

**Technical Specifications (In-Cash Procurement)****Technical summary for the ITER Cryodistribution system  
installation works including design, manufacturing and  
delivery of maintenance platforms and cable trays**

Technical summary for the pre-qualification of Contractors in view of the Call-for-Tender of  
Cryodistribution system installation



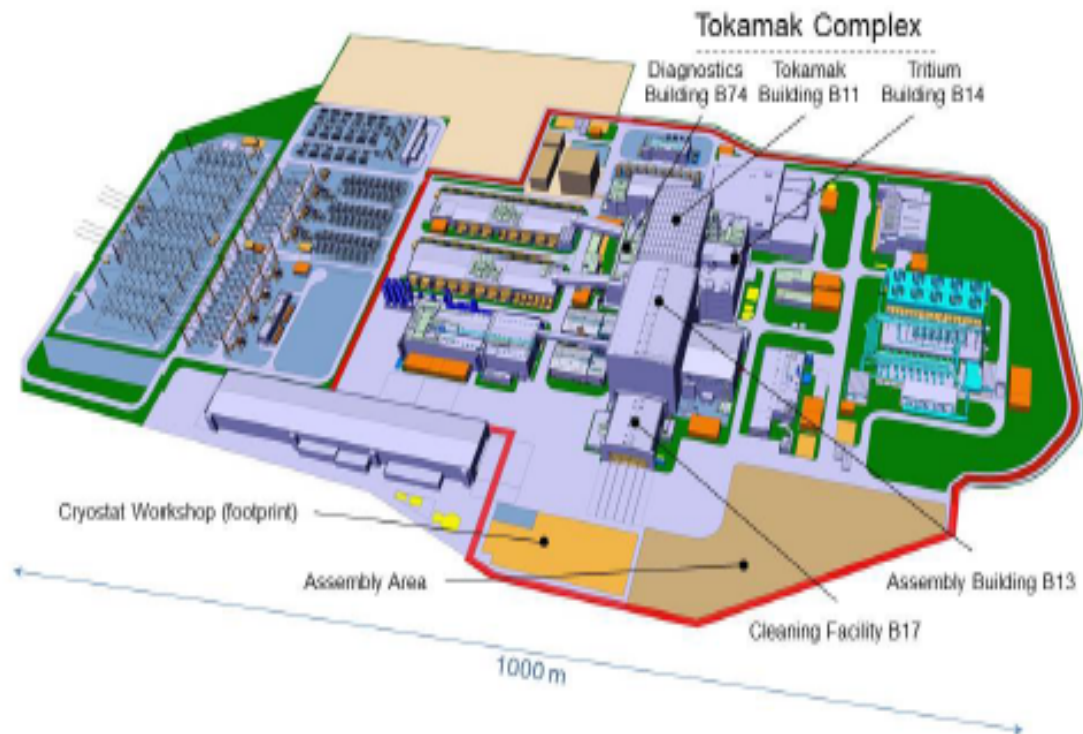
## **Technical summary for the ITER Cryodistribution system installation works including design, manufacturing and delivery of maintenance platforms and cable trays**

### **1. Purpose**

The purpose of this Pre-Qualification is to establish a list of candidates who will be invited to participate in a tender process leading to a contract for the ITER Cryodistribution system installation works including design, manufacturing and delivery of cable trays and maintenance platforms. The intended installation works will be carried out in the following Buildings on the ITER Organization (IO) Site, Cadarache, France (Figure 1):

- Building 11 (B11) - Tokamak building (L3 west and south galleries)
- Building 74 (B74) - Diagnostic building (L3 level)
- Buildings 17/13 (B17/13) - Cleaning and assembly buildings used mainly for introduction and transport of equipment to reach the installation area in B11 – L3 level

Note: L3 of B11 and B74 have different heights of which L3 of B11 is higher.



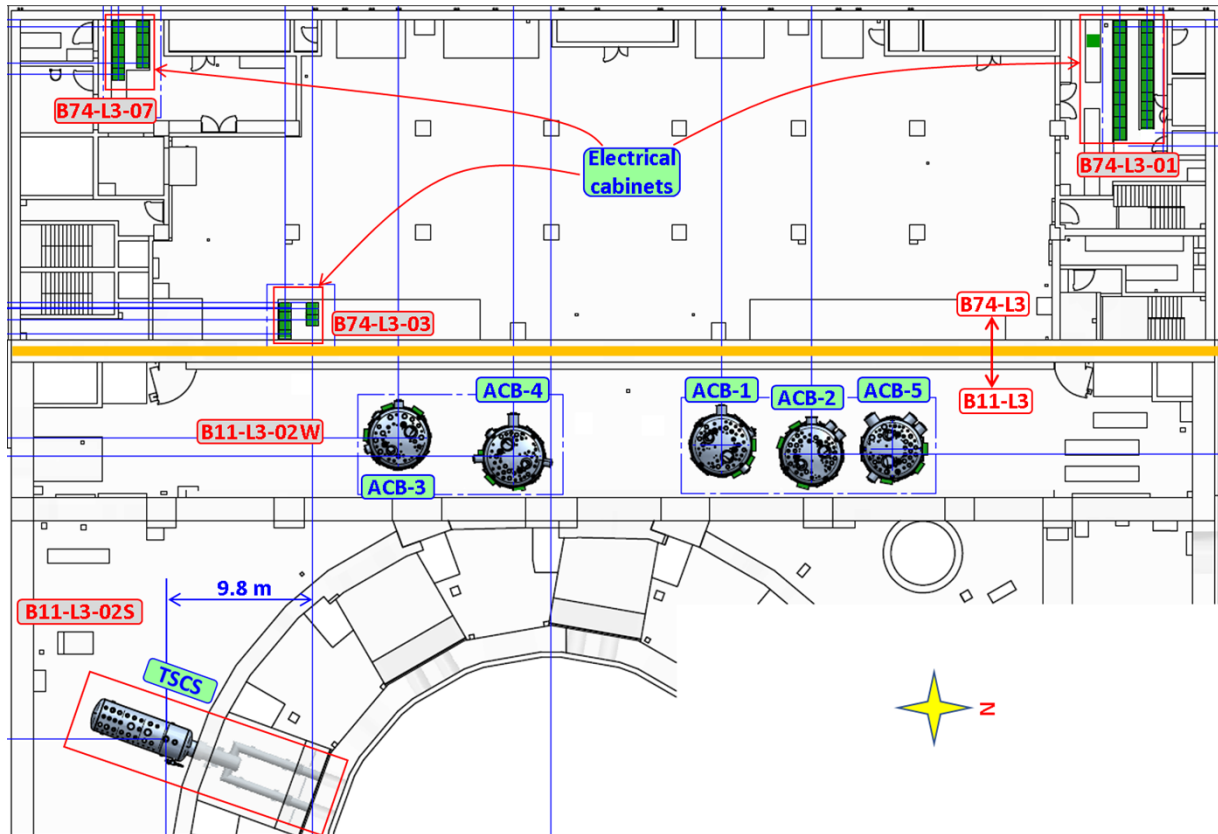
**Figure 1: ITER site platform overview**

## 2. Background

ITER is based on the 'Tokamak' concept of magnetic confinement, in which the plasma is contained in a doughnut-shaped vacuum vessel. The fuel - a mixture of Deuterium and Tritium, two isotopes of Hydrogen - is heated to temperatures in excess of 150 million °C, forming hot plasma. Strong magnetic fields are used to keep the plasma away from the walls; these are produced by superconducting coils surrounding the vessel, and by an electrical current driven through the plasma.

A large scale cryogenic system has been designed to provide the required operational conditions for the magnet system and the associated sub-systems. The Cryo-distribution (CD) system is part of the overall cryogenic system intended to distribute and recover the cold power needed by the cryogenic system.

It consists of five (5) Auxiliary Cold Boxes (ACBs), the Thermal Shield Cooling System (TSCS) in B11-L3 and their electrical cabinets in B74-L3 (segregated due to magnetic field and nuclear radiation in B11-L3) as shown in Figure 2.



**Figure 2: Spatial distribution of the ITER CD.**

## 2.1. ACB

As illustrated in Figure 3, each of the 5 ACBs in B11-L3 are consisting of:

- i) Cryostat housing all cryogenic components.
- ii) Pressure safety valve (PSV) and rupture disc (RD) panel integrated with all warm components for the proper function of the PSVs and RDs.
- iii) Purge panel integrated with all warm components for cryogenic volume purging.
- iv) Maintenance platform where PSV/RD and purge panel are located.

The PSV/RD panel of each ACB can consist of several units to be joined together on-site.

The maintenance platform is positioned around the ACB cryostat to create access for maintenance and support the warm PSV/RD and purge panels. A more detailed model of an ACB without maintenance platform is shown in Figure 4.

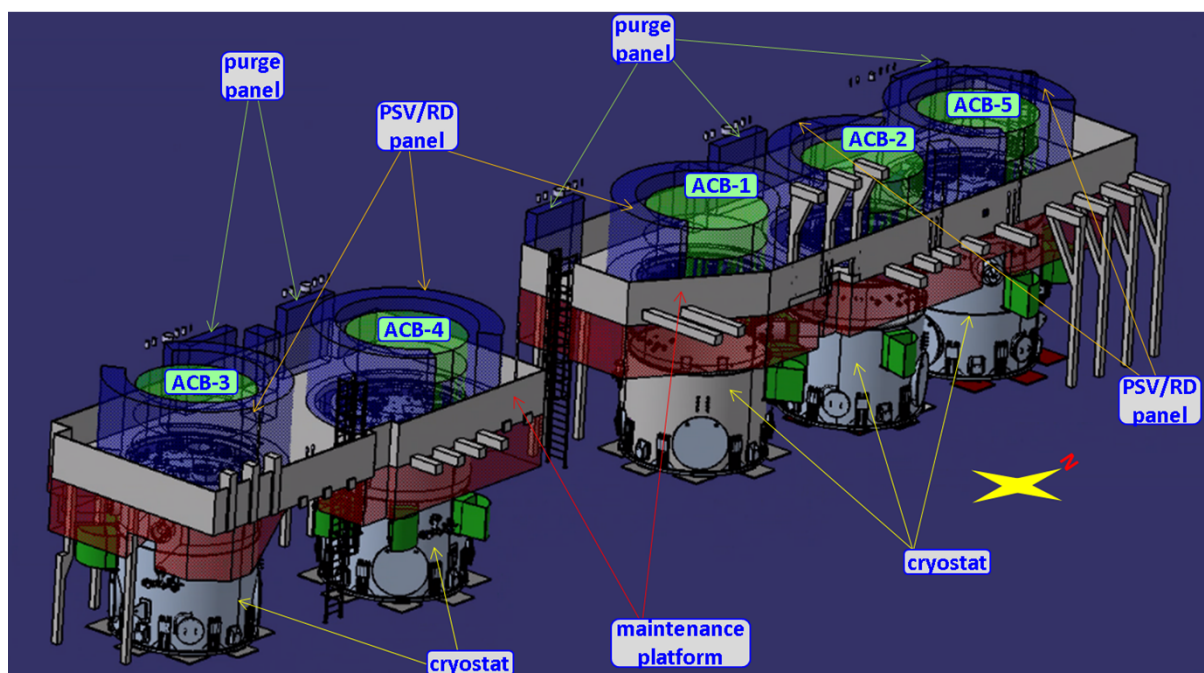


Figure 3: Illustration of ACB sub-system.

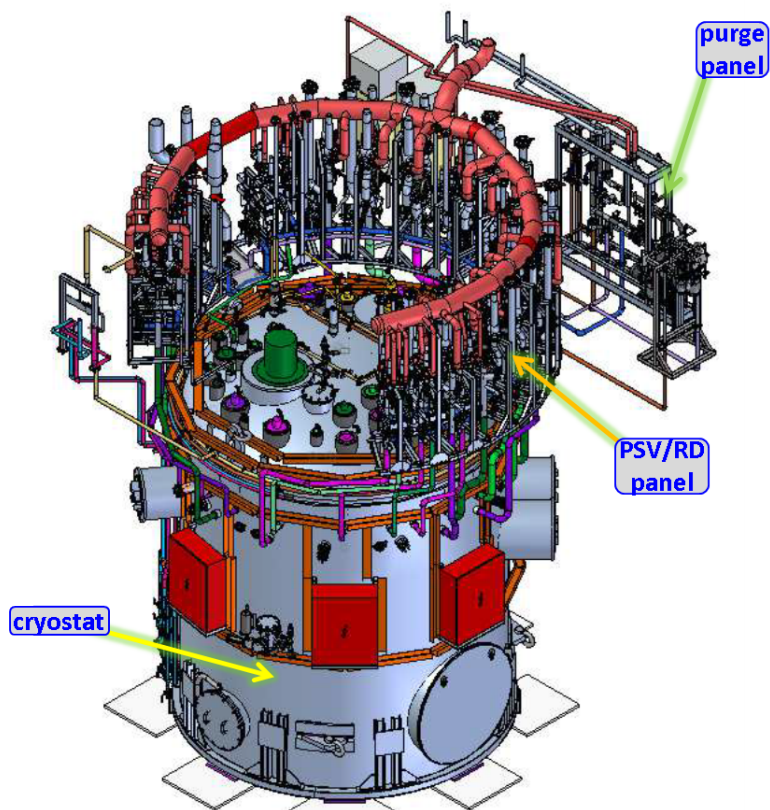


Figure 4: 3D model of a typical ACB.



## 2.2. TSCS

The TSCS, as illustrated in Figure 5, is consisting of:

- i) Cryostat or Thermal Shield Cold Valve Box (TCVB) housing all cryogenic components.
- ii) Manifold Box (MB) housing the cryogenic piping to be connected to the Tokamak Thermal Shield (TS) Manifolds.
- iii) Warm panels (PSV/RD panel and purge panel).
- iv) Maintenance platform.

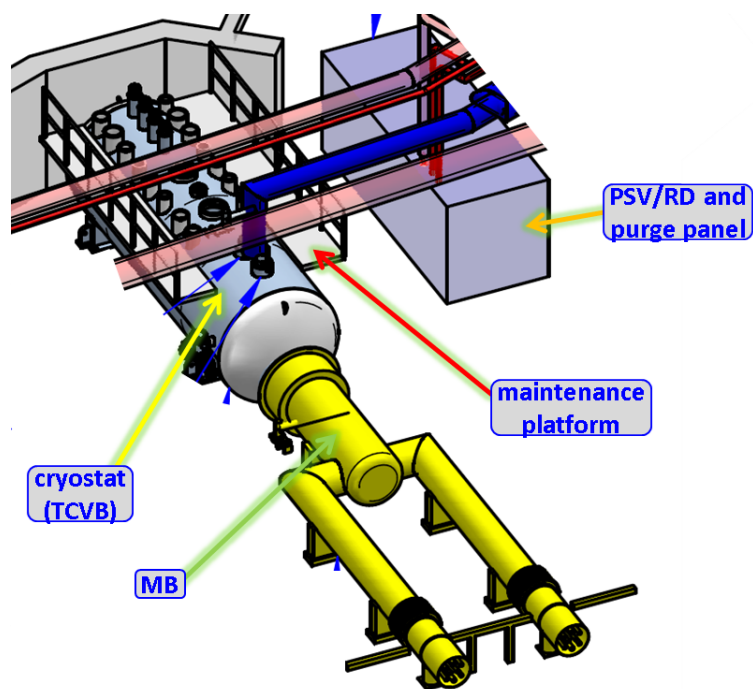


Figure 5: Preliminary 3D model of TSCS.

## 3. Scope of Work and installation challenges

### 3.1. Scope of work

The major tasks are:



- i) Design, manufacturing, delivery & installation of **maintenance platforms** for 5 ACBs and the TSCS.
- ii) Design, manufacturing, delivery & installation of **cable trays/conduits** for 5 ACBs and the TSCS.
- iii) **Lifting and positioning** of equipment & structures (cryostat, warm panels,) of 5 ACBs (installation of structures for TSCS is out of scope) and electrical cabinets of 5 ACBs and the TSCS.

Please refer to the annex at the end of this Technical Summary giving the main characteristics of the Cryo-distribution system to be installed and preliminary inputs to be used for the design of structures within the present scope.

### 3.2. Installation challenges

The installation of the ITER Cryo-distribution system in L3 of B11/B74 is a challenging and highly integrated task due to the tight positional tolerances, interface with upstream and downstream Cryolines and limited space. It demands a high level of precision whilst positioning the equipment and co-ordination between various installation agencies, quality and safety officers and site construction in-charge. The ITER Cryo-distribution systems are Quality Class One (QC 1) components. Specific inspections and controls to meet technical requirements will be performed during the installation and this has to be considered in the installation plan. It is important to maintain the schedule window provided for various installation activities, without interruption. In order to comply with the specified insulation vacuum pressure, strict cleaning activities and cleanliness controls are required during installation of other interfacing systems. Environments free from dust, particles, metal chips and other debris from building construction activities nearby are required to create a vacuum class environment. The site constraints, limitations and dependencies need to be considered to properly plan the installation.

## 4. Interfaces with Other Companies

There will be other contractors working on the IO site around and inside the involved in this scope of activities.

### 4.1. Scaffolding

The IO has in place a framework contract for the lease of scaffolding for the contractor. This scaffold is provided only for human access.

Due to the high level of interaction between different contractors, the use of this scaffolding Contract will be obligatory for all work being carried out in the Tokamak Complex as several works Contractors may use the same scaffolding. IO will pay the scaffolding contractor directly for works in the Tokamak Complex. For other areas, the contractor is responsible for



organizing the scaffolding with the IO scaffold supplier or their own supplier at their own expense.

#### **4.2. Lifting**

For the installation works in L3, the Contractor shall be responsible for the full handling and lifting operations (including preparation and associated documentation) to install equipment in their final position.

For the introduction and transport of equipment, the main delivery point will be in the Cleaning Facility before passing through the Assembly Hall (B13). Materials including handling and lifting tooling shall be decontaminated in the Cleaning Facility by the Contractor. The Contractor shall comply with Cleanliness requirements as per IO cleaning protocol.

The Contractor will be responsible for offloading materials from the delivery vehicle in the Cleaning Facility and for the downstream transportation to the point of use within their worksite.

The responsibility for the lifting operation shall remain with the Contractor and the Contractor shall provide qualified personnel as well as the handling/lifting tools.

#### **4.3. Workshop**

The IO will provide an area dedicated to the Contractor for the installation of his site facilities, possibly consisting of a workshop, local storage, and some facilities for pre-assembly activities on smaller components. These areas will be located on the ITER Worksite platform and will be connected to the potable water, electrical networks as well as to the industrial drainage network.

#### **4.4. Structure**

To manage the coactivity and the Installation schedule IO is currently working with a Construction Management-as Agent (CMA).

The IO, assisted by the Construction Manager as-Agent (CMA), will define the assembly process through Construction Work Packages (CWPs). Each CWP will define a package of works prepared and instructed to the Contractor by the CMA and performed by the Contractor as a unit, with a defined start and completion point and a required cost based upon the tendered unit rates for each type of work.



## 5. Required Competences

The competence and experience of the Contractor, and the ability, experience, and training of his engineering and construction team will have a direct influence on quality, re-work, and schedule, and ultimately on the performance of the Tokamak during operation; the Contractor will be required to demonstrate competence and experience in a number of key areas as listed down below.



Area of Competence
Codes and Standards (EN and EUROCODES)
Occupational Safety
Process Development and Qualification
Quality Assurance / Quality Control
Regulated construction
Mechanical equipment prefabrication & installation (including test)
Pressure Equipment regulation (if applicable)
Carbon and stainless steel welding process
Inspection and Non-Destructive Examination (if applicable)
Lifting and Handling
Tooling Maintenance, Storage and Preservation

## 6. Nuclear and Quality Requirements

The ITER Organization is the nuclear operator of the ITER nuclear fusion facility (INB 174) under French nuclear law.

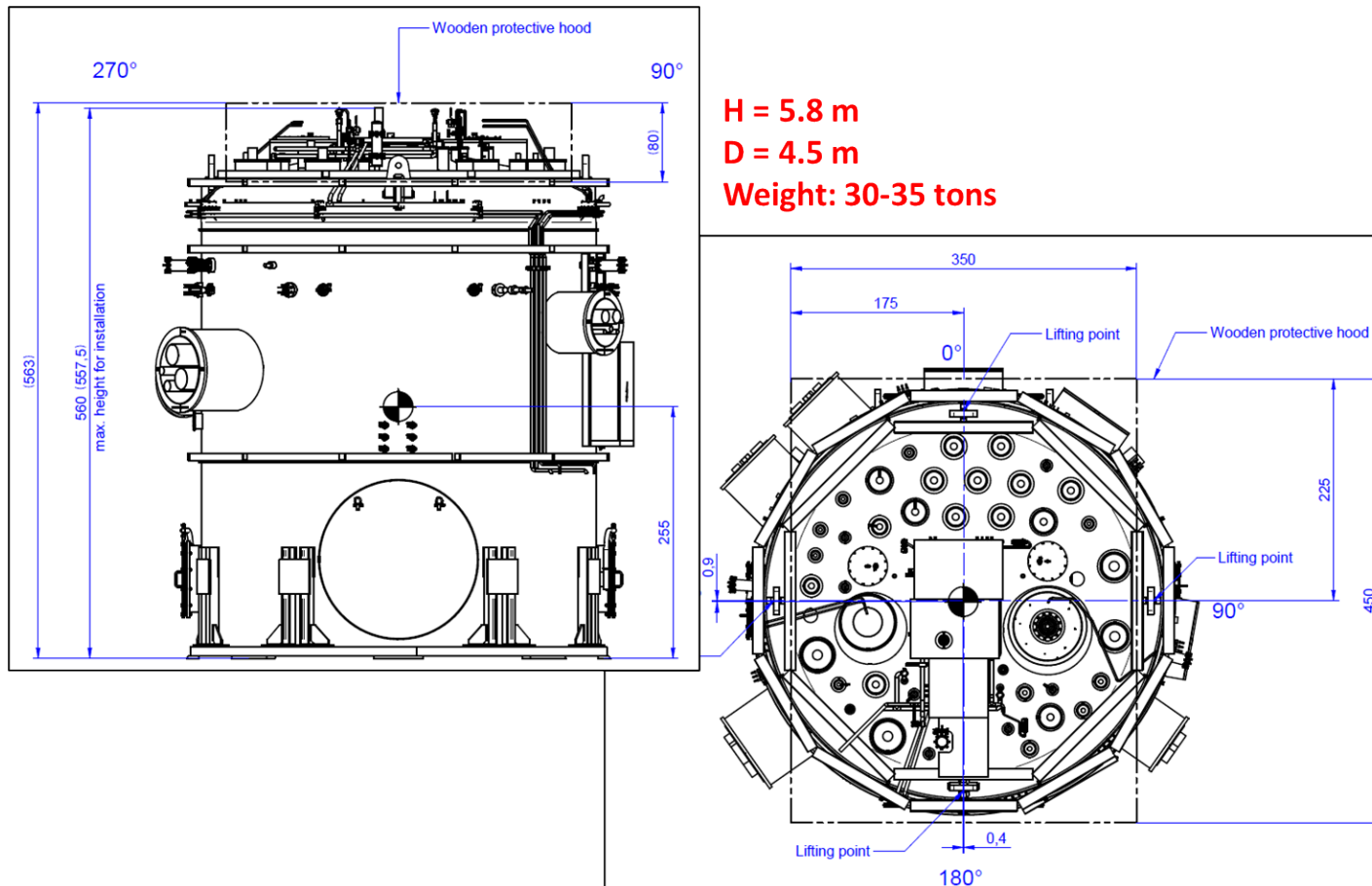
The Contractor shall have a Quality Assurance System required for manufacturing and installing of Pressure Equipment (if applicable to the scope of supply). He shall comply with the defined requirements associated with those components as well as with the French Order of 7th February 2012 establishing the general rules for basic nuclear installations (if applicable to the scope of supply). The Quality requirements imposed by the Pressure Equipment regulations, the defined requirements and the French Order of 7th February 2012 will be detailed at the Call for Tender stage.

The Protection Important Activity (PIA) list to be performed by this contract will be given in the Call for Tender phase (if applicable to the scope of supply).



# ANNEX A

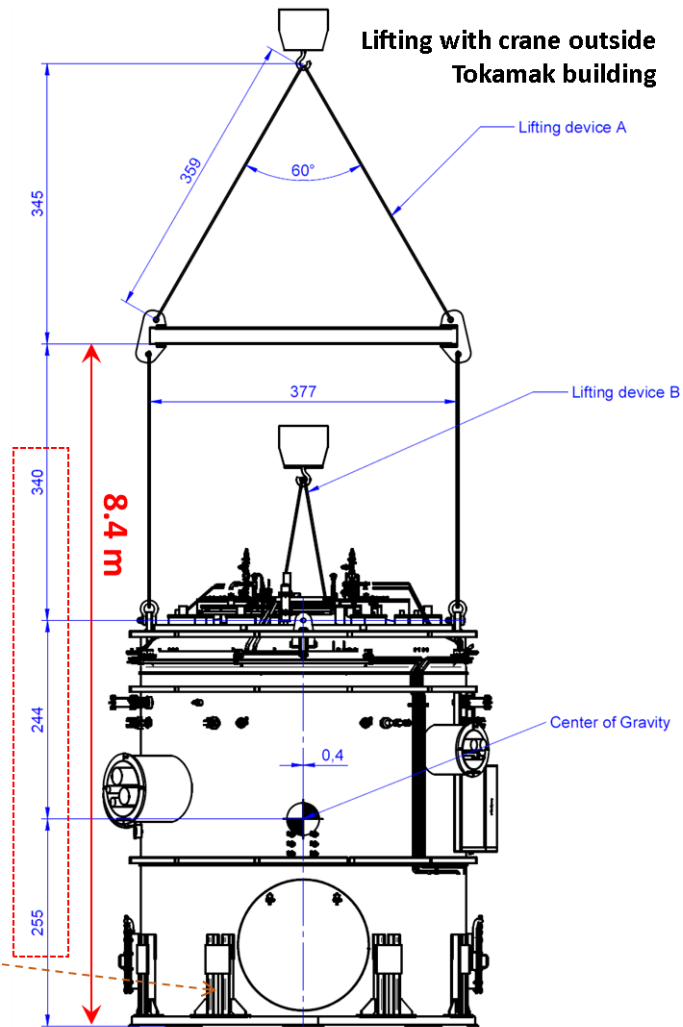
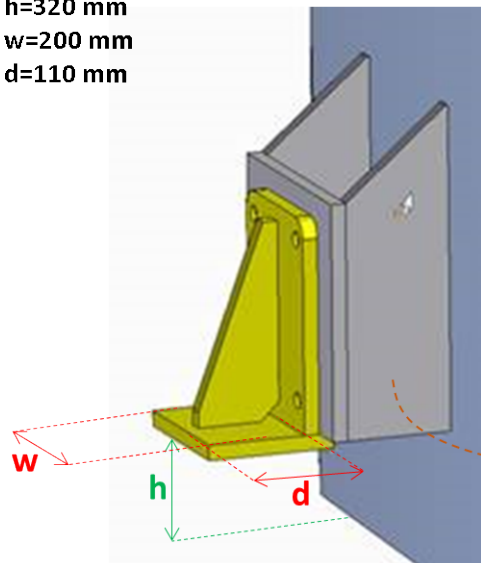
### ACB dimensions to be considered for installation



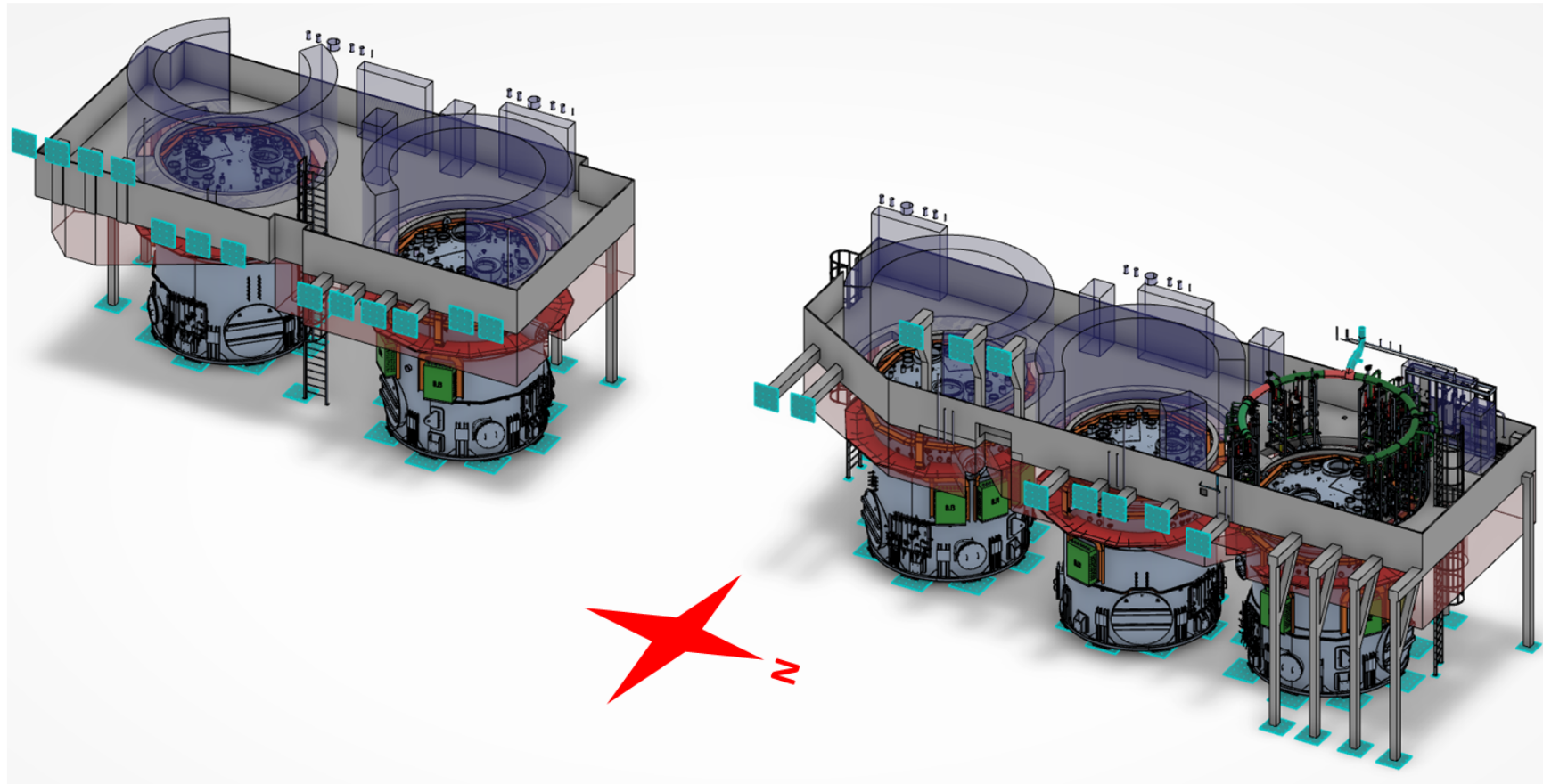
## ACB lifting

Four (4) cradles for lifting with hydro-jacks to transport and fine position inside B11-L3

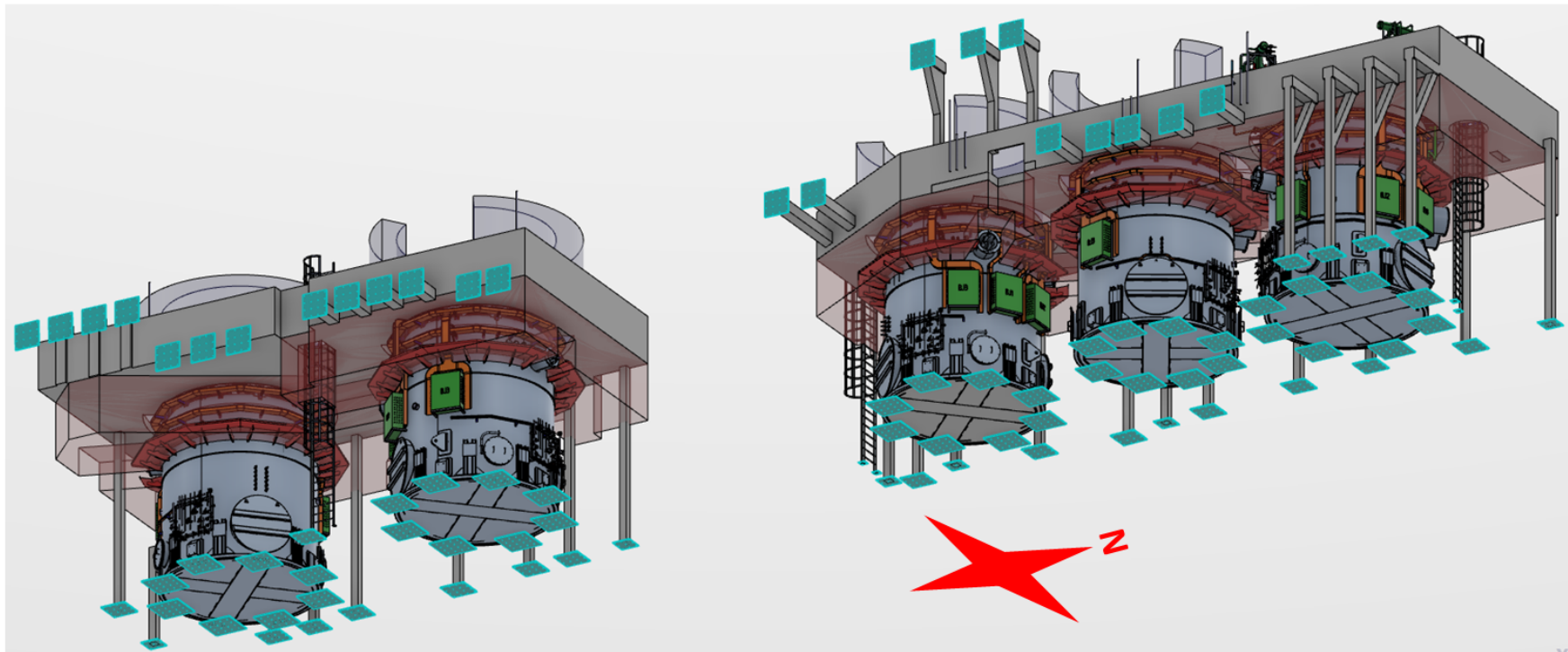
- $h=320$  mm
- $w=200$  mm
- $d=110$  mm



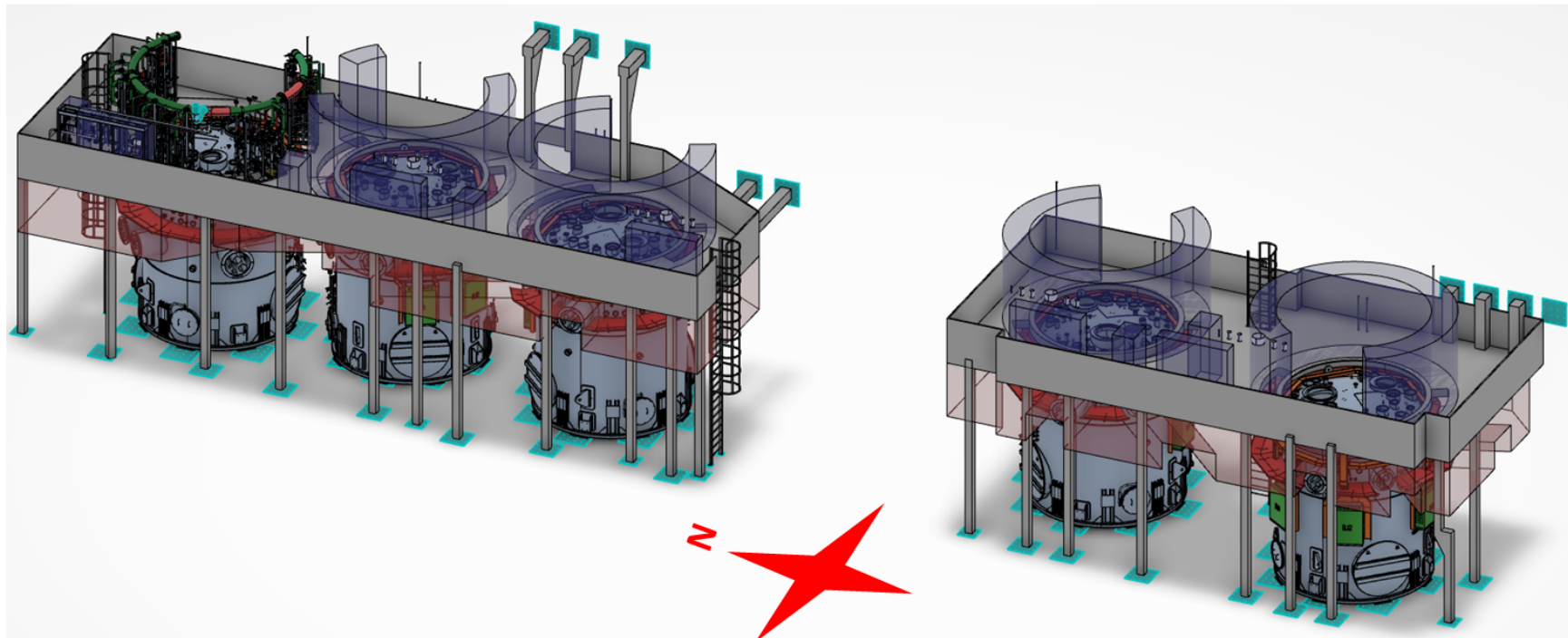
## ACBs with maintenance platform and assigned EPs (1)



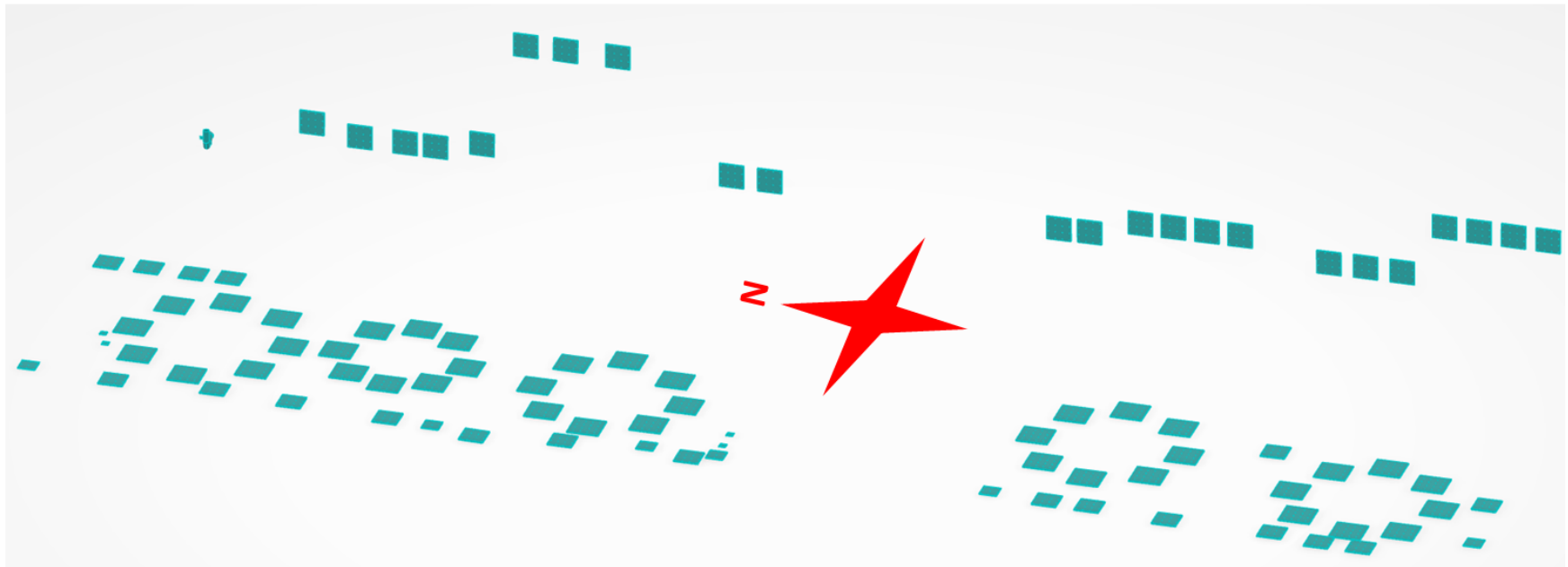
## ACBs with maintenance platform and assigned EPs (2)



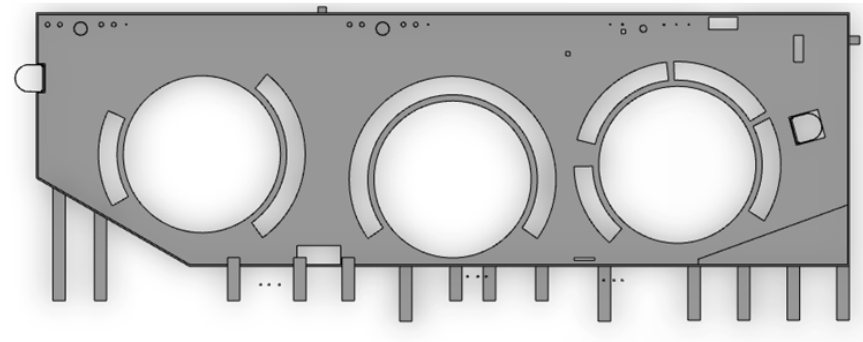
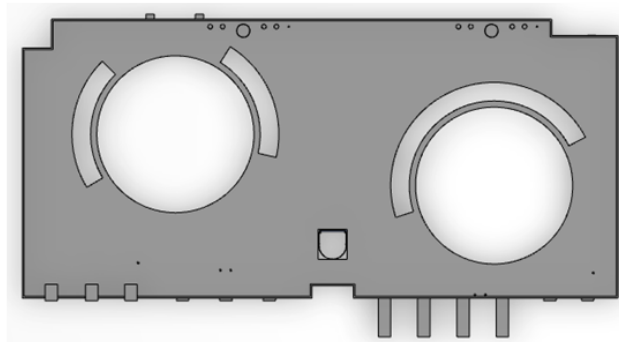
### ACBs with maintenance platform and assigned EPs (3)



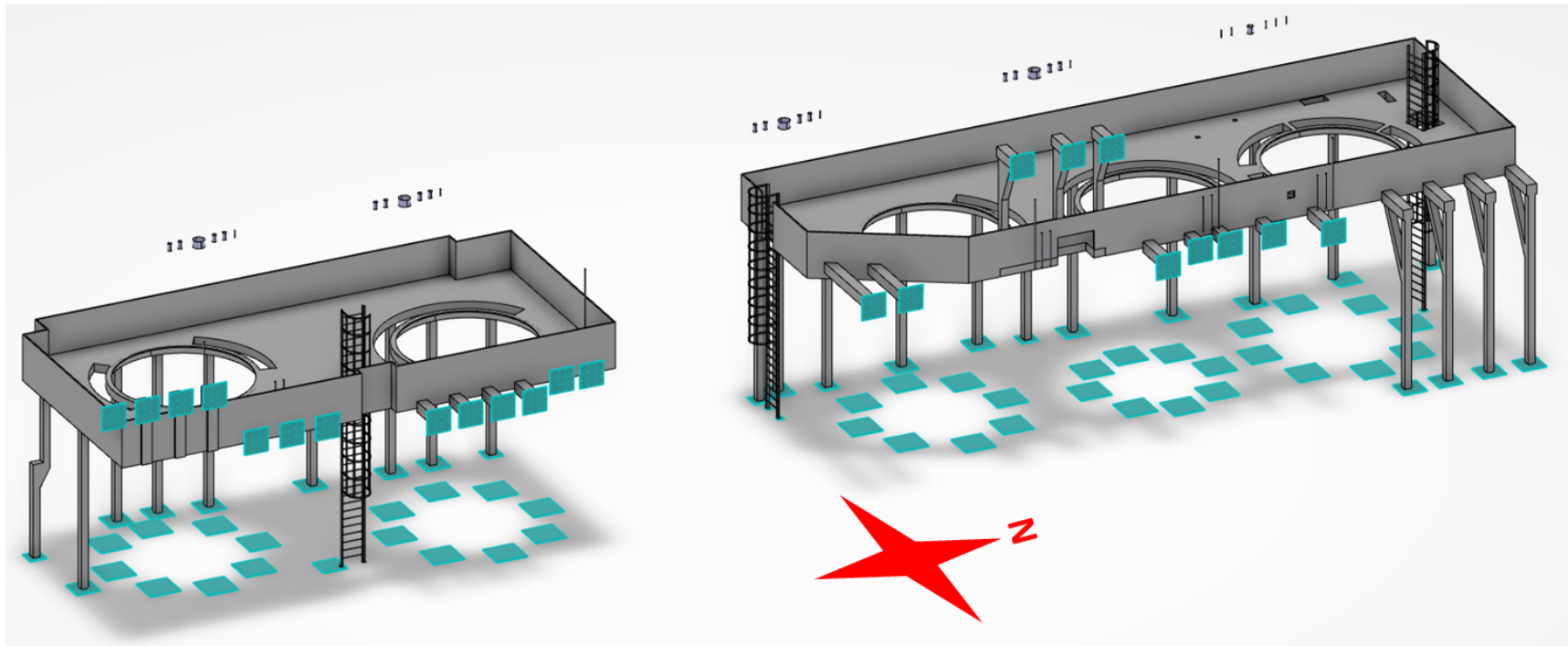
## ACBs and maintenance platform assigned EPs



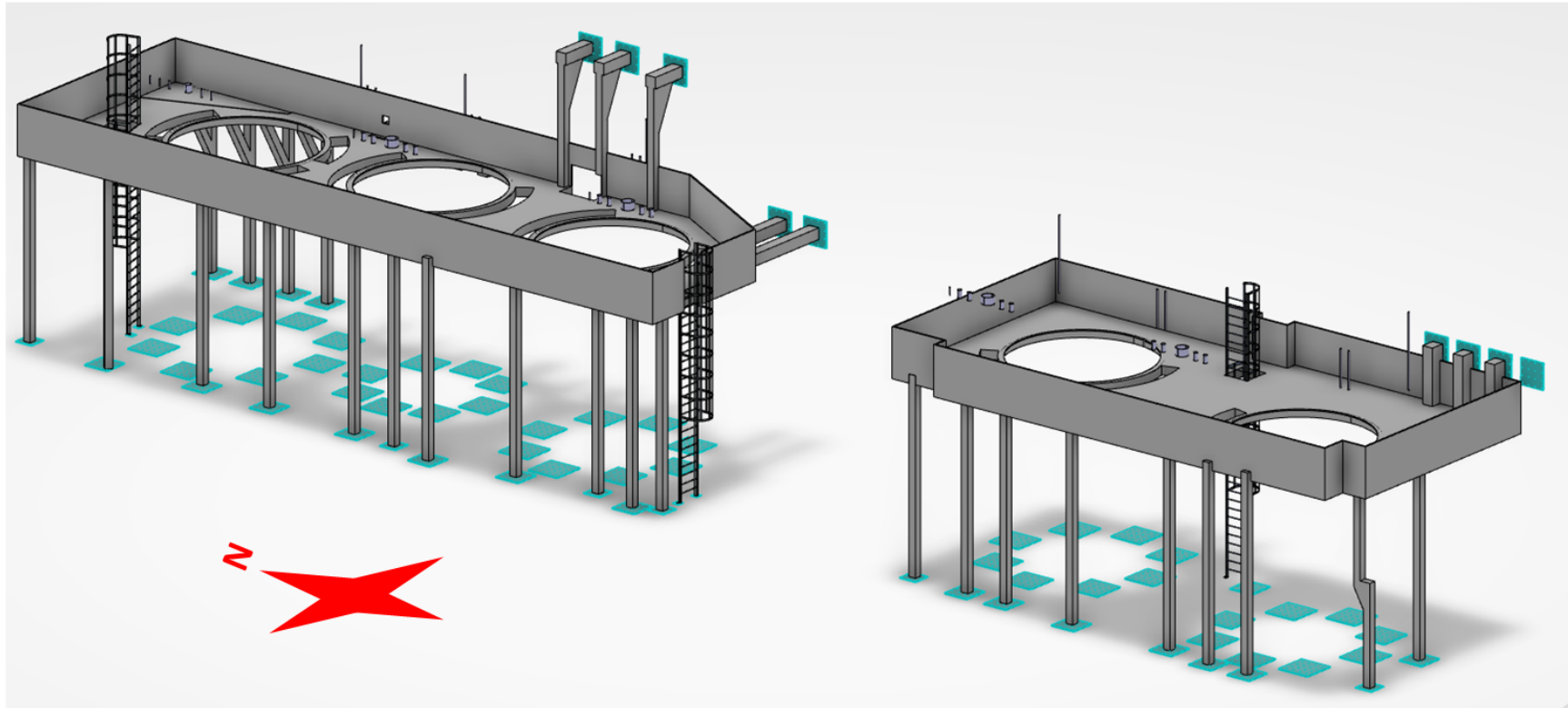
Maintenance platform assigned area top view



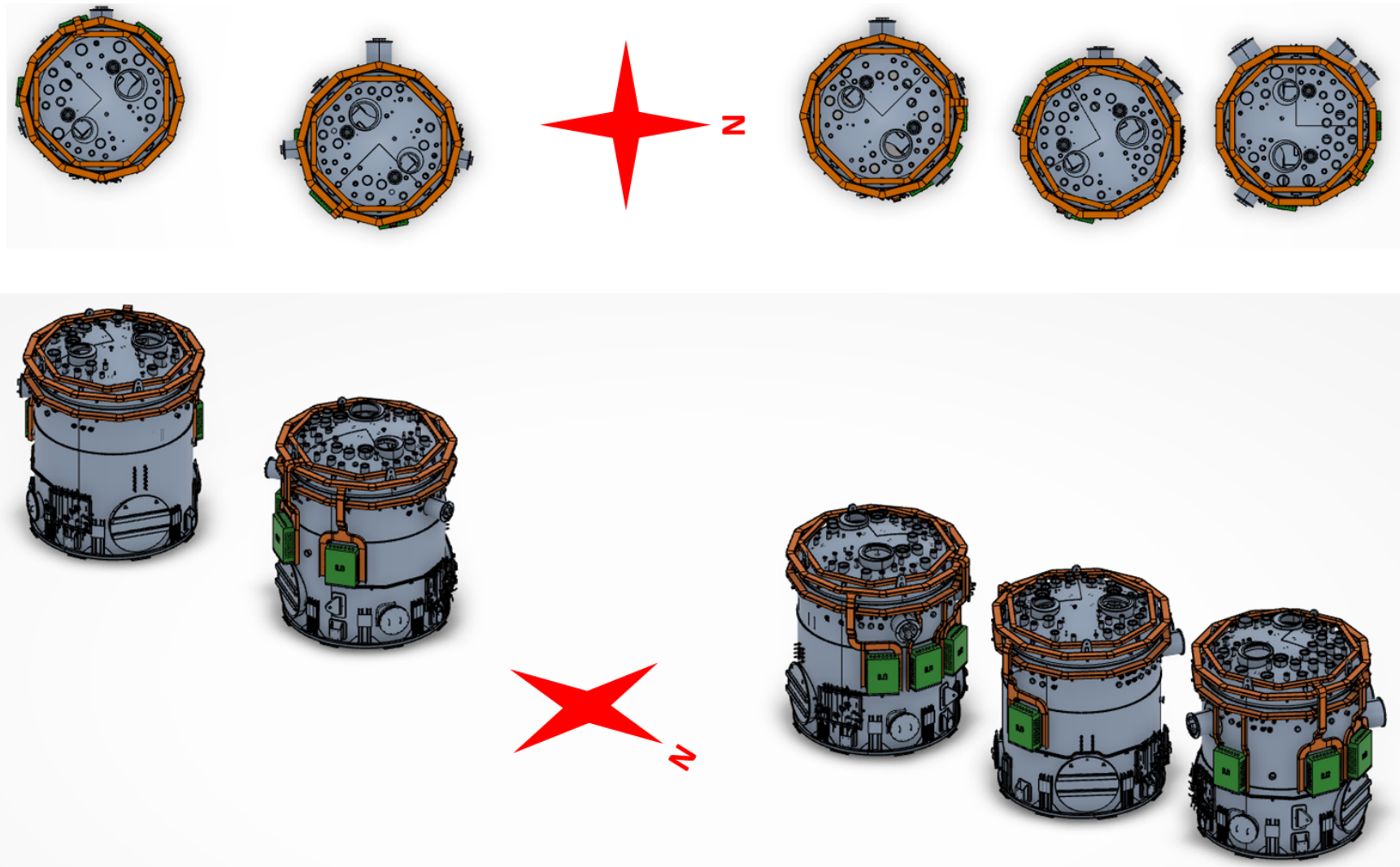
## Maintenance platform and assigned EPs (1)



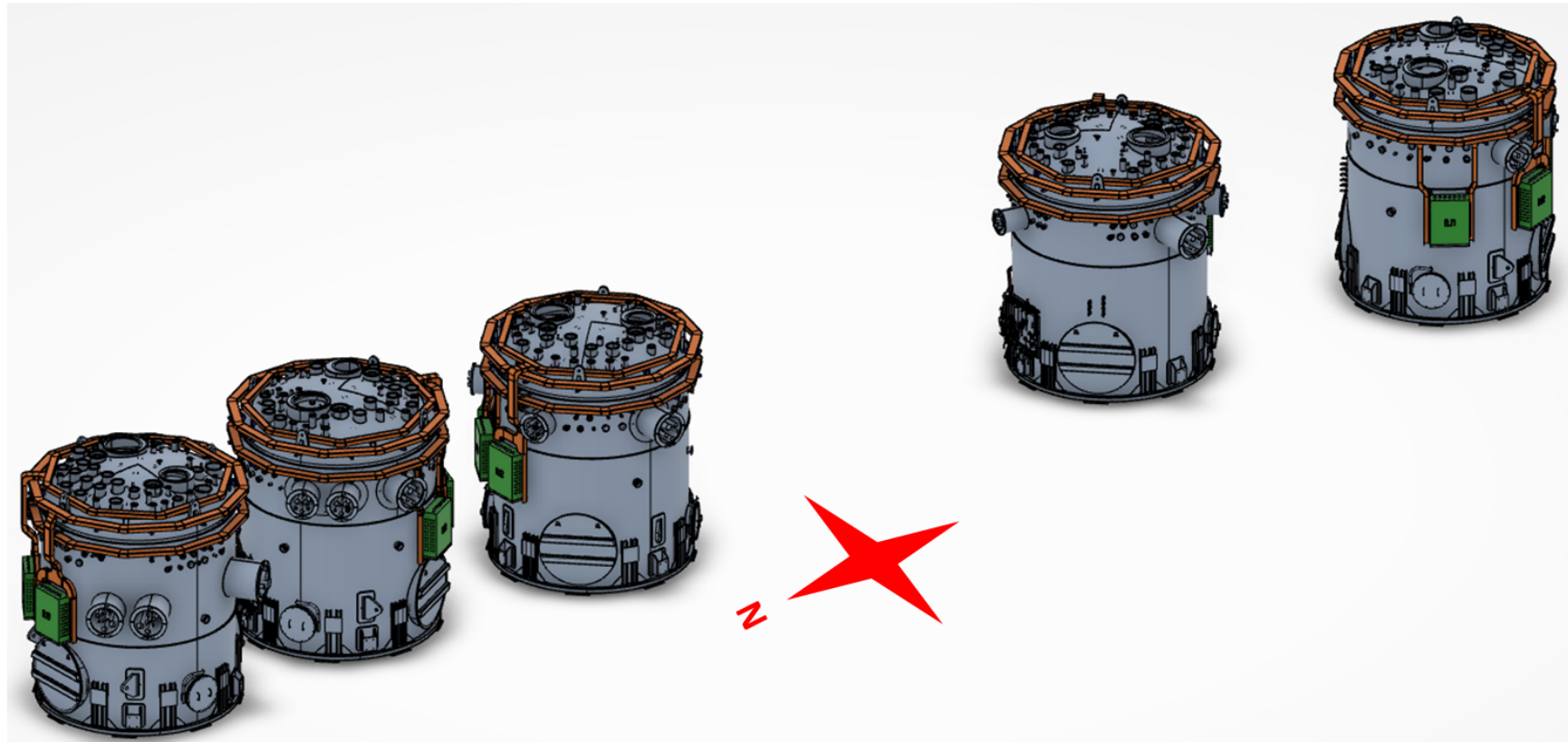
## Maintenance platform and assigned EPs (2)



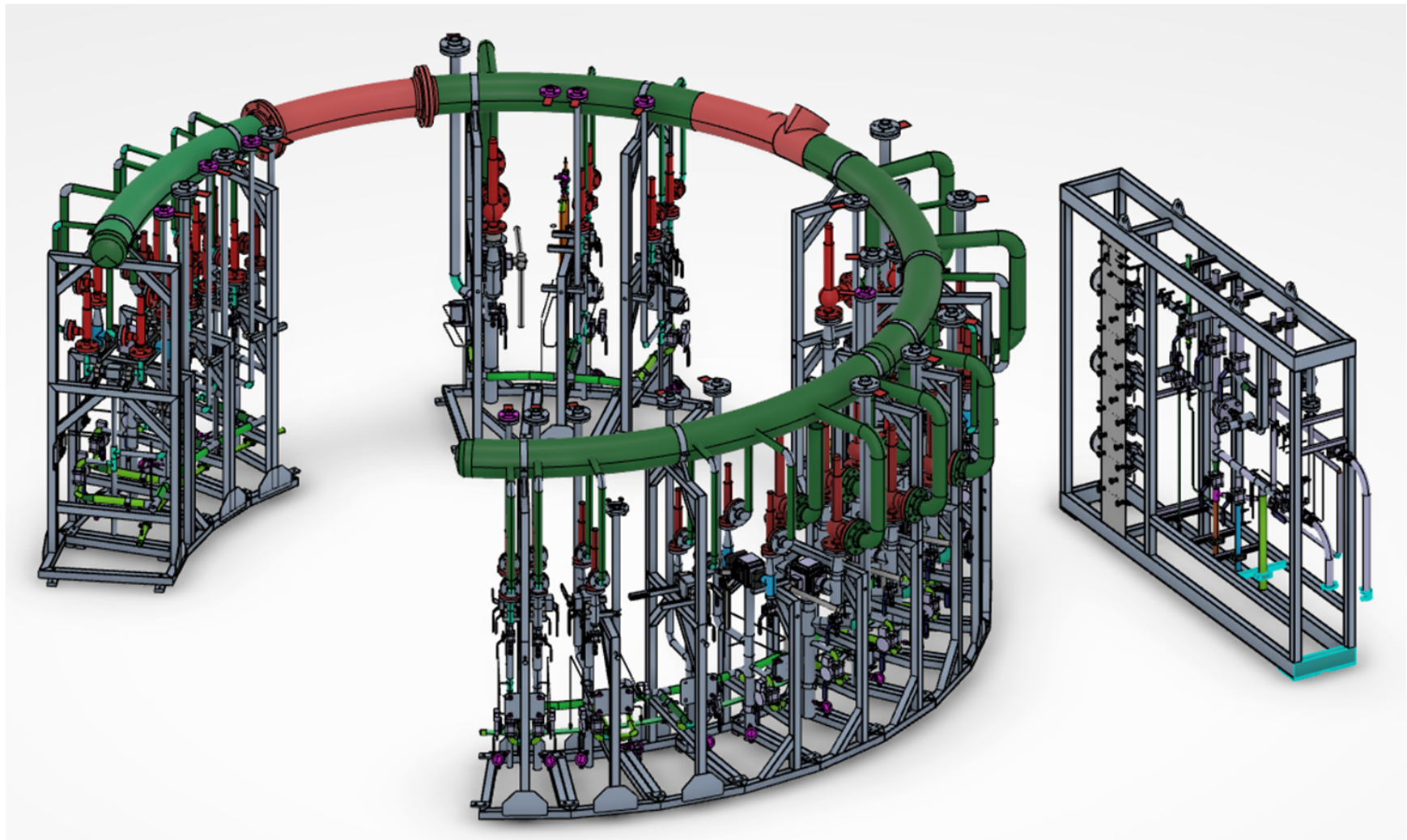
ACBs in delivery configuration on final position (1)



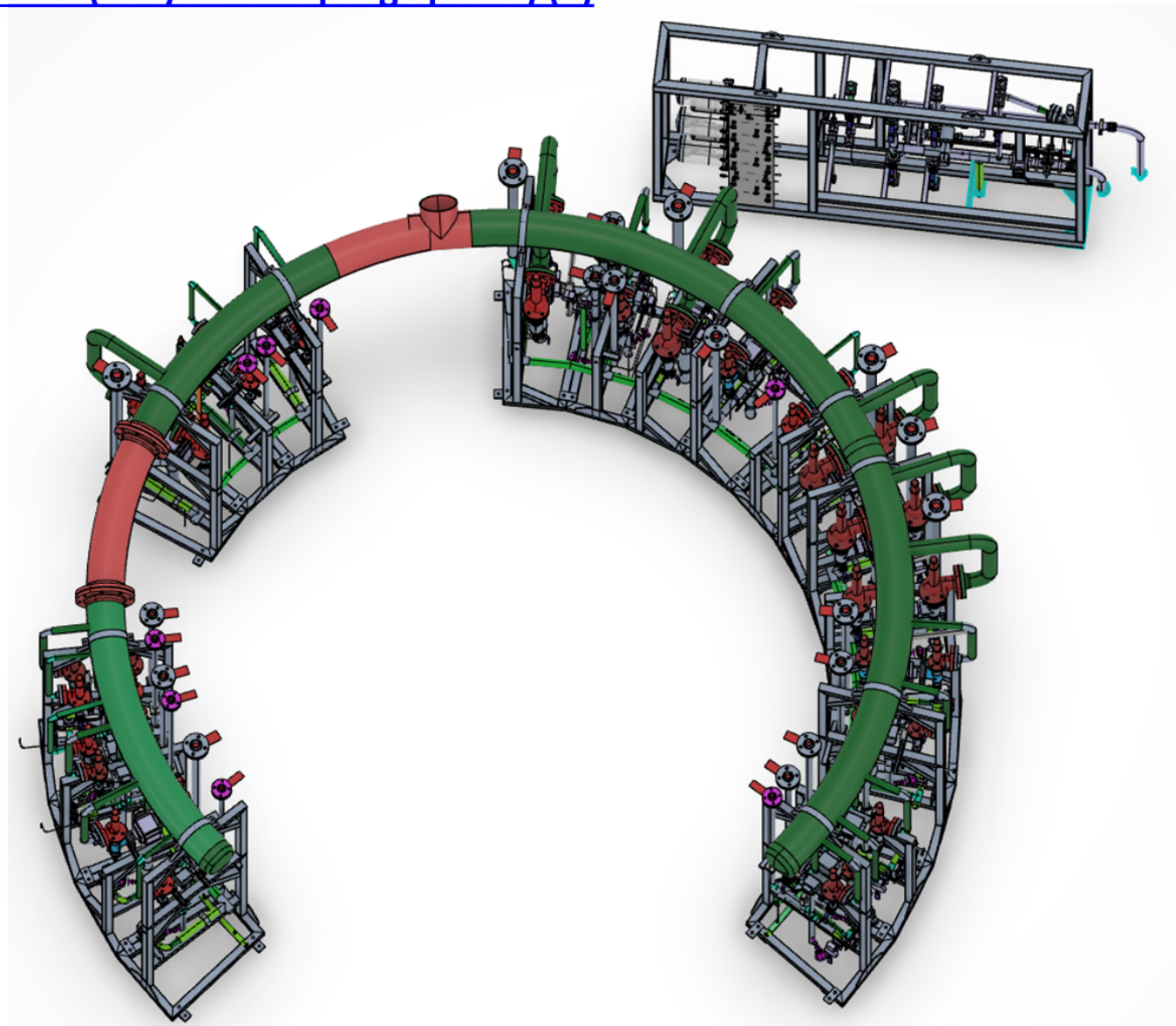
ACBs in delivery configuration on final position (2)



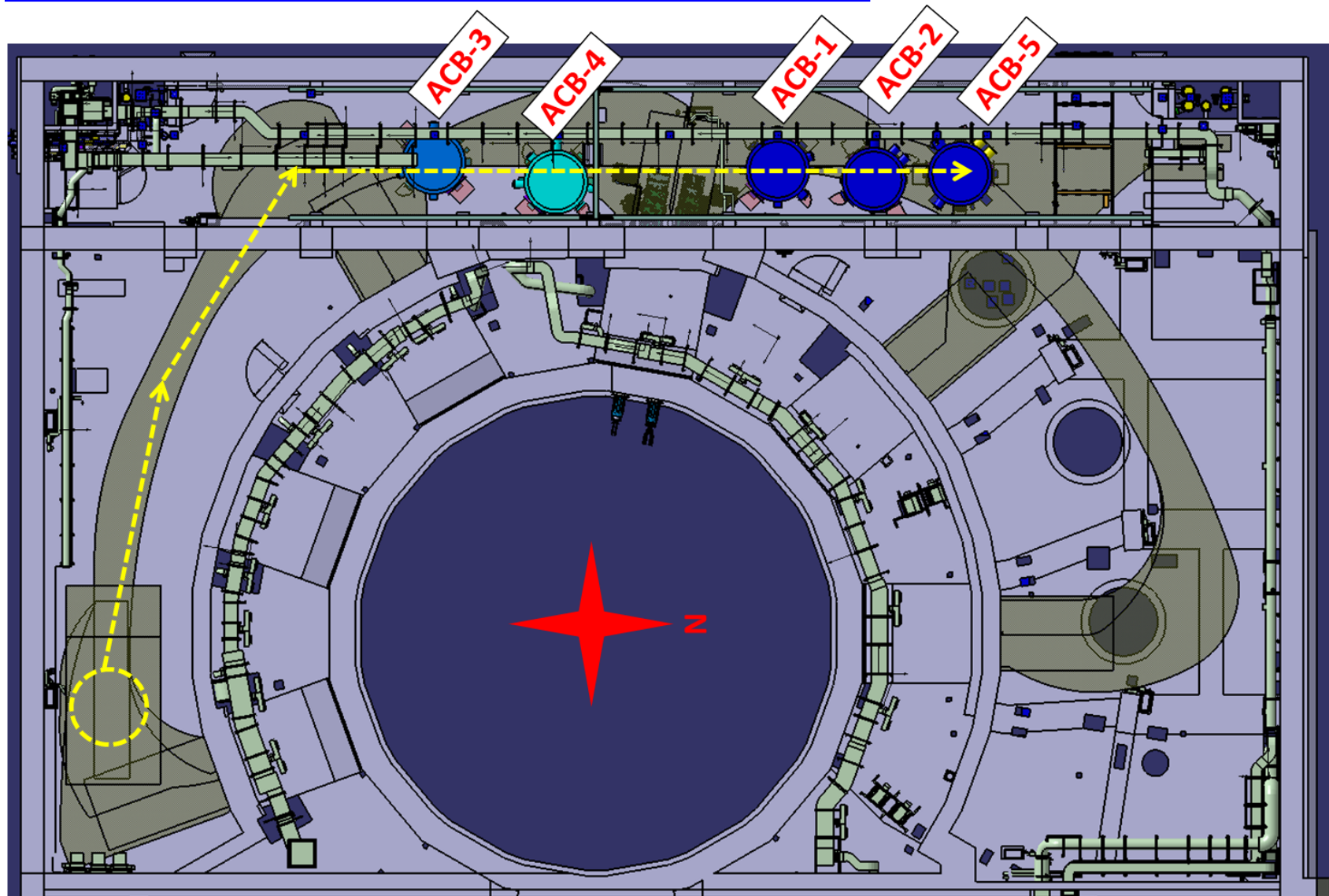
## Warm panel (PSV/RD and purge panel) (1)



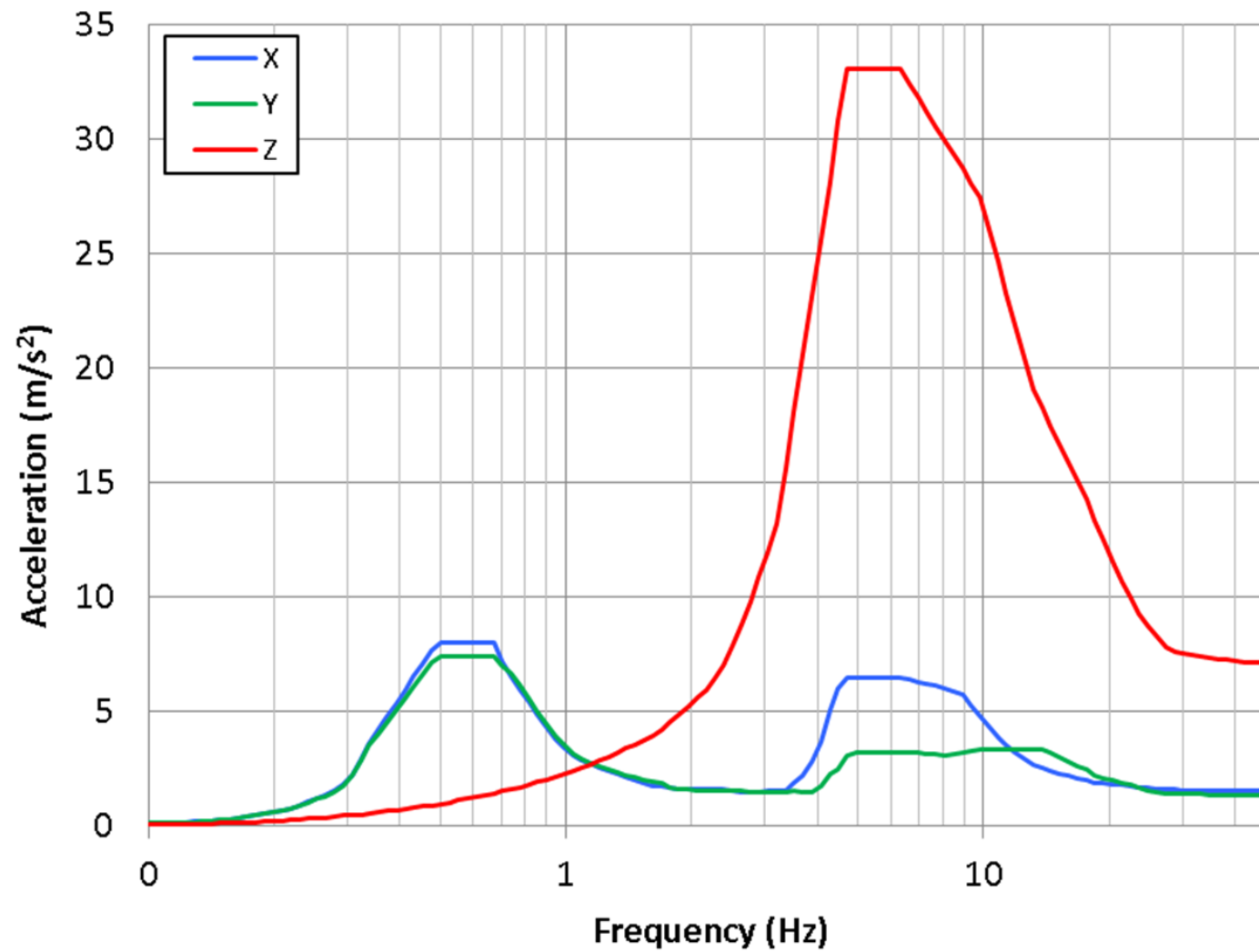
Warm panel (PSV/RD and purge panel) (2)



Route from “dropping” on B11-L3 floor to final location



### Maximum floor response spectra during worst seismic event



## Maximum magnetic field variation

