THE ITER PROJECT

IT / ITSO / SDCC Status

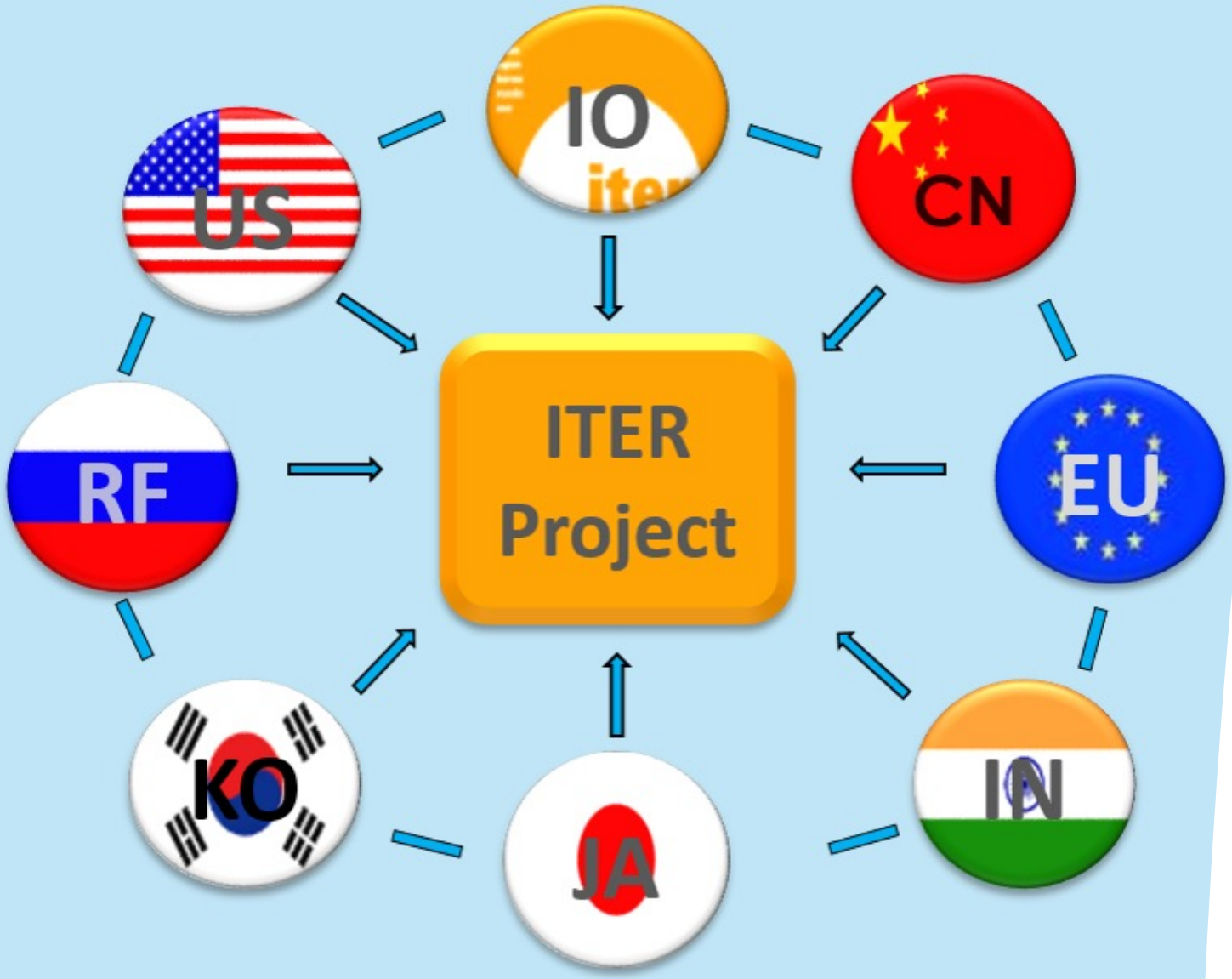
Peter Kroul *– Computing Center Officer*

iter

china eu india japan korea russia usa

A GENERATIONAL CHALLENGE

United in a common cause: to transform our energy legacy.



AN INTEGRATED PROJECT

ITER Organization and Domestic Agencies

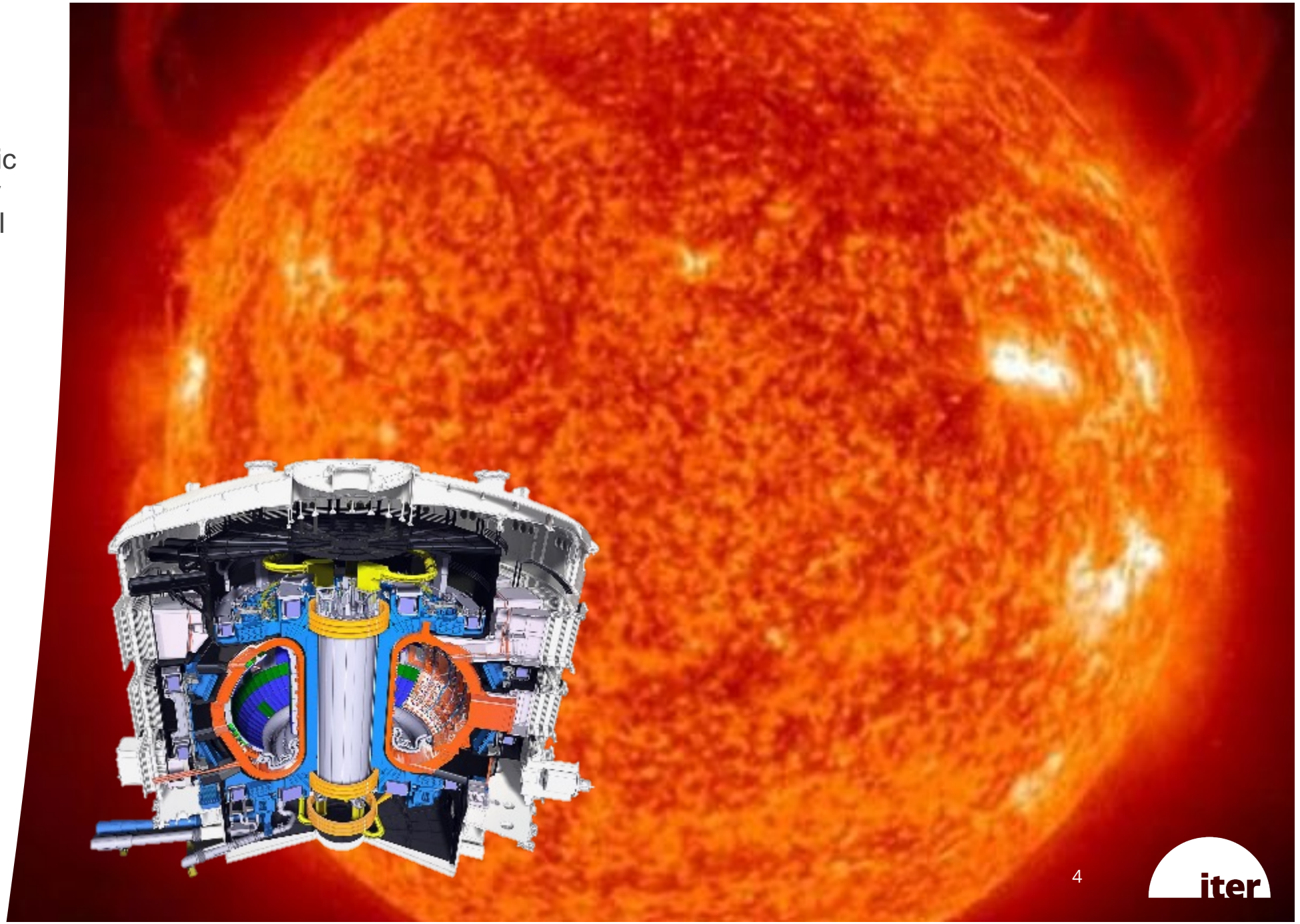
- Members contribute “in-kind” (80-90%)
- Domestic Agencies procure these in-kind contributions
- Europe, as host, contributes ~45%
- Non-EU members contribute ~9% each

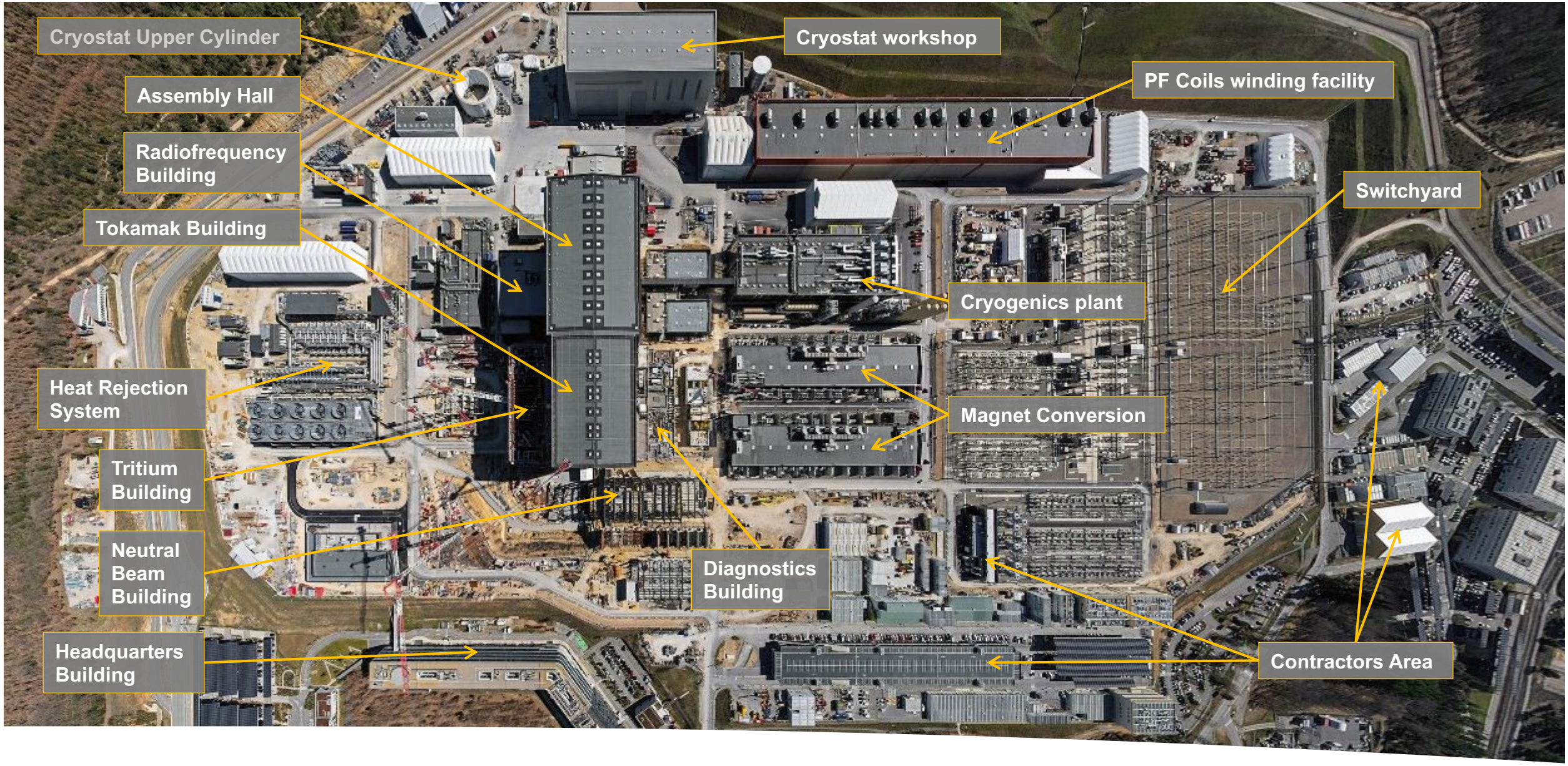
THE ITER MISSION

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

To create a controlled “burning” plasma

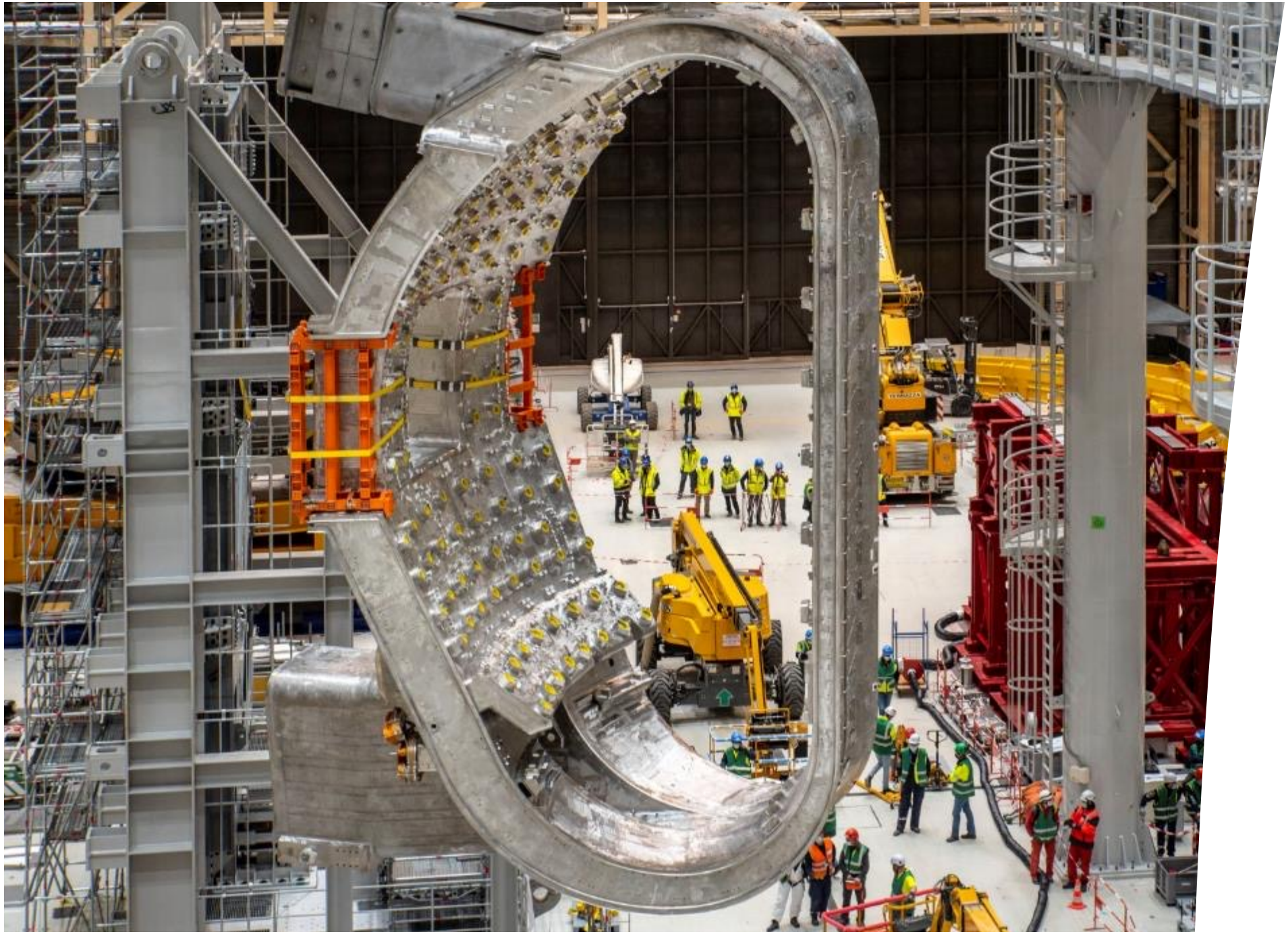
To achieve Q ≥ 10





WORKSITE CONSTRUCTION

Aerial perspective, March 2023



FIRST SECTOR SUBASSEMBLY

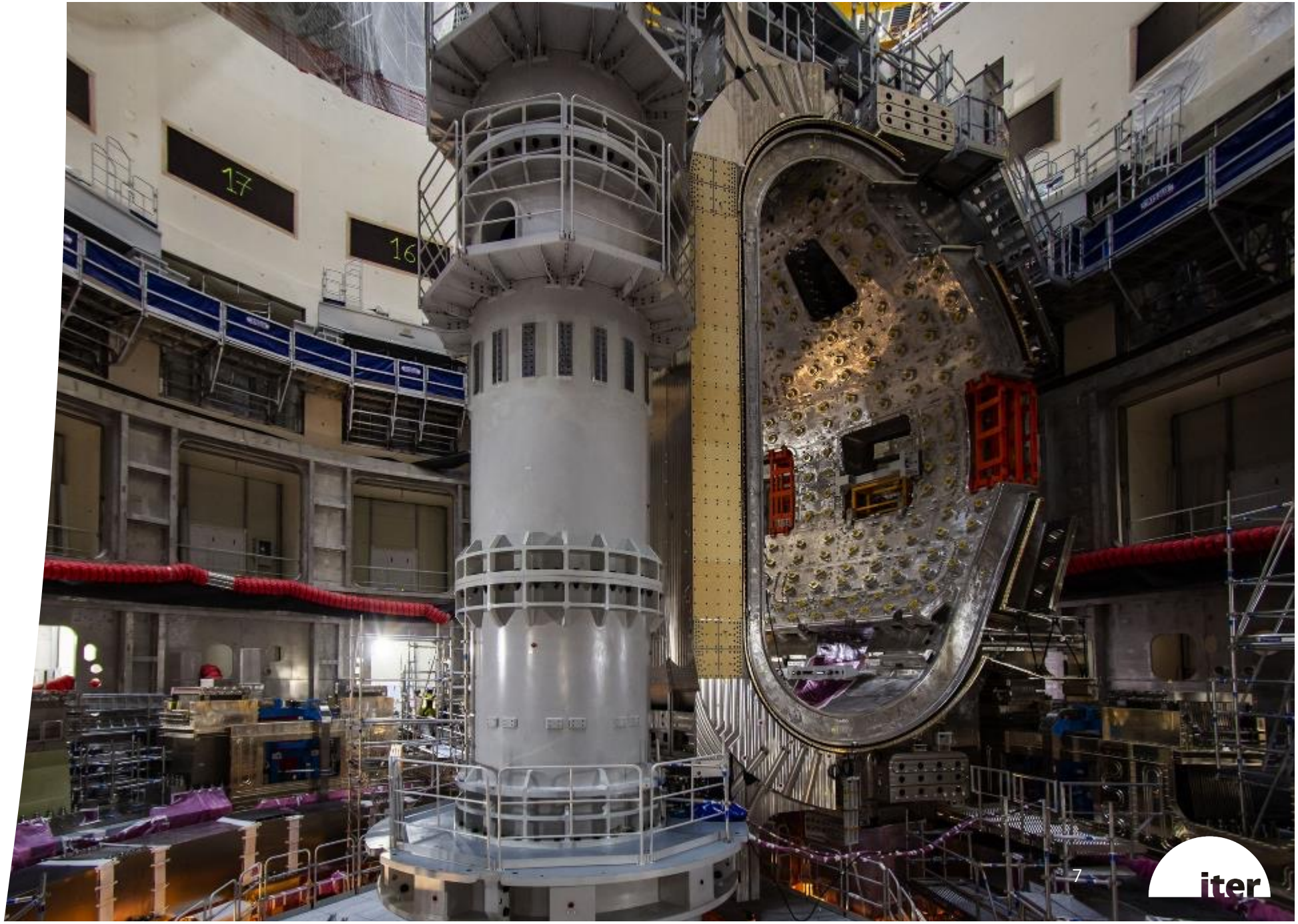
Vacuum Vessel Sector 6 placed on the Sector Sub-Assembly Tool

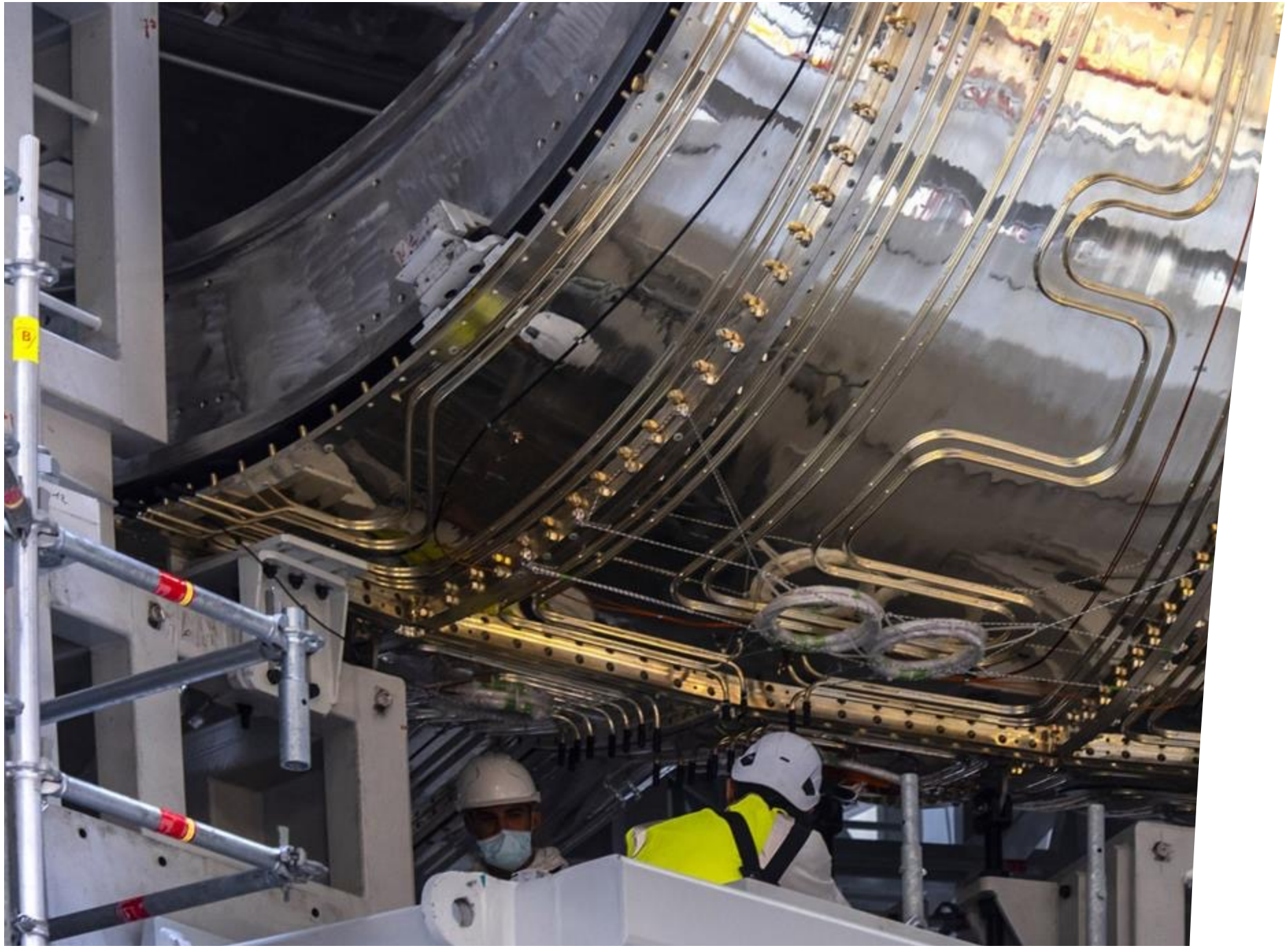
May-June 2021

ASSEMBLING THE MACHINE

First complete Vacuum Vessel Sector Module installation

May 2022





CHALLENGES OF FIRST-OF-A-KIND COMPONENTS

Leakage identified in thermal shield cooling piping due to chloride stress corrosion.

Repair strategy defined. Accelerated procedure underway to select specialize subcontractors for the repairs.

CHALLENGES OF FIRST-OF-A-KIND COMPONENTS

Geometric non-conformities found in Vacuum Vessel sector field joints.

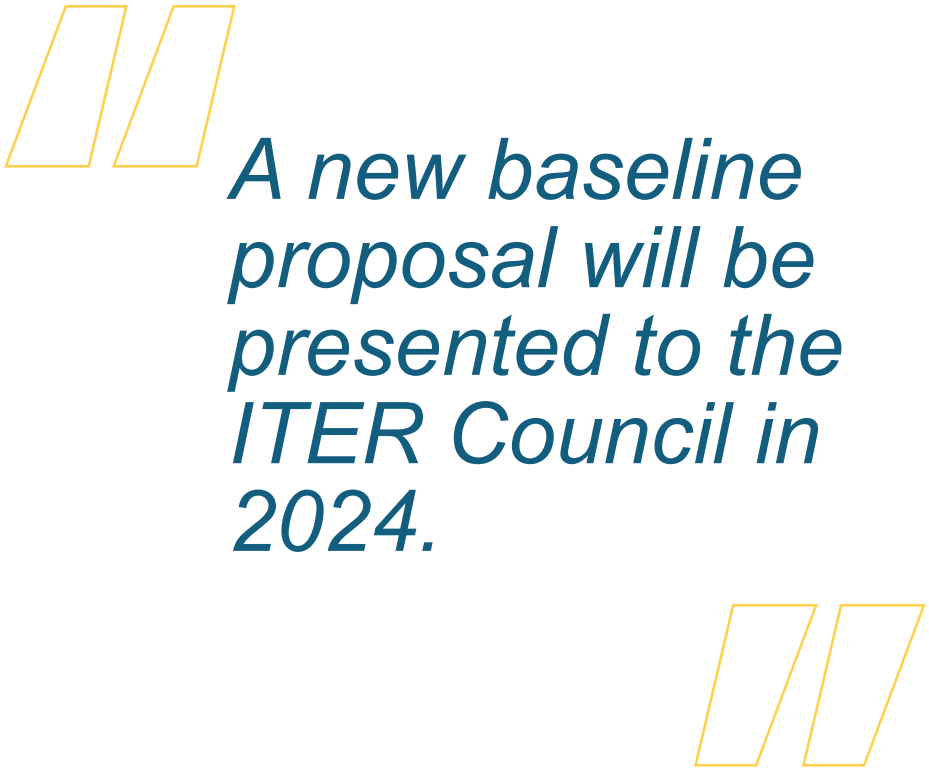
Repair strategy defined. Accelerated procedure underway to select specialize subcontractors for the repairs.

ADDRESSING CHALLENGES

The current ITER cost and schedule “baseline” was set in 2016. Given recent challenges, a review of the baseline is underway, and a new baseline proposal will be presented to the ITER Council in 2024.

Key challenges and considerations include:

- Known delays created by the Covid-19 pandemic and First-of-a-Kind technical challenges.
- Repairs to the Vacuum Vessel sectors and Thermal Shield cooling pipes, as described earlier.
- Ensuring mutual alignment with ASN, the French nuclear safety regulator, on any concerns.
- Ensuring a strong quality culture, project-wide.
- Opportunities to offset future risks by further testing of completed components.
- Adjustments to the scope of First Plasma (the first experimental campaign) or machine design elements that could add efficiency while preserving performance goals.



ITER Scientific Data and Computing Center

ITER data output from 100-2200 TB per day

- The ITER Scientific Data & Computing Center will **store, secure, process and distribute** the vast amount of data produced by the project.
- **Total scientific data rate is expected around 30-50+ GB/sec, Total scientific archive capacity 100-2200 TB/day.** Data is expected to be in the **Exabyte scale** around 2035
- Current HPC with 9000 cores and 4.5 PB data onsite and 2 copies offsite in 2 additional external data centers.

The ITER Project Requirements state:

Scientific and plant data must be stored outside of the INB platform

Computing resources for data processing must be provided (but no "supercomputer" planned)

A separate archive must be provided >50 km from the primary storage

SDCC Construction

Works completed:

- ✓ Pouring of the slabs
- ✓ Excavation for gutter
- ✓ reinforcement of the chimney stack
- ✓ Foundation of retaining wall
- ✓ Installation of gutters
- ✓ Installation of retaining wall
- ✓ Pouring of the chimney slab
- ✓ Removal of the air conditioners in the IT room
- ✓ Delivery of the water loop
- ✓ Proposed "clean room" ceiling
- ✓ Adaptation of the "Transformer and Building" switchboards

Works in progress

- ✓ modelling the soil in front of and behind the gutter
- ✓ completion of the retaining wall (water drainage basin)

SDCC Construction

Expected ready for commissioning in mid 2024

Racks to be delivered Q3

Cooling to be finished Q4+

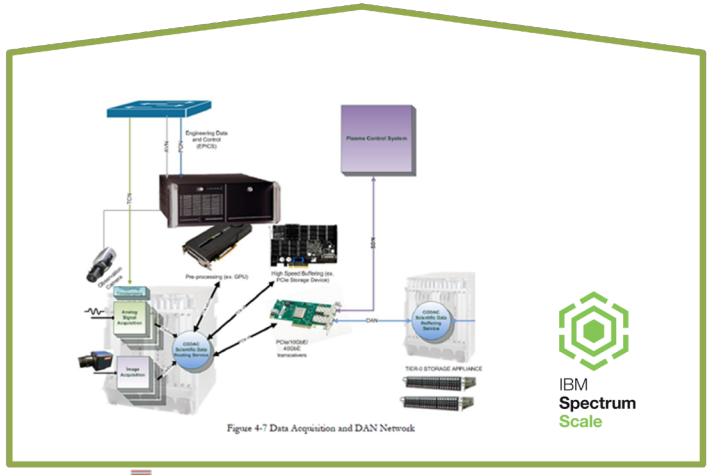
Power installation ongoing

Dual 1 MW power supply – separate transformers, separate generator, mutual cooling and fire protection.

Initially 48 racks with max 22 KW support each.

SDCC will be handled as a clean-room and prepared as such.

ITER SDCC Preliminary Future Design



IBM Spectrum Scale

POZ

4 x 400 Gbit DAN
8 X 10 Gbit SDN
2 x 10 Gbit PON
2 X 10 Gbit FileExchange

ARCHIVERS
ARCHIVERS
UDA SERVERS
NX LOGIN NODES
SDCC STORAGE
IBM Spectrum Scale
SDCC HPC
DATA MOVERS

SDCC

Multiple 10 G
Multiple 10 G
Multiple 10 G
Multiple 10 G
Firewall
Multiple 100 G
Multiple 100 G

SUPERCOMPUTERS
UNIVERISITIES
OTHER RESEARCH
IBM Cloud
amazon web services
Microsoft Azure
DA EU
DA USA
DA KOREA
DA CHINA
Google Cloud
DA JAPAN
DA RUSSIA
DA INDIA
Internet
GÉANT
ESnet ENERGY SCIENCES NETWORK
Multiple 100 G
Multiple 10 G
Multiple 100 G GEANT
Multiple 100 G (Inter)continental

DATA MOVERS
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DATA MOVERS
SDCC REPLICATION BUFFER 3 MONTHS
IBM Spectrum Scale

interxion

IBM Spectrum Protect
Tape

interxion
Long Term Tape Archive

Interxion / Dark Fiber

Currently under installation

Initial link speed at 400 Gbit
Expandable to 3.6+ Tbit

Racks ready at Interxion in MRS 3.

Links expected ready May/June

Equipment expected installed and configured June-August

Expected fully operational Q3 2023

Storage, network and backup/archive tests

Q2 / Q3 IBM ESS replication and copy test from ITER to Marseille.

Q4 Connectivity to GEANT

Q4 First 100 G test via GEANT to ESNET

Q4 eventual 100 G test to AWS via Marseille

All ITER IT backup now on IBM Spectrum Protect in 3 copies. Disk/Disk/Tape