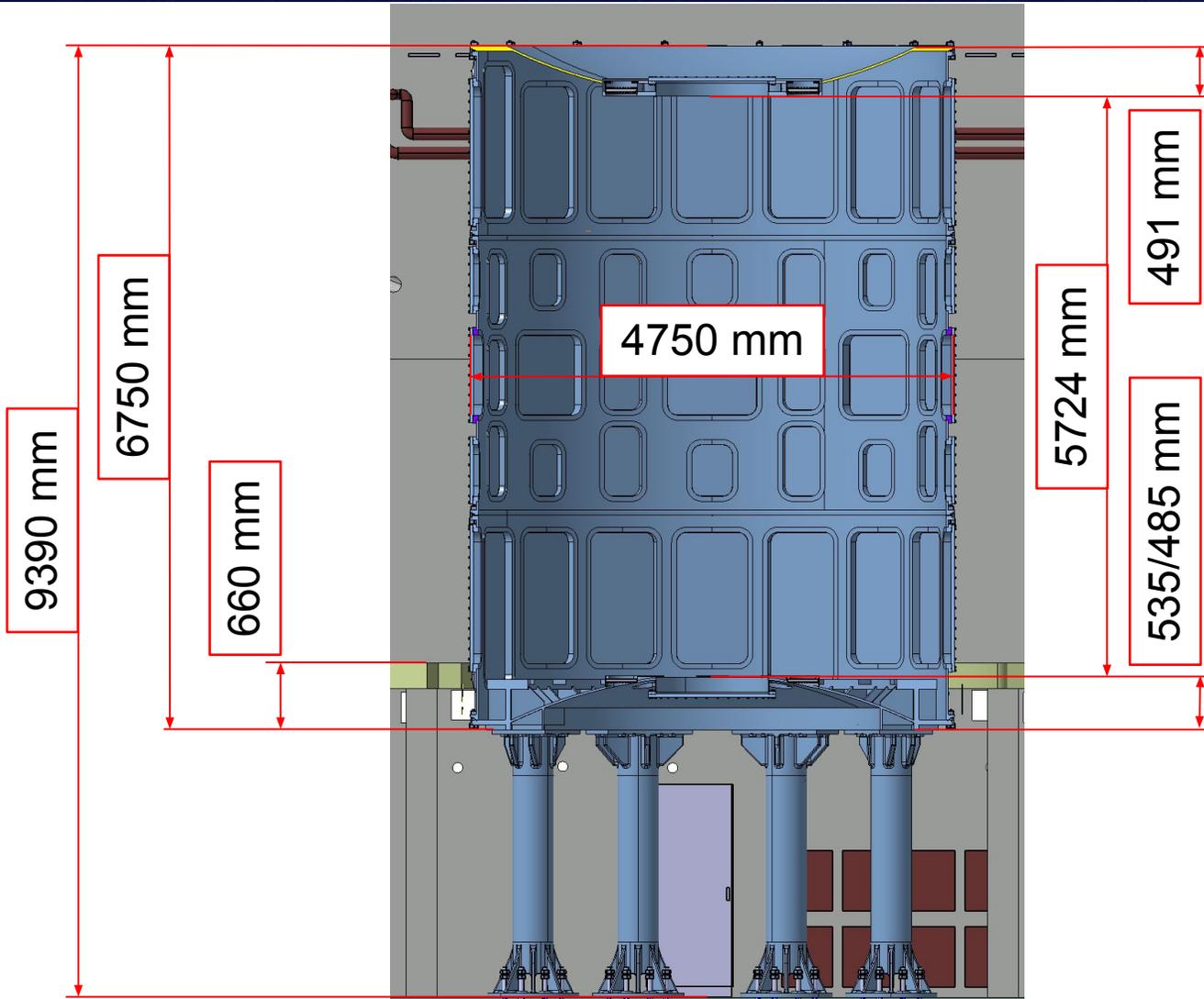


CRYOSTAT

ŠESTÁK DAVID

Presentation for preliminary market consultations
based on presentation for Internal tender design review 15. 5. 2025

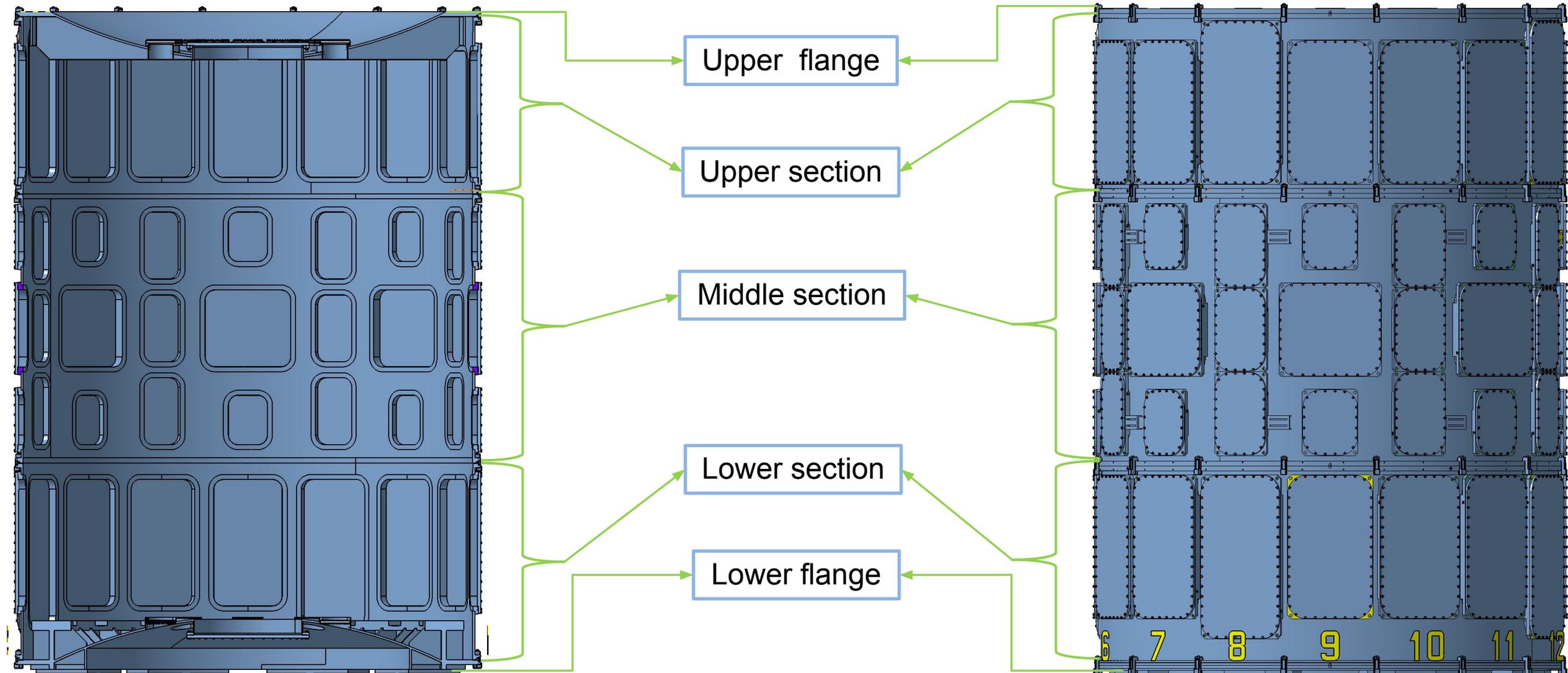
- Cryostat description
- Segment joints/seals
- Flanges seals
- Issues
- Space envelopes

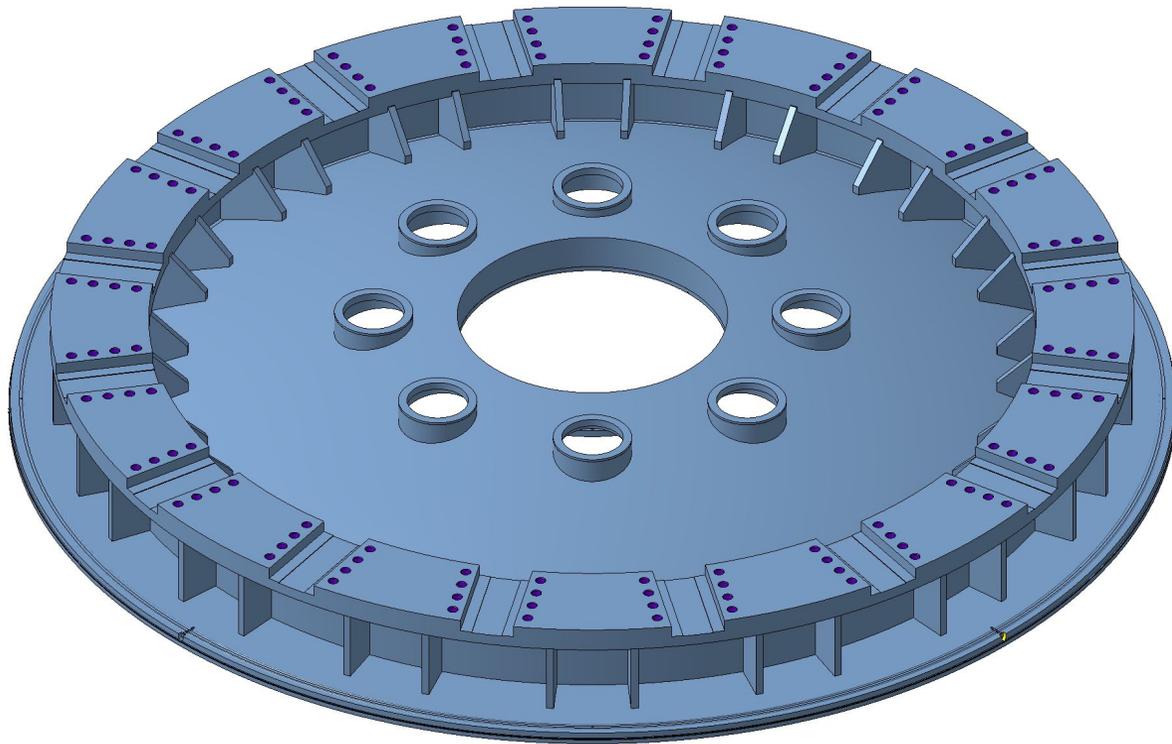


General dimensions of the cryostat are:

- Outer diameter 4.75 m
- Height 6.75 m
- Size over blanks of horizontal flanges 4.75 m
- Size over horizontal flanges 4.70 m
- internal diameter 4.59 m

The size of the cryostat can be modified. **All parts has to pass through the assembly hall door, this is 4.8 meter wide.**





General dimensions of LOWER LID are:

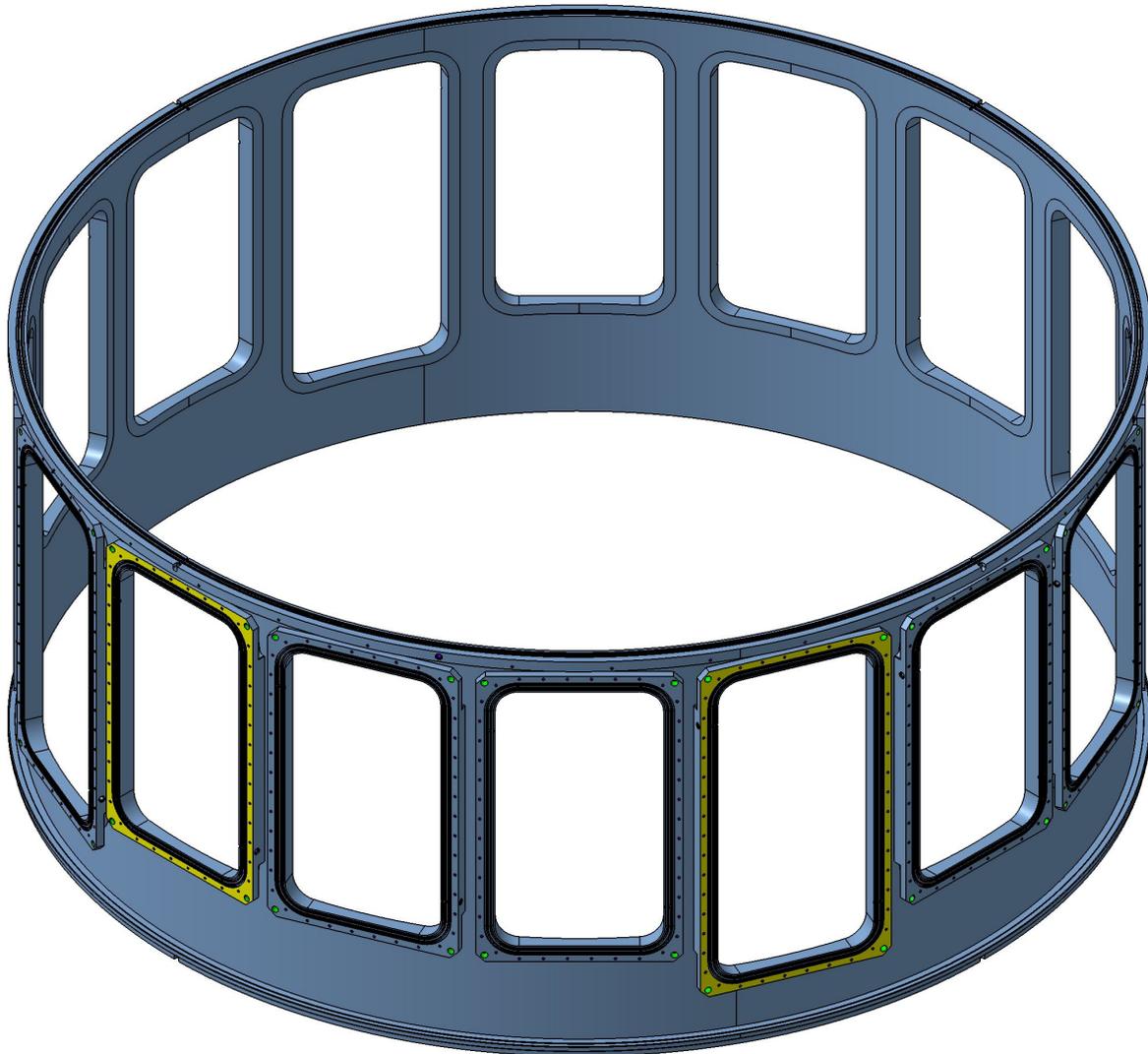
- Outer diameter 4.750 m
- Height 0.535 m
- Weight without blanks 12 178 kg

Flanges:

- Central DN1100 flange
- 8 times NW250CF flange on radii 0.89 m

Section parameters:

- Shell thickness 20 mm
- Section flange thickness 50 mm
- Support structure T shaped support head thickness 100 mm, foot thickness 50mm, rib thickness 30mm



General dimensions of LOWER SECTION are:

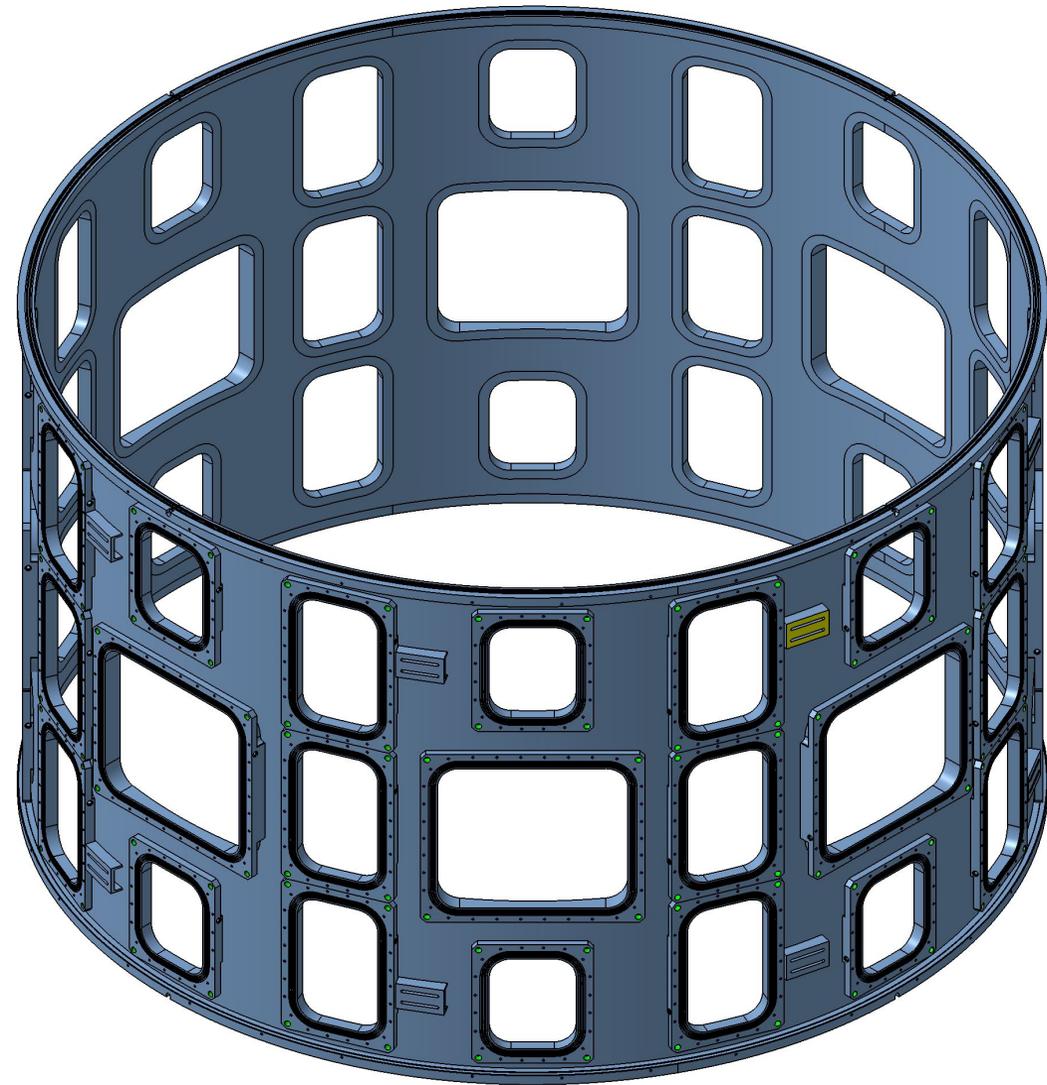
- Outer diameter 4.750m
- Height 2.020m
- Weight without blanks 5 222 kg

Flanges:

- 16 flanges regularly spaced
- 12 flanges DN1300x700 mm
- 4 flanges DN1500x700 mm
- All flanges are 25mm behind the main flange rim

Section parameters:

- Shell thickness 20 mm
- Section flanges thickness 50 mm
- Flanges are from 90mm thick plate



General dimensions of MIDDLE SECTION are:

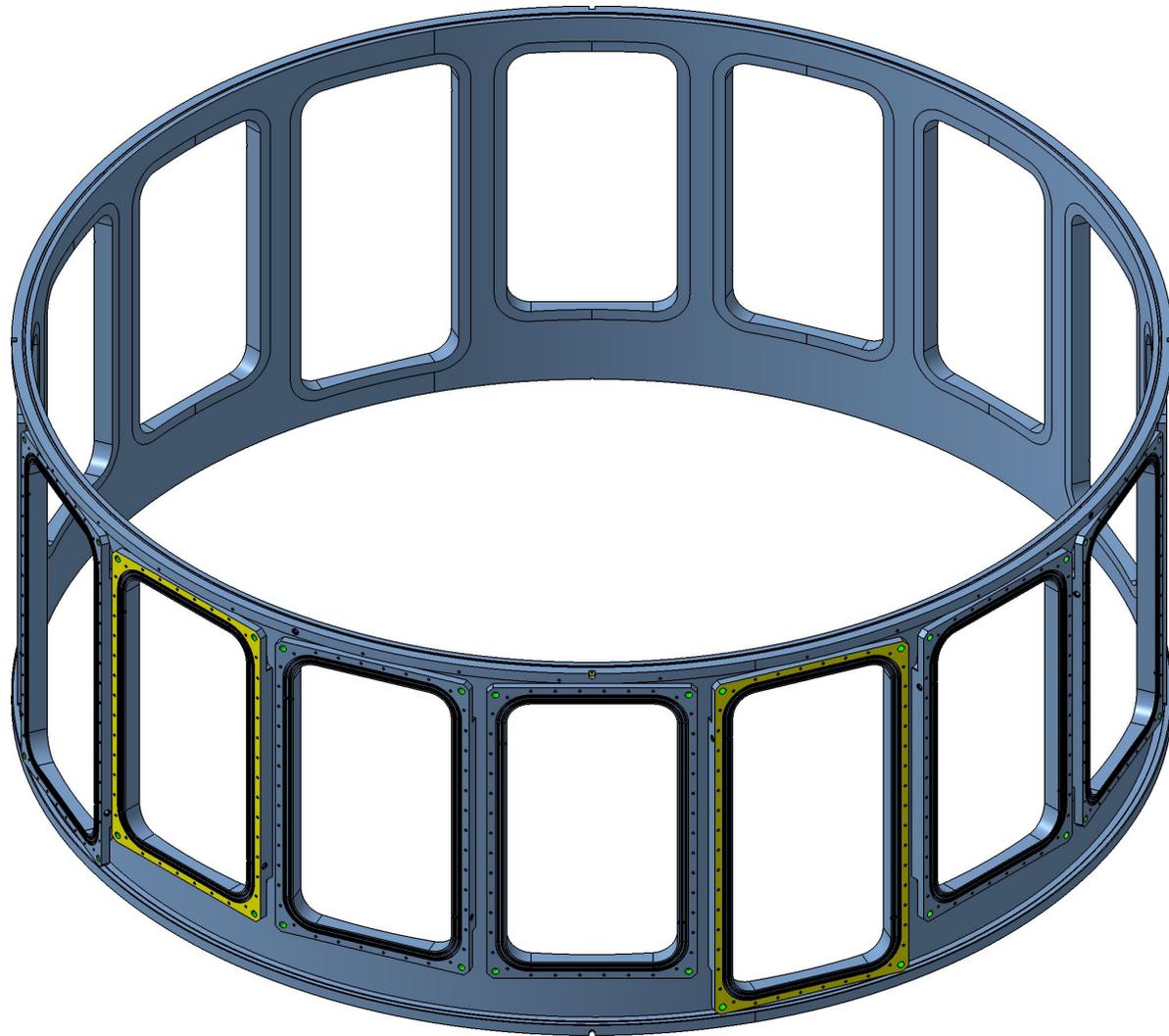
- Outer diameter 4.750 m
- Height 2.760 m
- Weight without blanks 8 028 kg

Flanges:

- 48 flanges regularly spaced
- 8 MX flanges DN790x875 mm
- 8 MN flanges DN690x400 mm
- 8 DLX + 8 DUX flanges DN510x400 mm
- 4 DLH + 4 DUH flanges DN690x400 mm
- 4 + 4 flanges DN690x400 mm
- All flanges are 25mm behind the main flange rim

Section parameters:

- Shell thickness 20 mm
- Section flanges thickness 50 mm
- Flanges are from 70 mm to 110 mm thick plate



General dimensions of UPPER SECTION are:

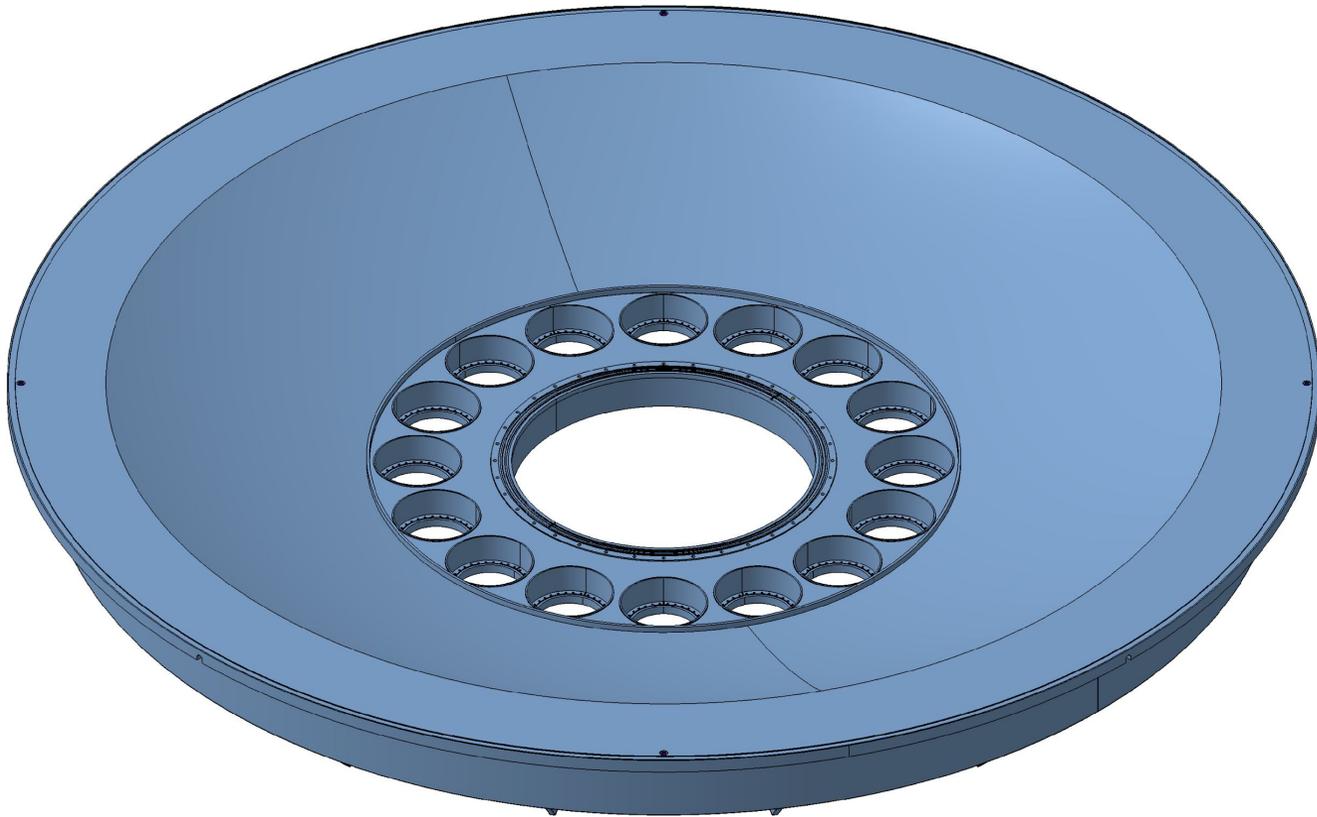
- Outer diameter 4.750m
- Height 1.820m
- Weight without blanks 4 798 kg

Flanges:

- 16 flanges regularly spaced
- 12 flanges DN1300x700
- 4 flanges DN1500x700
- All flanges are 25mm behind the main flange rim

Section parameters:

- Shell thickness 20 mm
- Section flanges thickness 50 mm
- Flanges are from 90mm thick plate



General dimensions of UPPER LID are:

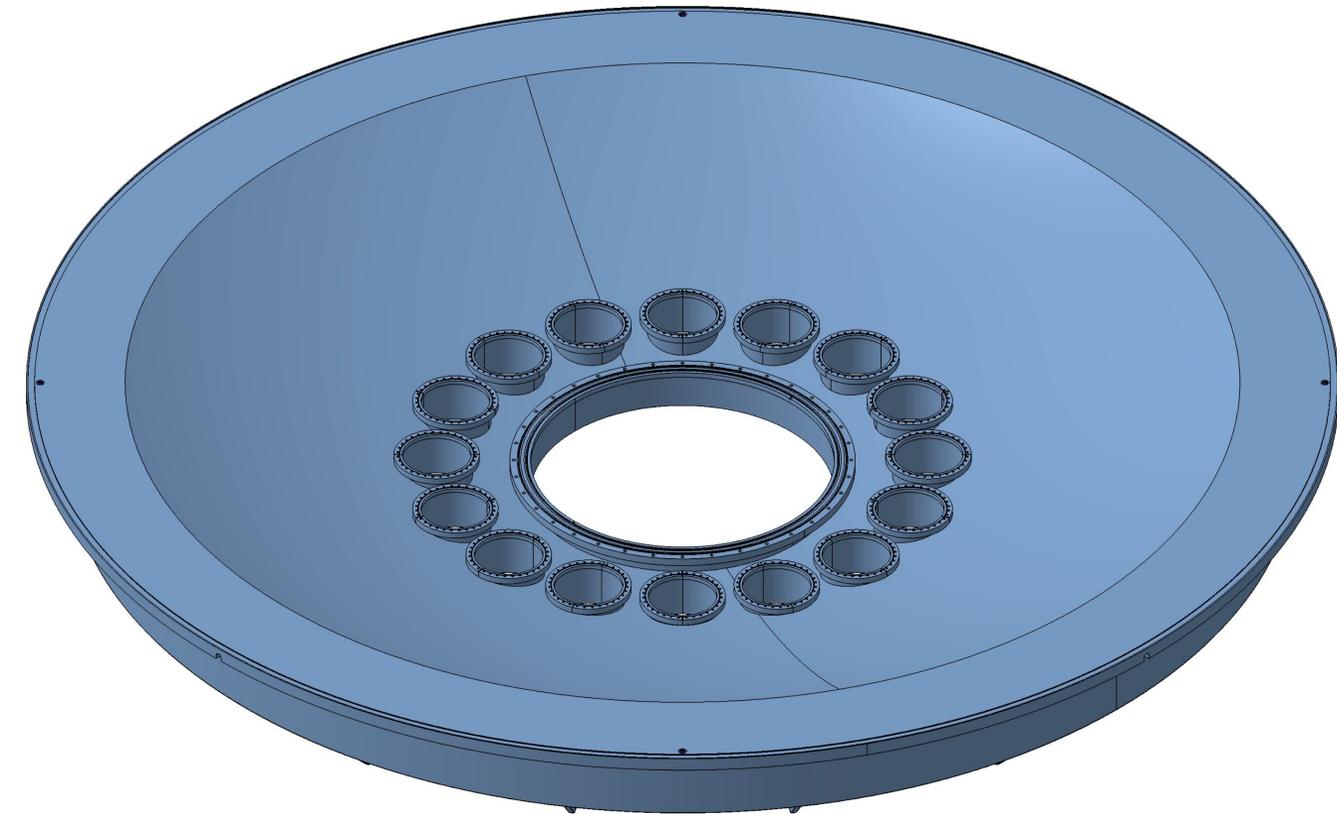
- Outer diameter 4.750m
- Height 0.491m
- Weight without blanks 5 953 kg

Flanges:

- Central DN1100 flange
- 16 times NW250CF flange on radii 0.89m

Section parameters:

- Shell thickness 20 mm
- Section flange thickness 50 mm
- Ribs 20 mm thick



General dimensions of UPPER LID are:

- Outer diameter 4.750m
- Height 0.491m
- Weight without blanks 5 655 kg

Flanges:

- Central IDN1100 flange
- 16 times NW250CF flange on radii 0.89m
- NW250CF flanges are 130mm farer from the plasma with respect to V08_F.7

Section parameters:

- Shell thickness 20 mm
- Section flange thickness 50 mm
- Ribs 20 mm thick

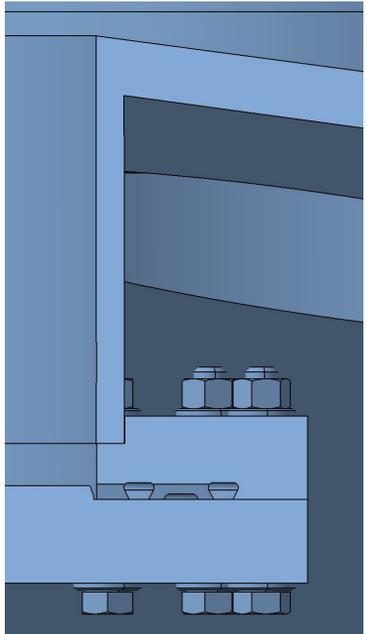
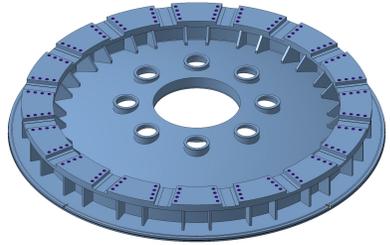
- Cryostat description
- Segment joints/seals
- Flanges seals
- Issues
- Space envelopes



All 4 connections are:

- Double elastomer seals with differential pumping groove
- Groove depth 6.1 mm
- Groove width at narrow point ~7.4 mm
- Groove angle 55 deg
- Area of the groove for dif. pumping is ~19mm square
- Flange height 50 mm
- Flange radial width 80 mm
- Grooves distance from the inner surface 12.1 mm
- Grooves spacing 25 mm
- Connection to differential pumping groove every 90 deg.
- Seals secured by 16 clams per seal
- Positioning of segments secured by 4 stones per joint

- Cryostat description
- Segment joints/seals
- Flanges seals
- Issues
- Space envelopes

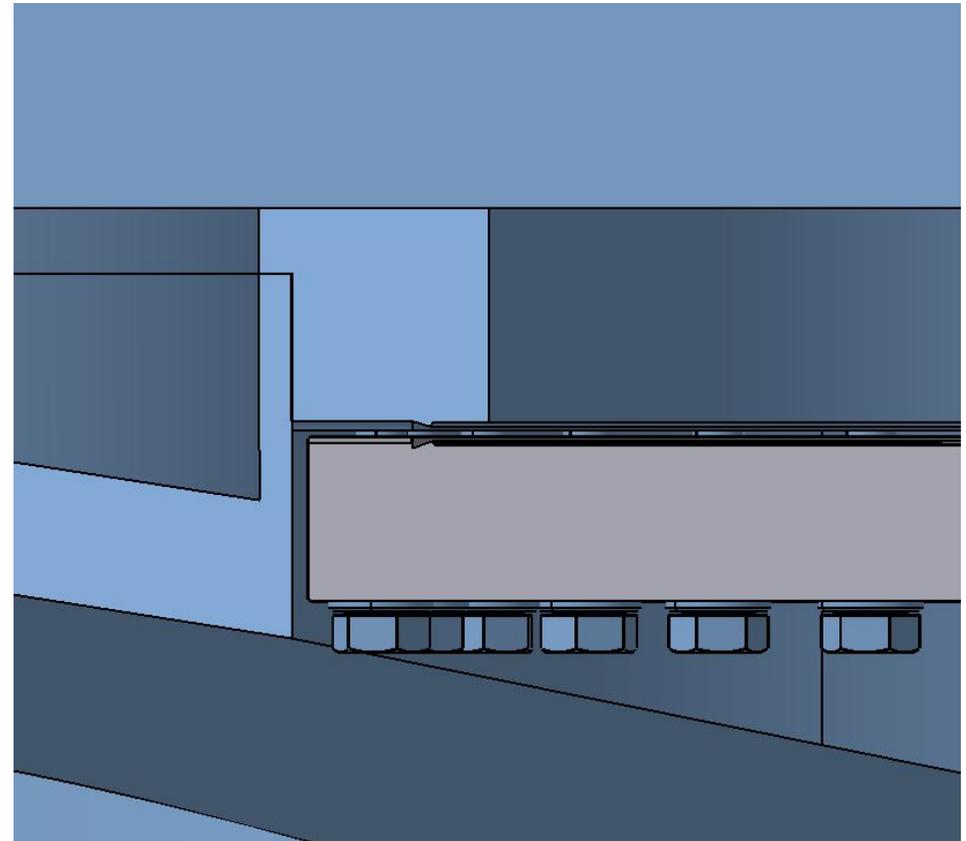


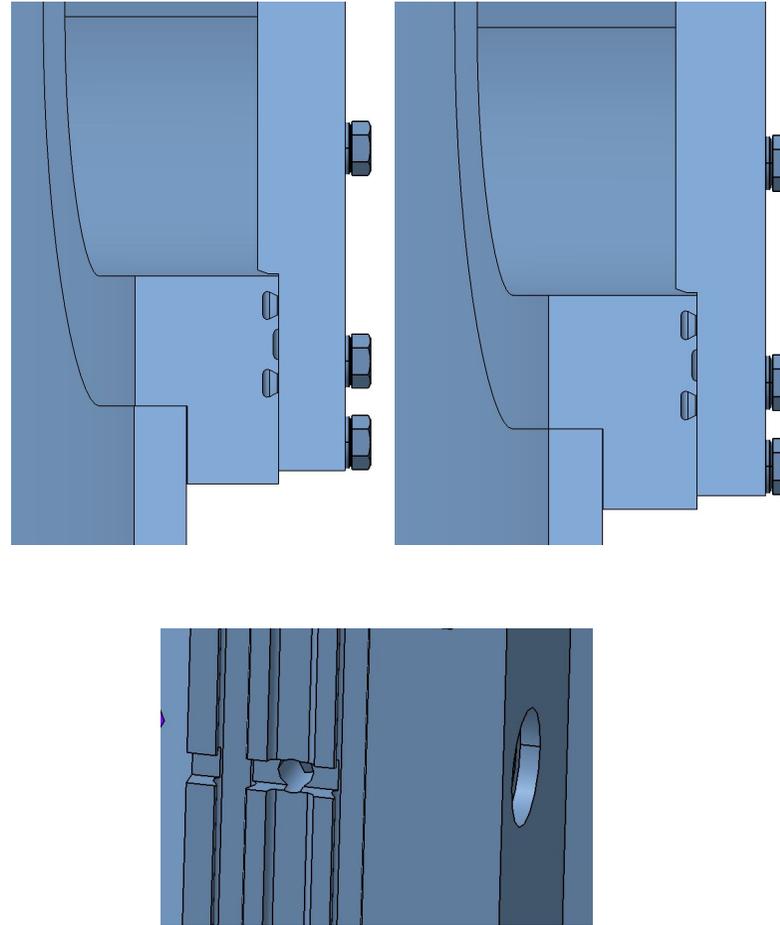
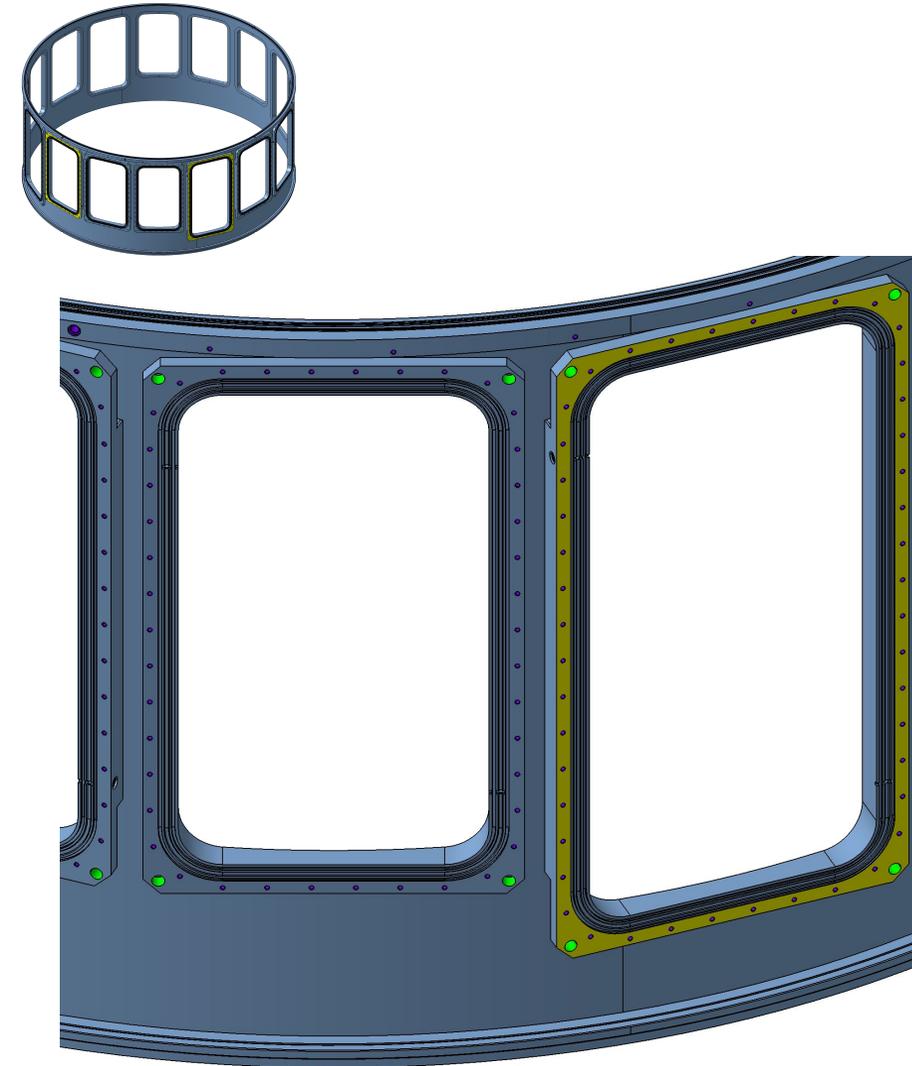
DN1100 Iflange:

- Double elastomer seals with differential pumping groove
- Groove depth 6.1 mm
- Groove width at narrow point ~7.4 mm
- Groove angle 55 deg
- Area of the groove for dif. pumping is ~9.5 mm square
- Grooves distance from the inner surface 9.6 mm
- Grooves spacing 30 mm
- Connection to differential pumping groove every 180 deg.

NW250 CF:

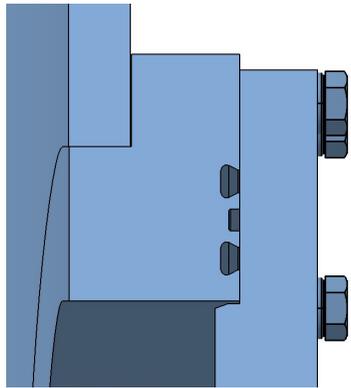
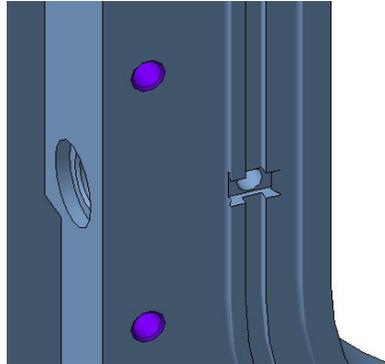
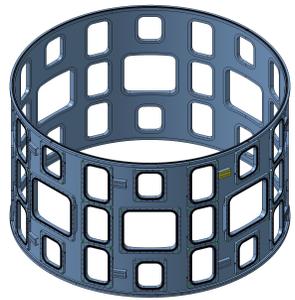
- Metallic seal



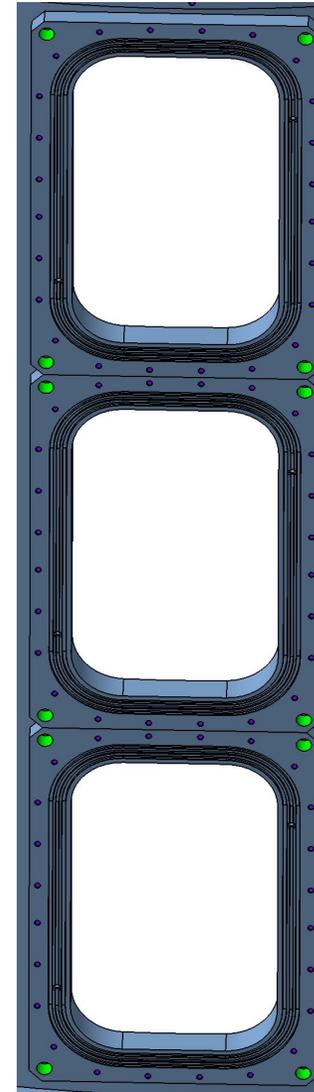
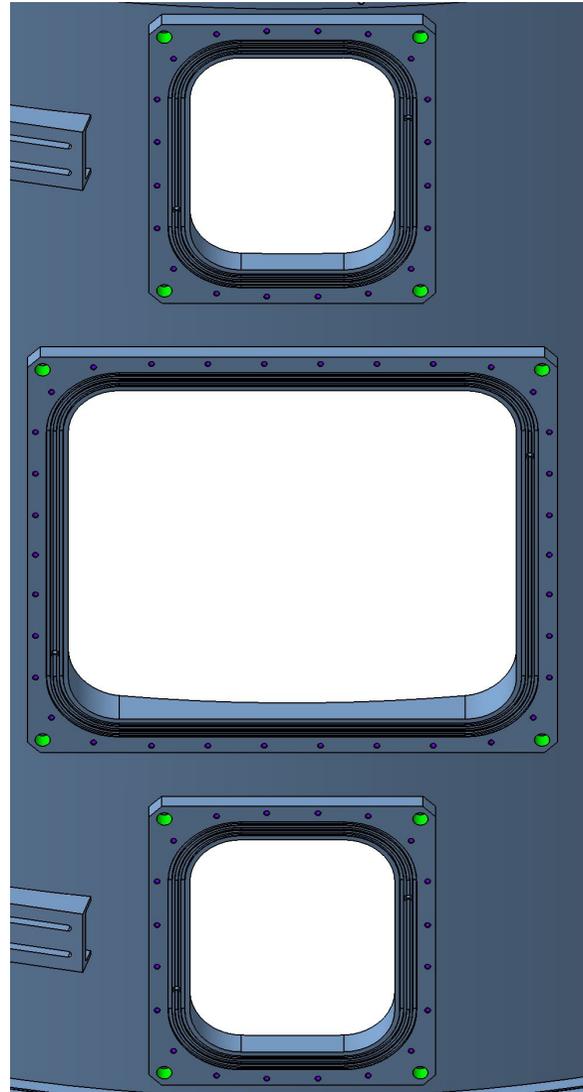


DN1300x700 DN1500x700 are:

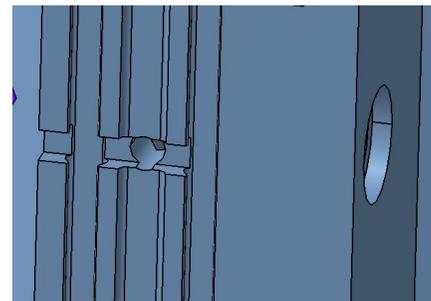
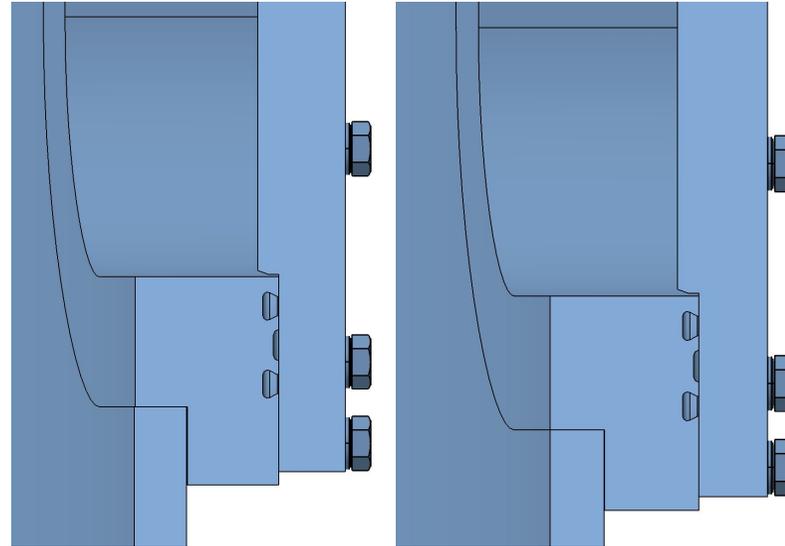
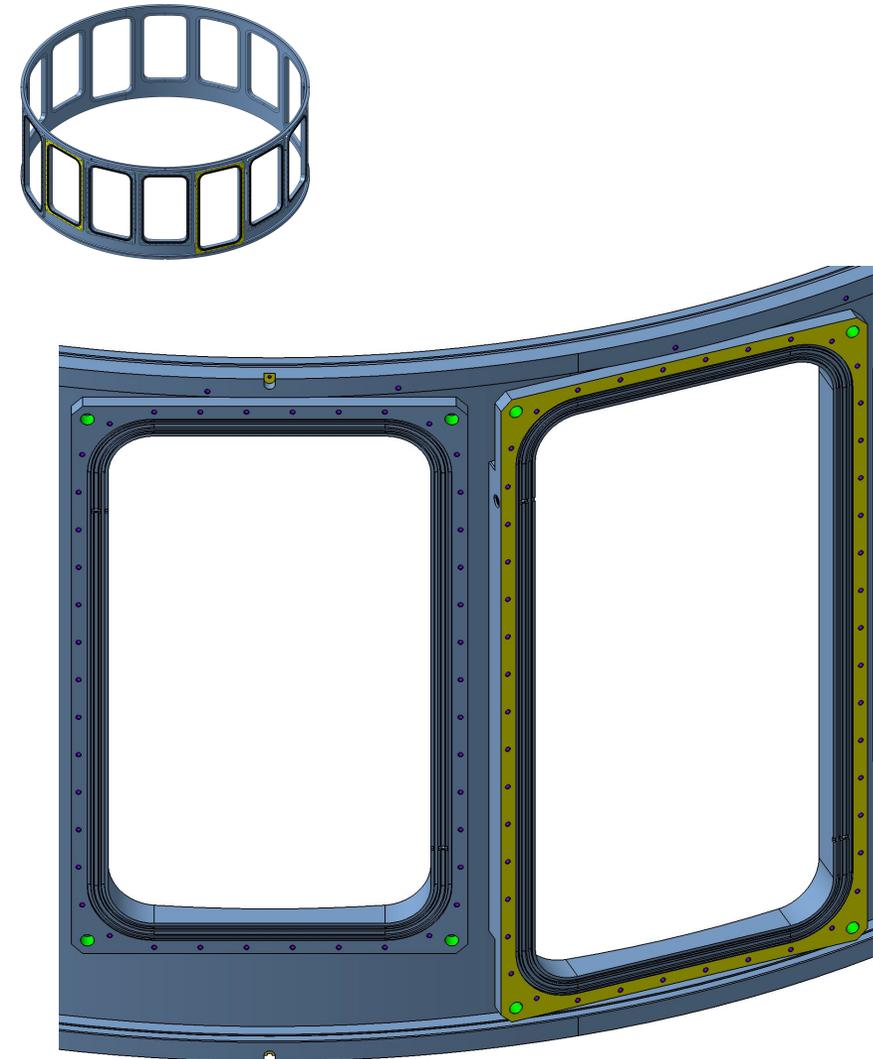
- Double elastomer seals with differential pumping groove
- Groove depth 6.1 mm
- Groove width at narrow point ~7.4 mm
- Groove angle 55 deg
- Area of the groove for dif. pumping is ~9.5 mm square
- Grooves distance from the inner surface 5.85 mm
- Grooves spacing 30 mm
- 2 connections for differential pumping.
- all flanges are framed with 4 30 mm holes for location purposes of port plugs manipulator



- all flanges are framed with 4 30 mm holes for location purposes of port plugs manipulator

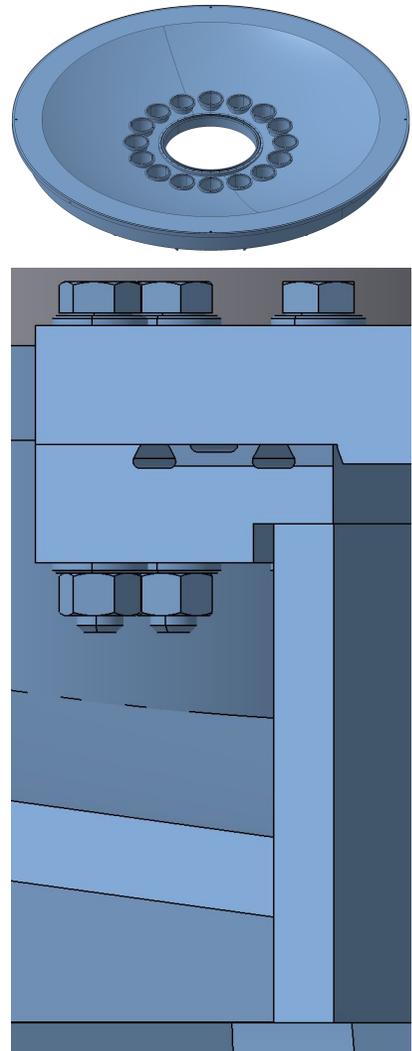


- MX flanges DN790x875
- MN flanges DN690x400
- DLX, DUX flanges DN510x400
- DLH, DUH flanges DN690x400
- flanges DN690x400:
 - Double elastomer seals with differential pumping groove
 - Groove depth 6.1 mm
 - Groove width at narrow point ~7.4 mm
 - Groove angle 55 deg
 - Area of the groove for dif. pumping is ~24 mm square
 - Grooves distance from the inner surface 8.35 mm
 - Grooves spacing 25 mm
 - 2 connections for differential pumping.



DN1300x700 DN1500x700 are:

- Double elastomer seals with differential pumping groove
- Groove depth 6.1 mm
- Groove width at narrow point ~7.4 mm
- Groove angle 55 deg
- Area of the groove for dif. pumping is ~9.5 mm square
- Grooves distance from the inner surface 5.85 mm
- Grooves spacing 30 mm
- 2 connections for differential pumping.
- all flanges are framed with 4 30 mm holes for location purposes of port plugs manipulator

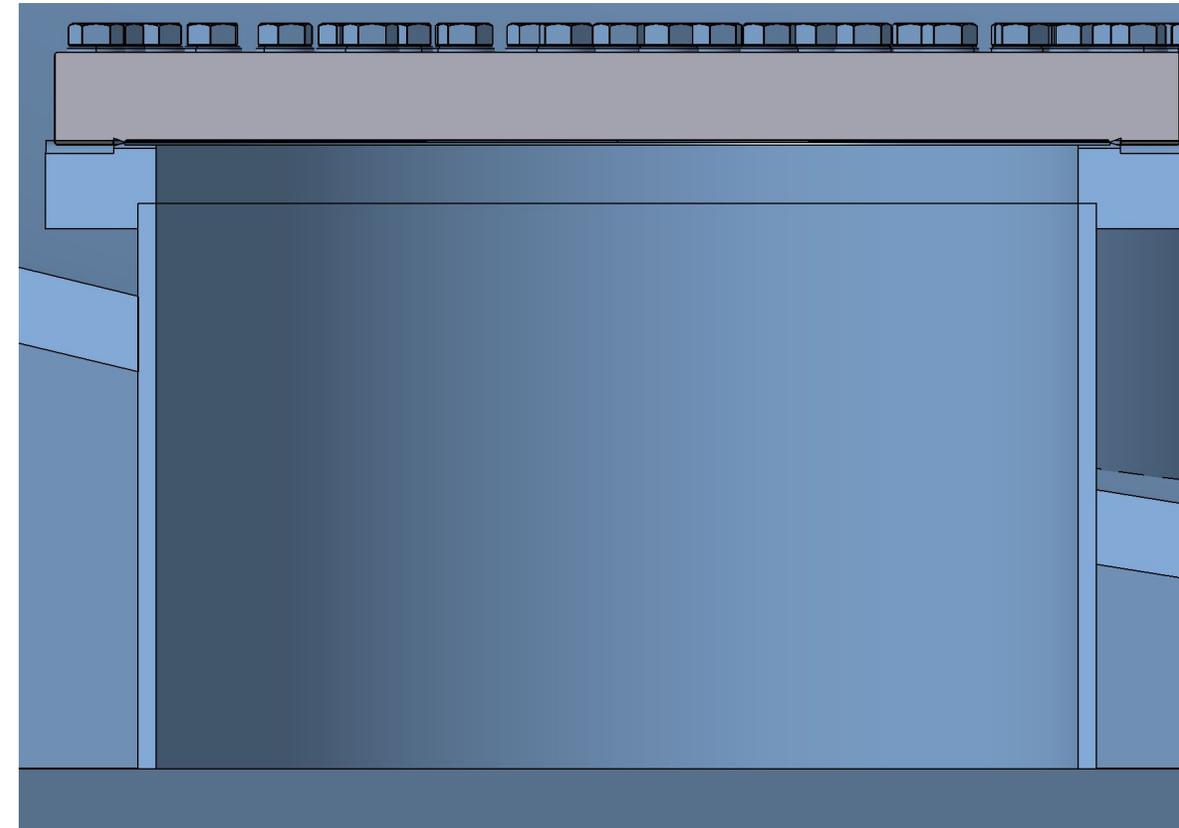


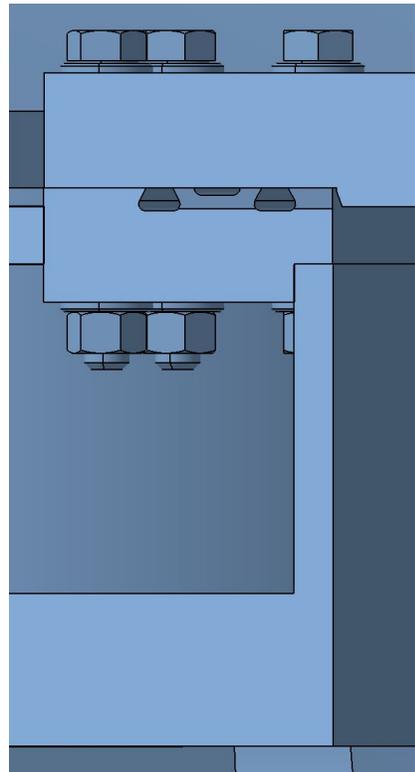
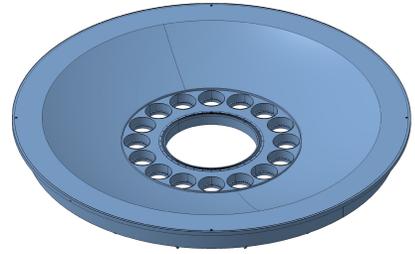
DN1100 flange:

- Double elastomer seals with differential pumping groove
- Groove depth 6.1 mm
- Groove width at narrow point ~7.4 mm
- Groove angle 55 deg
- Area of the groove for dif. pumping is ~9.5 mm square
- Grooves distance from the inner surface 9.6 mm
- Grooves spacing 30 mm
- Connection to differential pumping groove every 180 deg.

NW250 CF:

- Metallic seal



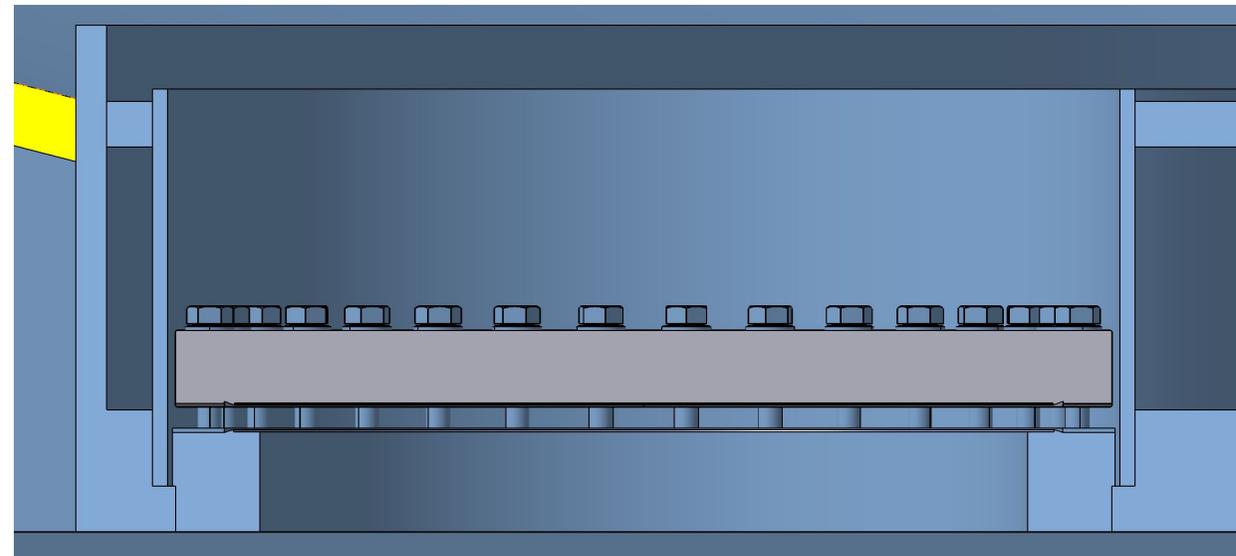


DN1100 flange:

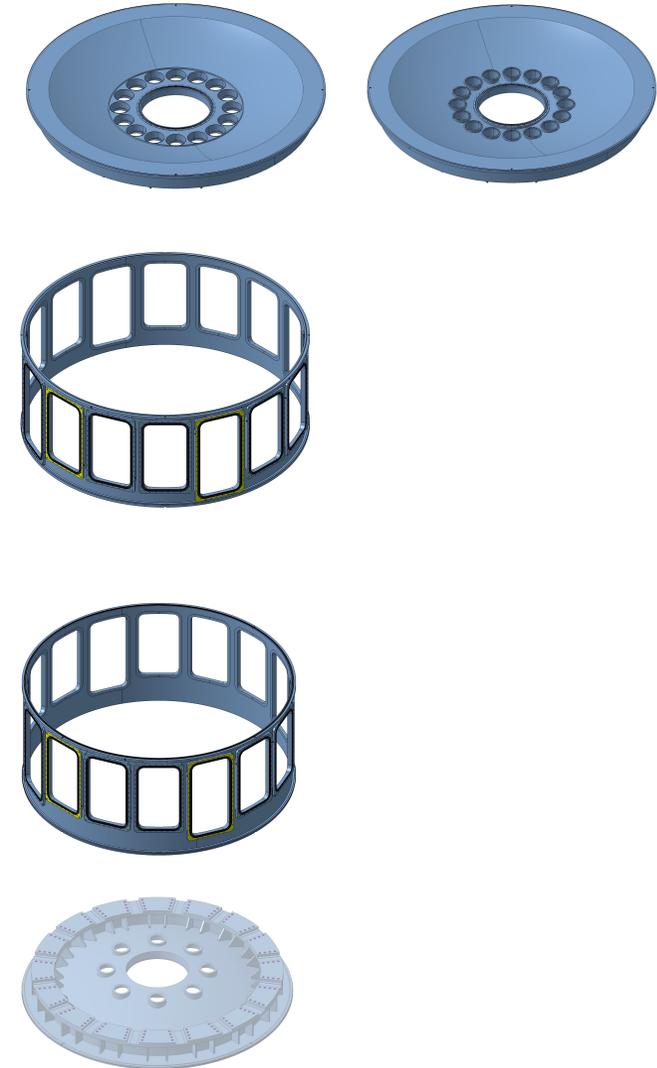
- Double elastomer seals with differential pumping groove
- Groove depth 6.1 mm
- Groove width at narrow point ~7.4 mm
- Groove angle 55 deg
- Area of the groove for dif. pumping is ~9.5 mm square
- Grooves distance from the inner surface 9.6 mm
- Grooves spacing 30 mm
- Connection to differential pumping groove every 180 deg.

NW250 CF:

- Metallic seal

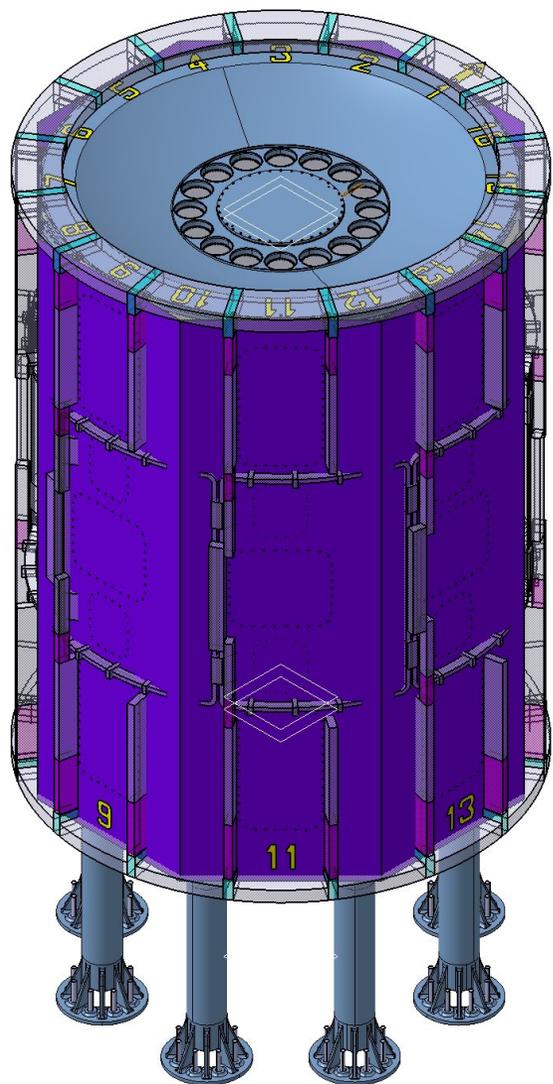


- Cryostat description
- Segment joints/seals
- Flanges seals
- **Issues**
- Space envelopes

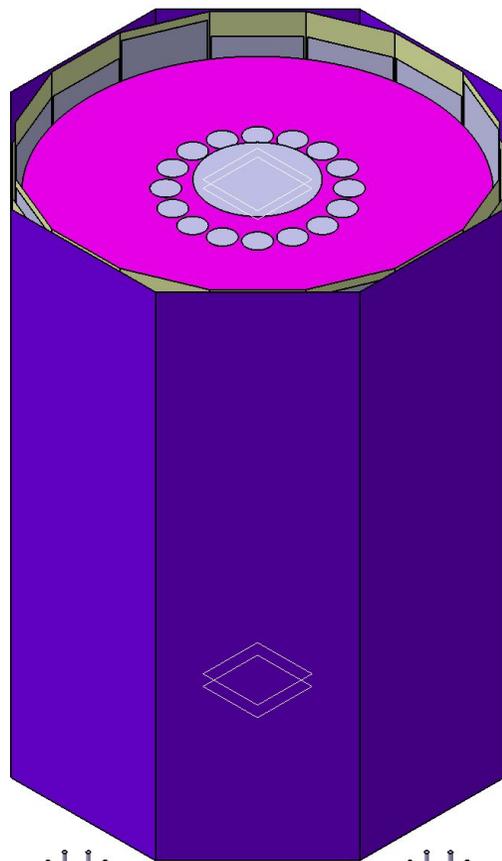


- 2 variants of upper lid
- possibly 2nd variant of vertical ports of lower lid
- sliding of the sealing surfaces of port plugs of LOWER and UPPER cryostat section

- Cryostat description
- Segment joints/seals
- Flanges seals
- Issues
- Space envelopes

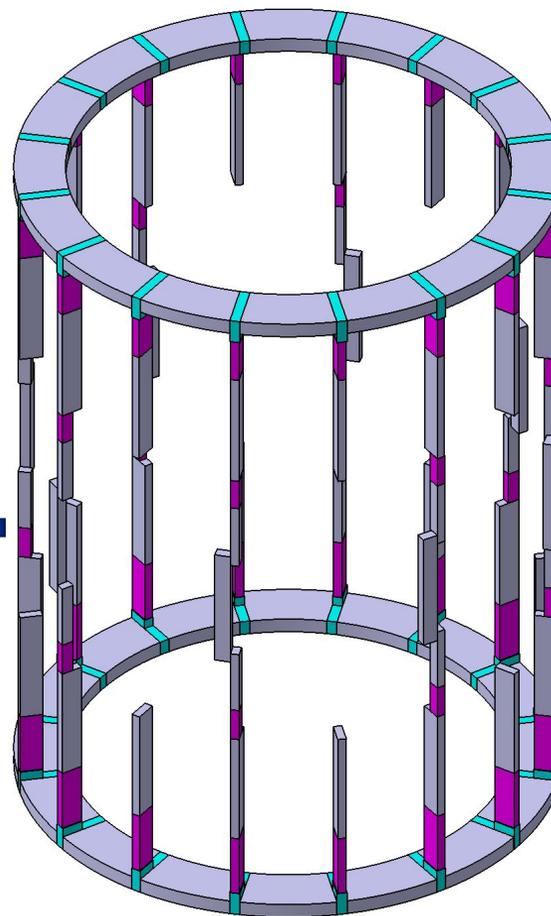


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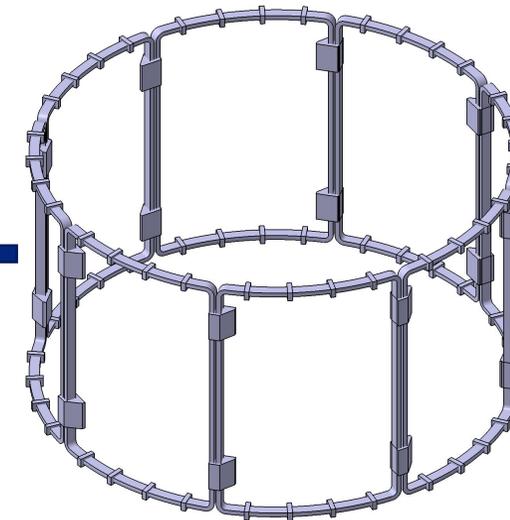
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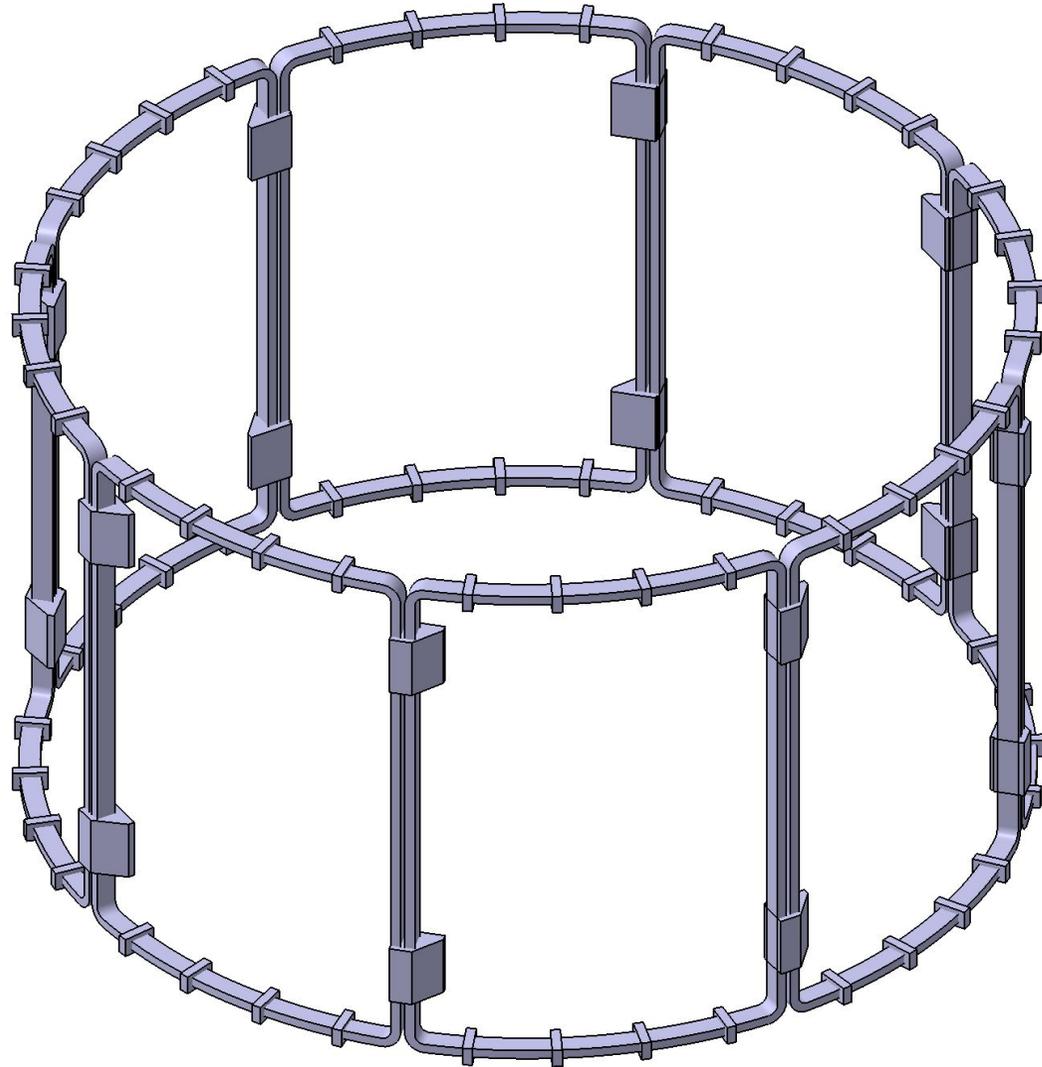


104380_V01_PRT

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100514_V03_PRT



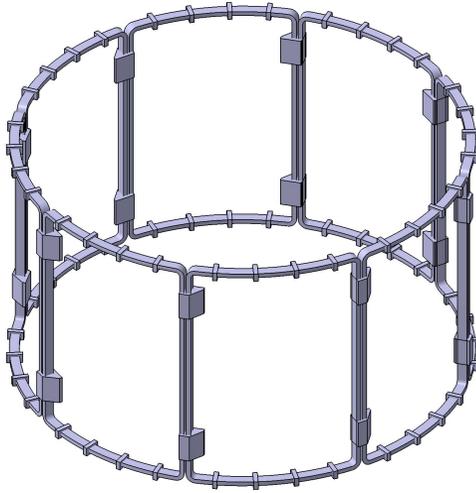
Volume consist of:

- 8 envelopes of coils itself, 50x106 mm profile
- 4 + 4 “clam” type holders on horizontal sections per coil
- 2 holders on vertical section per coil

Supplier duties

- Can NOT interfere with the volume
- Can NOT modify the volume

No connection elements are part of the envelope at the moment

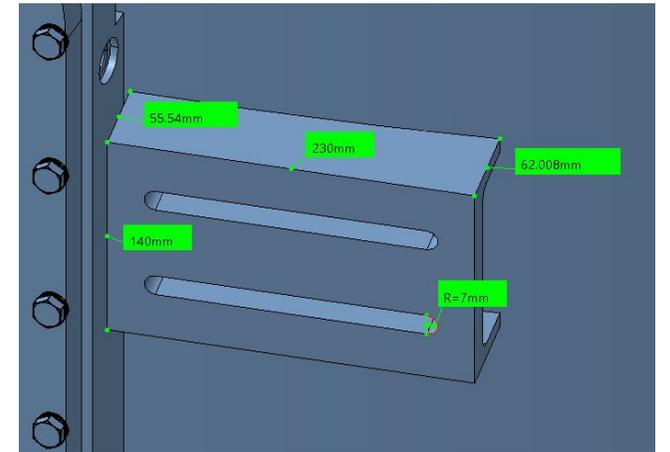
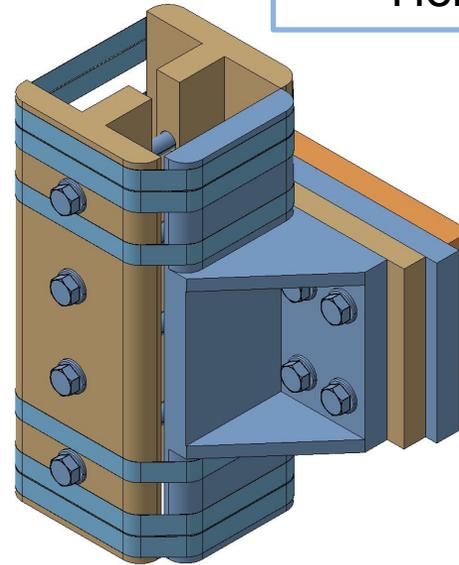
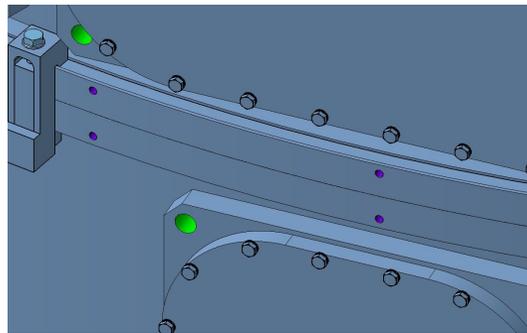
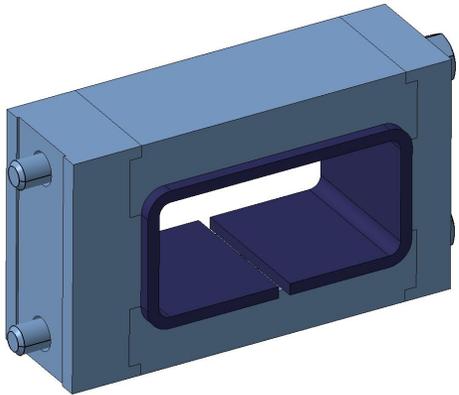


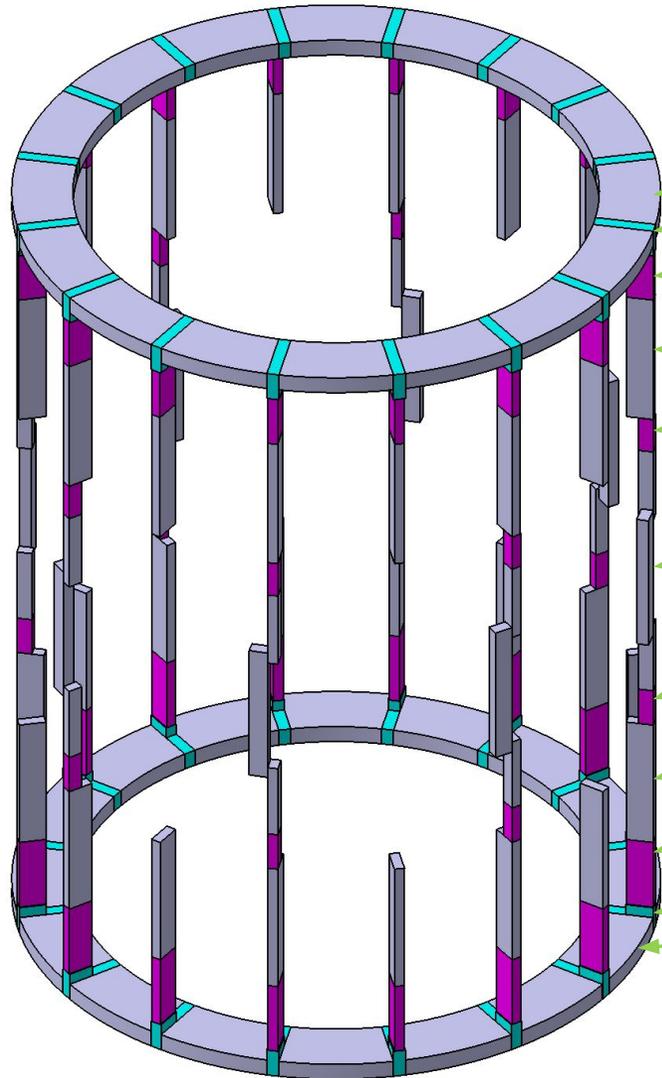
“clam” type holders for horizontal

- Held in place by 2 M12 bolts

holders on vertical section per coil

- Held in place by 6 M12 bolts

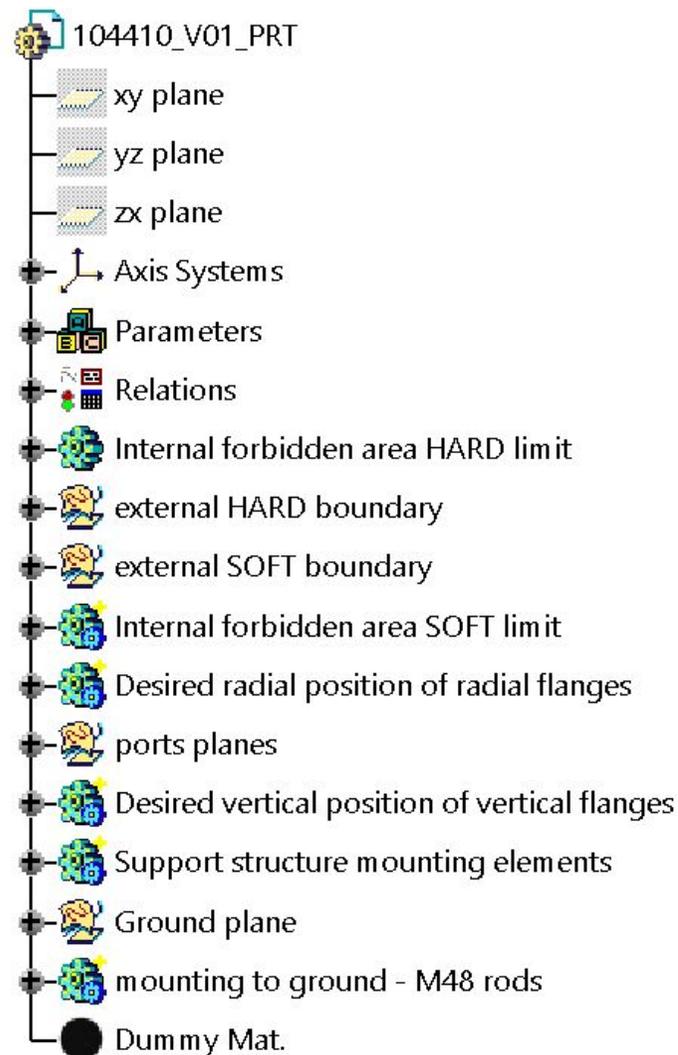
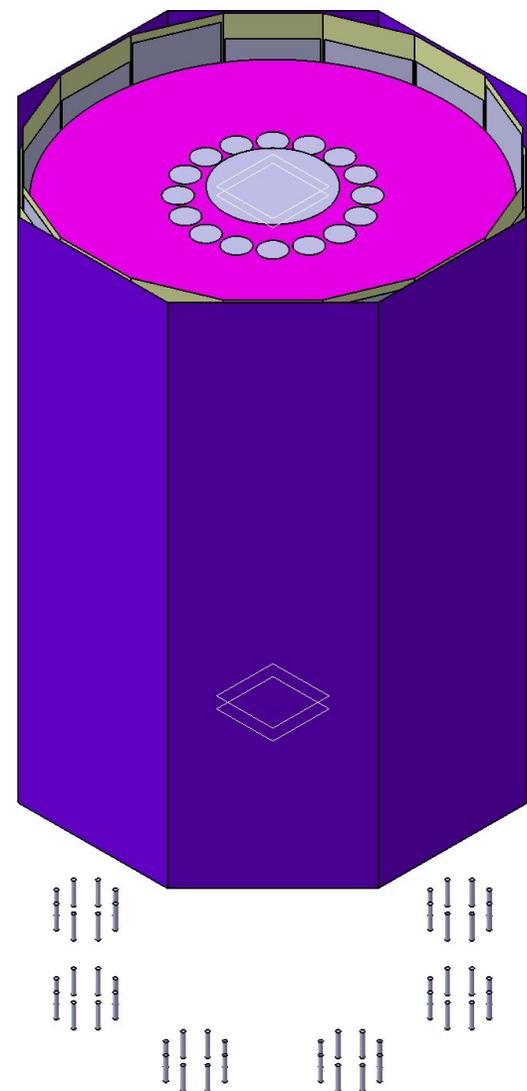




Volume consist of:

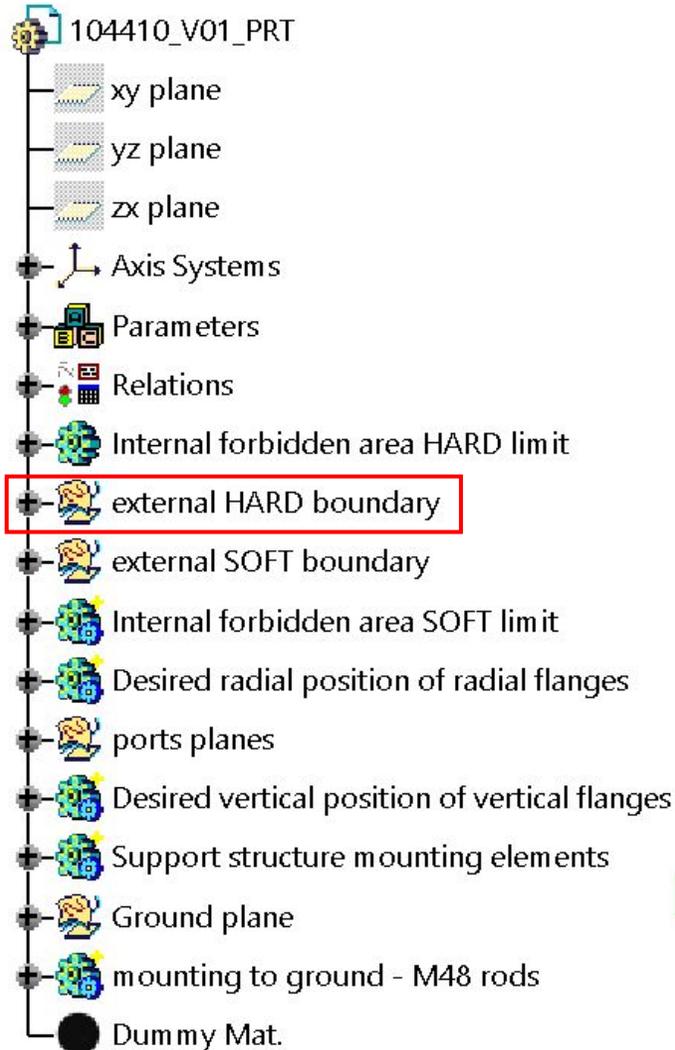
- Upper distribution piping
- 16 valves for individual vertical lines
- Flexible coupling with split element in between upper lid and upper section (can/can ton be part of ?)
- Piping for upper cryostat section with 2 connection for 2 ports
- Flexible coupling with split element in between upper section and middle section (can/can ton be part of ?)
- Piping for middle cryostat section with 6 connection for 6 ports
- Flexible coupling with split element in between middle section and lower section (can/can ton be part of ?)
- Piping for lower cryostat section with 2 connection for 2 ports
- Flexible coupling with split element in between lower section and lower lid (can/can ton be part of ?)
- 16 valves for individual vertical lines
- Lower distribution piping

Supplier shall stay with the piping WITHIN the envelope. Small (DN16-KF connection elements are not bound by the envelope.



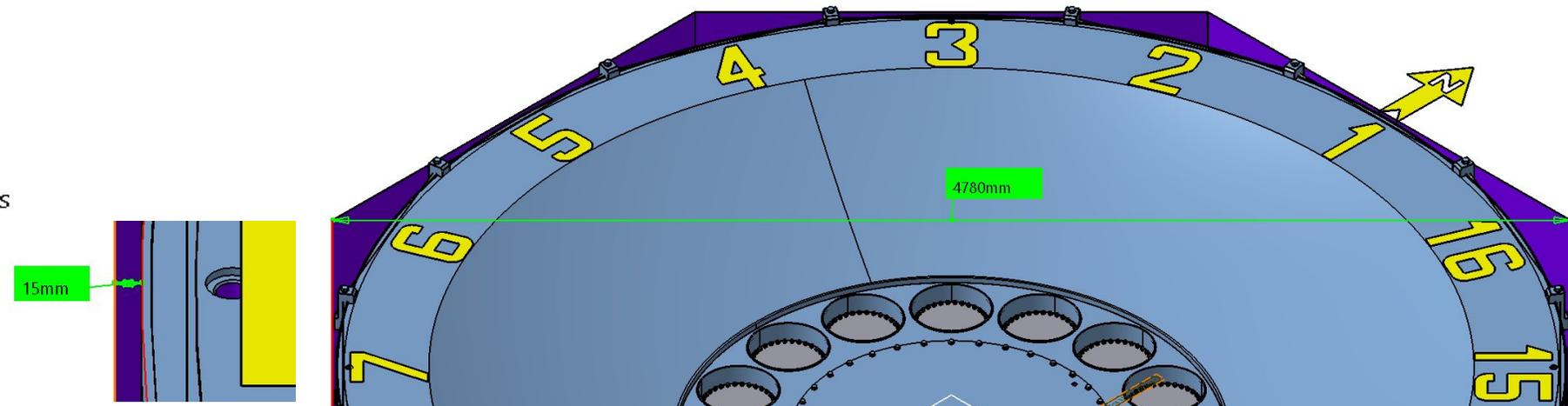
design limited by several geometries:

- HARD boundaries are never to be crossed
- SOFT boundaries can be crossed after negotiation
- PORT PLANES are ideal position of the ports
- DESIRED position gives tolerance zone
- IDEAL geometries of connection elements

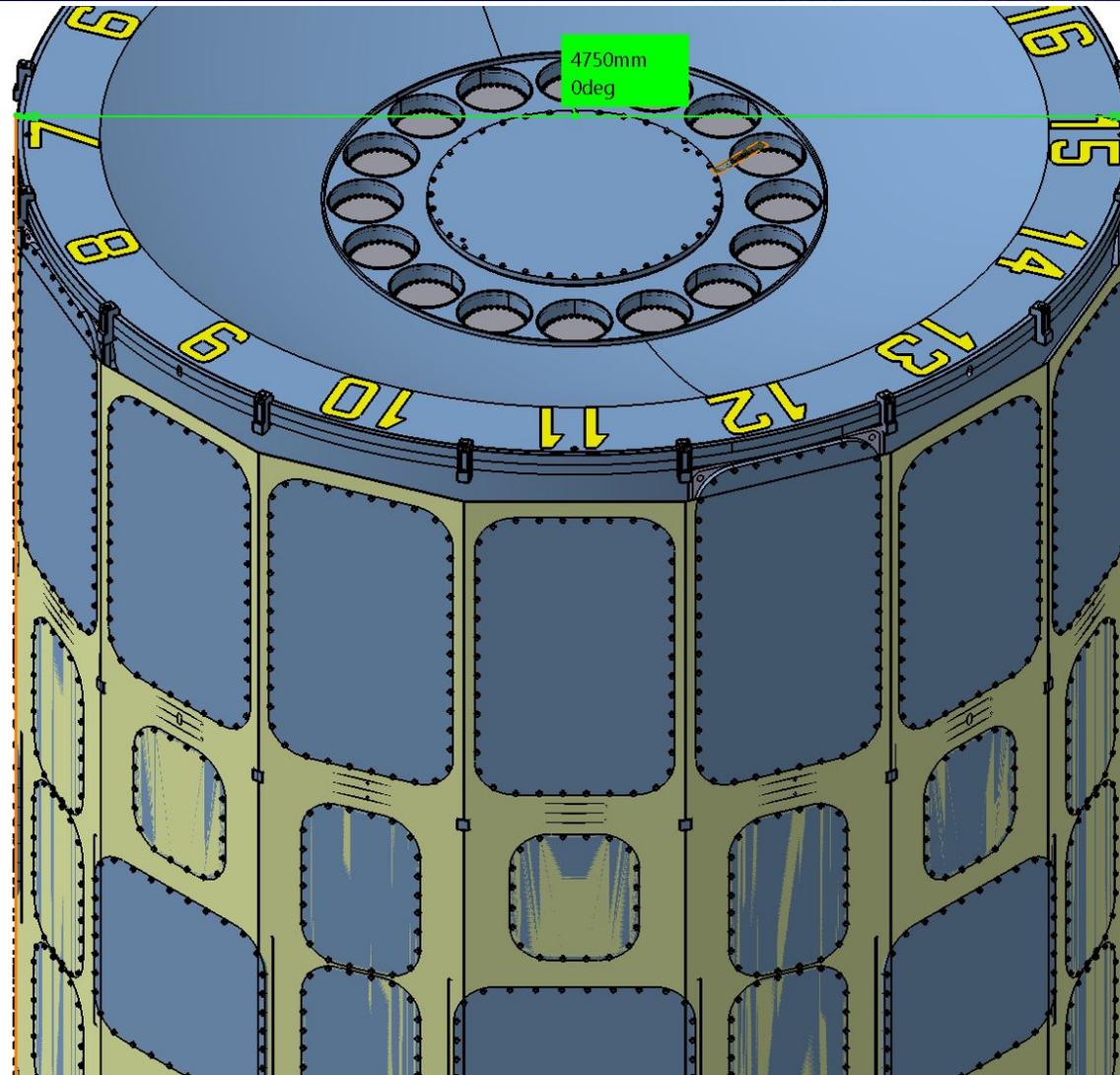


External HARD boundary:

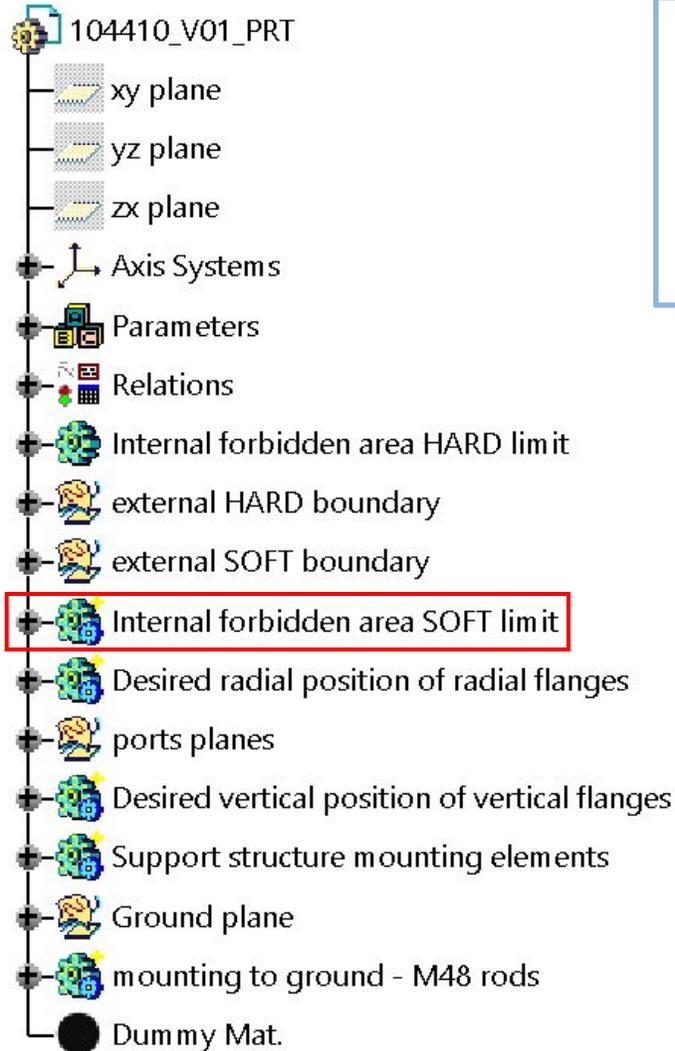
- Gives maximal possible width of the cryostat
- Does not limit the cryostat in vertical direction
- It is 15 mm larger radii then cryostat main flange radii
- It is 2 cm smaller than the width of assembly hall entrance



- 104410_V01_PRT
- xy plane
- yz plane
- zx plane
- Axis Systems
- Parameters
- Relations
- Internal forbidden area HARD limit
- external HARD boundary
- external SOFT boundary**
- Internal forbidden area SOFT limit
- Desired radial position of radial flanges
- ports planes
- Desired vertical position of vertical flanges
- Support structure mounting elements
- Ground plane
- mounting to ground - M48 rods
- Dummy Mat.

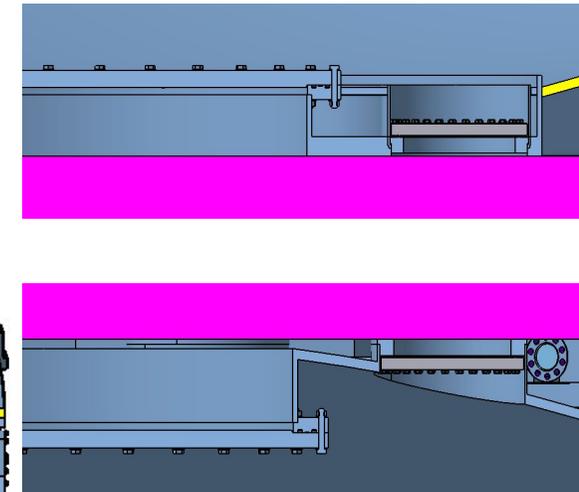
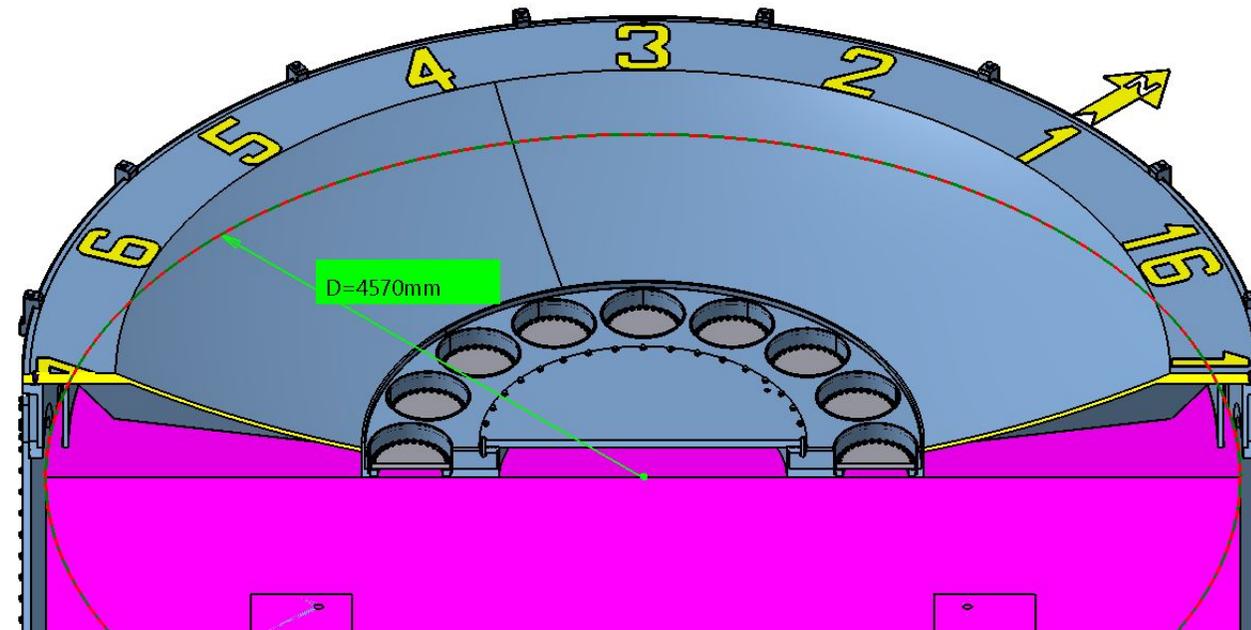


- External SOFT boundary:
- Represents size of the main flange
 - Does not limit the cryostat in vertical direction
 - Bolt heads, some blank flanges and clams are extending over this boundary

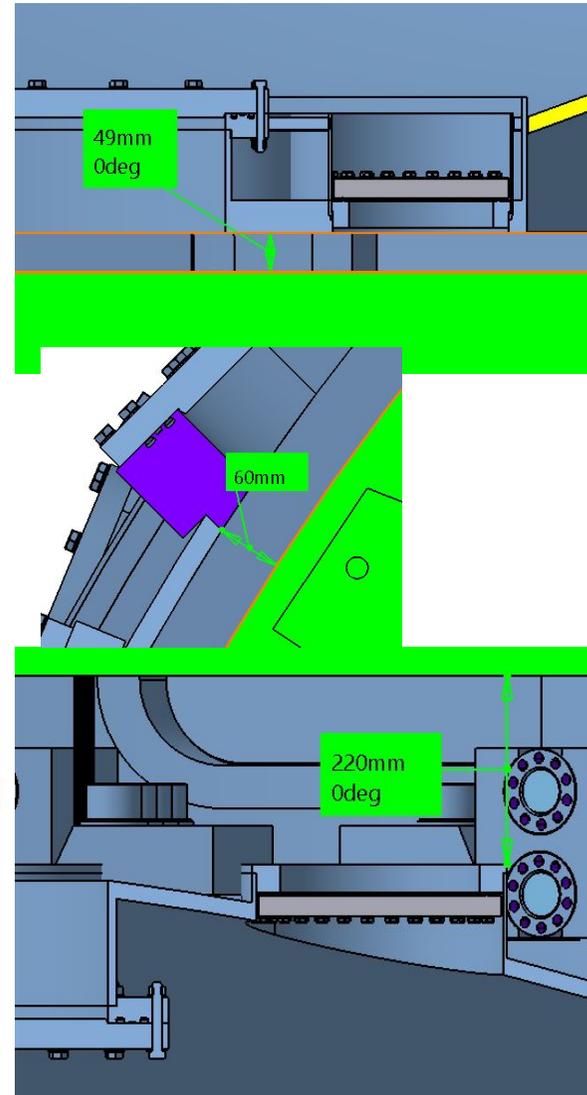
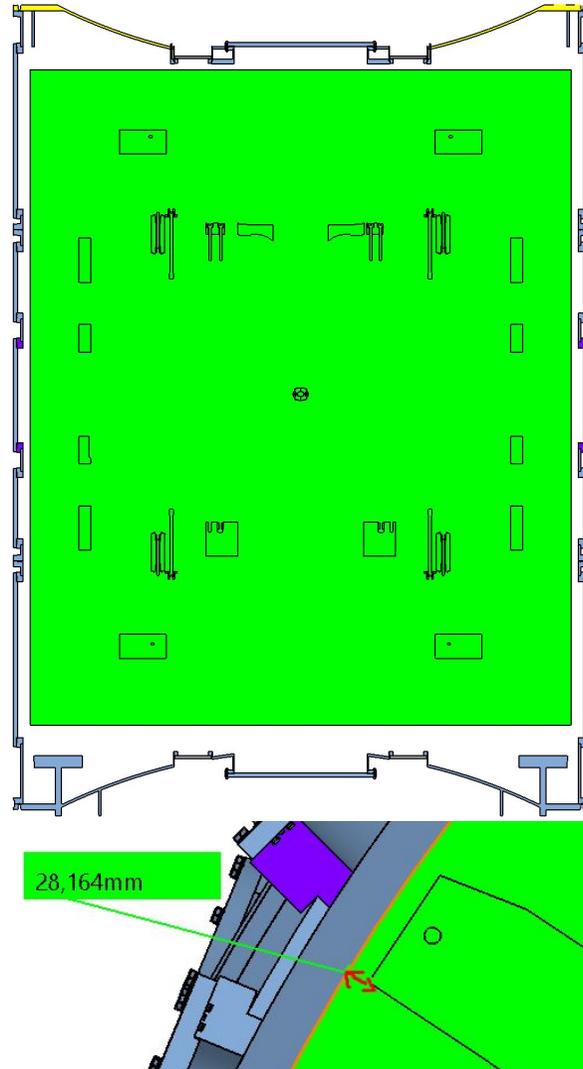


Internal SOFT boundary:

- Represents volume (D=4570 mm, L=5724 mm) inside of the cryostat which can be occasionally crossed
- It is 1 cm smaller than inner radii of the cryostat
- It is touching the upper lid



- 104410_V01_PRT
- xy plane
- yz plane
- zx plane
- Axis Systems
- Parameters
- Relations
- Internal forbidden area HARD limit**
- external HARD boundary
- external SOFT boundary
- Internal forbidden area SOFT limit
- Desired radial position of radial flanges
- ports planes
- Desired vertical position of vertical flanges
- Support structure mounting elements
- Ground plane
- mounting to ground - M48 rods
- Dummy Mat.



Internal HARD boundary:

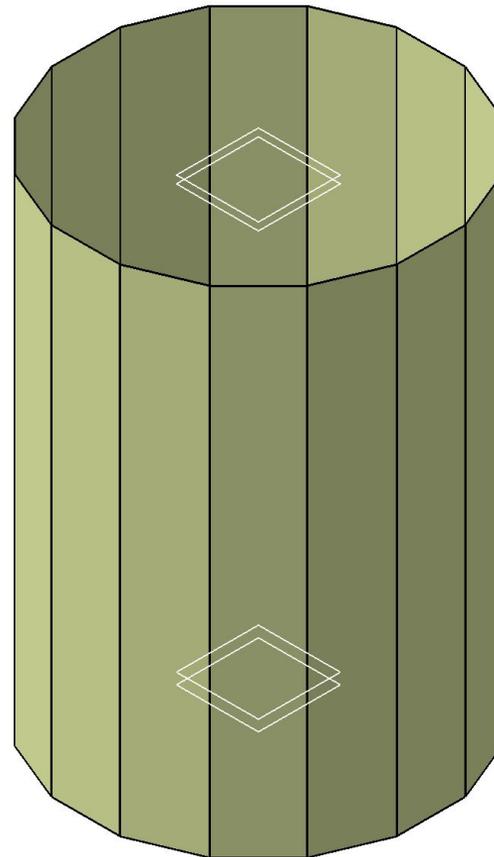
- Represents volume (D=4470 mm, L=5455 mm) inside of the cryostat which can NOT be crossed
- It is 6 cm smaller than inner radii of the cryostat
- It is covering support structure and cryogenic piping + 2 cm on multilayer insulation

104410_V01_PRT

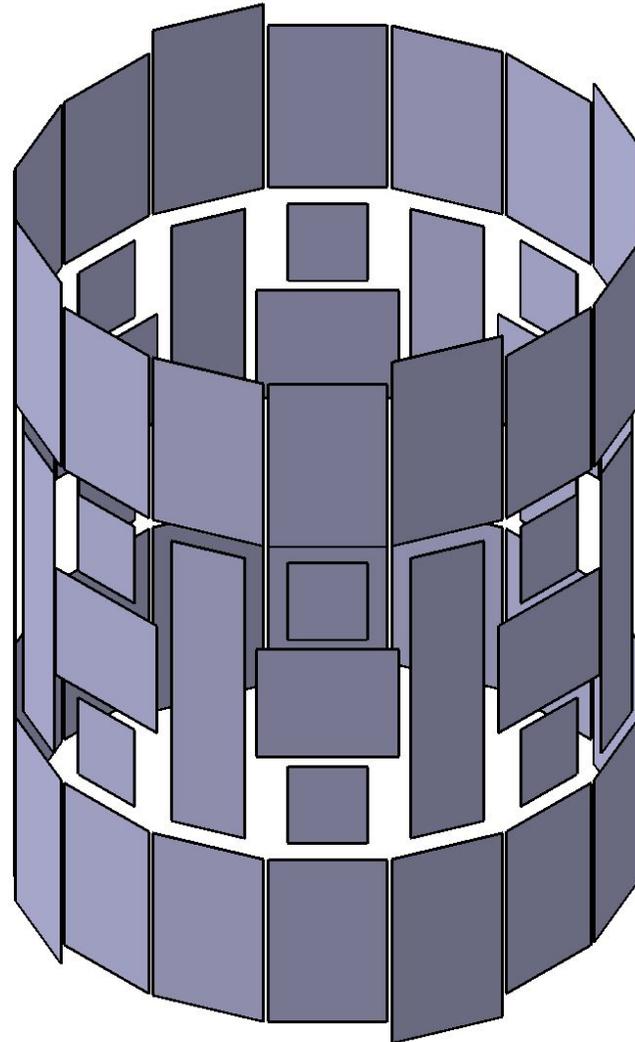
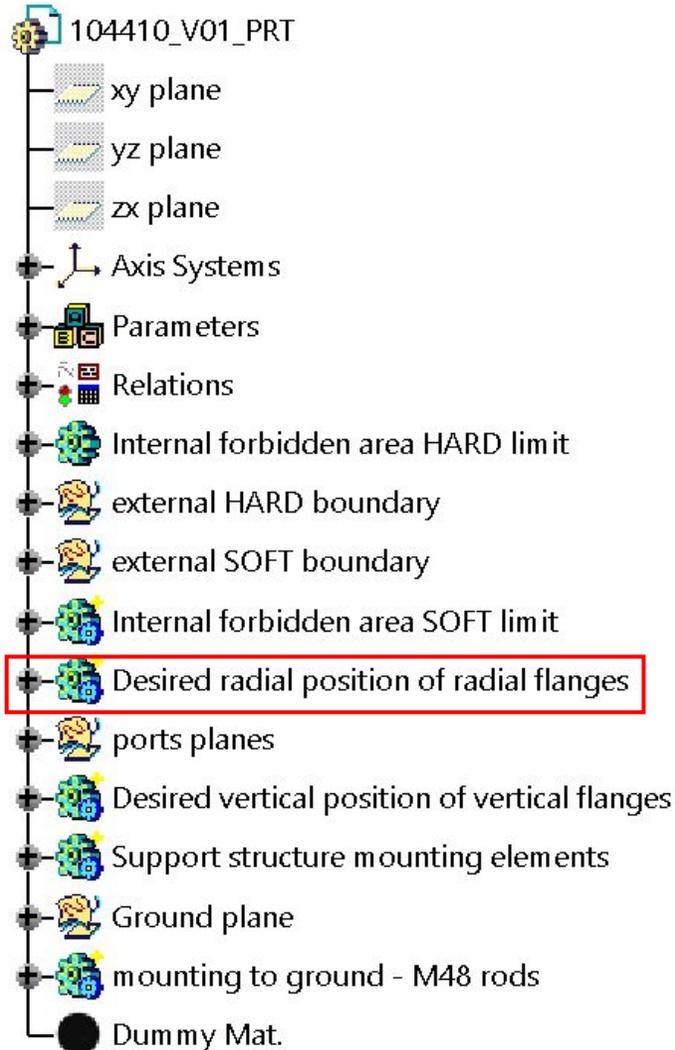
- xy plane
- yz plane
- zx plane
- Axis Systems
- Parameters
- Relations
- Internal forbidden area HARD limit
- external HARD boundary
- external SOFT boundary
- Internal forbidden area SOFT limit
- Desired radial position of radial flanges
- ports planes
- Desired vertical position of vertical flanges
- Support structure mounting elements
- Ground plane
- mounting to ground - M48 rods
- Dummy Mat.

Port planes:

- Represents ideal plane on which the ports should be placed



- ports planes
- Sketch.6
- Extrude.3
- UPPER central ISO-K flange Plane.1
- LOWER central ISO-K flange Plane
- UPPER central ISO-CF flange Plane.1
- LOWER central ISO-CF flange Plane
- Sketch.9
- Sketch.11
- Sketch.13

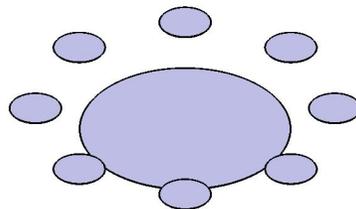
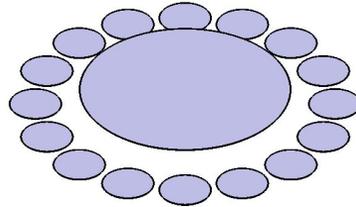
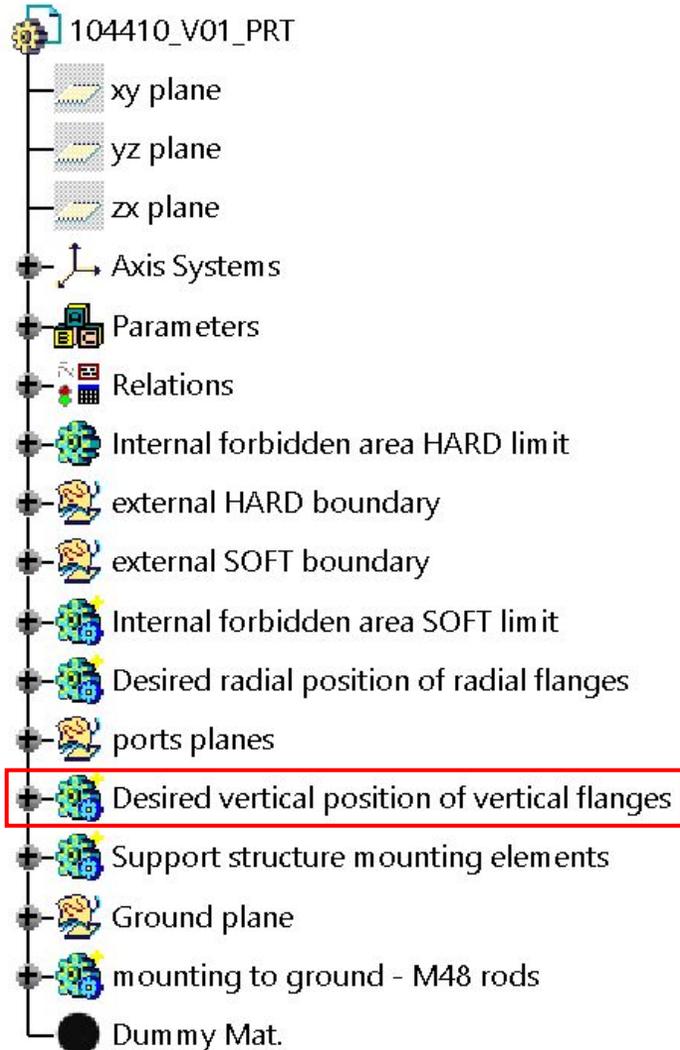


Desired RADIAL position of radial flanges (ports on cylindrical sections):

- Area in between 2 parallel planes in which the real surface of the port planes shall be
- These 2 planes are symmetrical around the PORT PLANES
- At he moment **all the ports** have the same tolerance zone of 1mm

The thickness of the tolerance zone gives

- Port position in radial direction
- Inclination in vertical and toroidal direction
- Inclination is size of the port in he given direction divided by the thickness of the tolerance zone

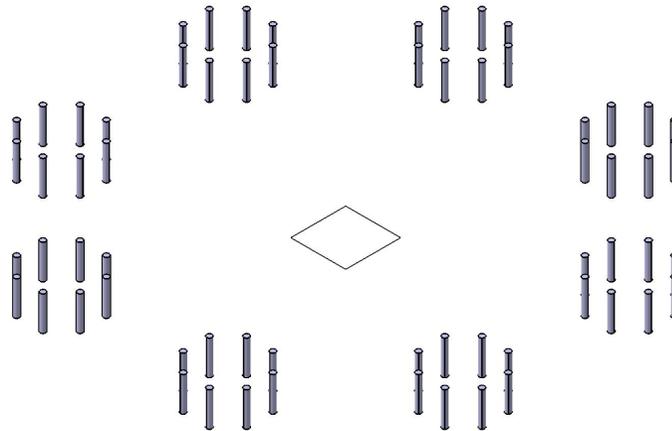
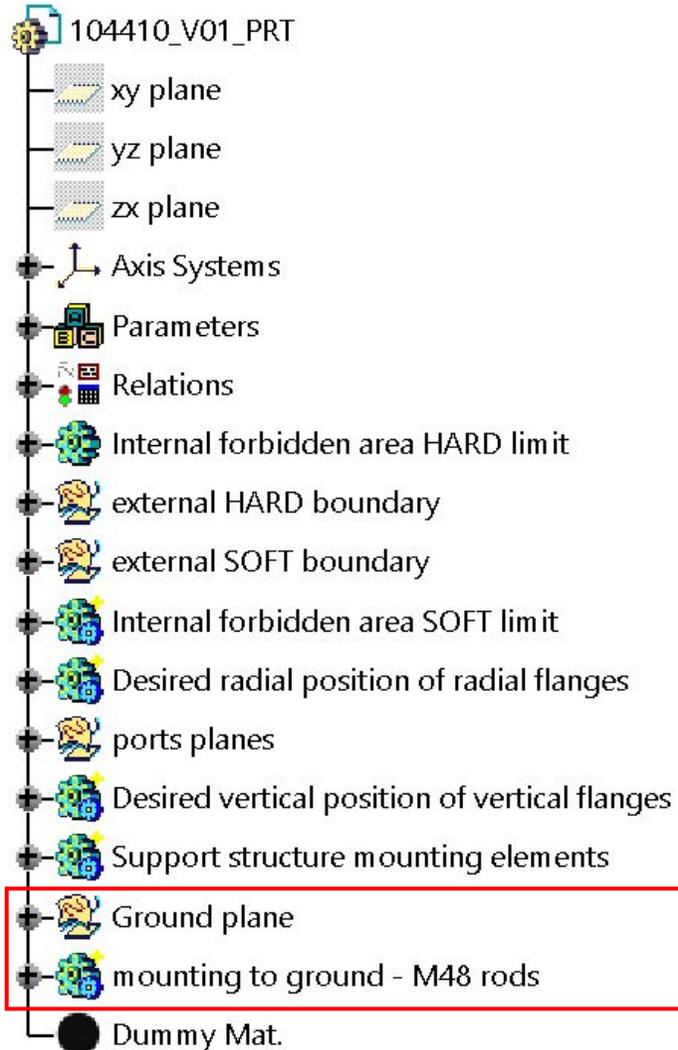


Desired VERTICAL position of vertical flanges (ports on the lids):

- Area in between 2 parallel planes in which the real surface of the port planes shall be
- These 2 planes are symmetrical around the PORT PLANES
- At he moment **all the ports** have the same tolerance zone of 1mm

The thickness of the tolerance zone gives

- Port position in radial direction
- Inclination in vertical and toroidal direction
- Inclination is size of the port in he given direction divided by the thickness of the tolerance zone

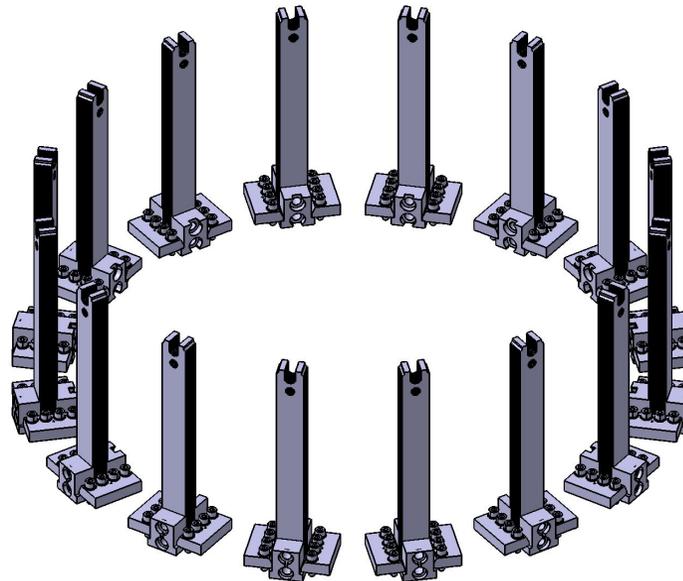
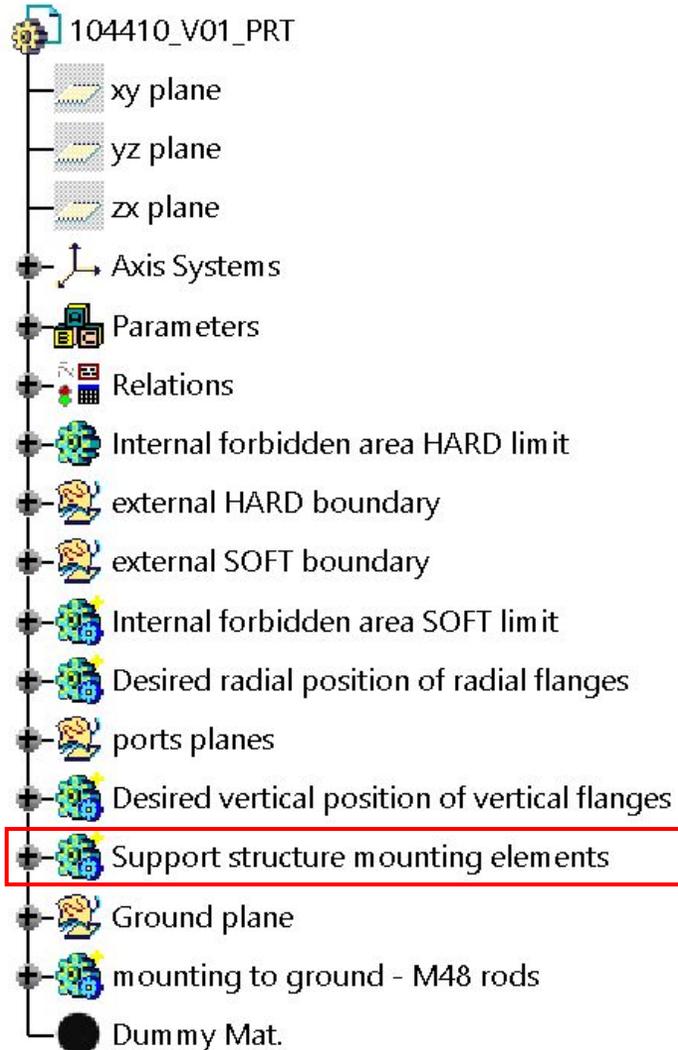


Ground plane:

- Represents the plane to which cryostat supports are mounted
- There is no tolerance zone at the moment

M48 rods

- Represents the threaded rods which will be used to secure the cryostat to the ground
- There is no tolerance zone at the moment



Support structure mounting elements:

- Represents the interface in between the cryostat and support structure and are NOT part of THIS TENDER
- No tolerance zone exist at the moment
- It is in plan to ADD the TOLERANCE ZONE



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