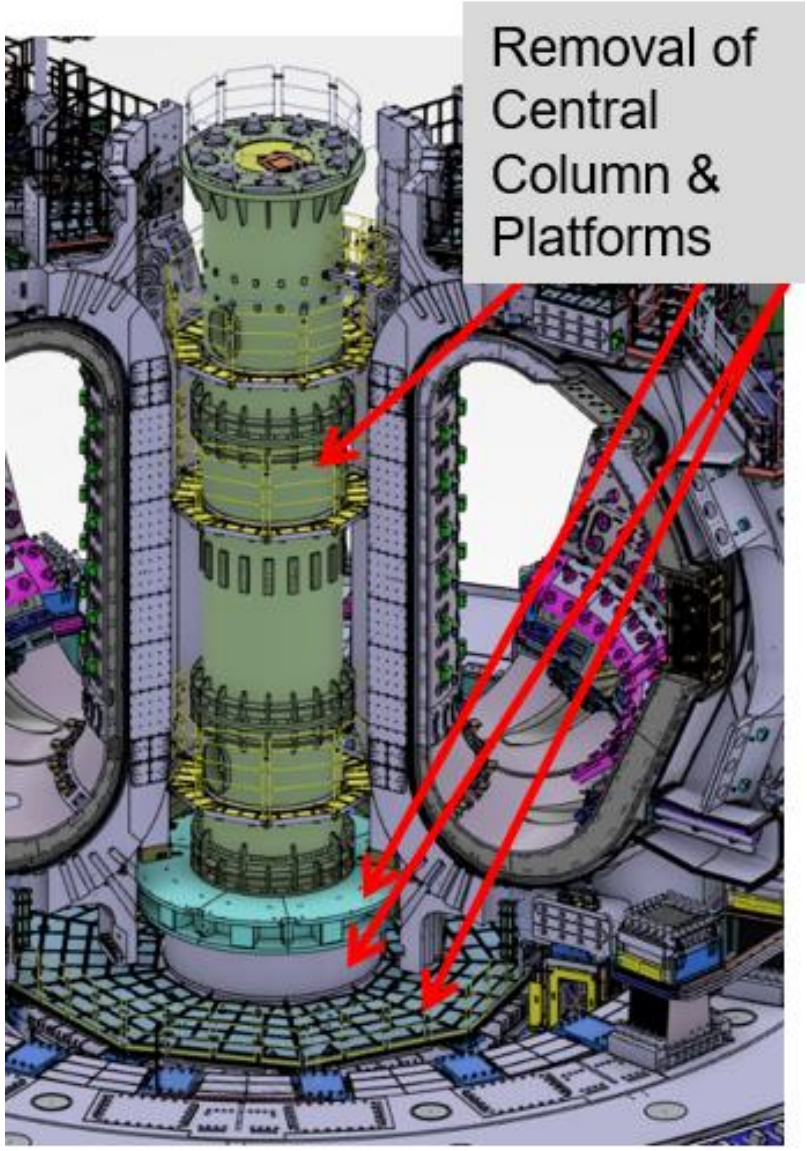
2. The ITER Machine

Challenges during Assembly - Tight Gaps



Central Solenoid Stacking & Connections

Extremely limited clearance between components few millimeters left while handling major components (e.g on CS coil: ~12m height and 18 mm gap in radius)



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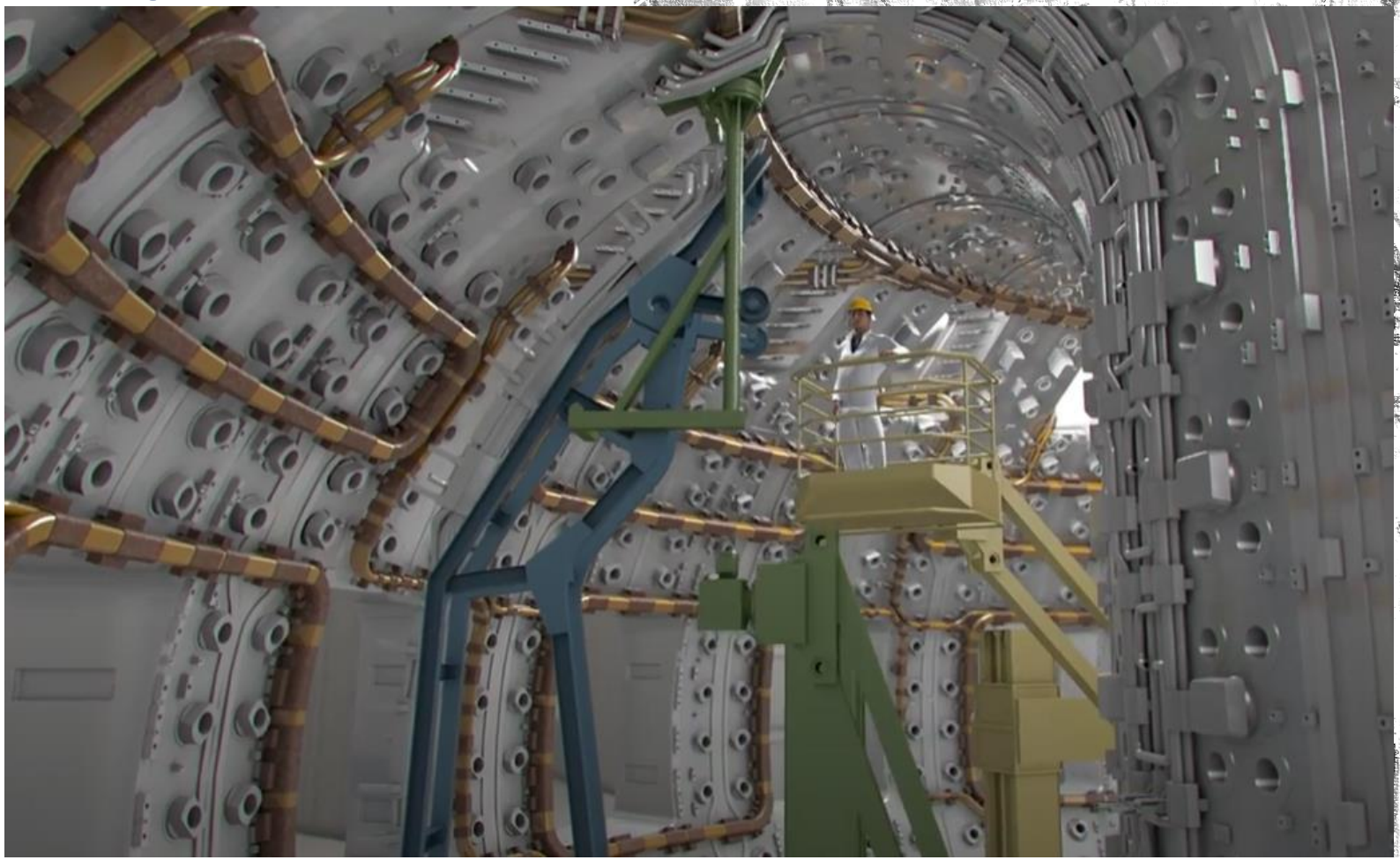
Challenges during Assembly- Specific Tools

Consequent & parallel Preparation of coming Assembly Processes

- Development of **assembly tools and technologies** (e.g port and bellows welding, in-vessel installation tools)
- Pre-qualification of processes and workers before execution in the field
- Upfront **technical risk assessment with development of plan B**
- Smoothen flows of materials, works execution, information, and documentation



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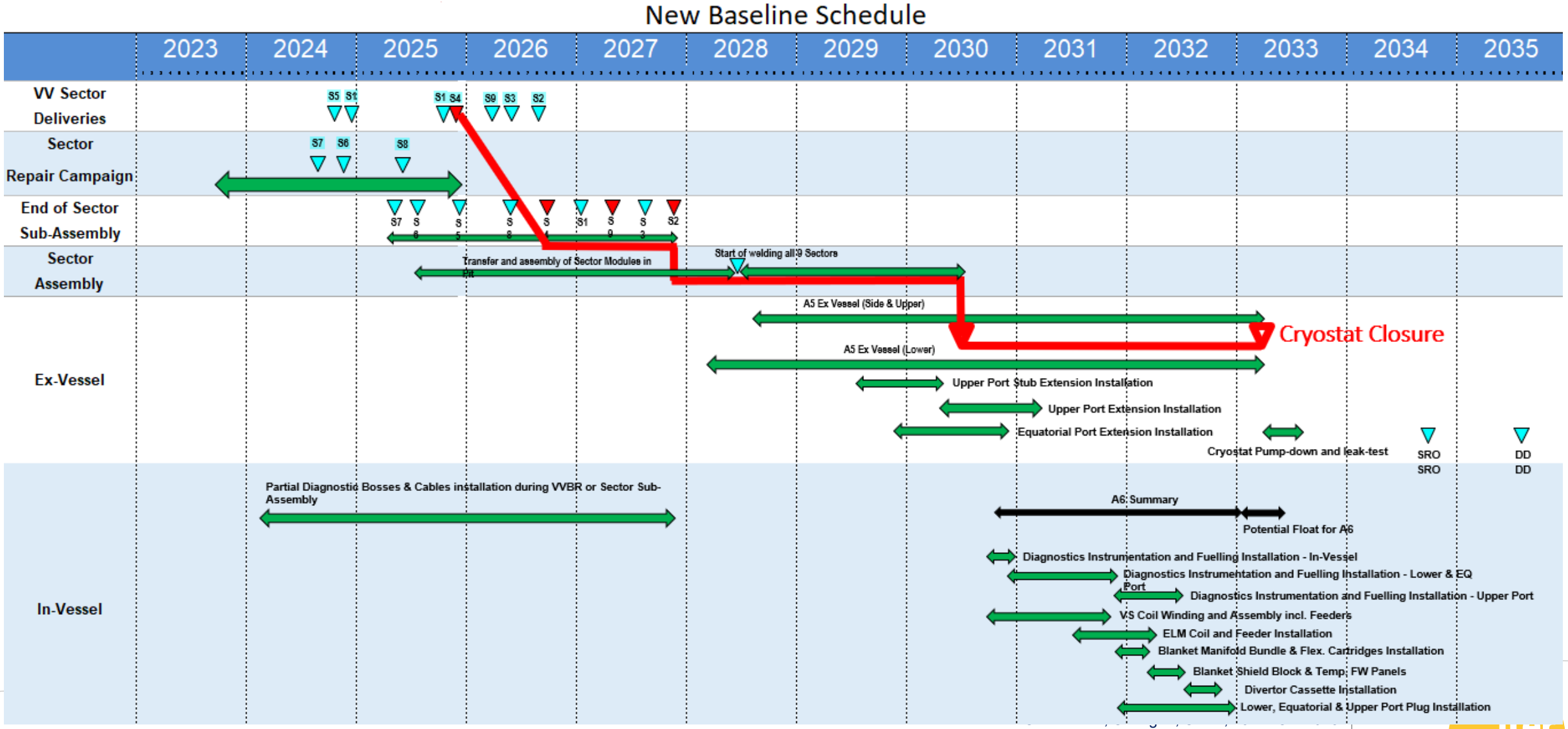
Challenges during Assembly - Timeline to Completion Schedule



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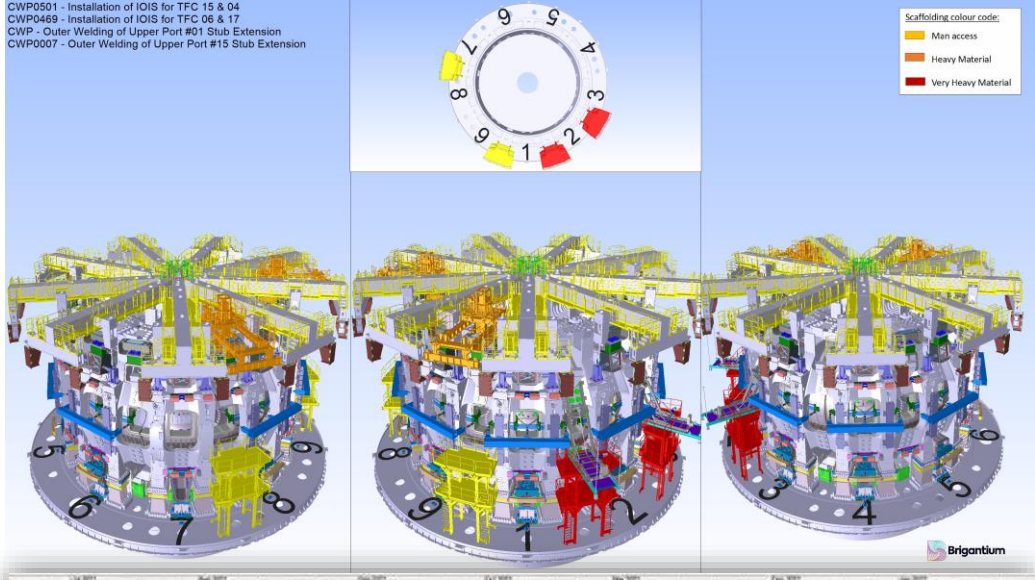
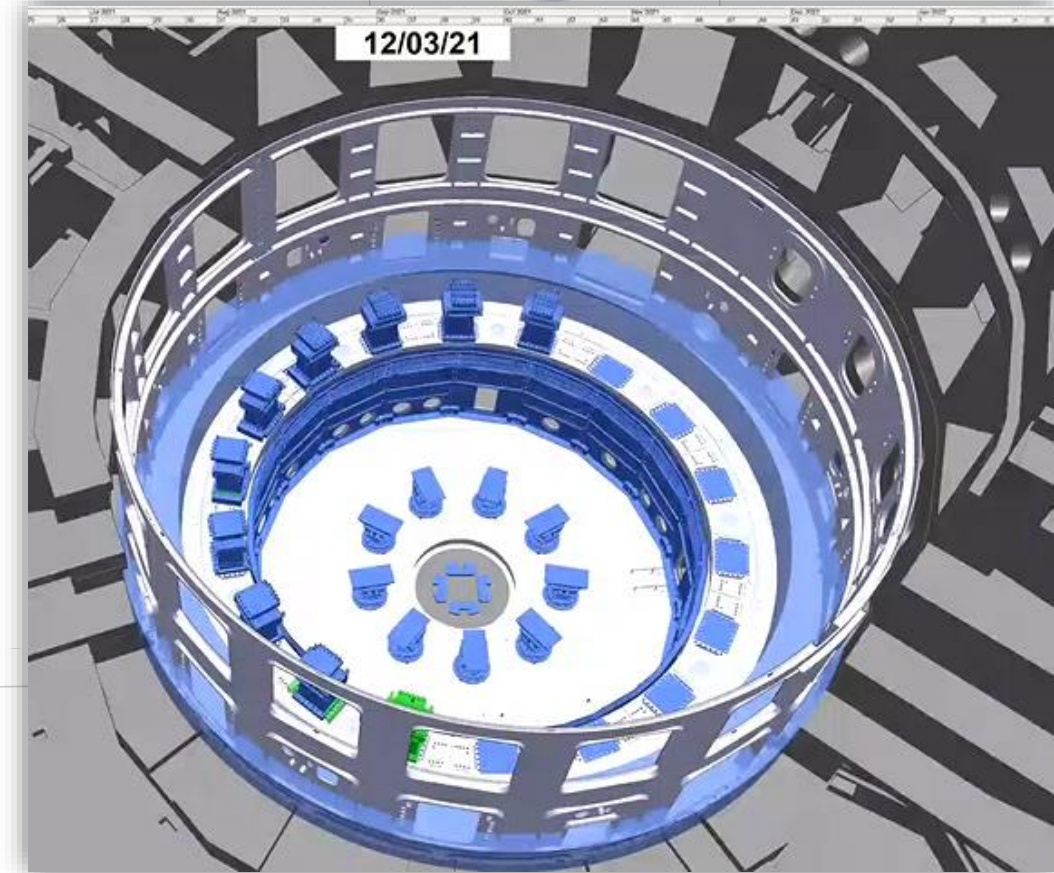
Solutions - Opportunities

Schedule management

- Continual review and adjustment of long-, mid- and short-term schedules, trickled down to operational level.
  - Long-term: 5-8 years > identify opportunities that may require long-lead actions (e.g. tooling redesign),
  - Mid-term: 6months-1 year > sequence adjustments to level resources, detailed review of durations,
  - Short-term: 3months down to 3 weeks > operational coordination schedule, booking of services, distribution to all stakeholders.

- Use of 4D planning to validate long- and mid-term schedules





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Solutions - Opportunities

Use Opportunities

- 2 Upending Tools (UTs) to accelerate and to give opportunities to carry out preparation activities in parallel with assembly

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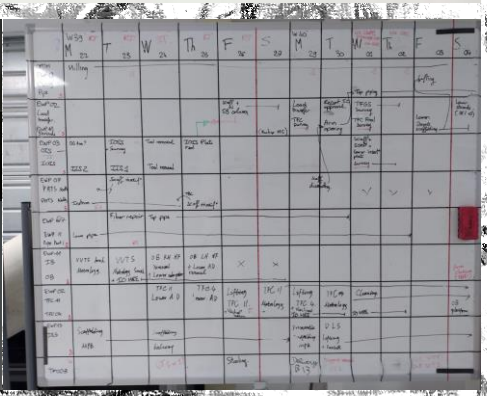
Solutions - Opportunities

Worksite Organization

- Strong coordination of onsite activities with multiple stakeholders aligned
- Rapid turnaround to address field issues
- Process improvement, especially for repetitive activities, with minimized paperwork
- Implementation of 3-shift scheme
- SQEP – definition of required upfront training on IO tools (lifting, rigging, welding, NDT, logistics, machining, instrumentation installation)



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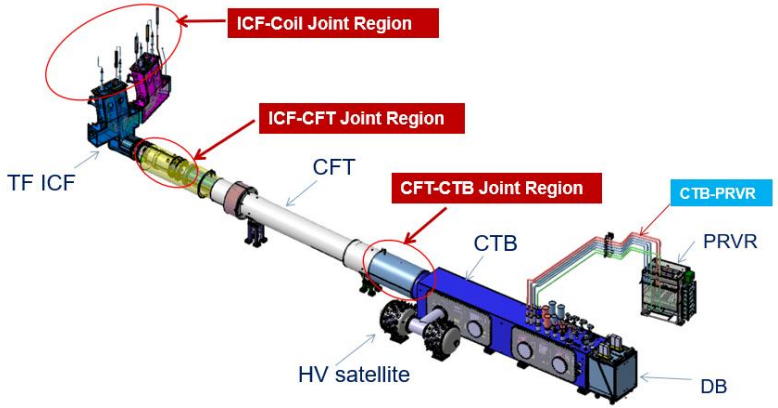
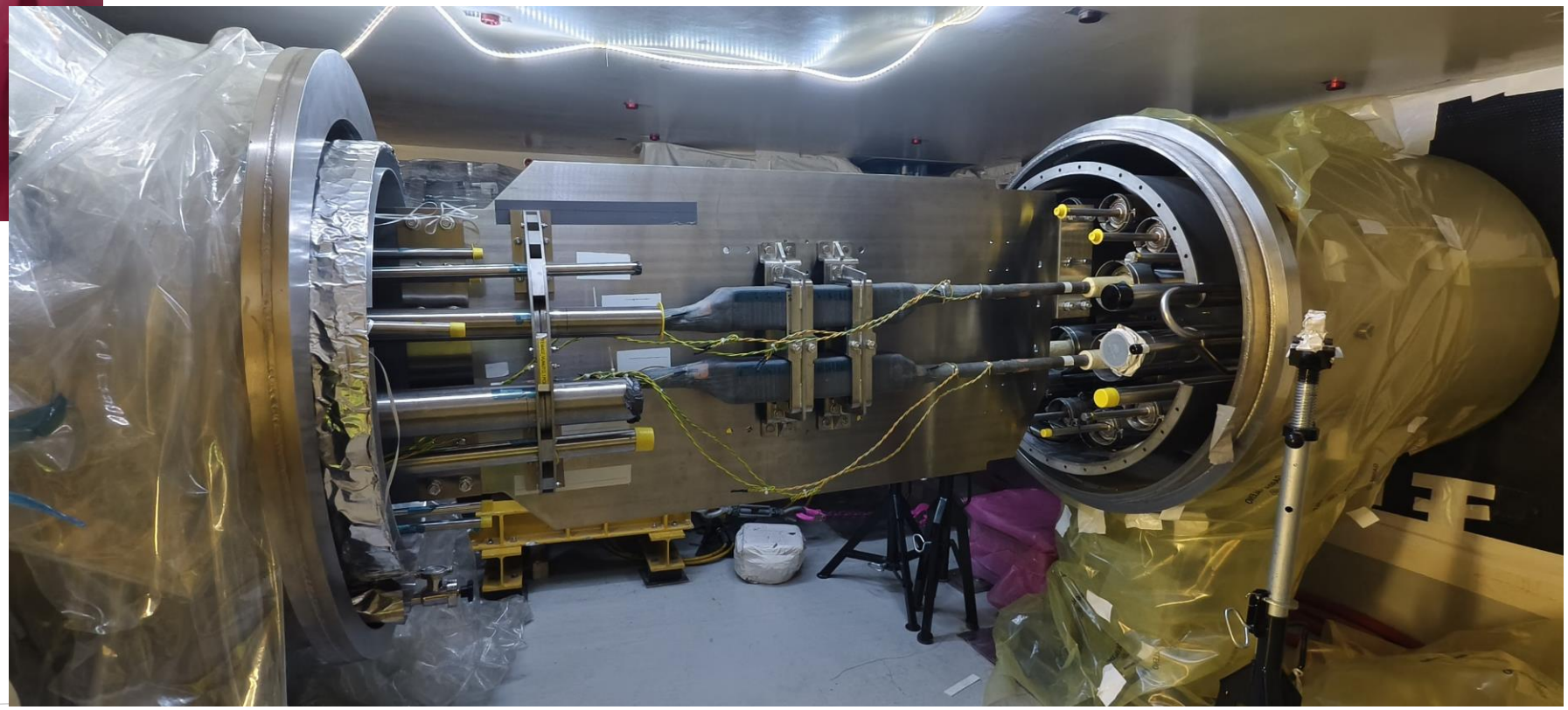
Challenges during Assembly - Special Processes





Superconducting Connection Joints between Magnet Feeders and Coils as a specific process with insulation, and high voltage instrumentation, cryogenic supply lines, HV and cryogenic testing

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Challenges during Assembly - Special Processes

- IO/CNPE-C Qualification team
- Off-site full-scale mock-up
- Reproducing conditions of physical constraints to be expected on site

3. The ITER Machine

Collaboration in Partnership

Partnership: one team, one goal !

- Cross-cultural collaboration
- Problem-solving mindset

  >> Put problems on the table, find solutions together
- Agree target dates upfront with long-term look-ahead approach
- Coordinate with the contractor on daily/weekly basis to make it happen
- Long-lasting partnership based on trust, reciprocal support, and common pride in achieving challenging results.


Thank you!