DEMO WP4 B2024
CEA TF mechanical models (3D)

WPMAG Final meeting 2024

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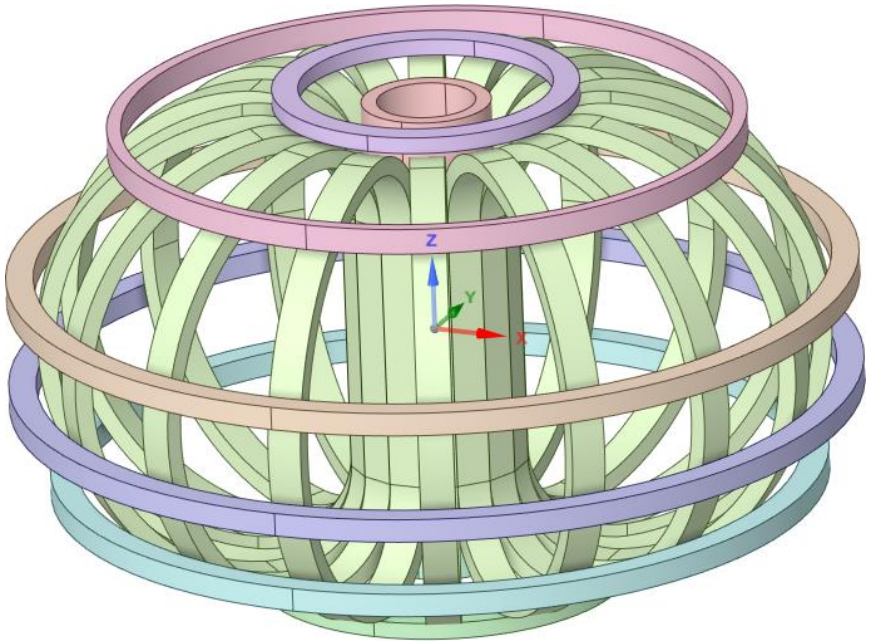
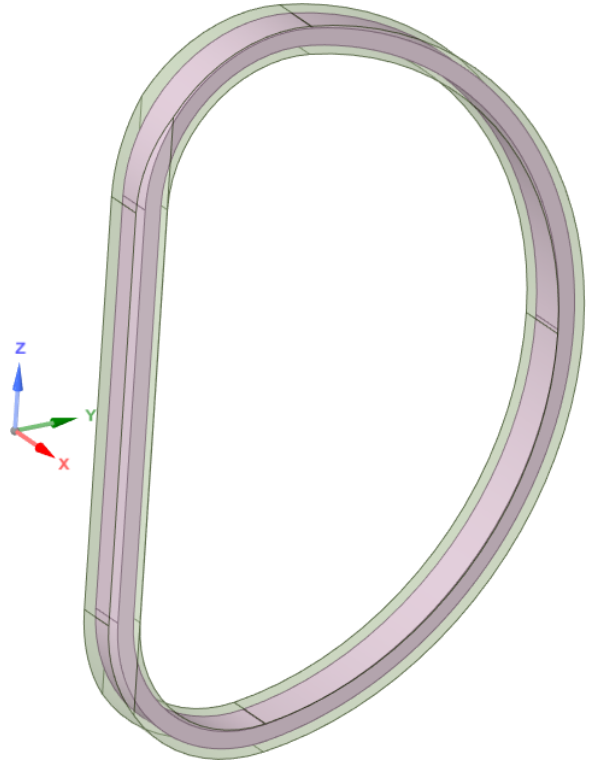
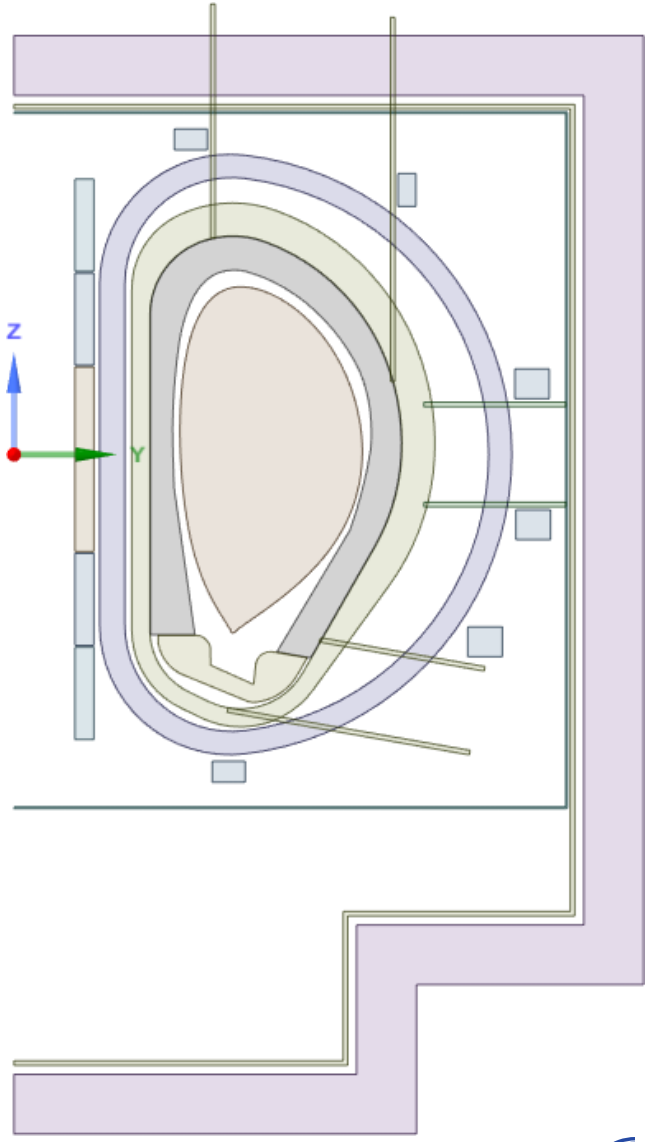
DEMO LAR 2024 - Magnet System

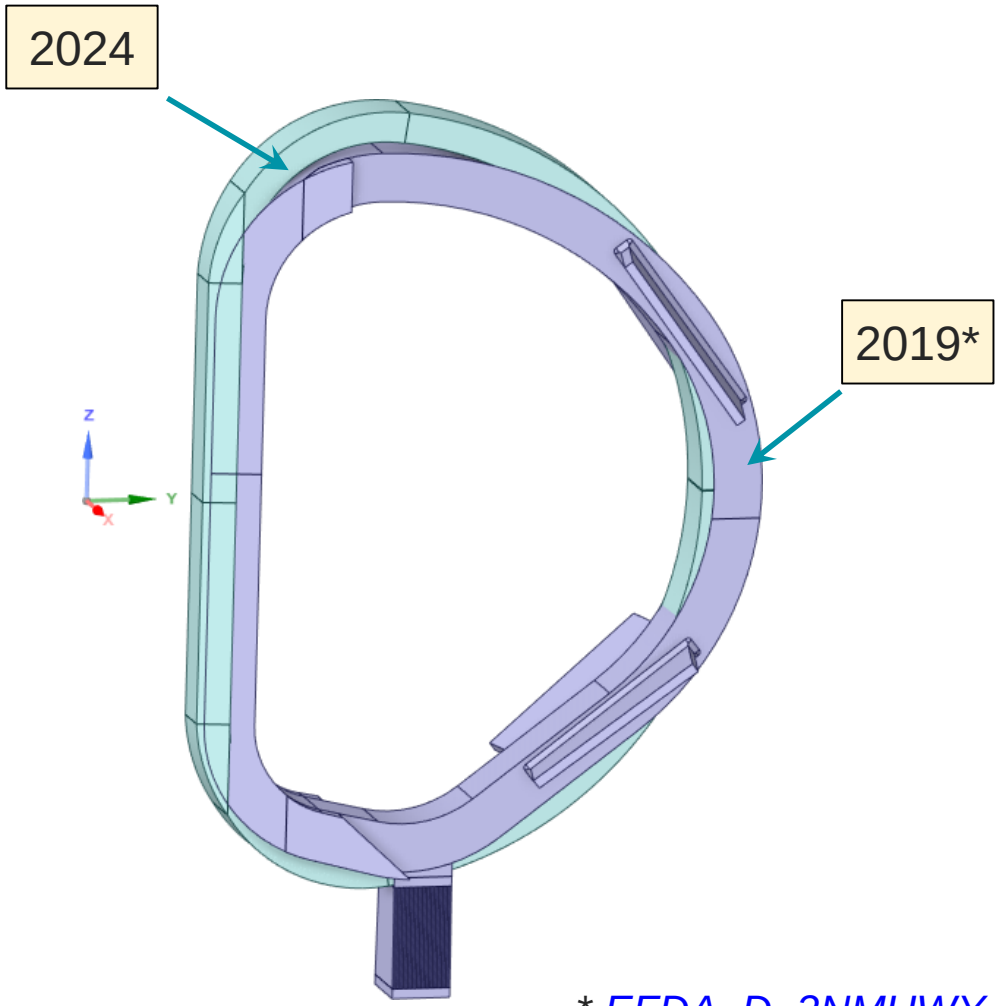
- Input files received at the beginning of December 2024: DEMO_LAR-Magnet_System (2RZ529 v1.0)

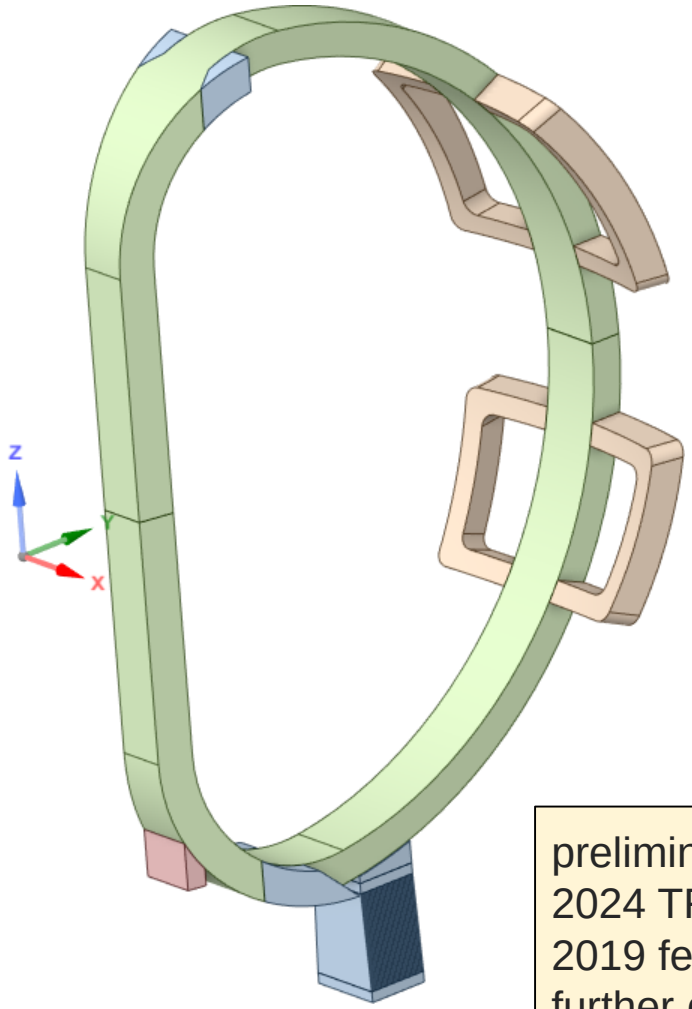






DEMO LAR 2024 - TF coil



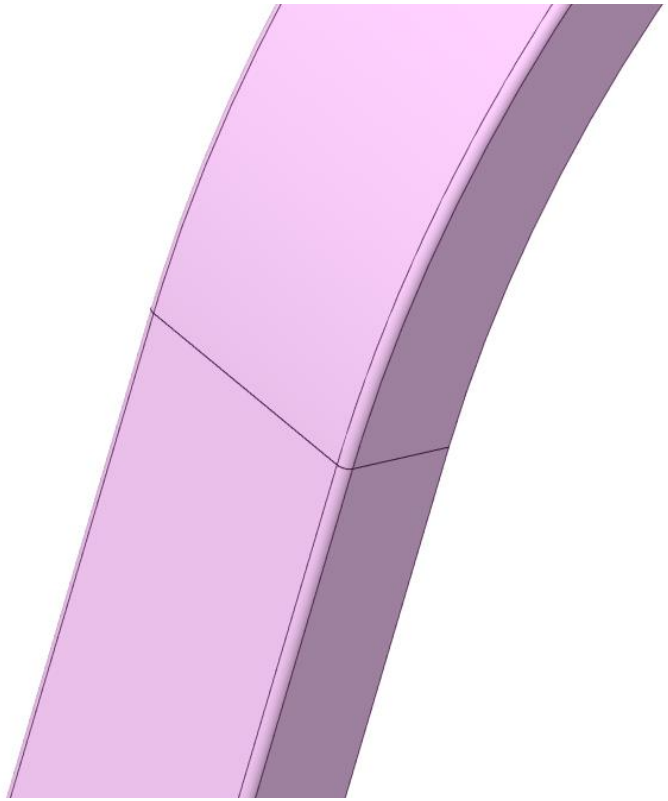


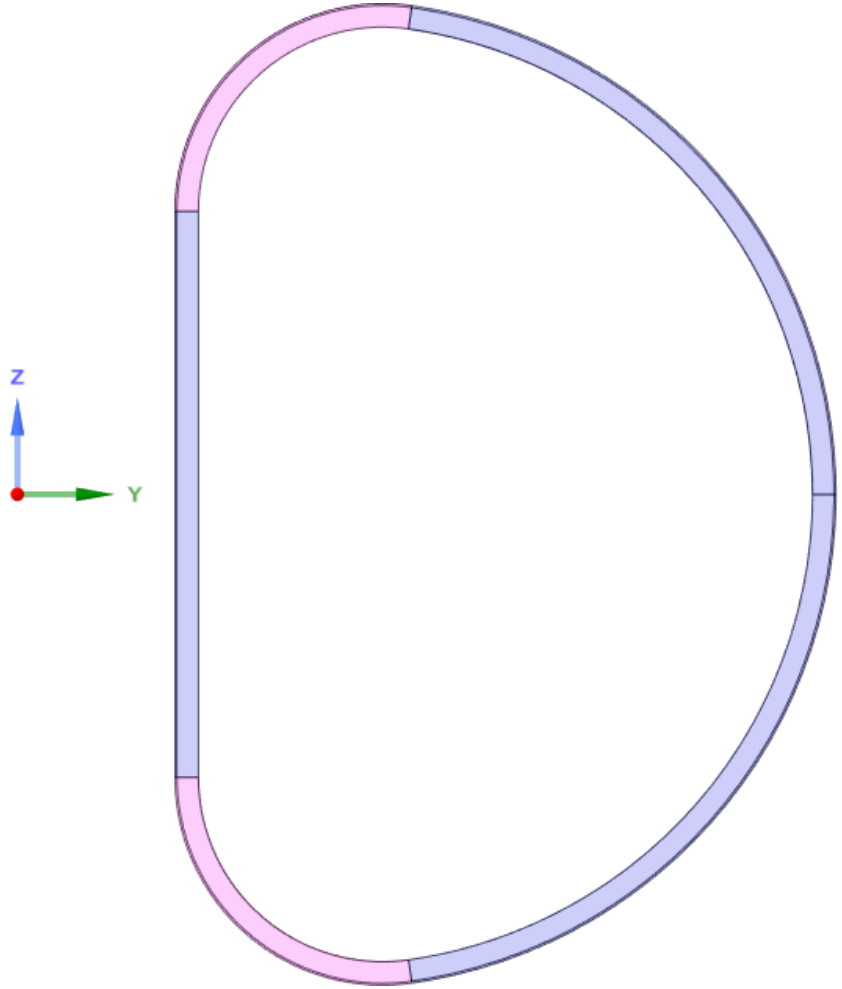
preliminary design of 2024 TF coil based on 2019 features (plus further developments)

* *EFDA_D_2NMUWY*

DEMO LAR 2024 - TF coil

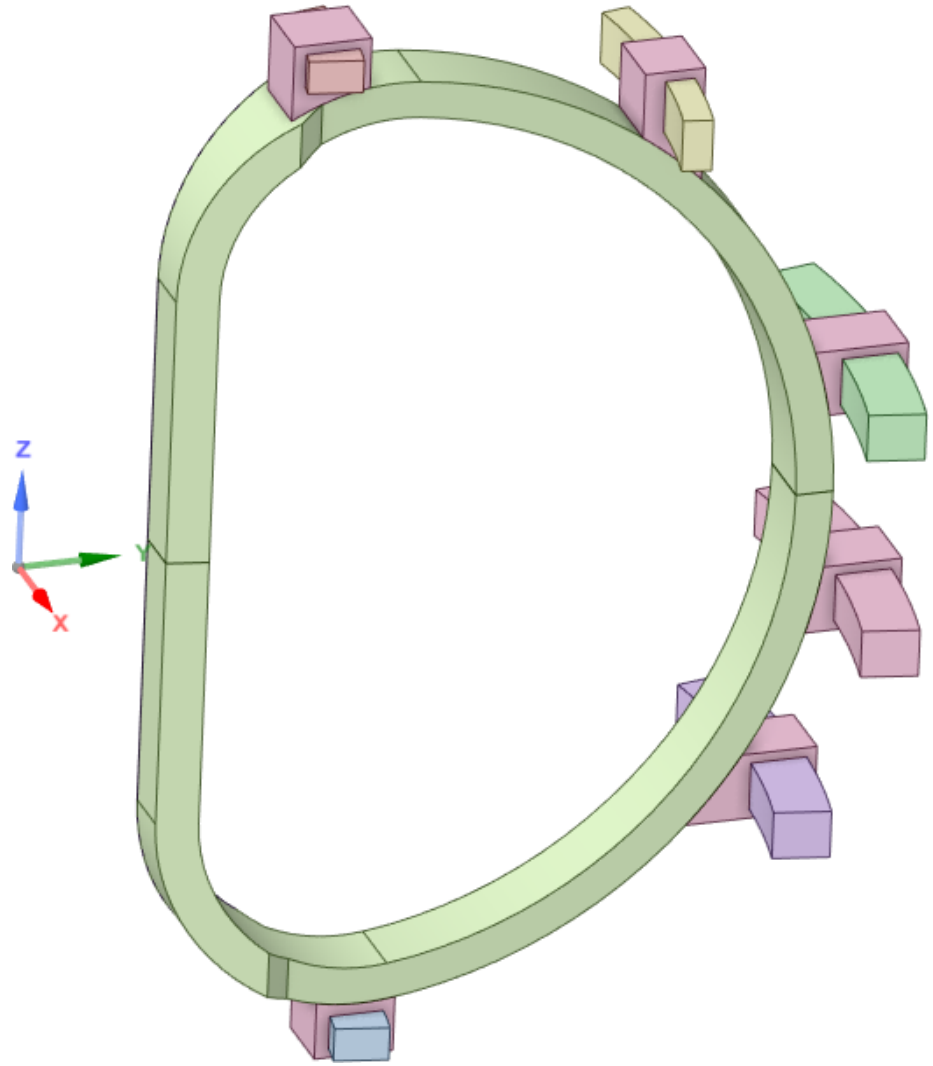
- Addition of a 38 mm bend in the external part of the TF coil WP (it has been consequently added to the Casing as well, so that the two perfectly match)





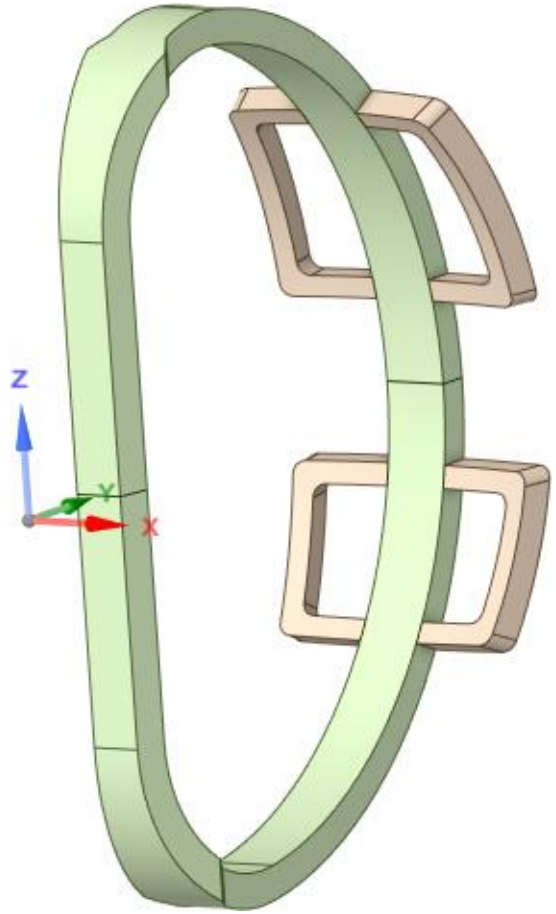
DEMO LAR 2024 - PF coils

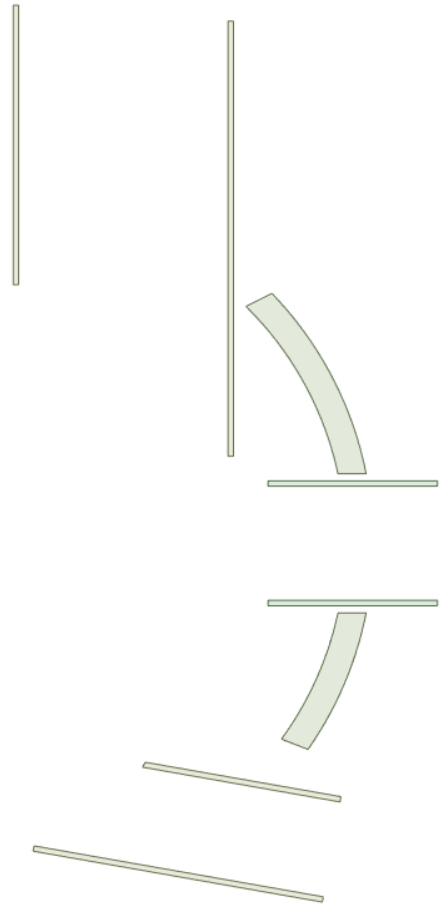
- "*PF Coils - DEMO LAR 10-2024.stp*"
- PF coils supports:
  - have the same width of the curved leg of the TF coil casing (1.471 m)
  - have been designed so to leave a minimum distance of 200 mm with the coils themselves (unless the side that touches the TF coil is considered)
  - the support of PF5 has been connected horizontally to the TF coil casing, while in 2019 was connected vertically



DEMO LAR 2024 - OIS

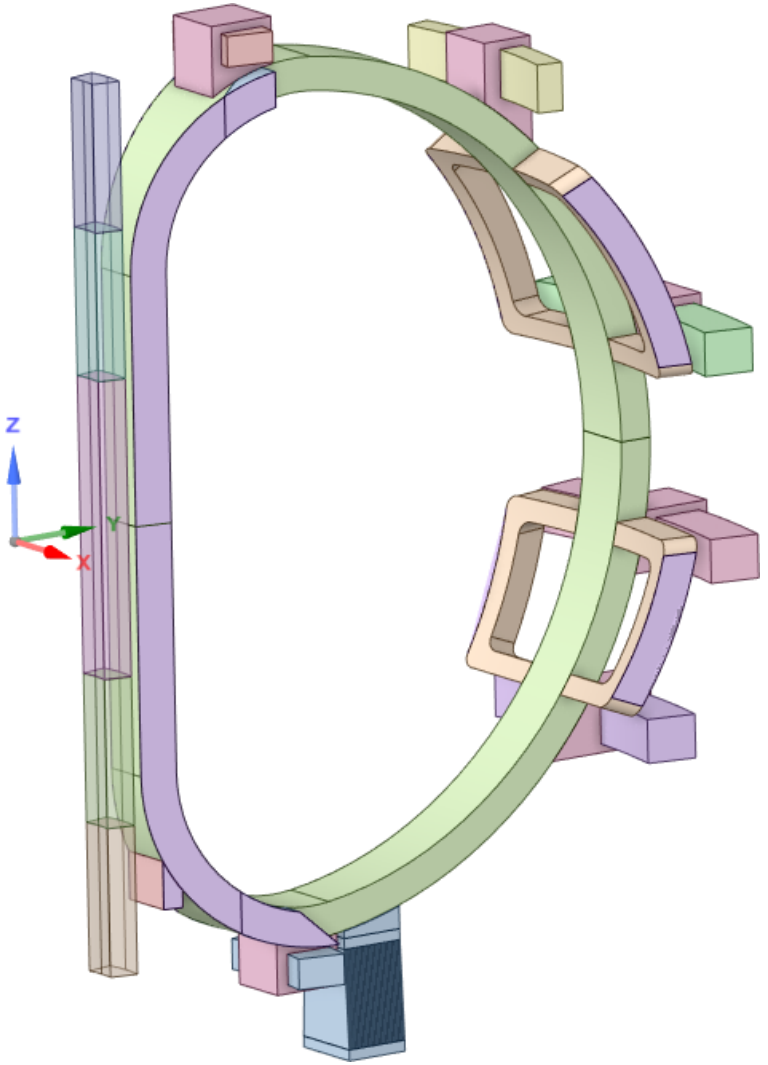
- Devised to remember optimised OISs from 2019 analyses + taking into account the available space between the Ports





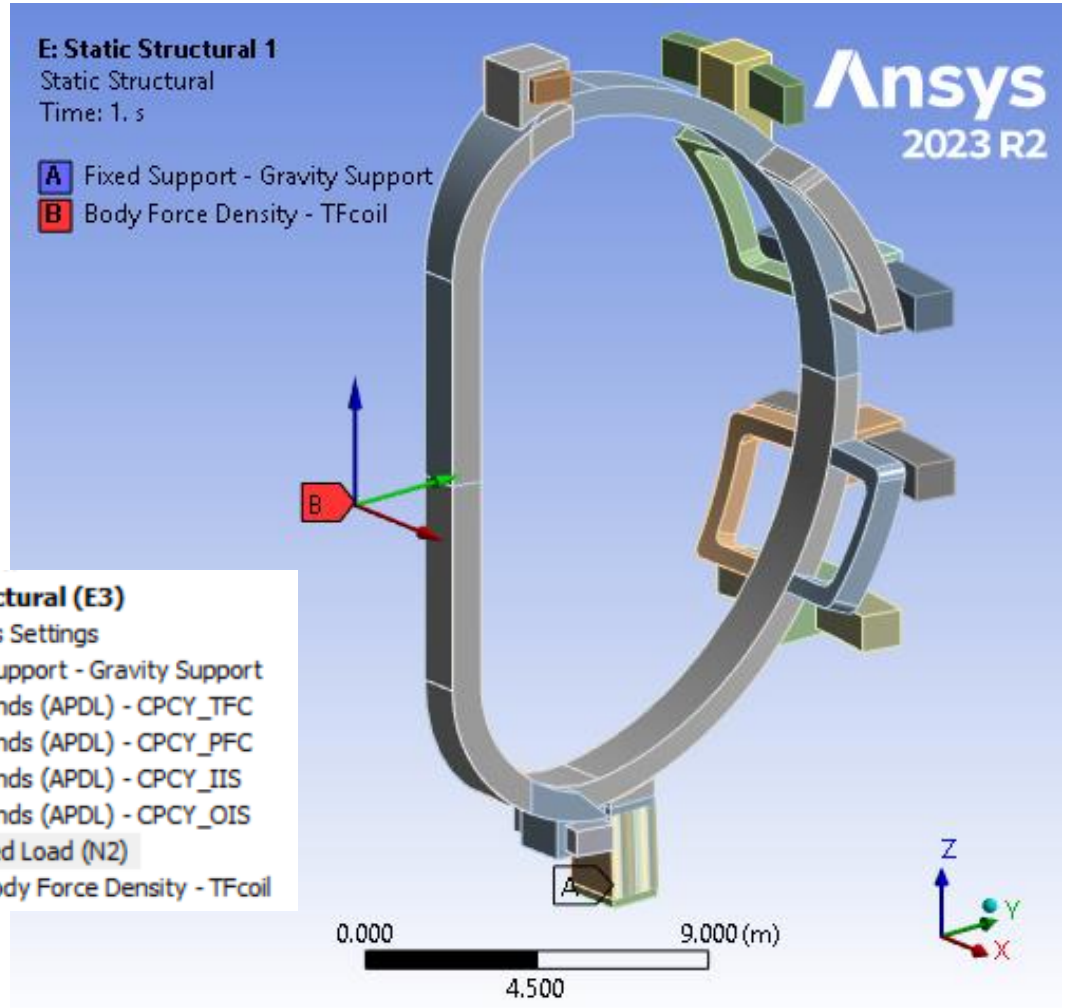
DEMO LAR 2024 - TF coil Assembly

- General considerations at this first step of analyses:
  - only in-plane loads have been considered (EM loads coming from the TF coil)
  - CS and CSS have not been taken into account
  - Extra structure has been added to the TF coil casing to host the IIS shear pins
  - Symmetry plates have been added to TF coil casing and OIS and cyclic symmetry BCs have been imposed to their symmetry surfaces



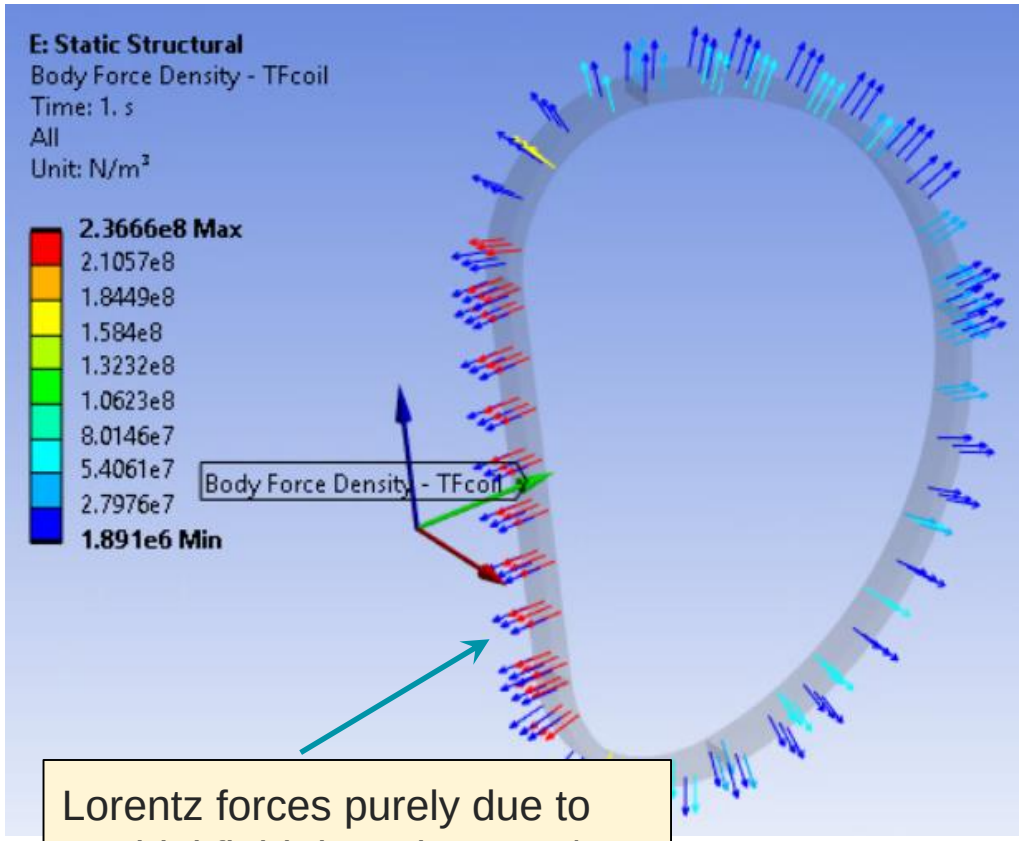
DEMO LAR 2024 - 3D TF mechanical model

- First Iteration Analysis
  - Static Structural block in Ansys Workbench
  - Cyclic symmetry conditions at the insulation plates (hence coupled mesh at the symmetry surfaces)
  - In-Plane EM Loads: **I**x**B** (only from toroidal field, provided by A. Torre)
  - Default stainless steel everywhere
  - Fixed support at the GS base
  - Bounded connections

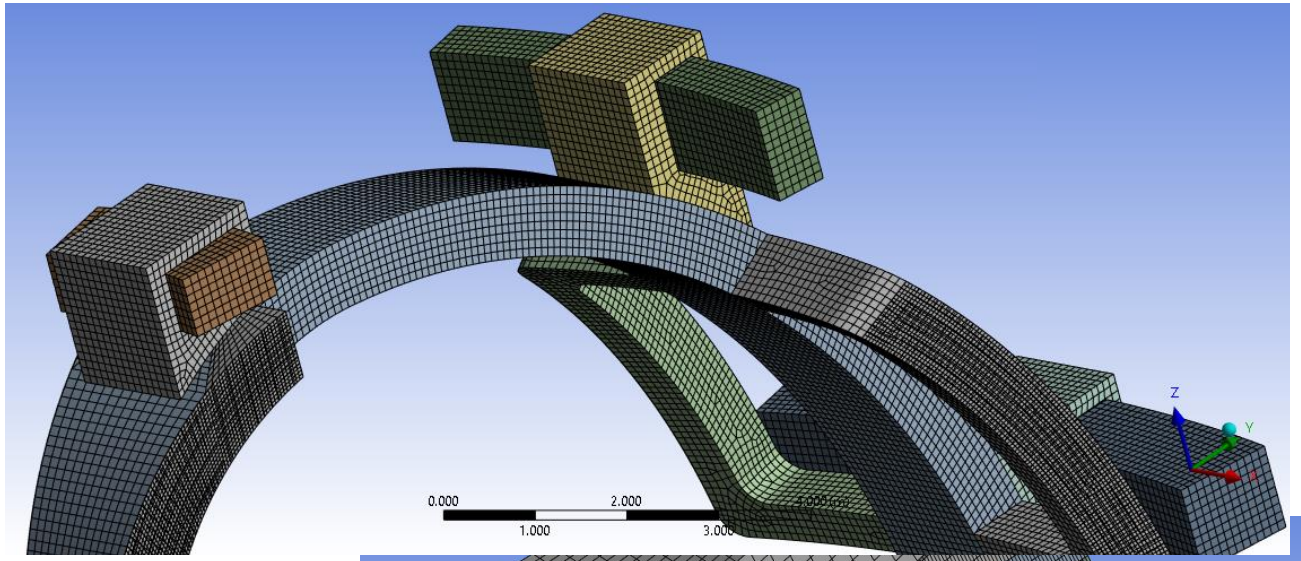


DEMO LAR 2024 - 3D TF mechanical model

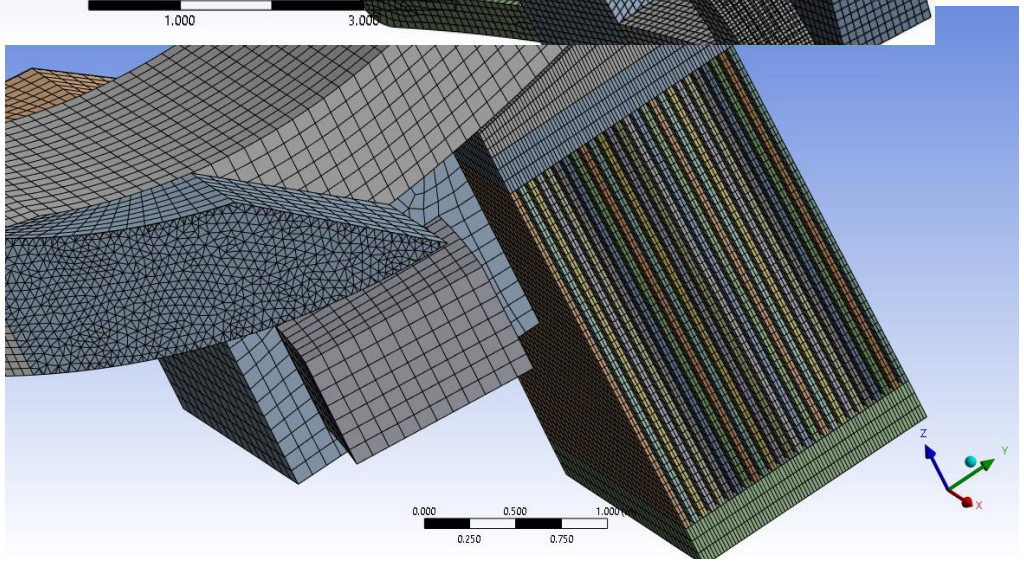
- First Iteration Analysis



Lorentz forces purely due to toroidal field decaying as 1/r (with B0 = 4.4 T @ R0 = 8.6 m)

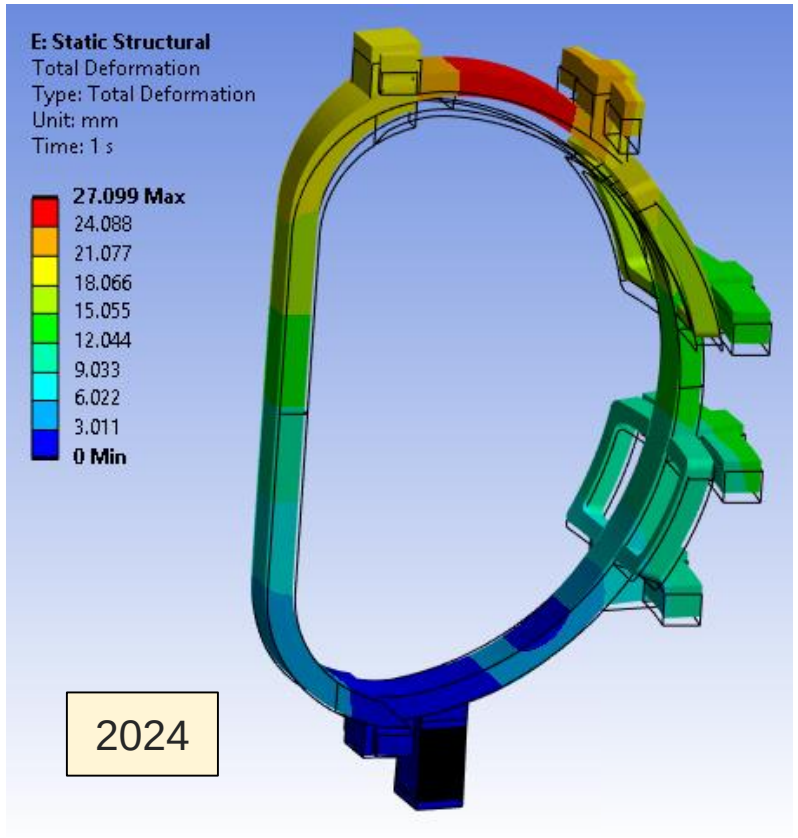


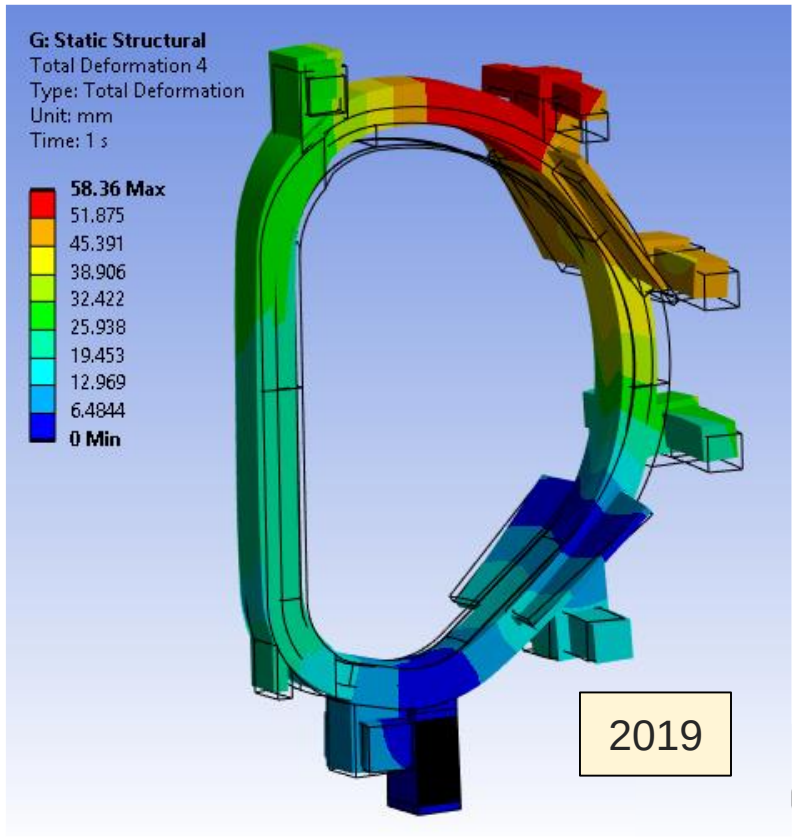
Statistics	
Nodes	1427581
Elements	285134



DEMO LAR 2024 - TF coil

- First Iteration Analysis
  - Results are of the same order of magnitude of the ones of 2019 (EFDA_D_2NMUWY)





DEMO LAR 2024 - Next steps/2025 Task

- Report for 2024 task is foreseen for March 2025

- 2025 Task - CEA TF mechanical models (3D) - foreseen 3 PMs: update of the existing 3D mechanical model, taking into account:
  - more realistic materials and friction coefficients
  - out-of-plane EM loads
  - the presence of Central Solenoid and CSS

EUROfusion Values

FAIRNESS

Transparency
Collaboration
Loyalty

OPENNESS

Open doors
Open hearts
Open minds
Open ears

COMMITMENT

Ownership
Critical thinking
Determination
Respect

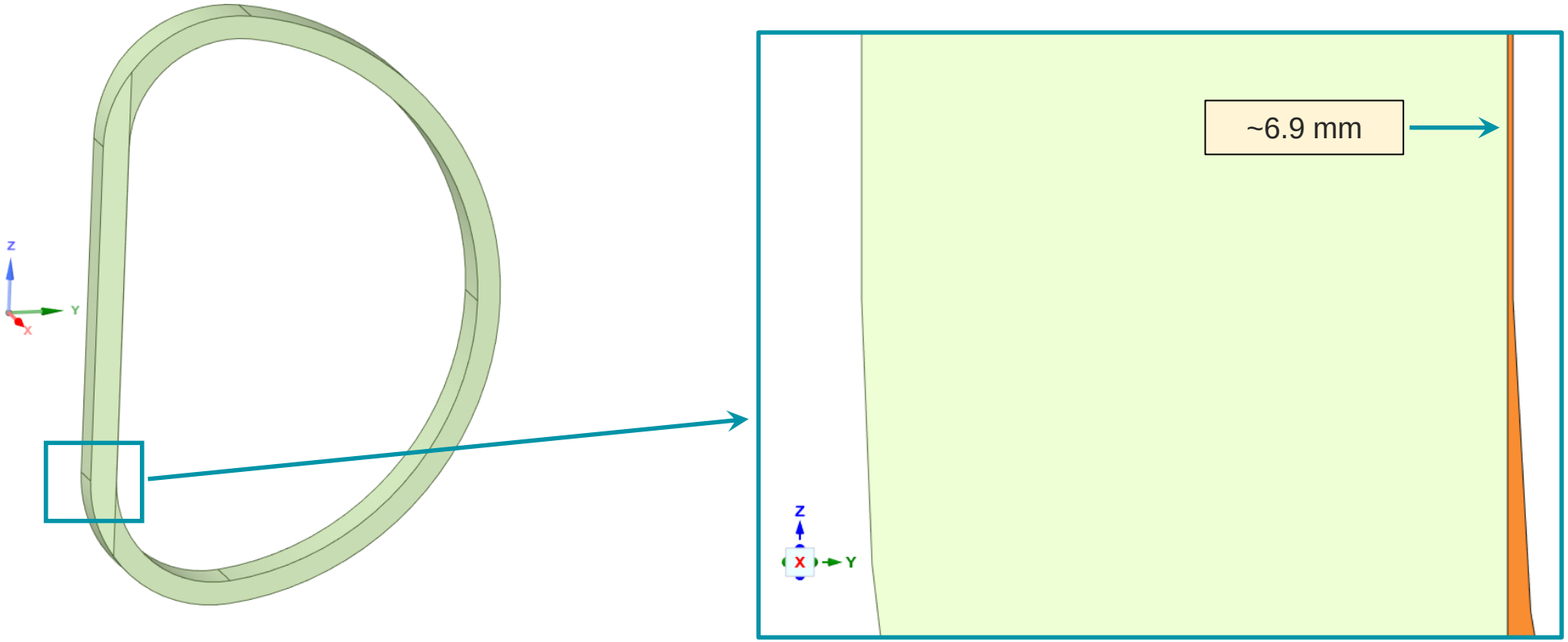
DIVERSITY

Cooperation
Equal opportunities
Inclusion

Extra slides - Notable features

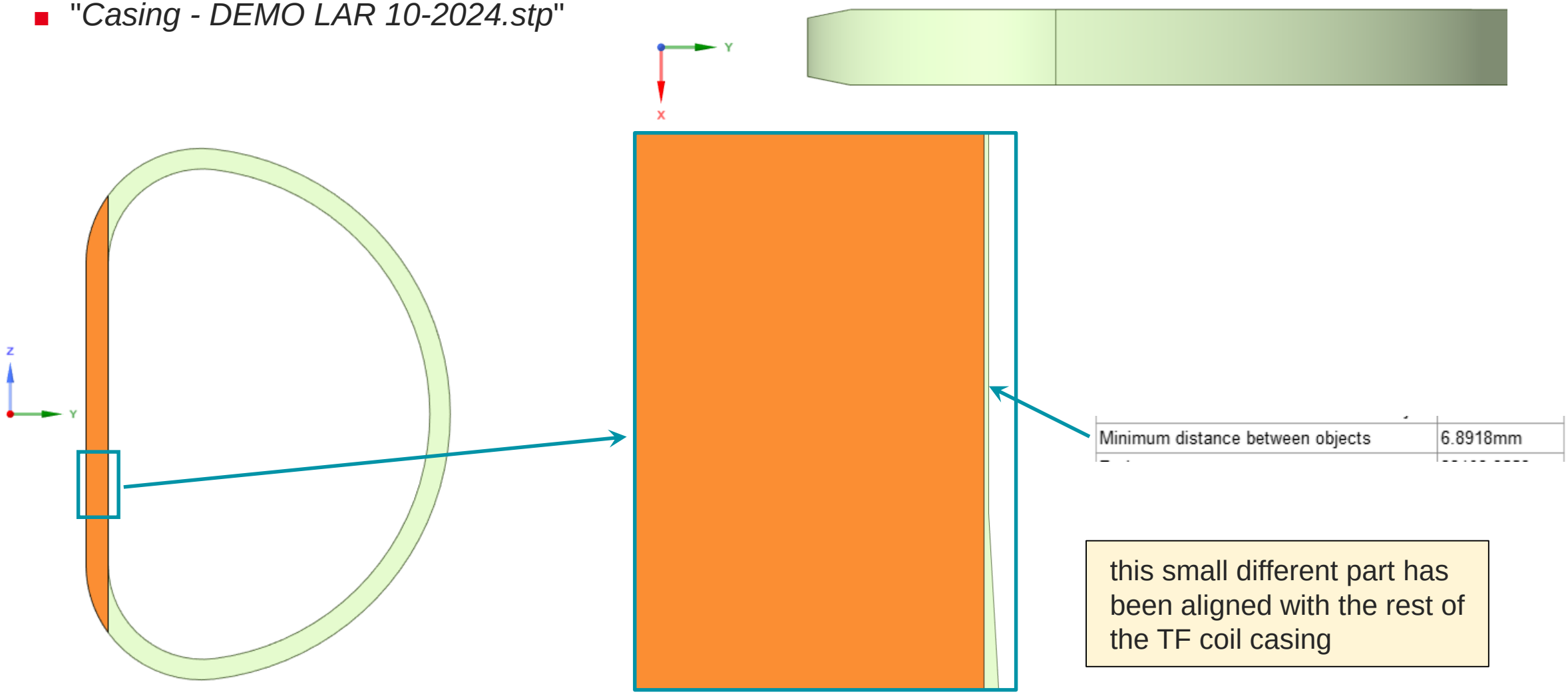
DEMO LAR 2024 - TF coil

- "*Casing - DEMO LAR 10-2024.stp*"



DEMO LAR 2024 - TF coil

- "*Casing - DEMO LAR 10-2024.stp*"

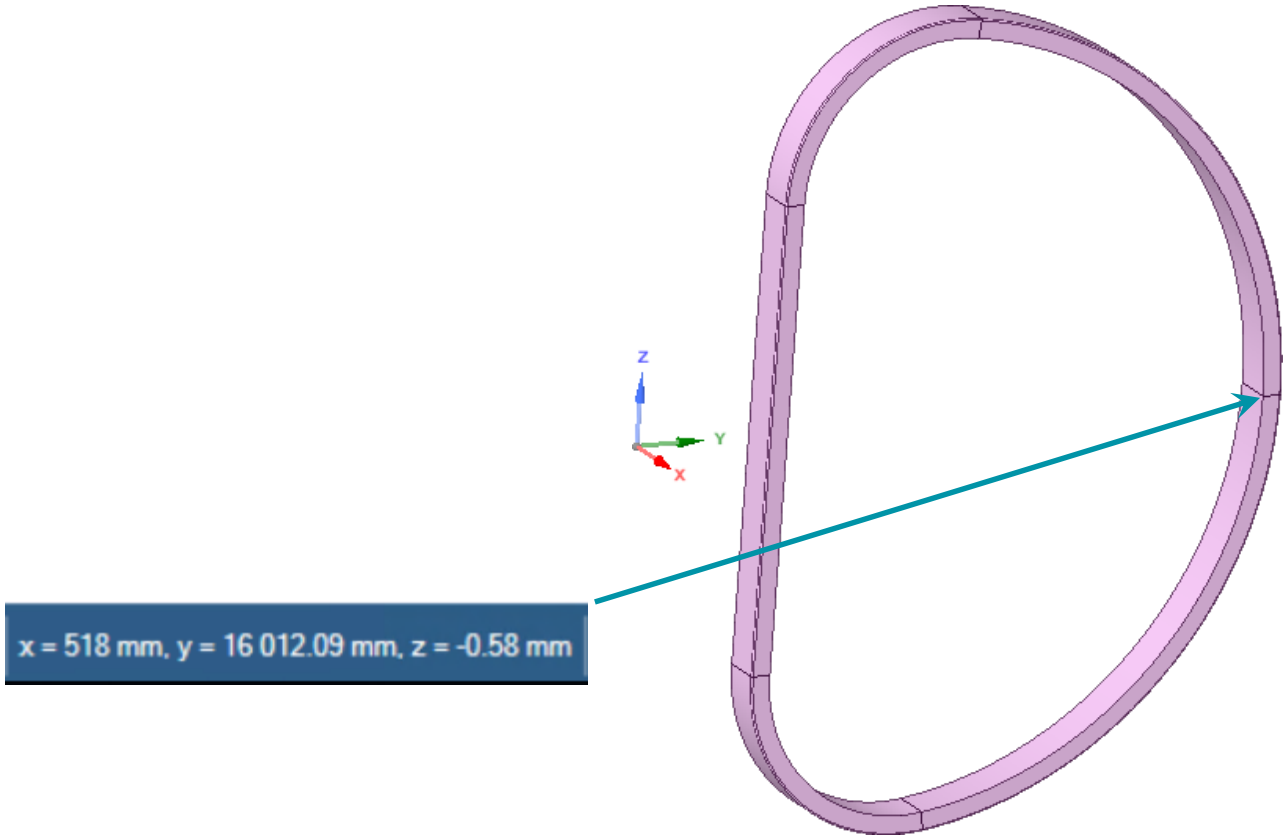


Minimum distance between objects	6.8918mm

this small different part has been aligned with the rest of the TF coil casing

DEMO LAR 2024 - TF coil

- "*Casing - DEMO LAR 10-2024.stp*"
- The default edge at the equatorial position of the outer leg is not exactly at z = 0 m



DEMO LAR 2024 - Central Solenoid

- "*Central Solenoid - DEMO LAR 10-2024.stp*"