# Investigation of PP1_outerwall

## ITk PP1

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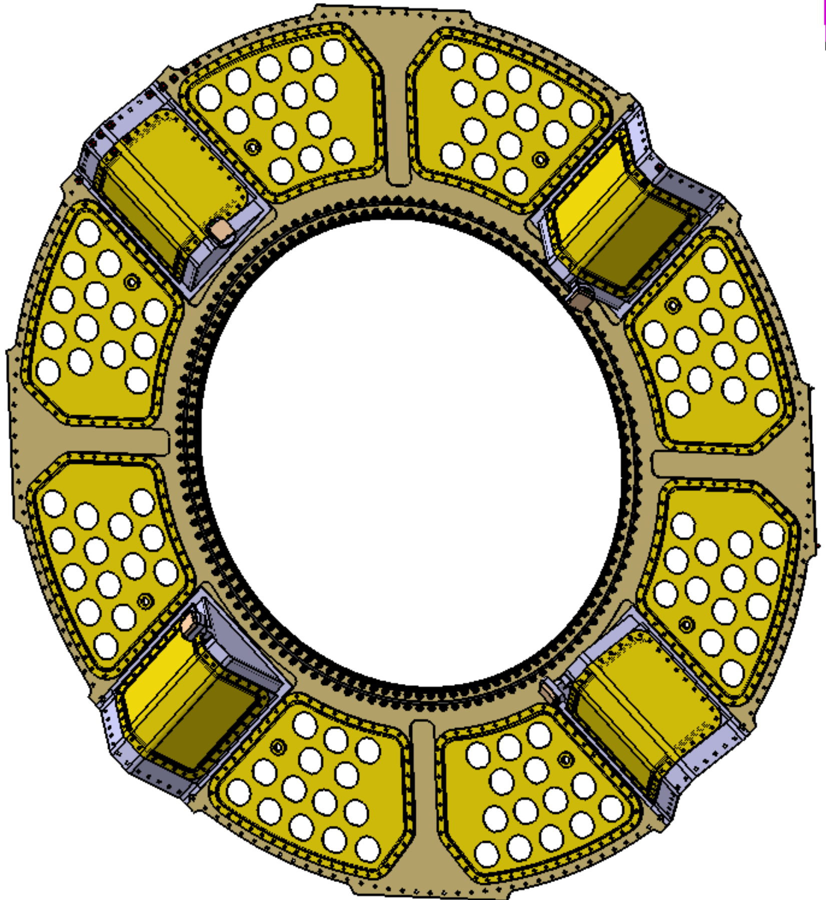
Team Leader: Alexander Sharmazanashvili

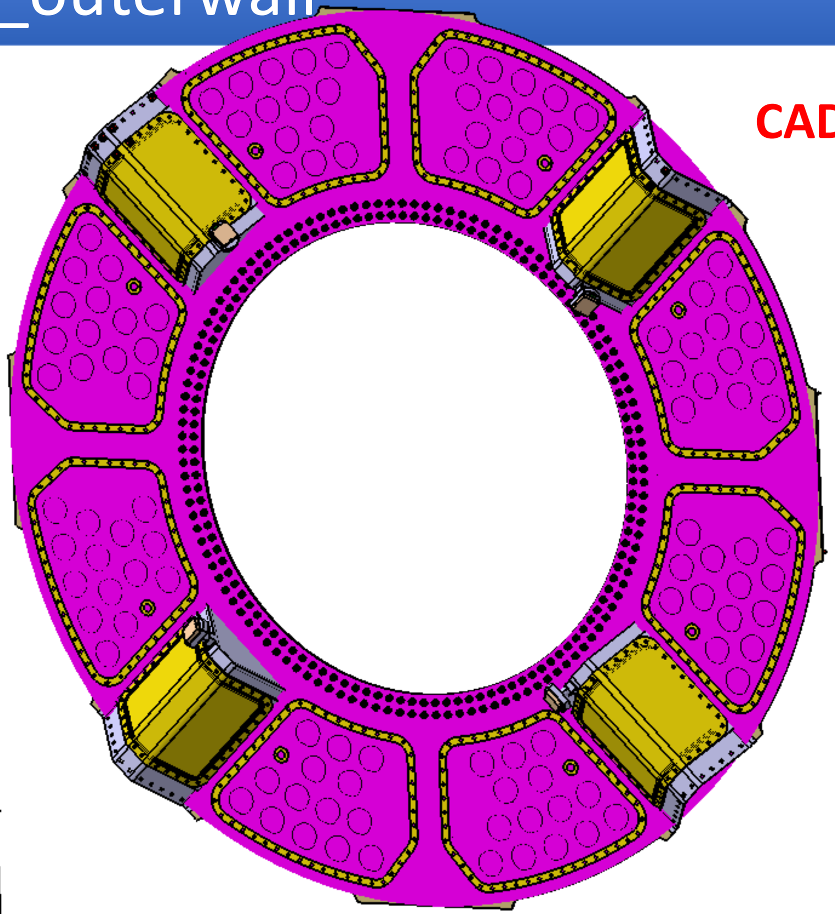
ITk Offline SW, 23 Sept 2022

# CAD model vs. gmx - PP1_outerwall

CAD Model

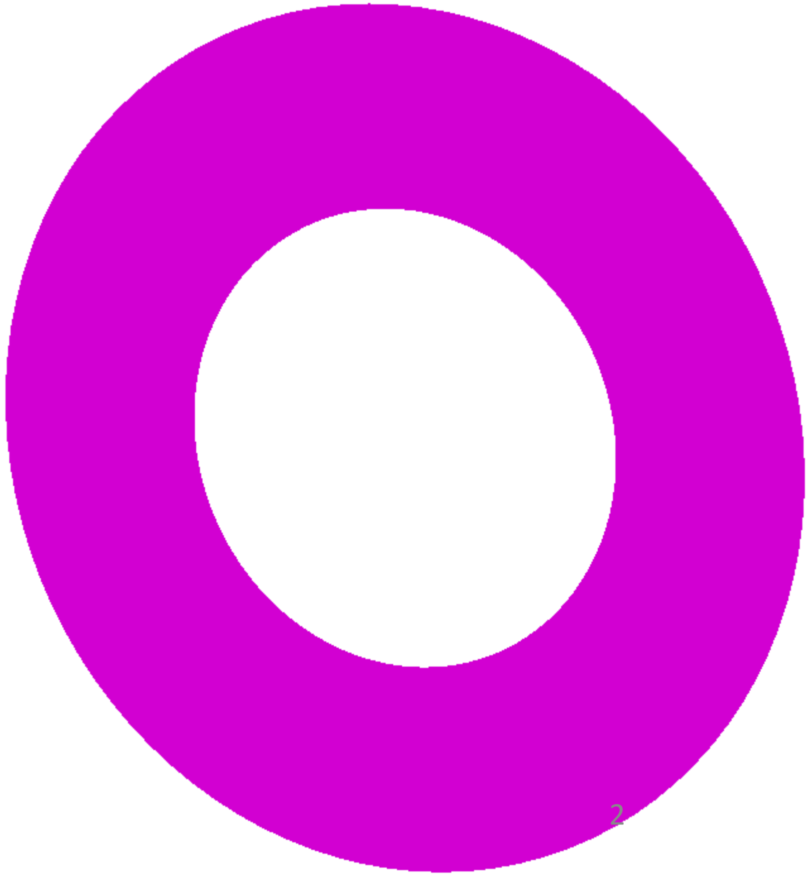


CAD Model + gmx

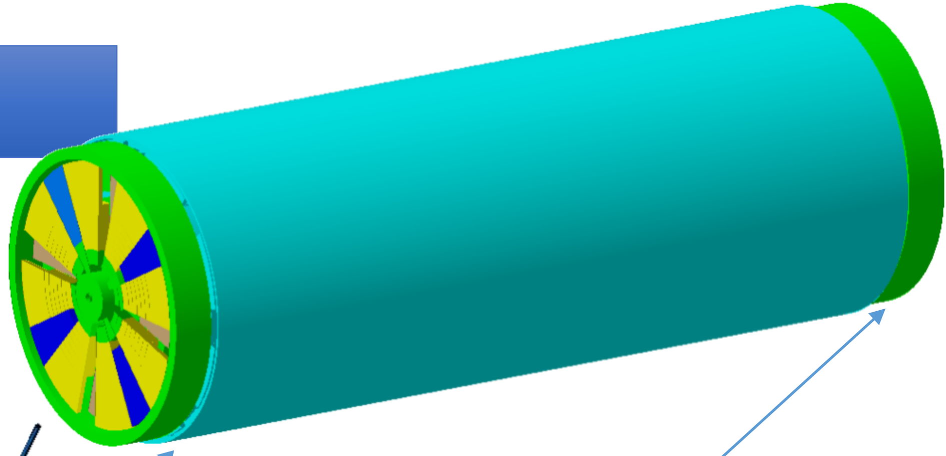


Vs.

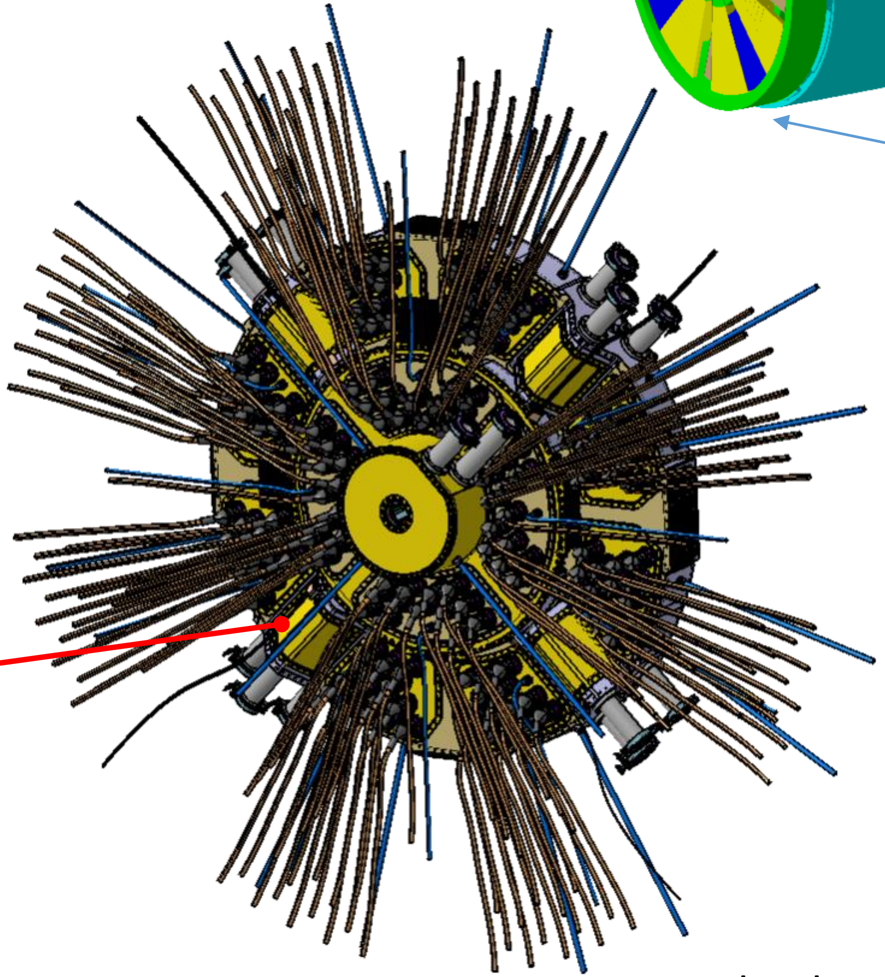
gmx

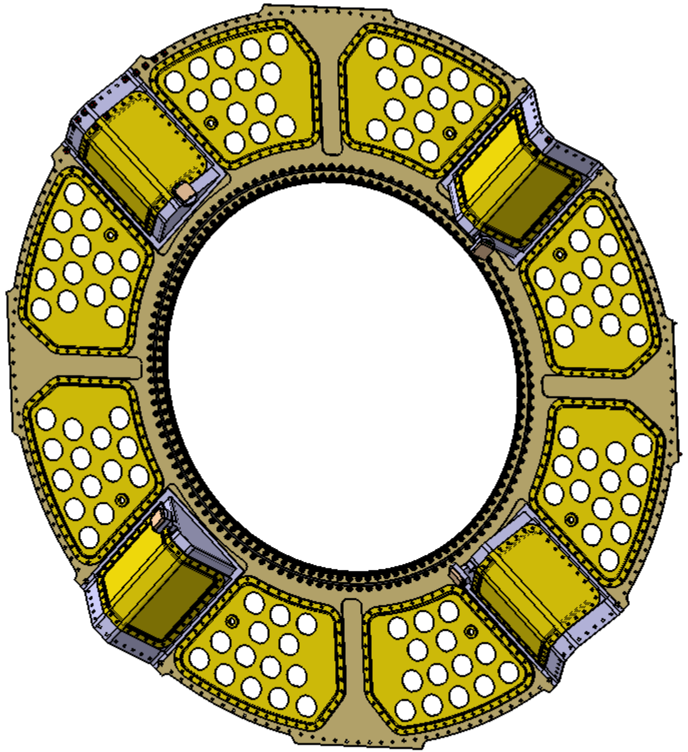


# CAD model of PP1_outerwall



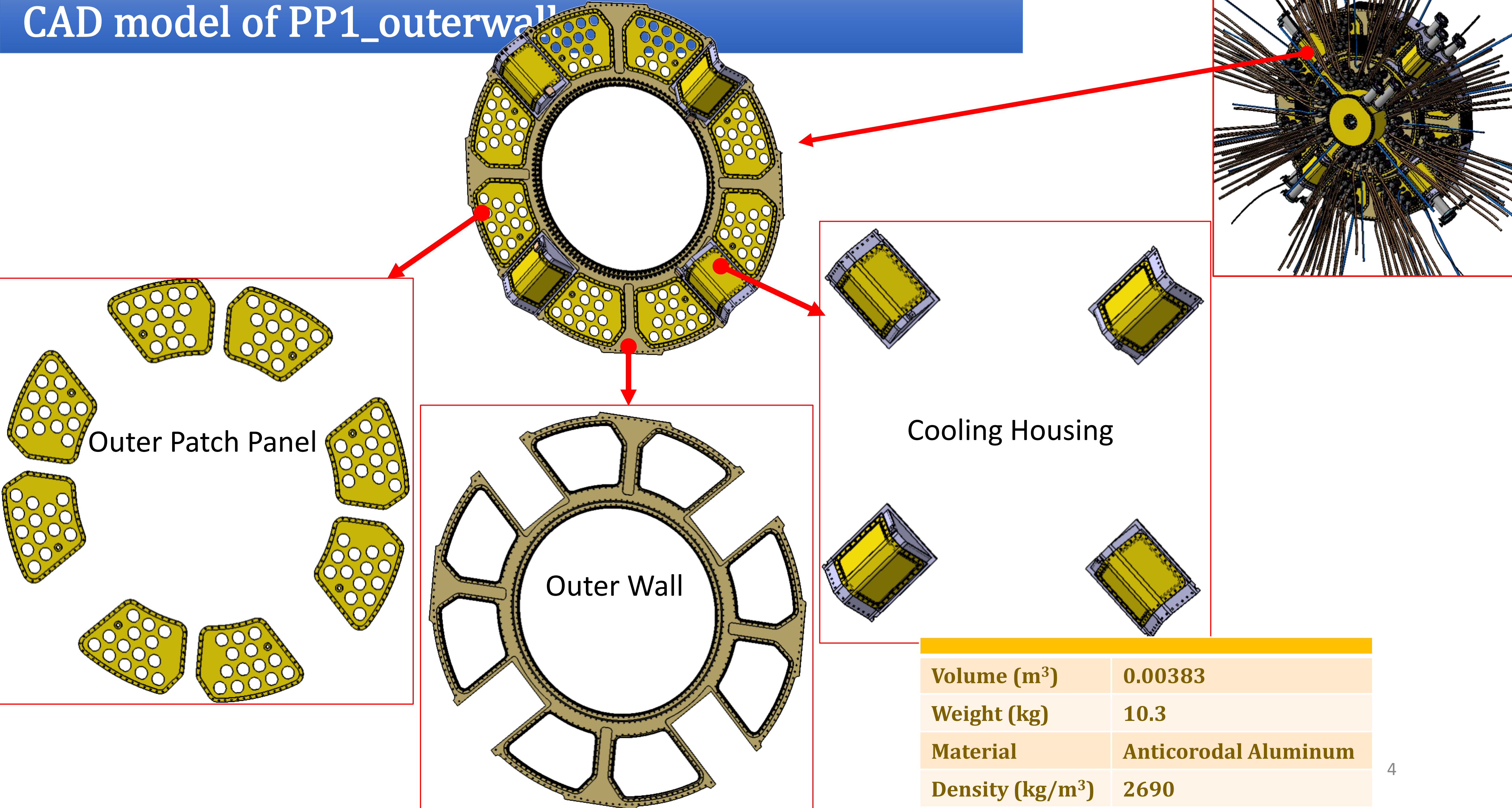
PP1 in simulation





Thank to Sandro Tomassini for CAD Model

# CAD model of PP1_outerwall




| | |
|---|---|
| Volume ($m^3$) | 0.00383 |
| Weight (kg) | 10.3 |
| Material | Anticorodal Aluminum |
| Density ($kg/m^3$) | 2690 |

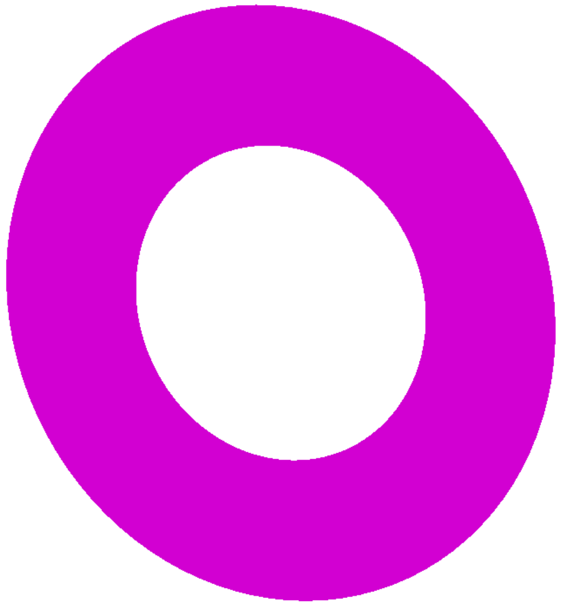
# PP1_outerwall in gmx (Simulation)

```
<var name="PP1_outerwall_innerR"              value="370.0"/>
<var name="PP1_outerwall_outerR"              value="700.0"/>
<var name="PP1_outerwall_Z"              value="1.0"/>

<tubs name="PP1_outerwall_tubs" rmin="PP1_outerwall_innerR" rmax="PP1_outerwall_outerR"
                                  zhalflength="PP1_outerwall_Z" sphi="0" dphi="2*PI"/>

<logvol name="PP1_outerwall" shape="PP1_outerwall_tubs" material="AlAnticorodal" />
```

```
<material name="AlAnticorodal" density="2.690">
      <materialref fraction="0.9875" ref="AlMetal"/>
      <materialref fraction="0.003" ref="SiMetal"/>
      <materialref fraction="0.001" ref="FeMetal"/>
      <materialref fraction="0.001" ref="CuMetal"/>
      <materialref fraction="0.001" ref="MnMetal"/>
      <materialref fraction="0.0035" ref="MgMetal"/>
      <materialref fraction="0.0005" ref="CrMetal"/>
      <materialref fraction="0.0015" ref="ZnMetal"/>
      <materialref fraction="0.001" ref="TiMetal"/>
</material>
```

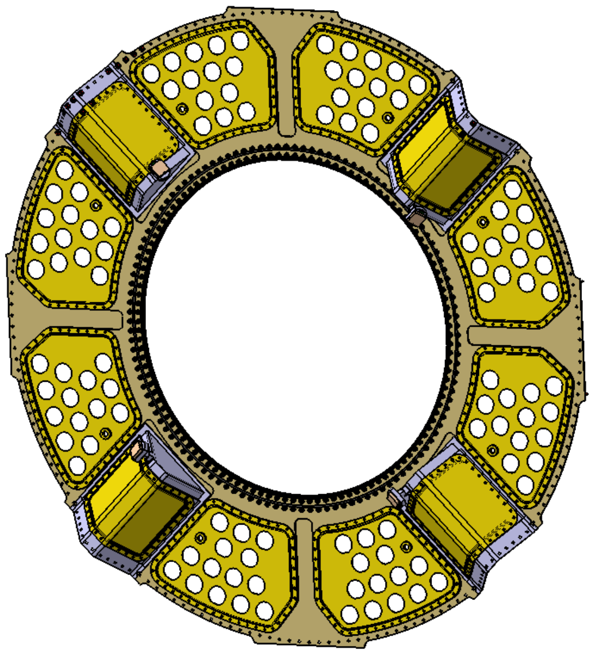
| | |
|---|---|
| Volume ($m^3$) | 0.00222 |
| Weight (kg) | 6 |
| Material | Anticorodal Aluminum |
| Density ($kg/m^3$) | 2690 |

# PP1_outerwall – Result of Compare Analyses



**CAD Model**

| # | Name | material | Volume ($m^3$) | Weight (kg) |
|---|---|---|---|---|
| 1 | PP1_outerwall | Anticorodal Aluminum | 0.00383 | 10.3 |
| | | **Total:** | **0.00383** | **10.3** |



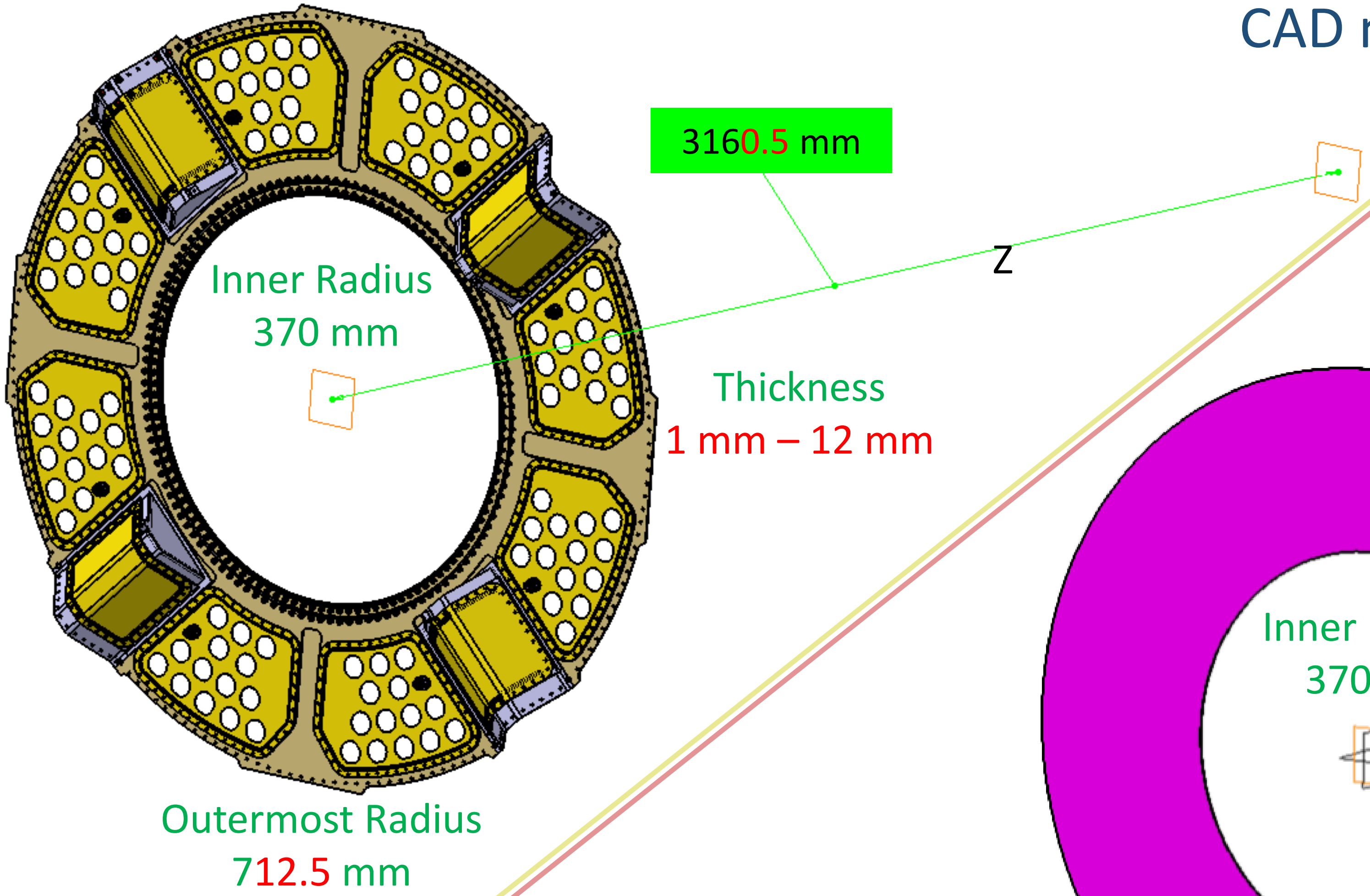
**gmx - Simulation**

| # | Name | material | Volume ($m^3$) | Weight (kg) |
|---|---|---|---|---|
| 1 | PP1_outerwall | Anticorodal Aluminum | 0.00222 | 6 |
| | | **Total:** | **0.00222** | **6** |

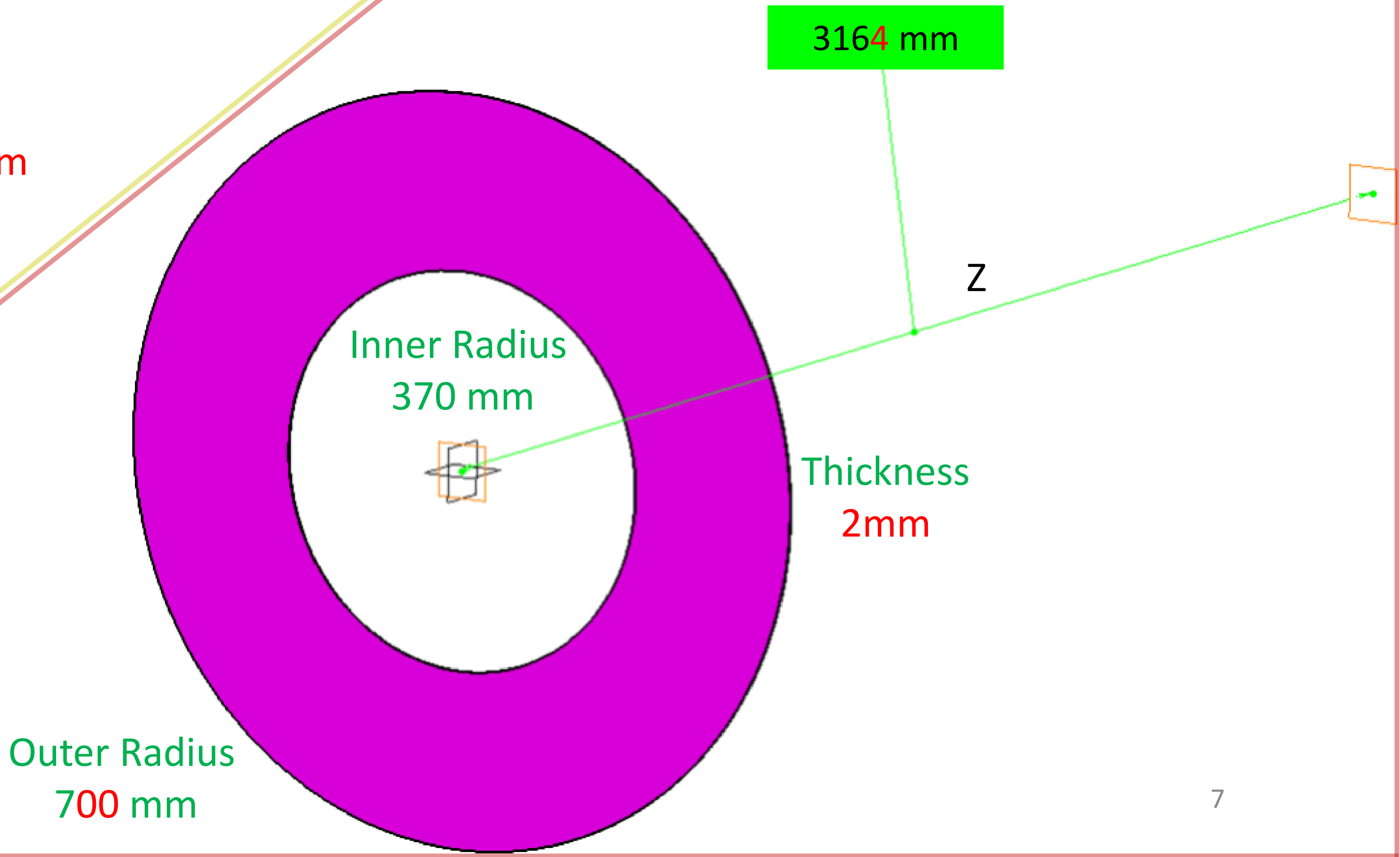
**Diff: 4.3 kg**

# PP1_outerwall – Dimensions and Positions

CAD model

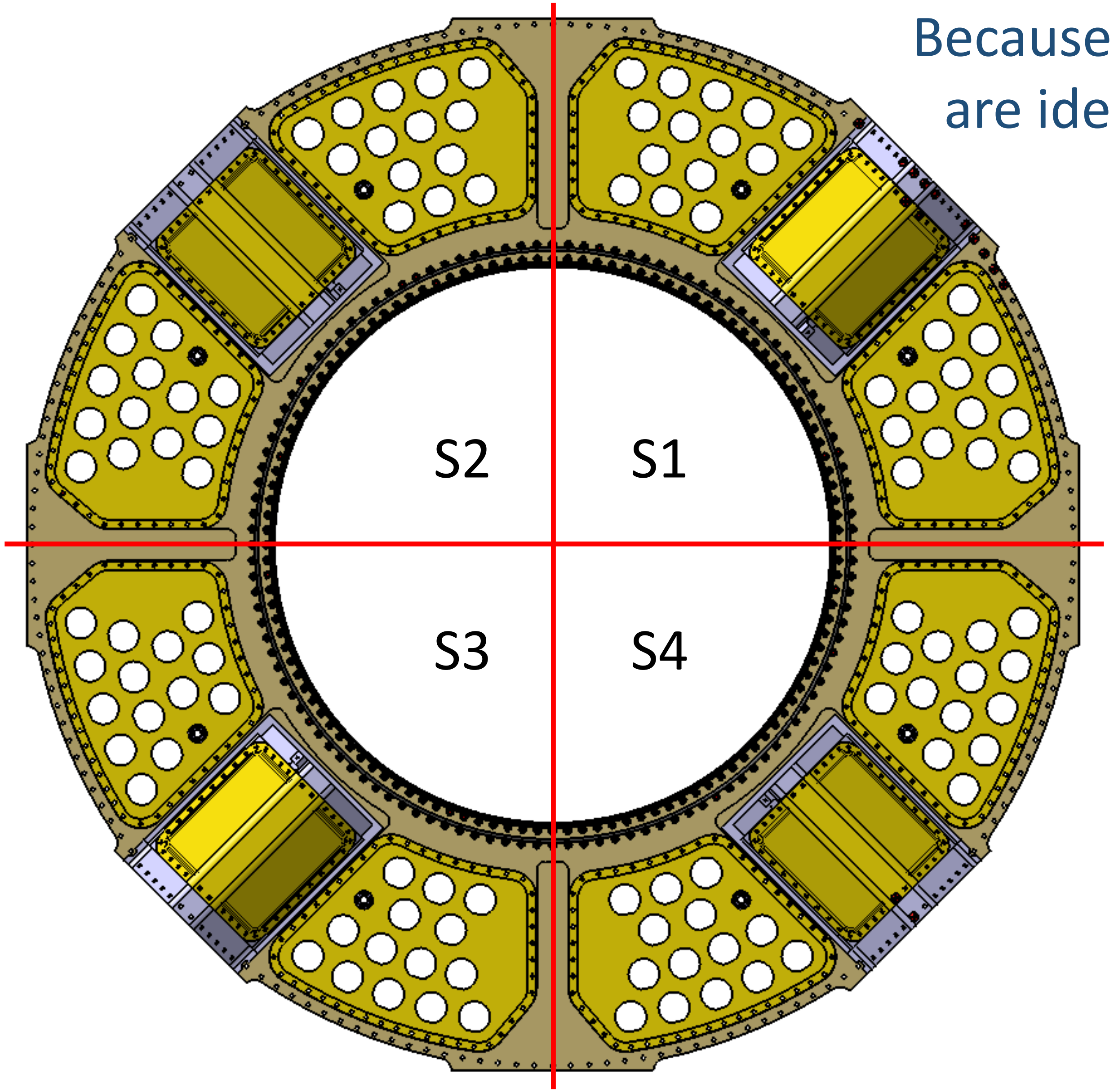



gmx - Simulation



# Calculation of Radiation Length L(Xo)

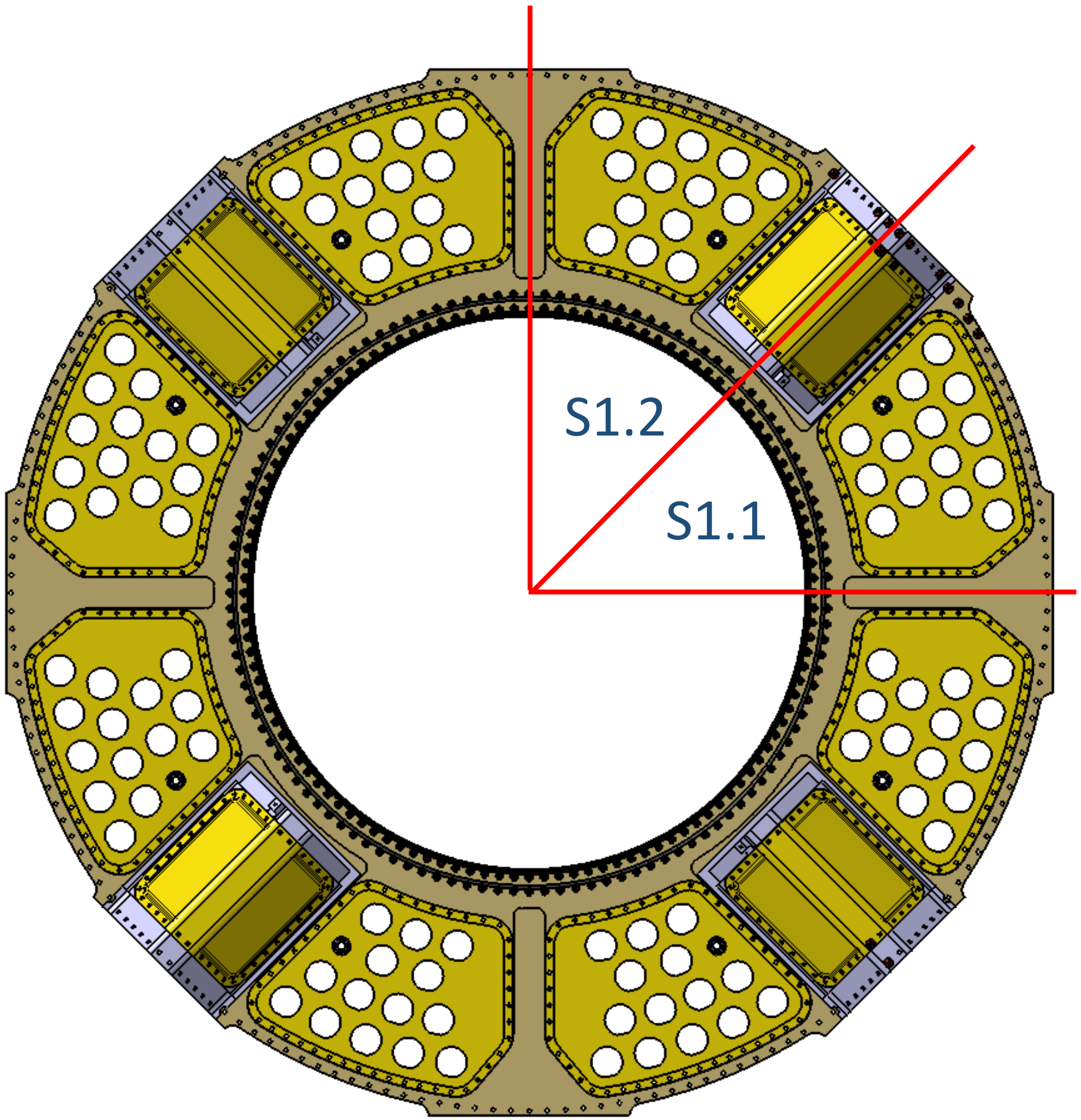
# Selection Area for calculation Radiation Length L(Xo)

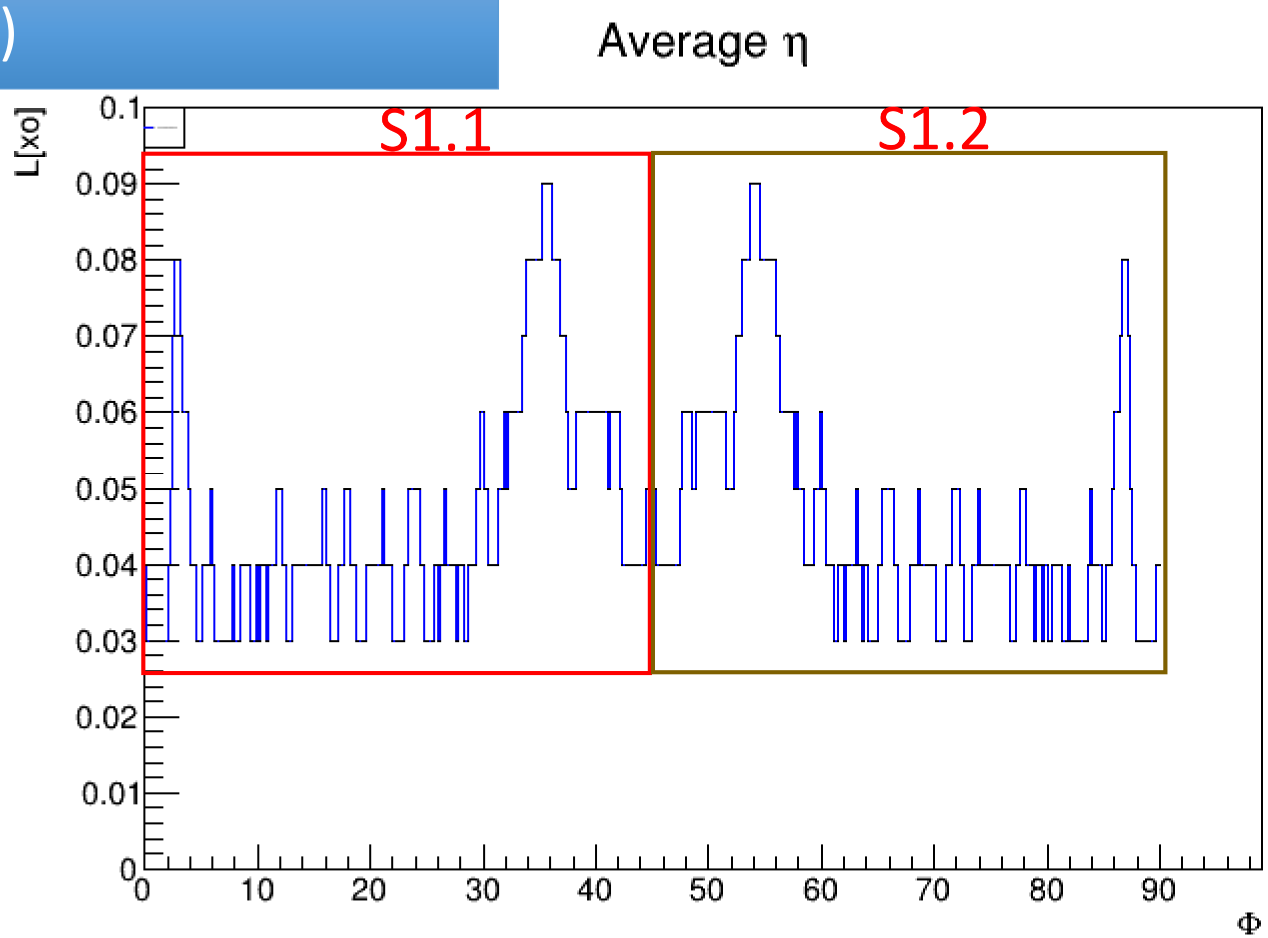



Because of geometries in each sectors (S1, S2, S3, S4) are identical the **Radiation length** will be the same for all of them

S1 = S2 = S3 = S4

# Select area for calculation Radiation Length L(Xo)



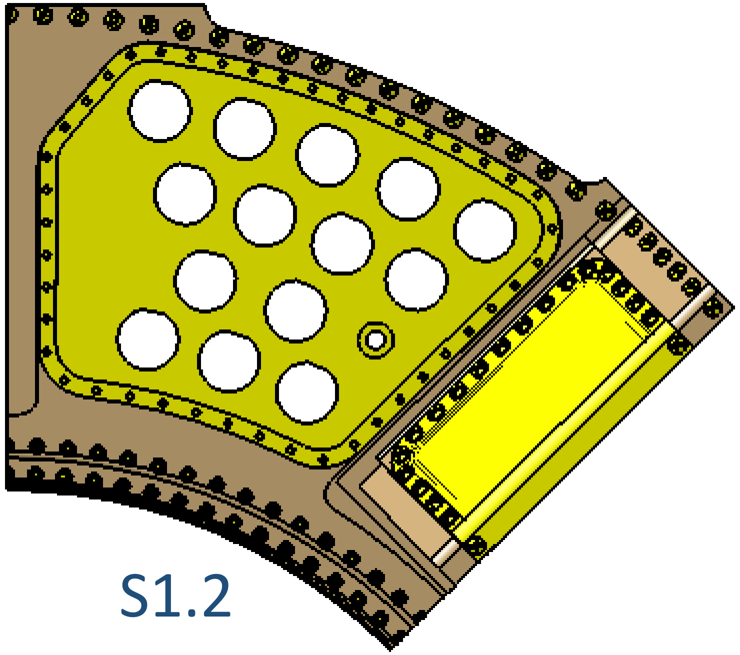

Also, Radiation Length for the S1.1 and S1.2 Sectors are the same.

So, detailed calculation of the Radiation Length performed for the S1.2 sector

# Calculation of Radiation Length L(Xo)

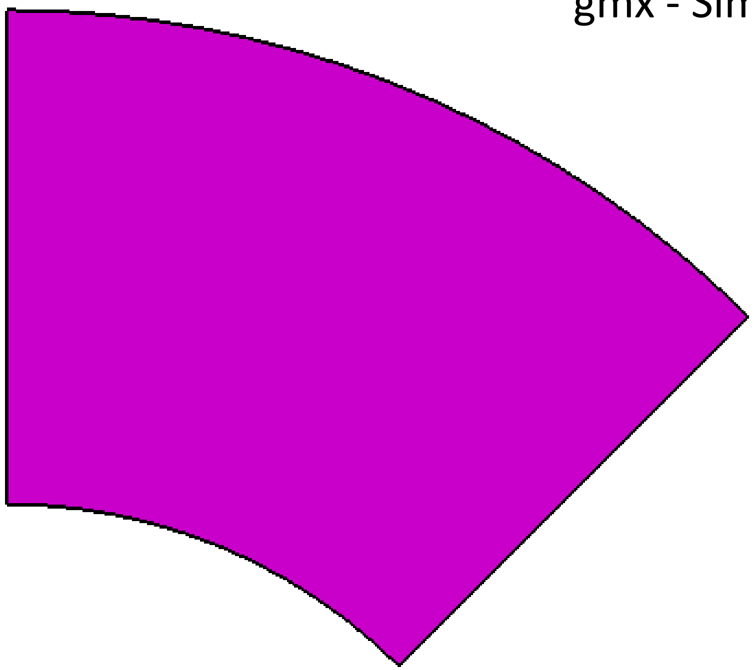
Detailed CAD Model

gmx - Simulation

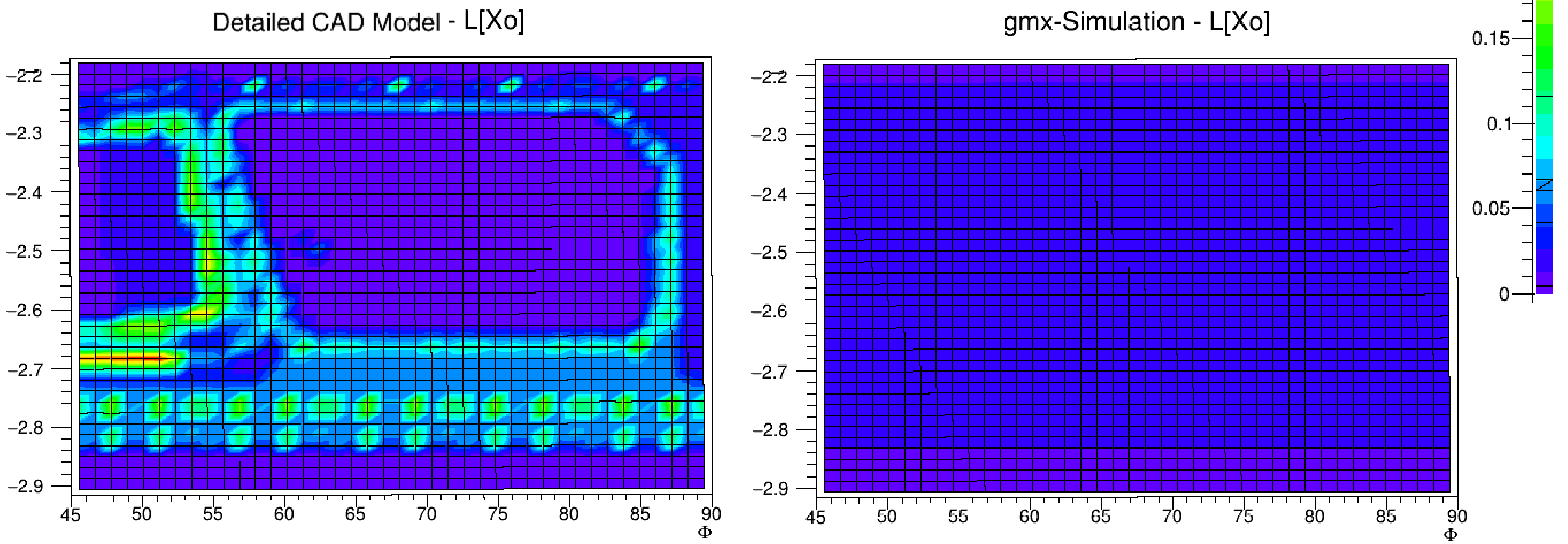


S1.2

Vs.



# Compare Analyses – Radiation Length L(Xo)



# Calculation of Radiation Length L(Xo)

$\eta = -2.253$

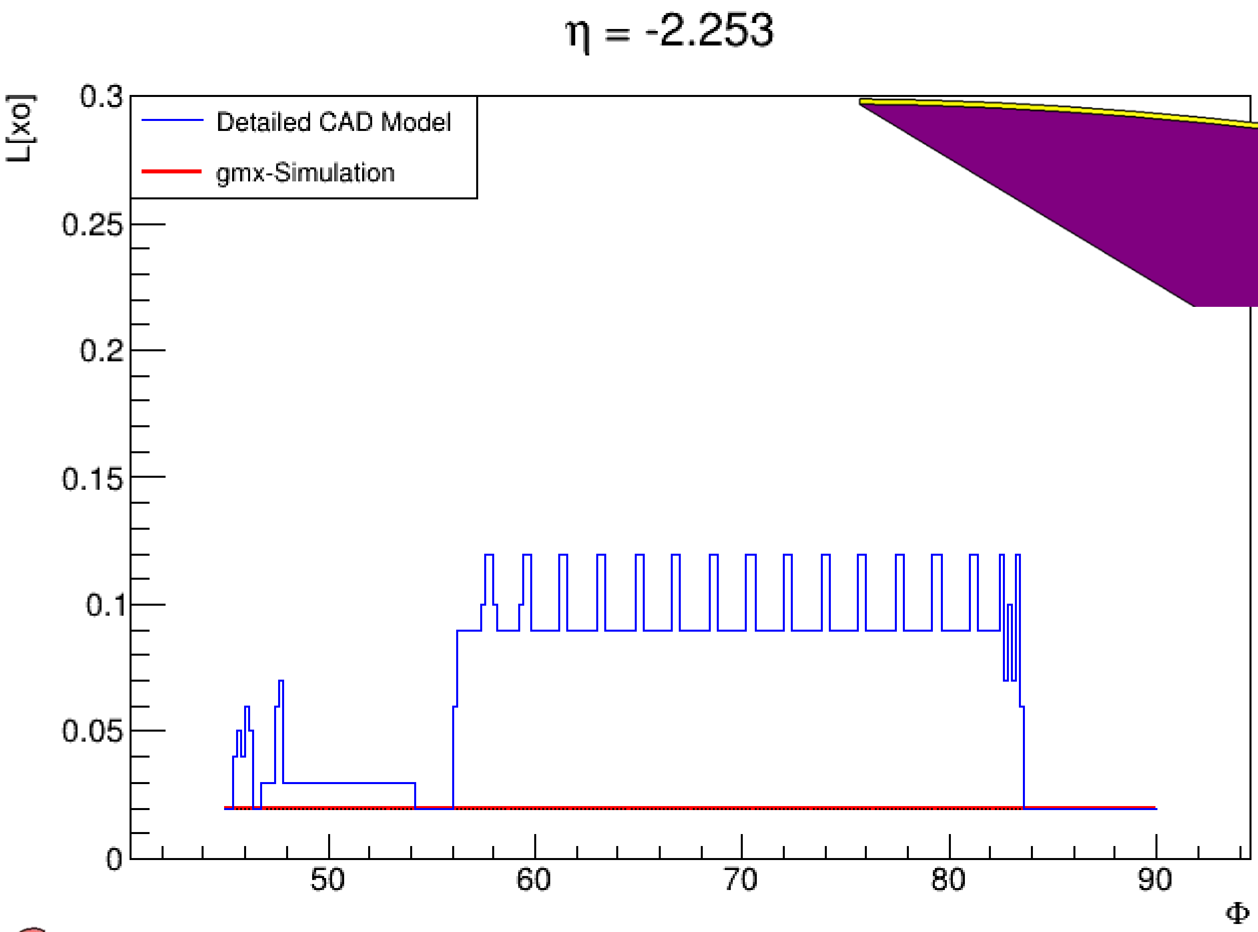
$\eta = -2.397$

$\eta = -2.686$

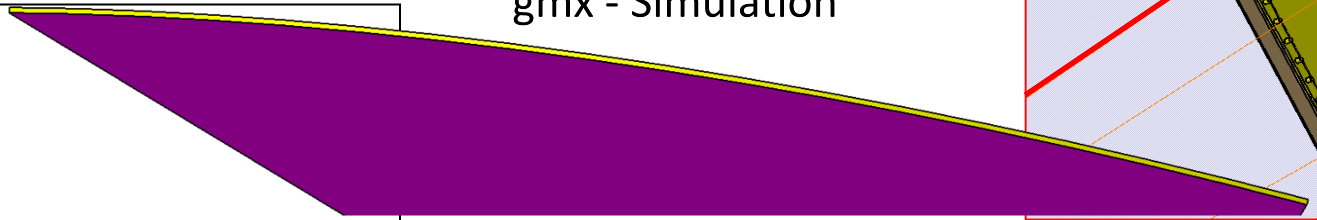
$\eta = -2.823$

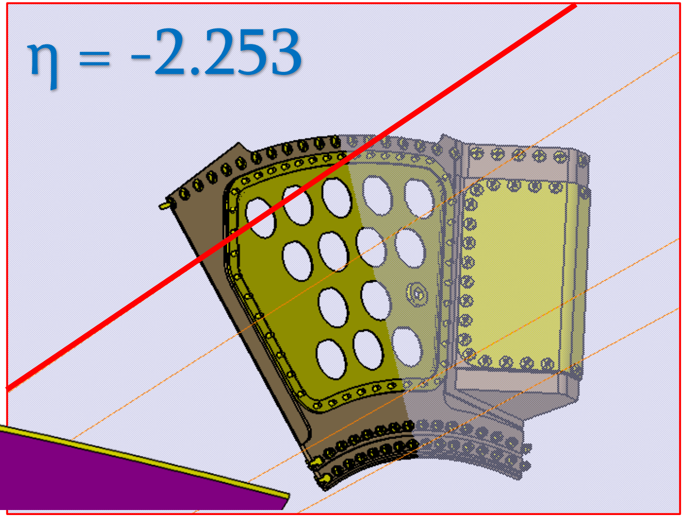
$45 < \Phi < 90$

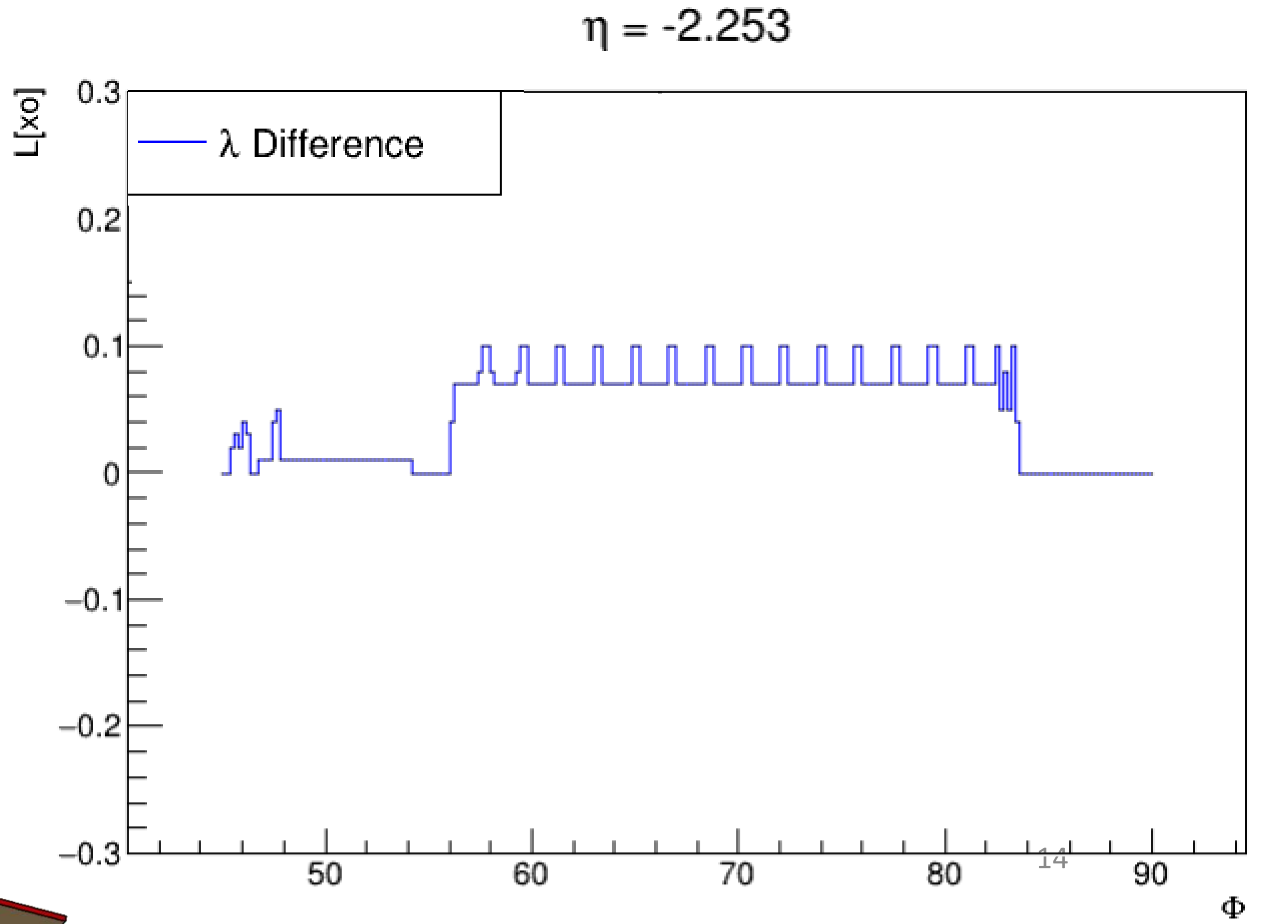
# Compare Analyses – Radiation Length L(Xo) – Line 1



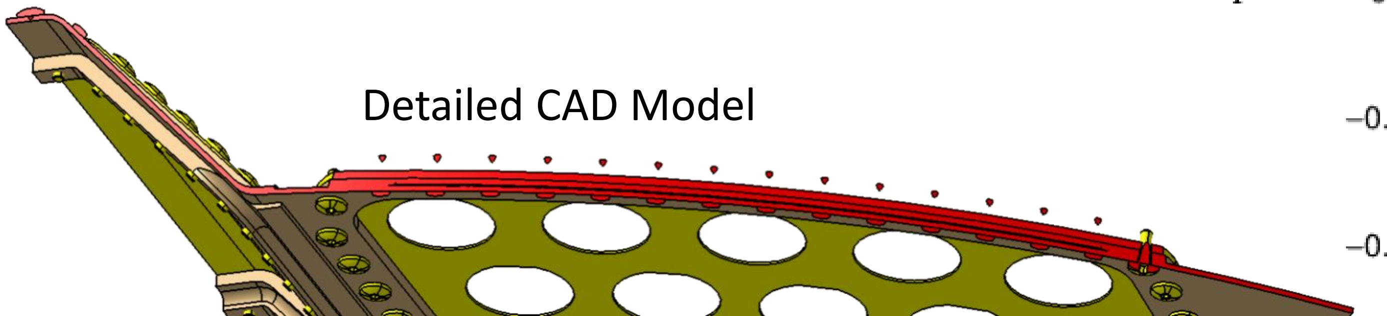

gmx - Simulation



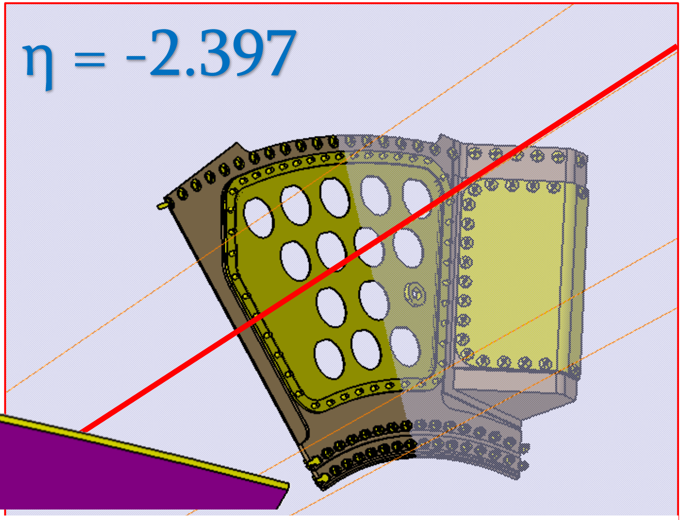


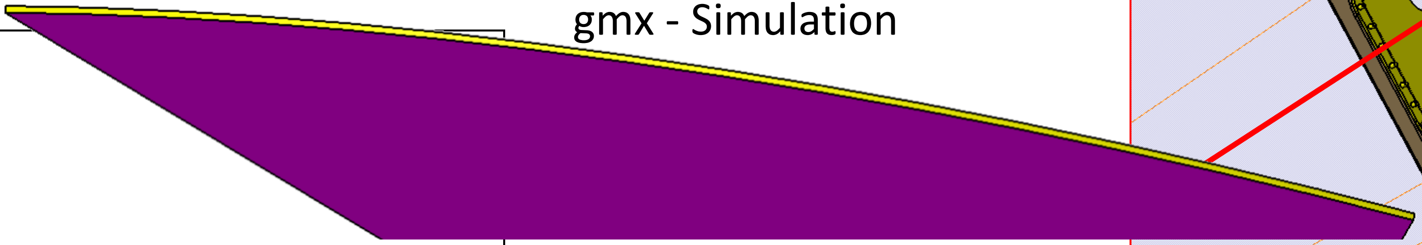

Detailed CAD Model



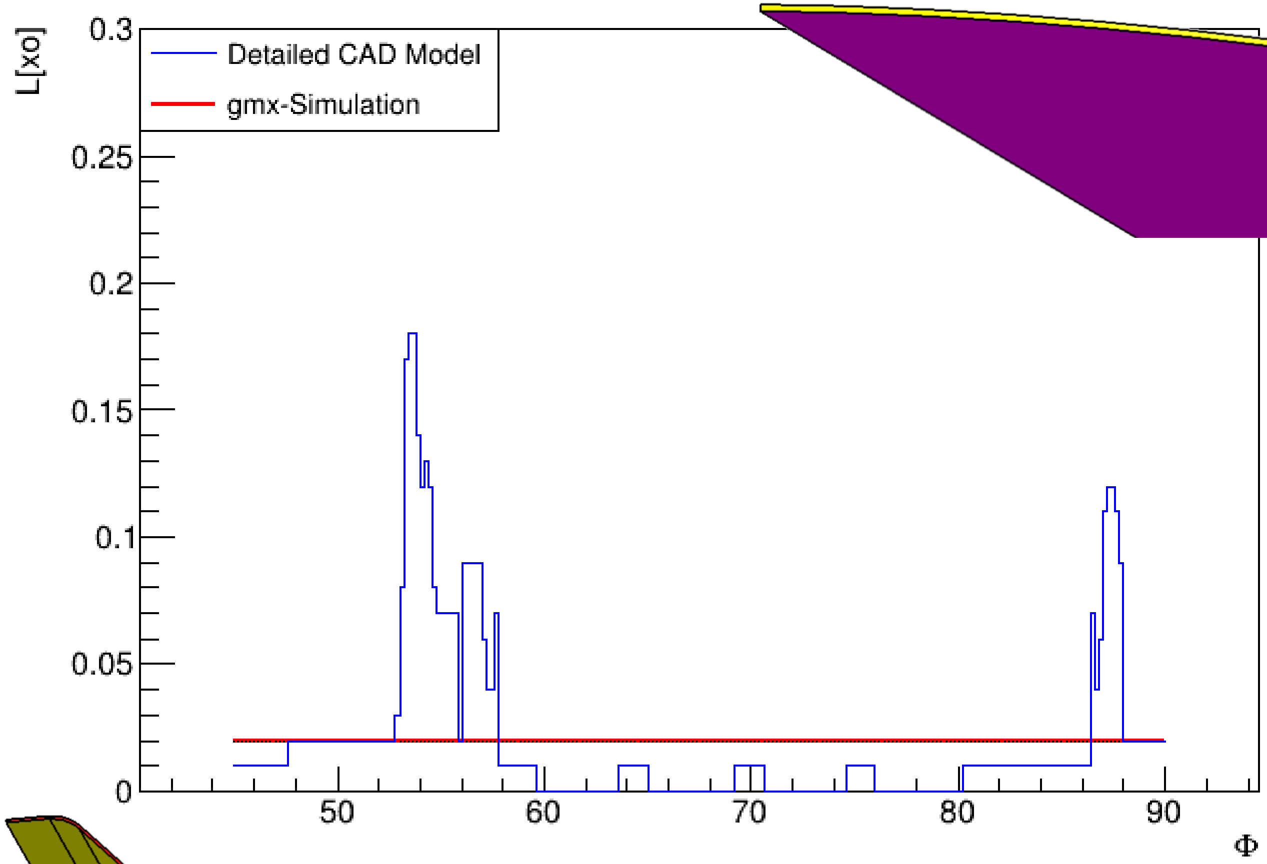
# Compare Analyses – Radiation Length L(Xo) – Line 2



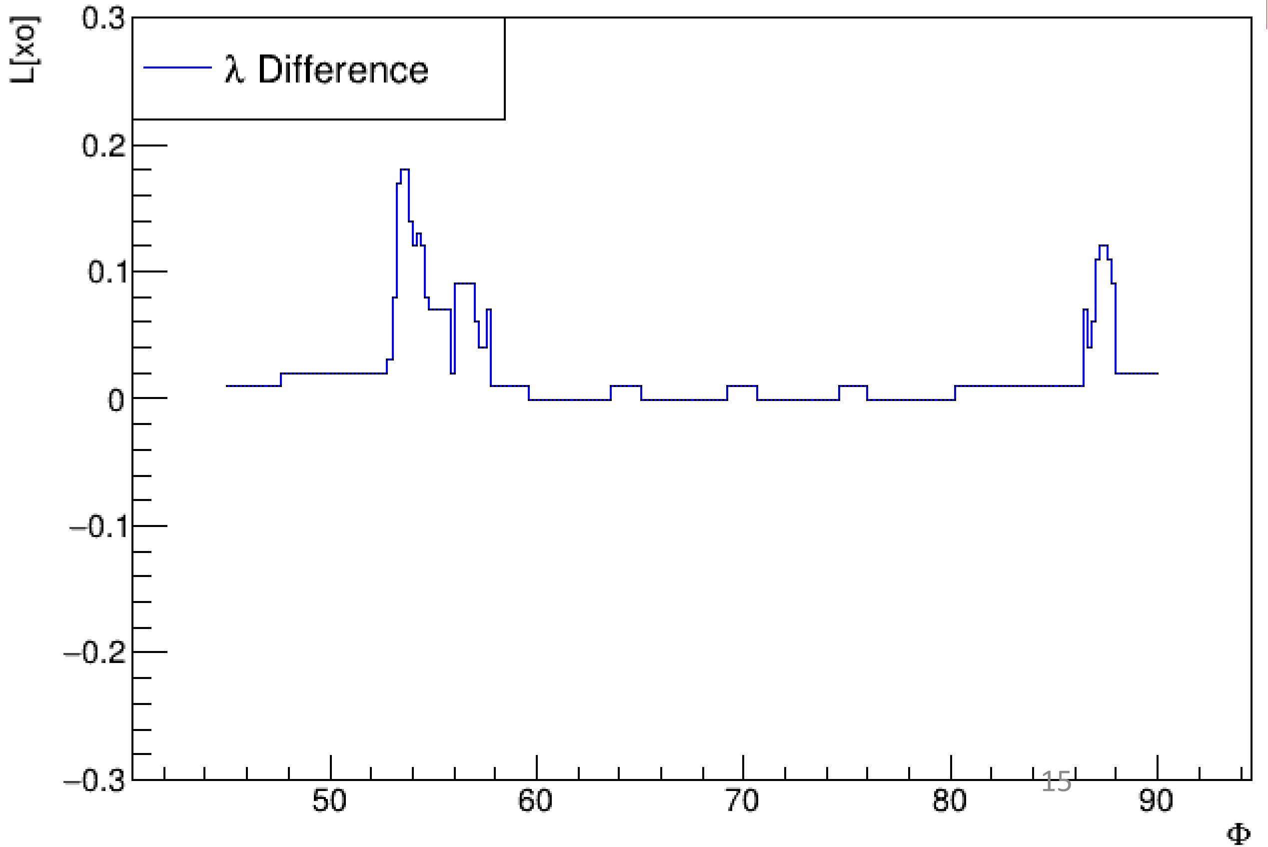

gmx - Simulation

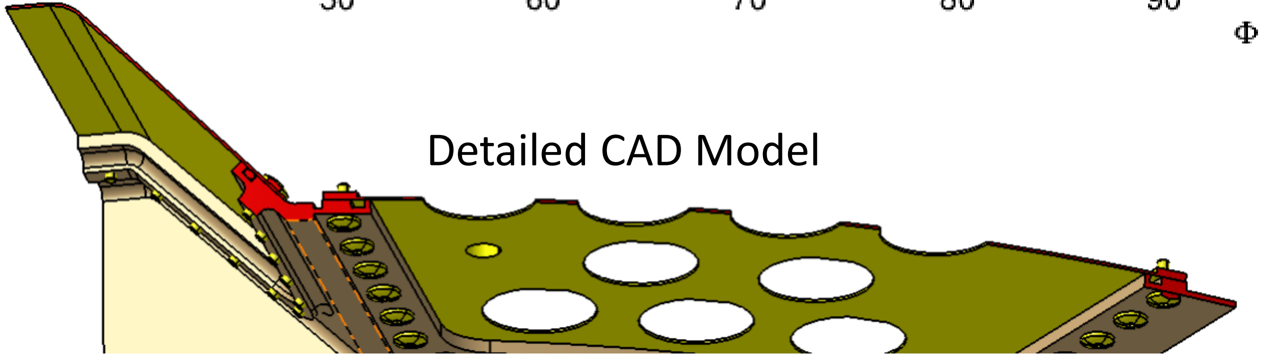


η=-2.397



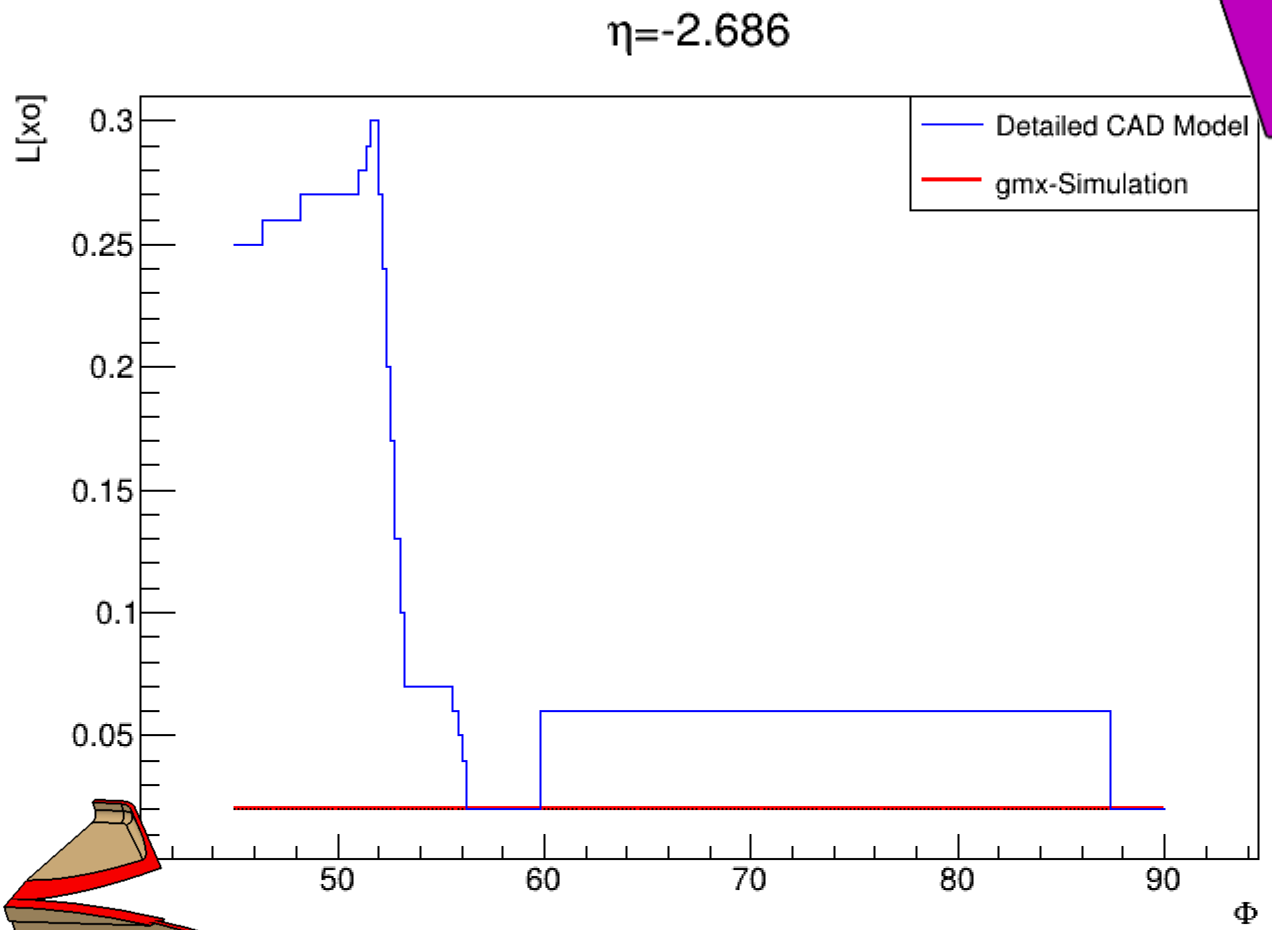

η = -2.397

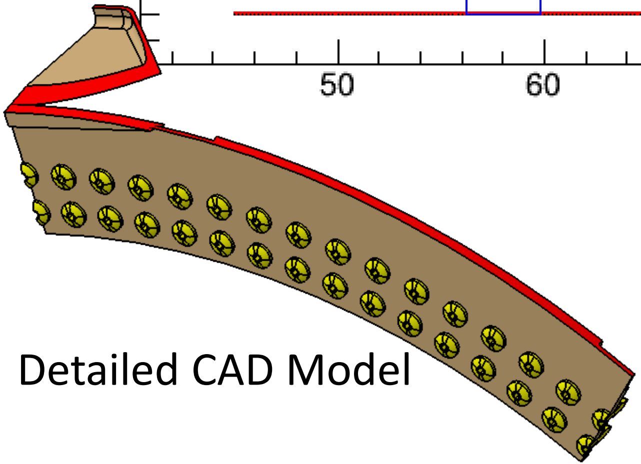


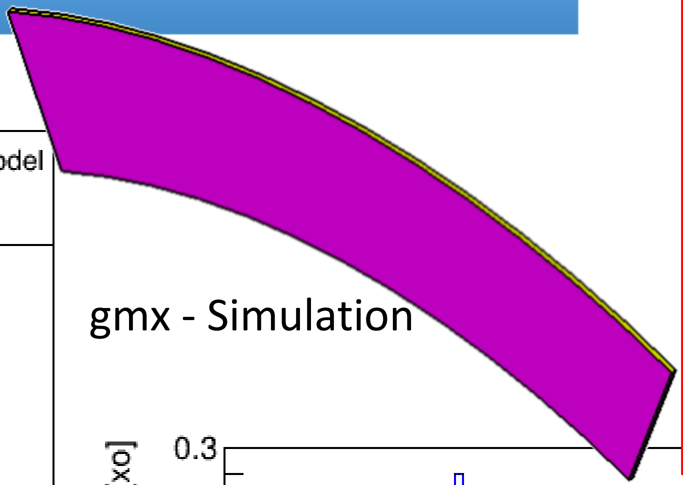
Detailed CAD Model

# Compare Analyses – Radiation Length L(Xo) – Line 3

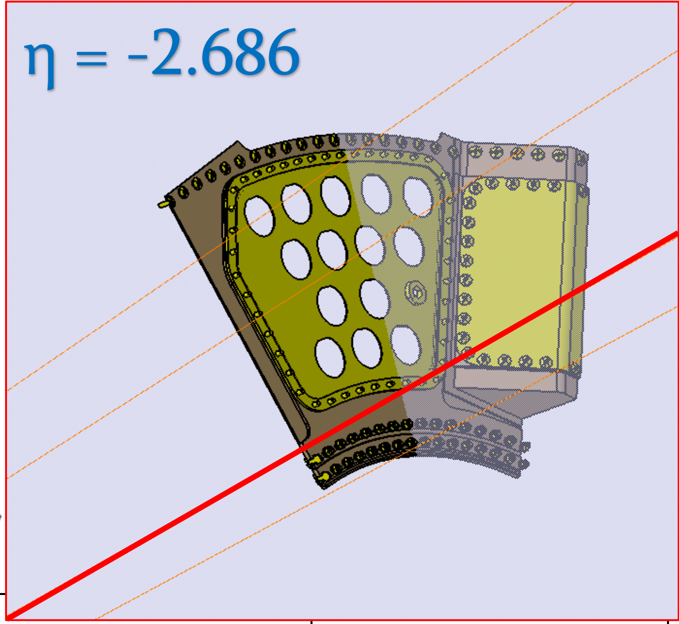


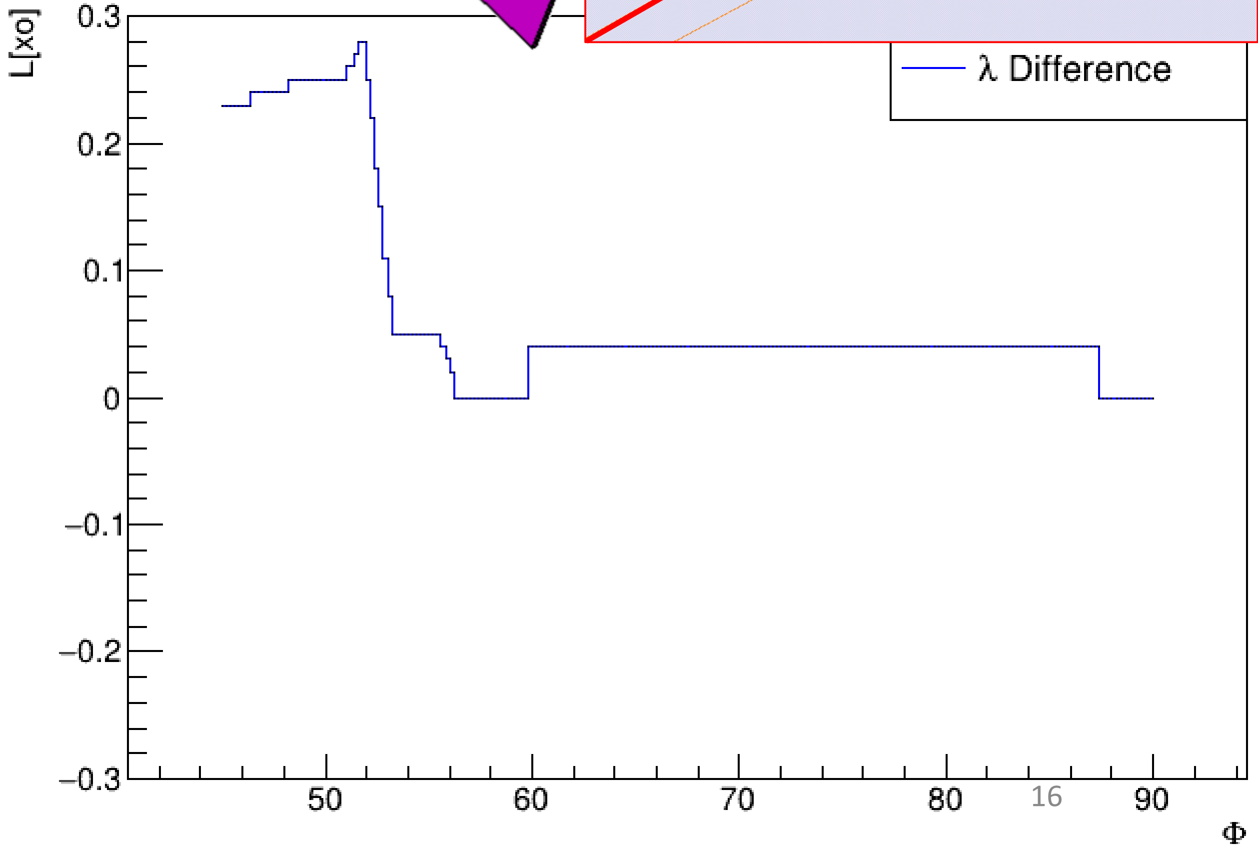



Detailed CAD Model

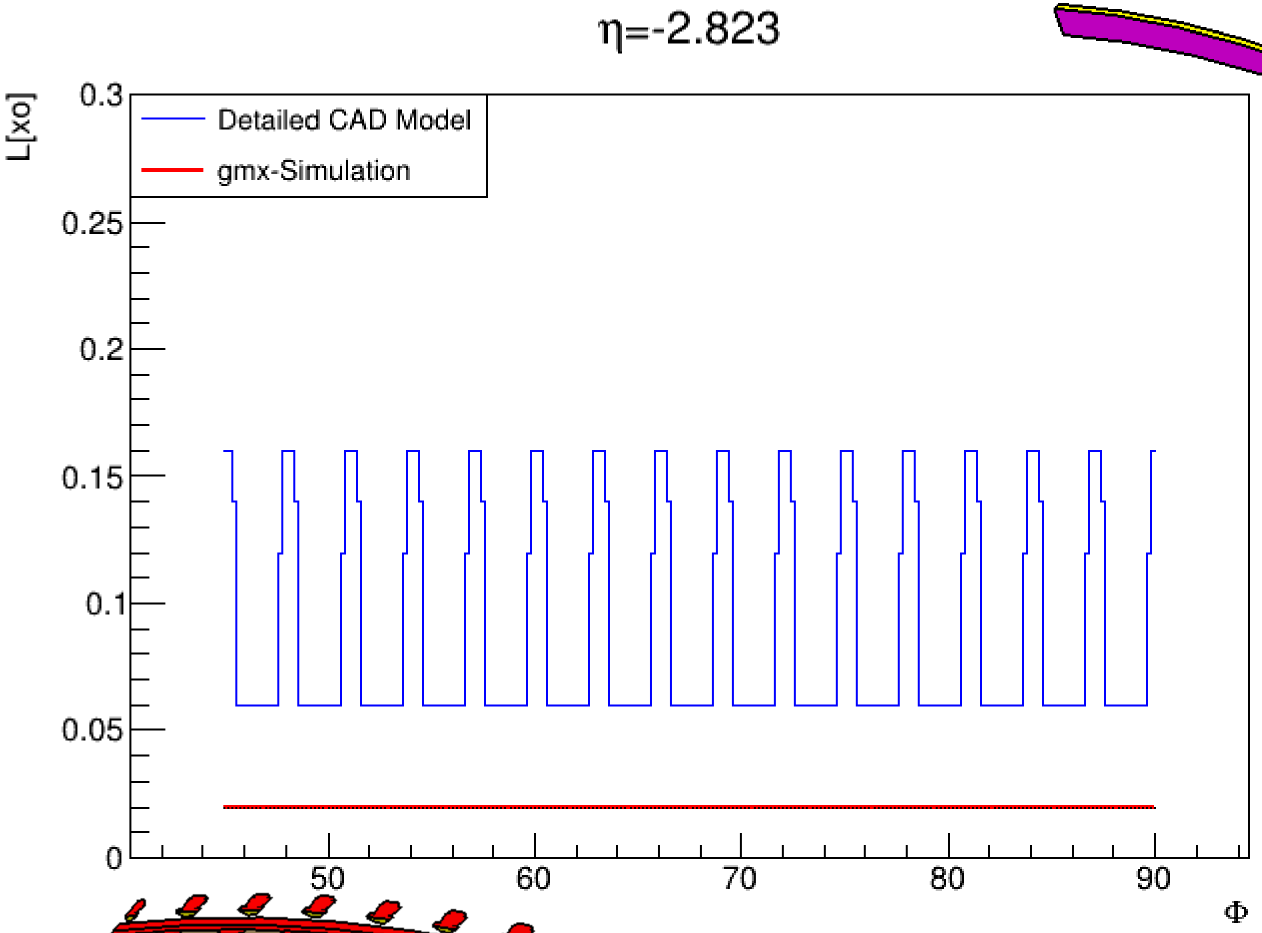


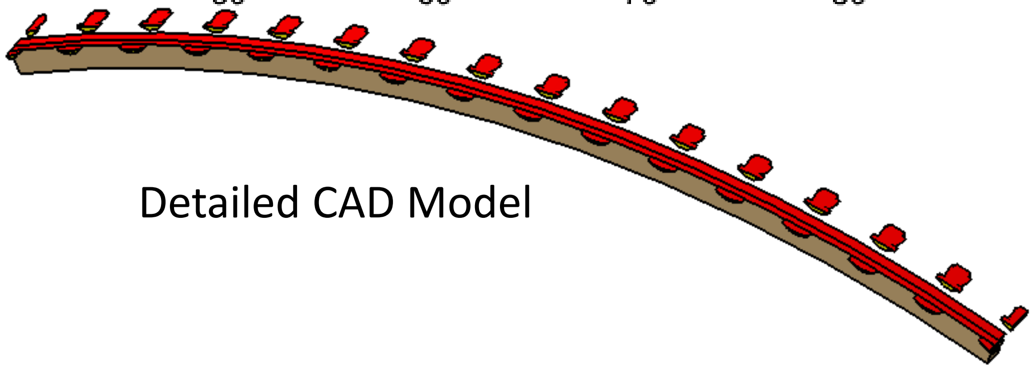
gmx - Simulation



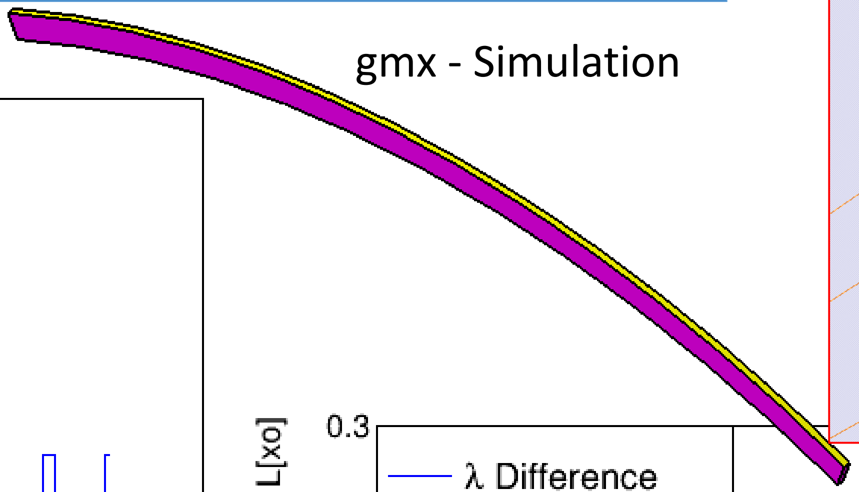



# Compare Analyses – Radiation Length L(Xo) – Line 4

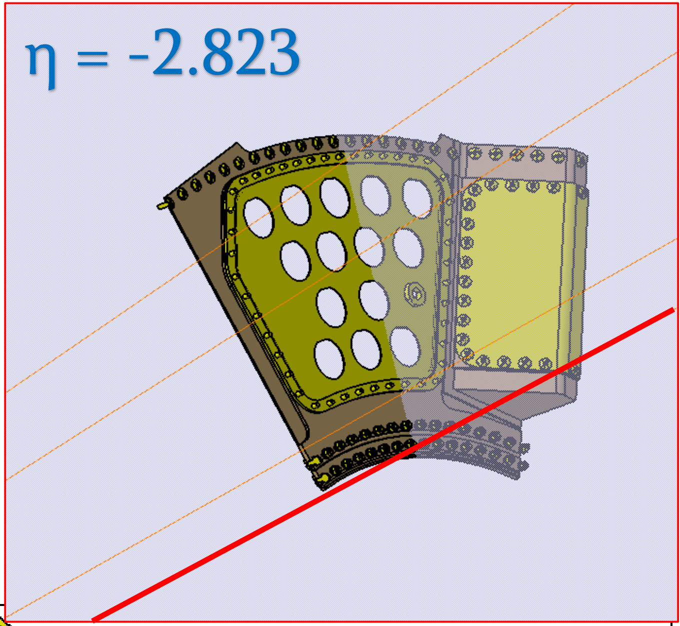


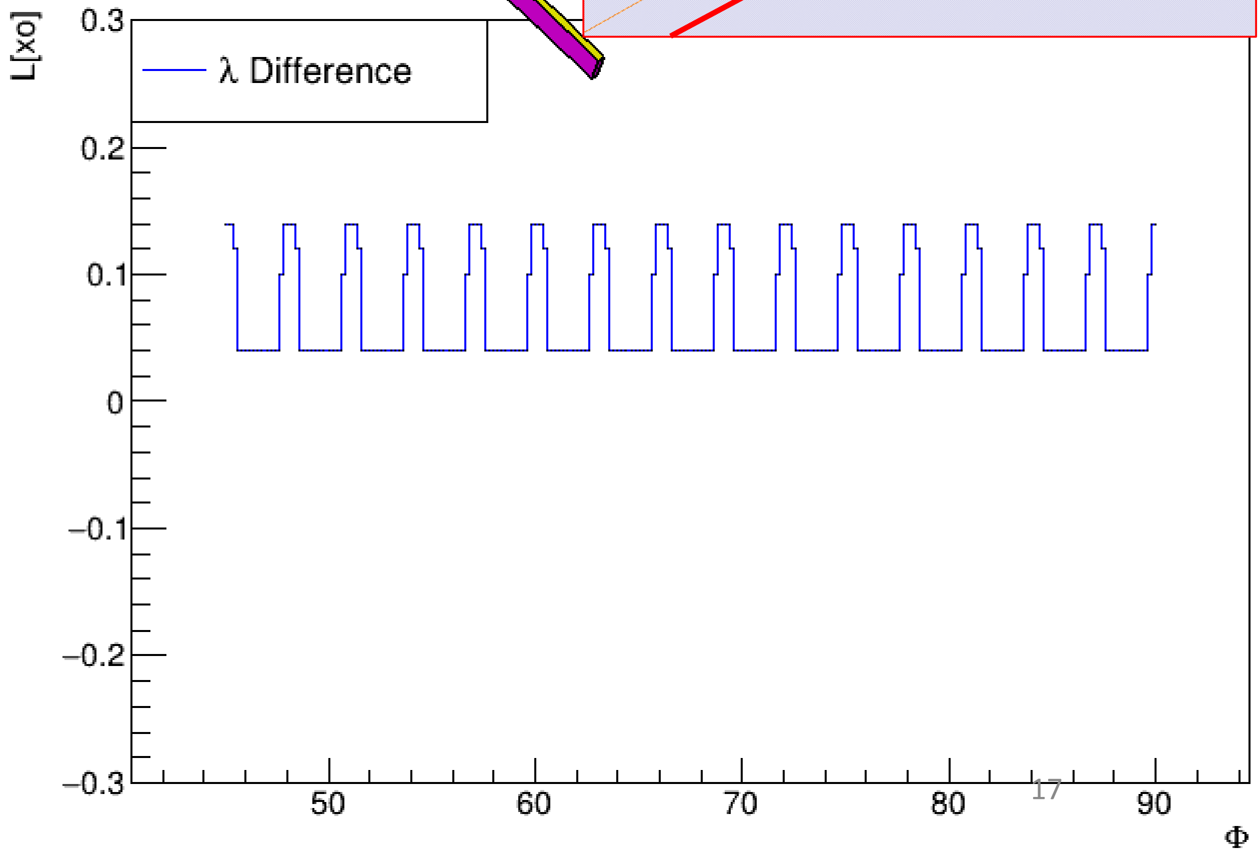



Detailed CAD Model



gmx - Simulation



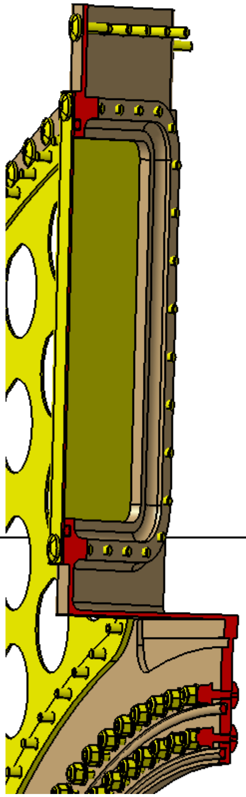
# Calculation of Radiation Length (Xo)

$\Phi = 45.2$
$\Phi = 54.4$
$\Phi = 70.6$
$\Phi = 87$

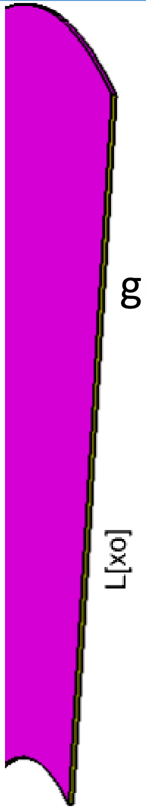
$-2.916 < \eta < -2.172$

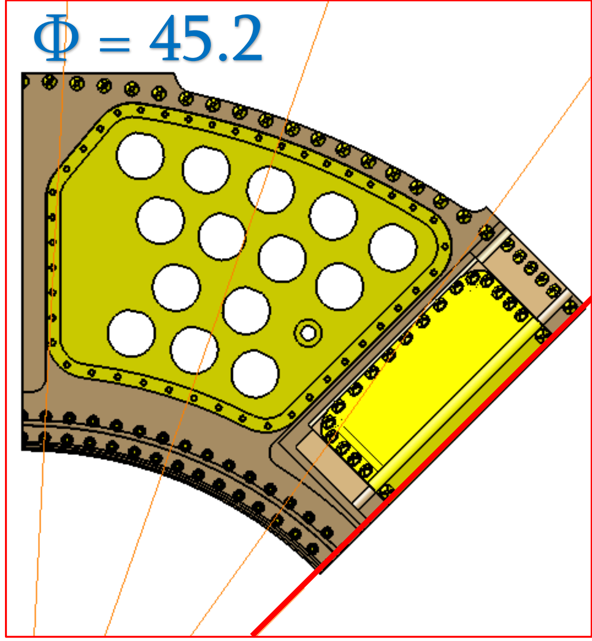
# Compare Analyses – Radiation Length L(Xo) – Line 1

Detailed CAD Model



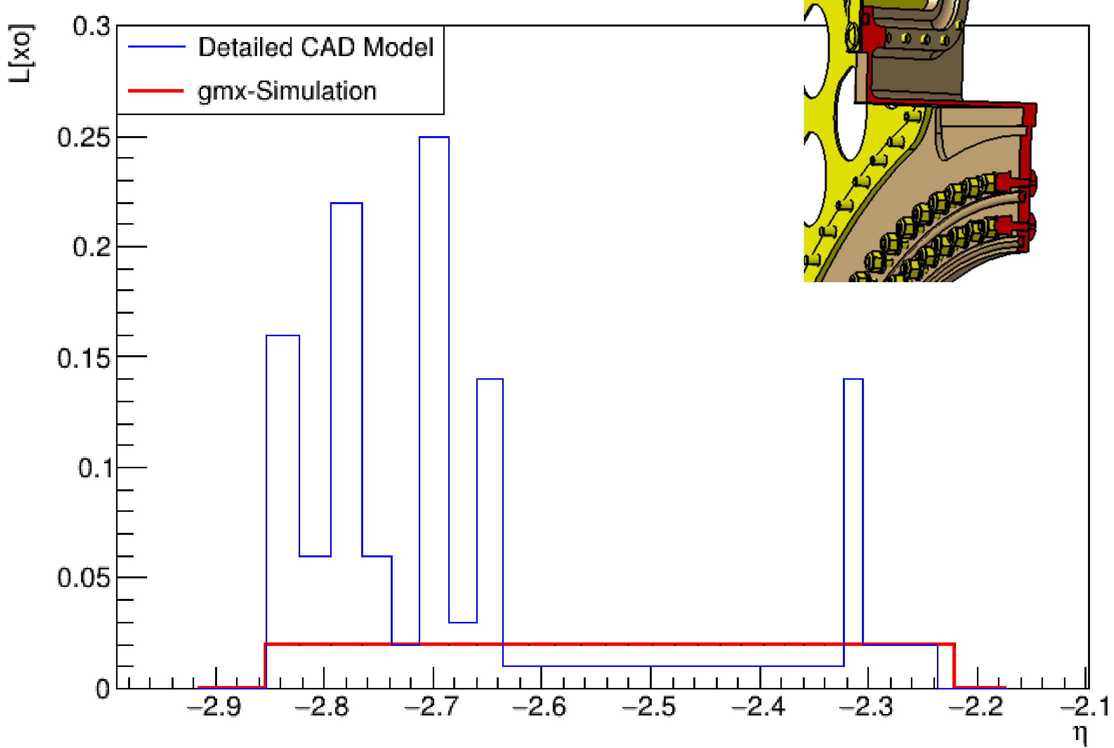
gmx - Simulation

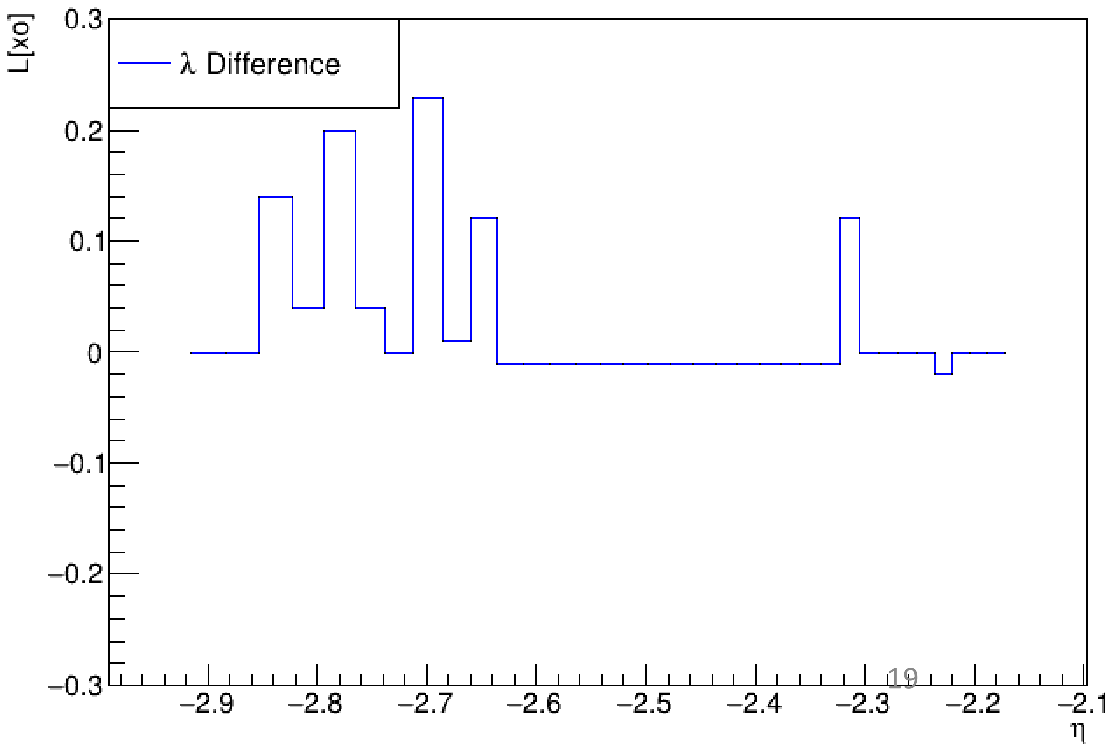





Φ = 45.2

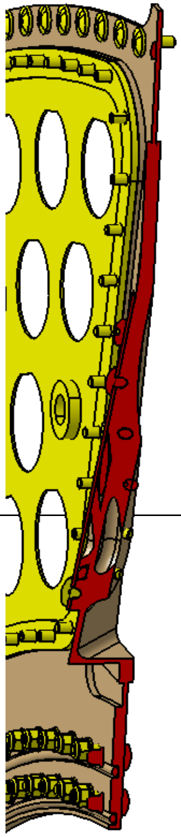
Φ=45.2

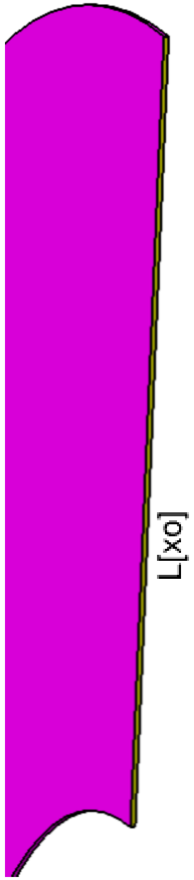


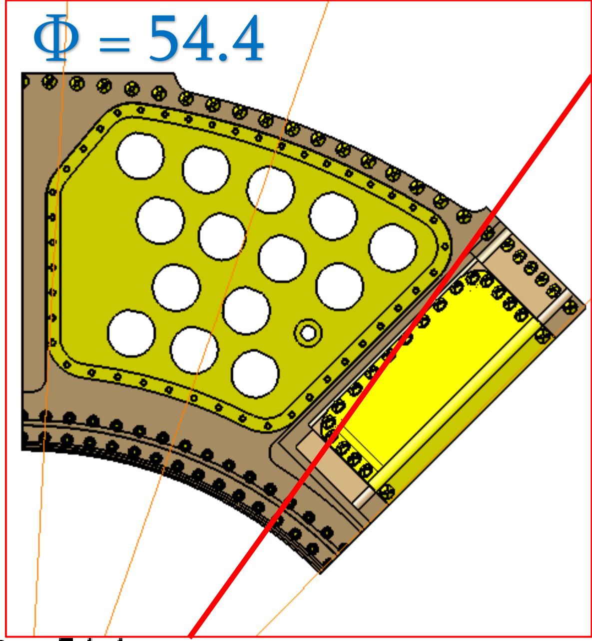
# Compare Analyses – Radiation Length L(Xo) – Line 2

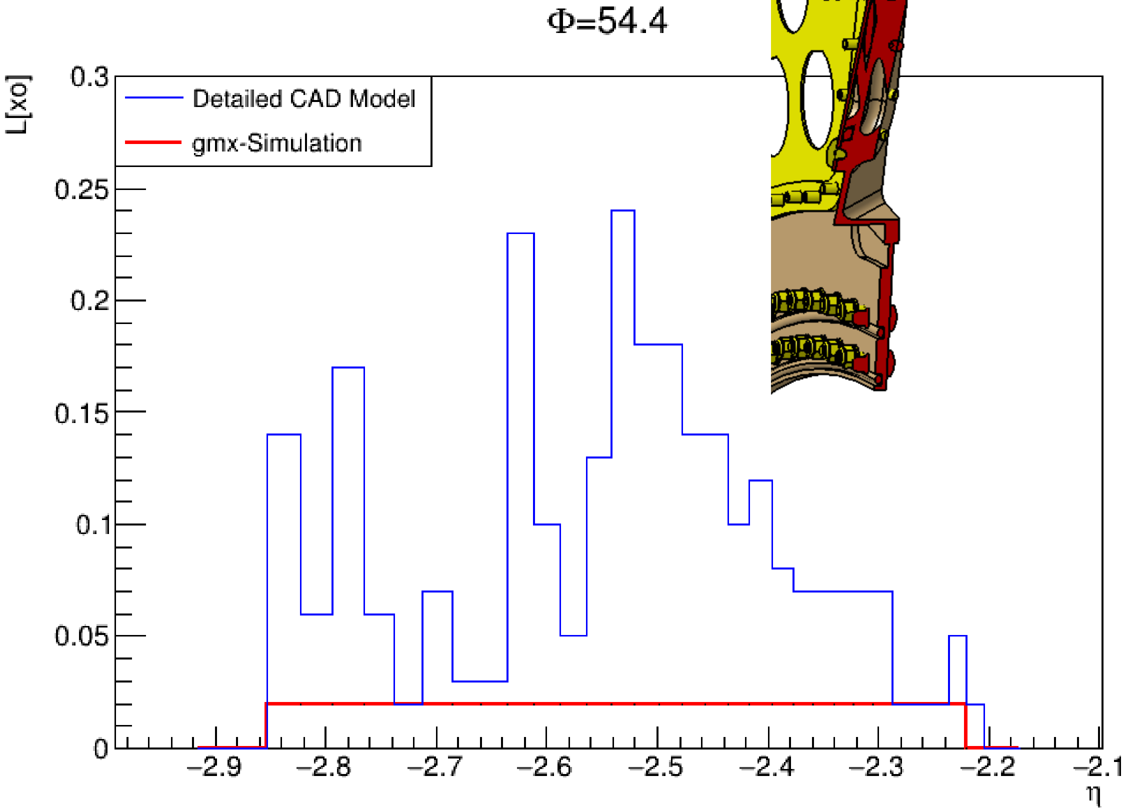
Detailed CAD Model

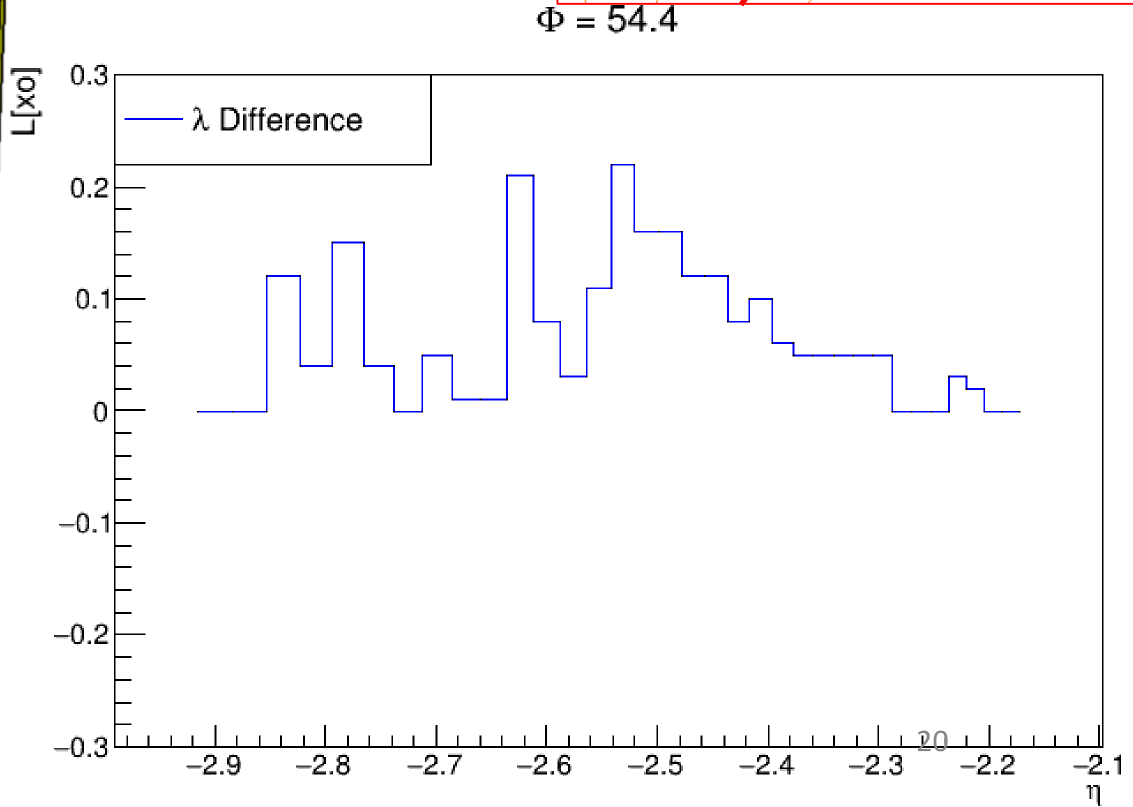




gmx - Simulation

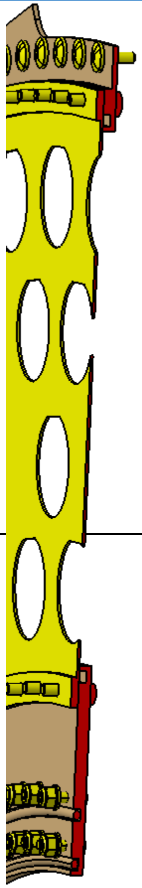


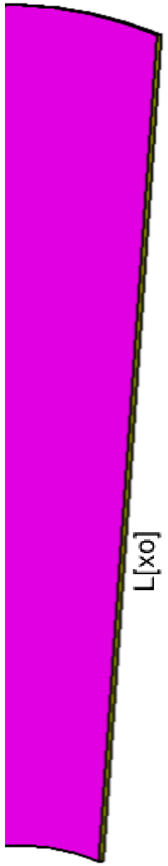



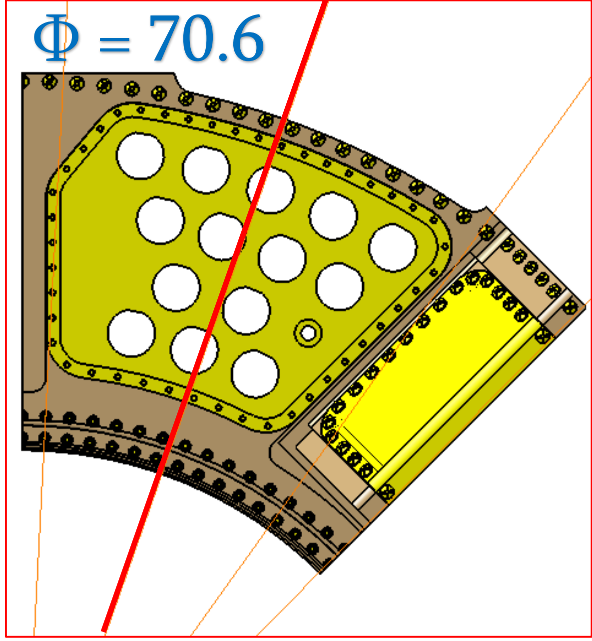
# Compare Analyses – Radiation Length L(Xo) – Line 3

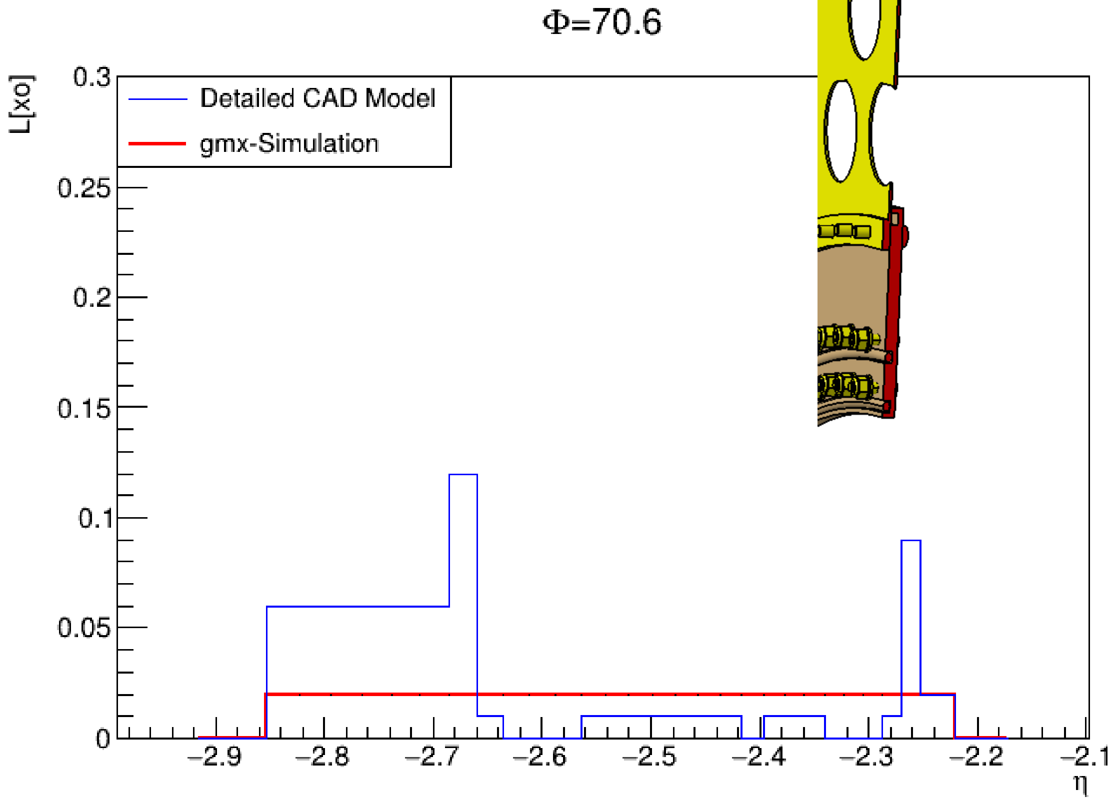
Detailed CAD Model

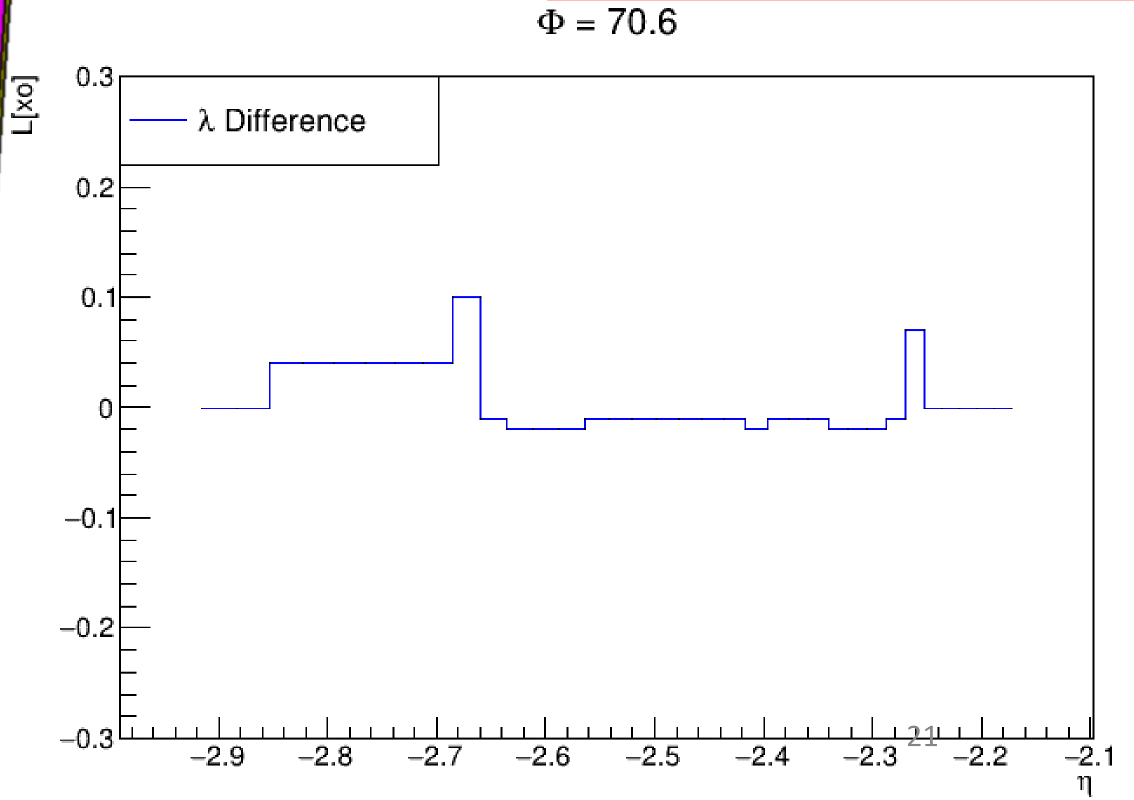




gmx - Simulation



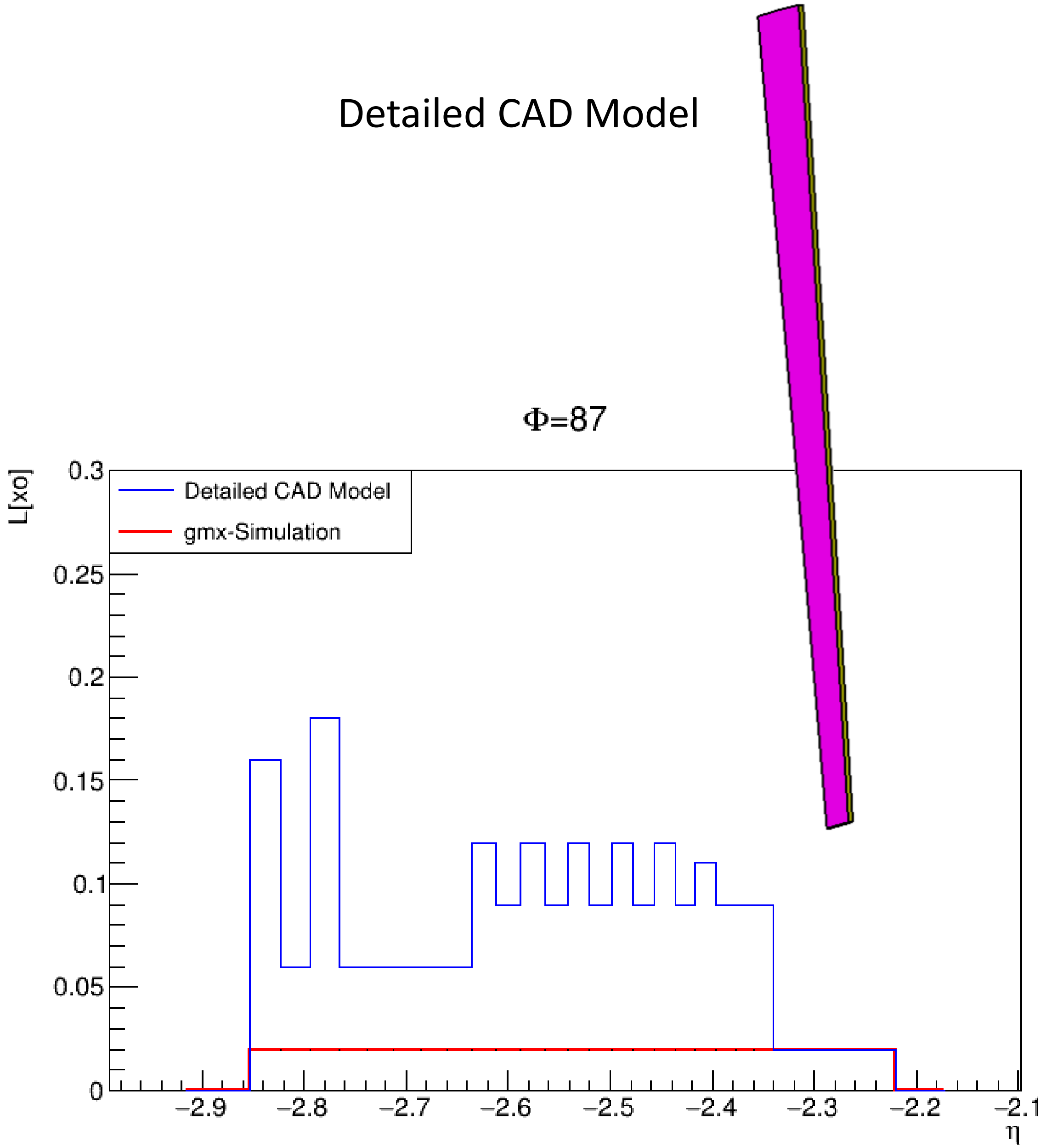



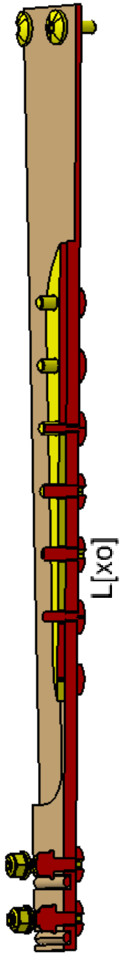



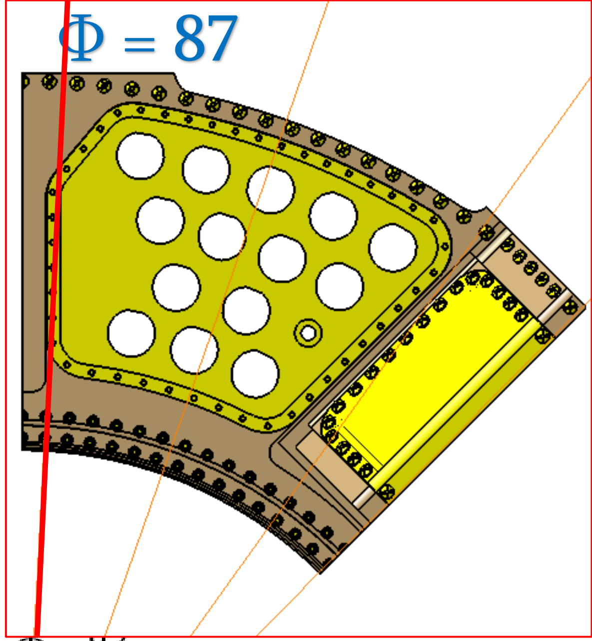
# Compare Analyses – Radiation Length L(Xo) – Line 4

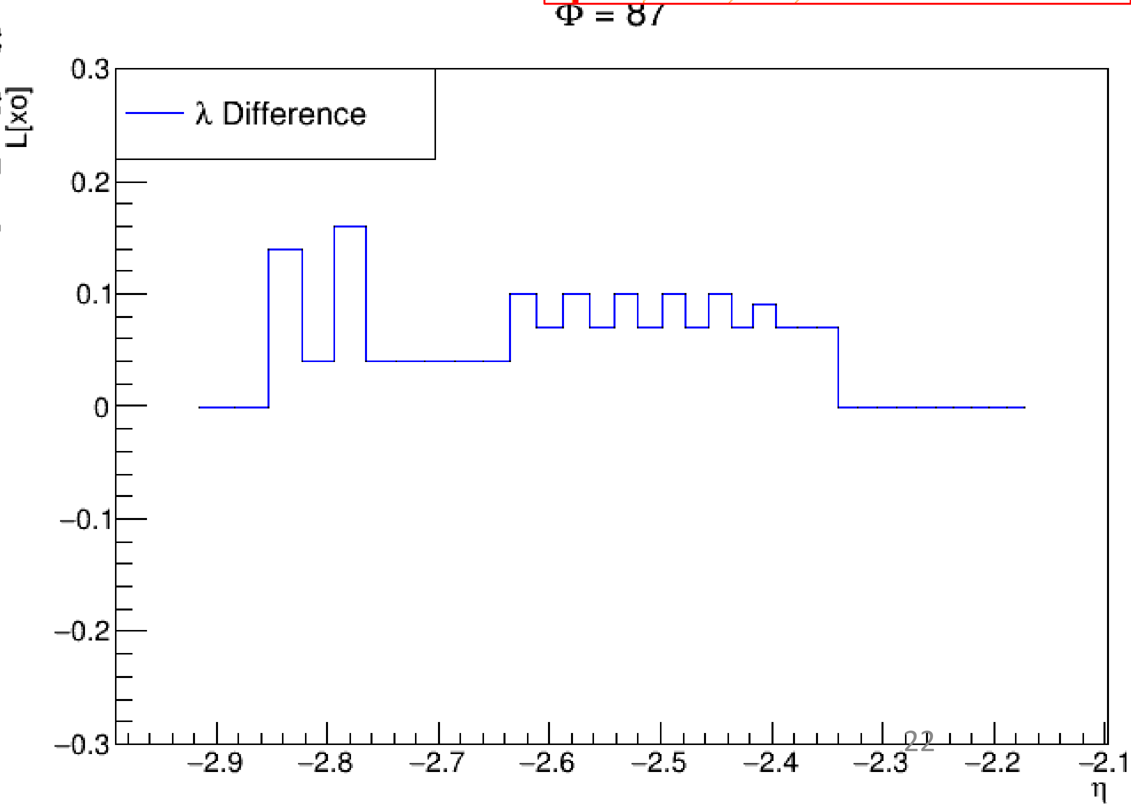
Detailed CAD Model

gmx - Simulation

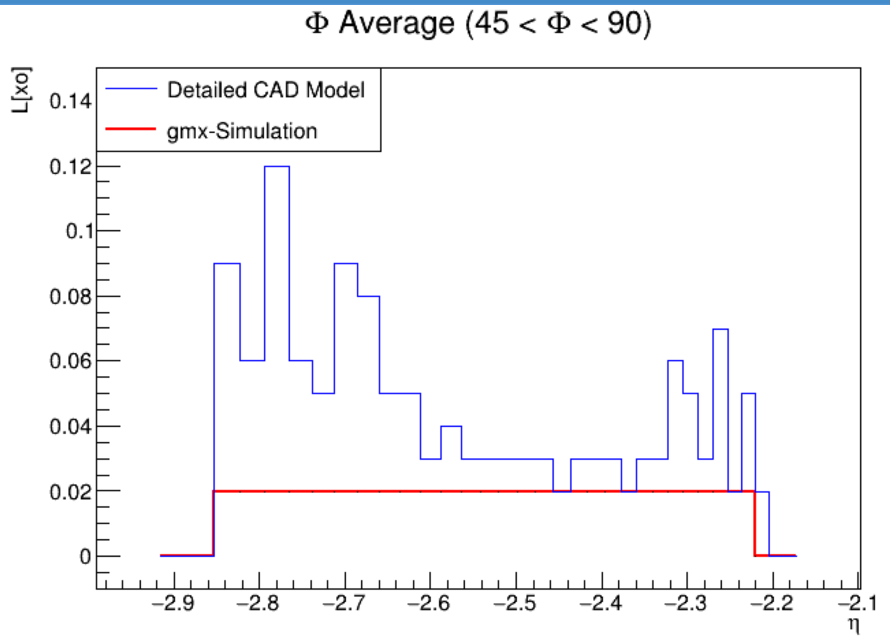


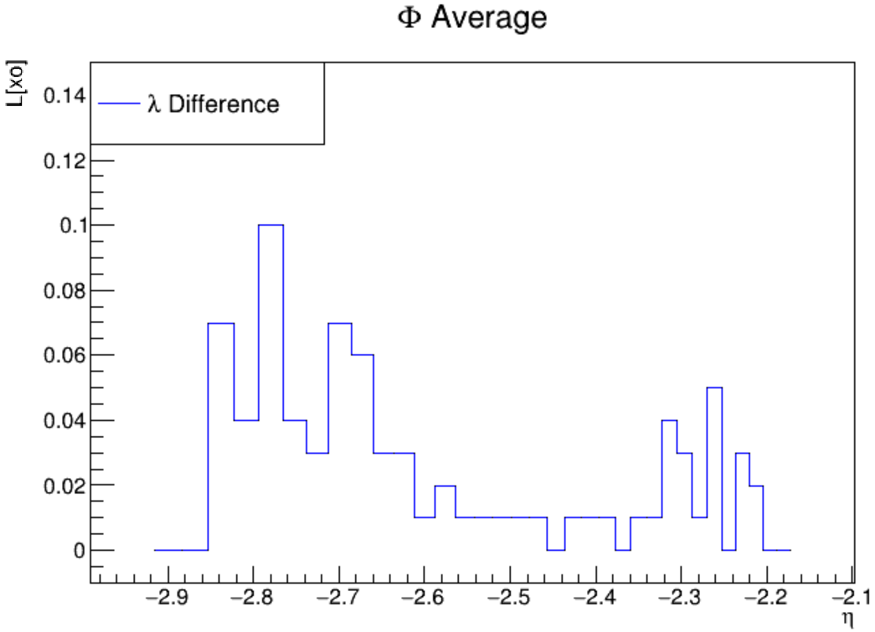



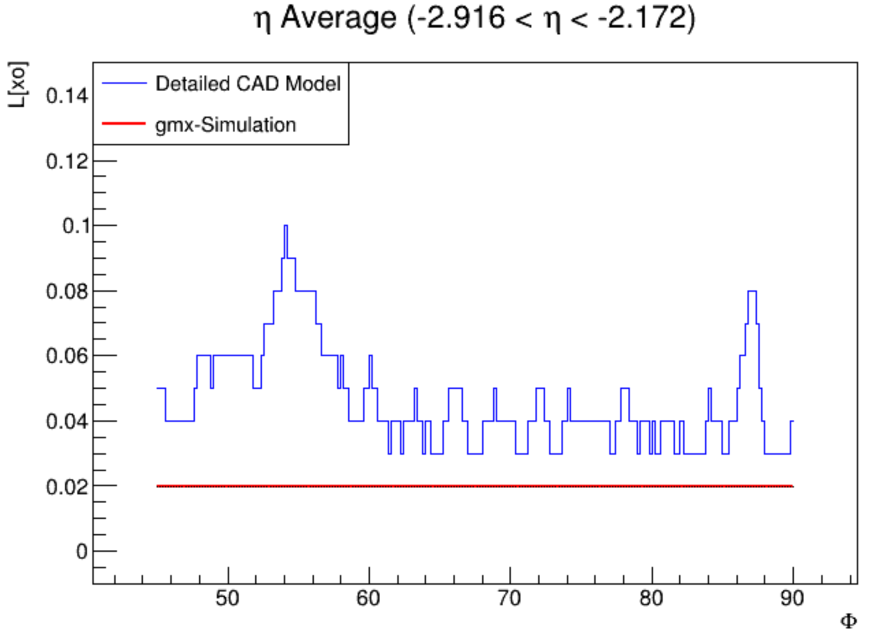


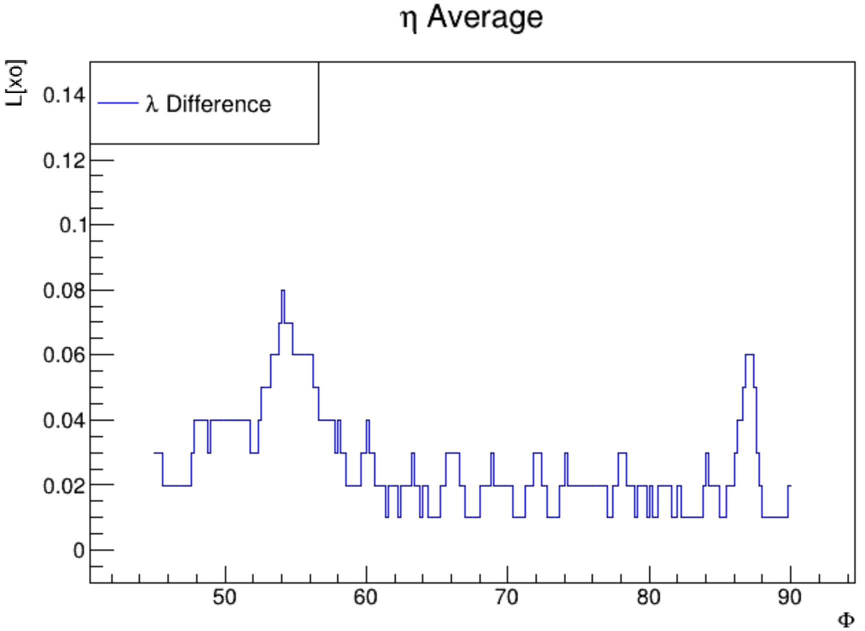



# Compare Analyses – Radiation Length (Average Values)



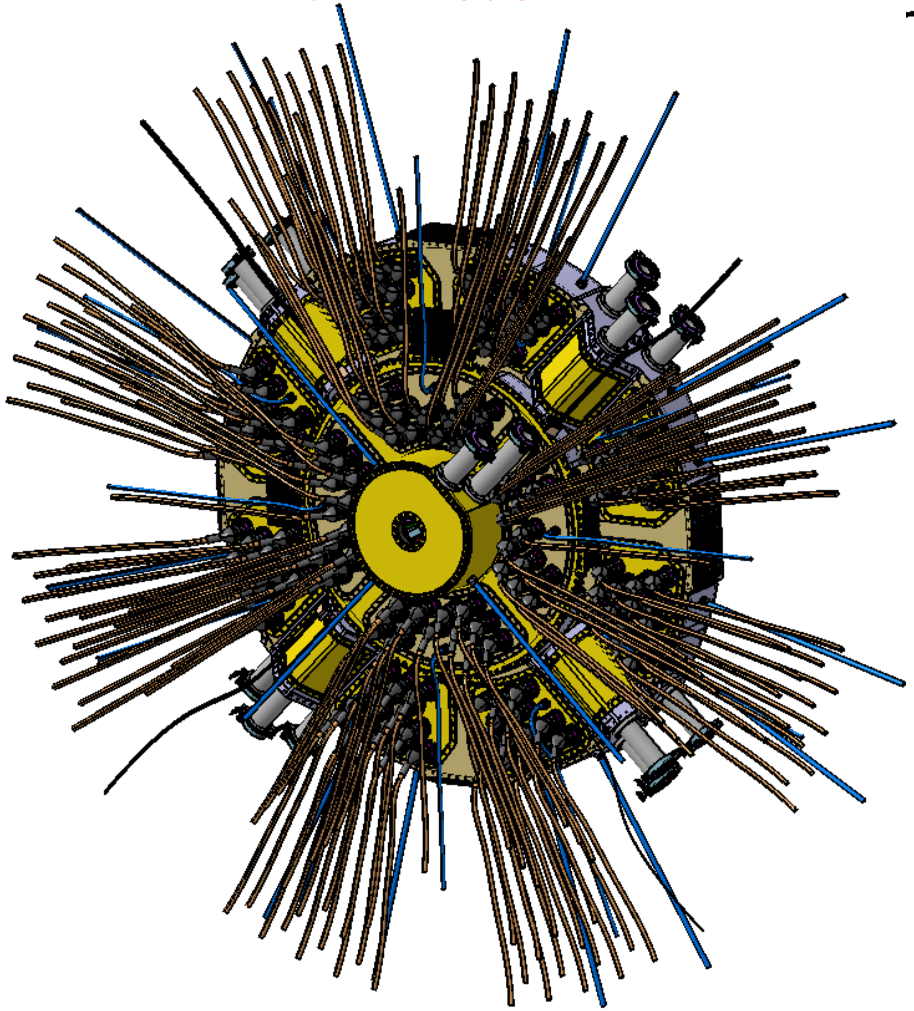
# CAD Model vs. gmx

## ITk PP1 region

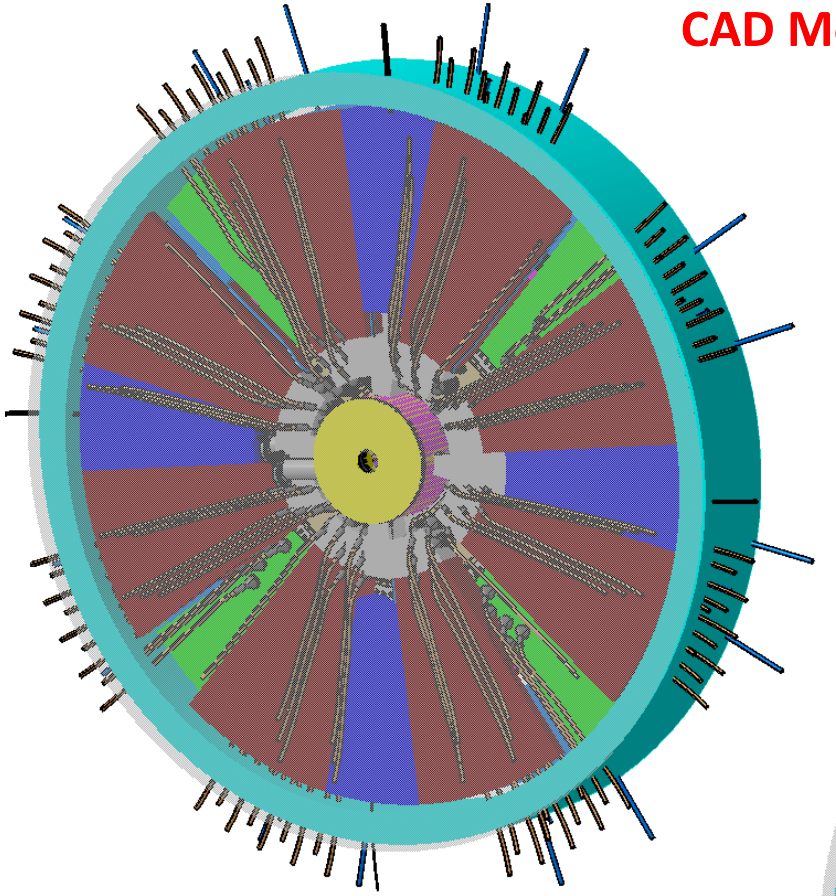
gmx: ITKLayouts (17.06.2022)
https://gitlab.cern.ch/Atlas-Inner-Tracking/ITKLayouts

# PP1

CAD Model

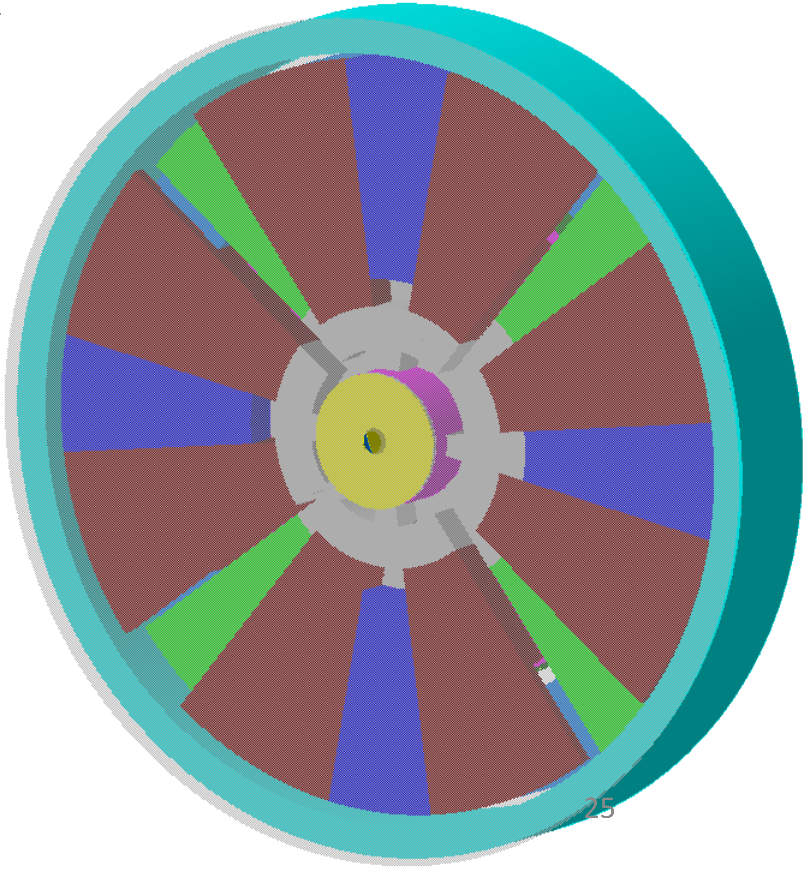


CAD Model + gmx

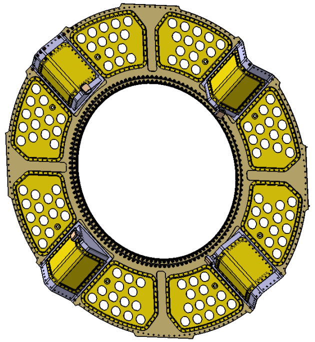
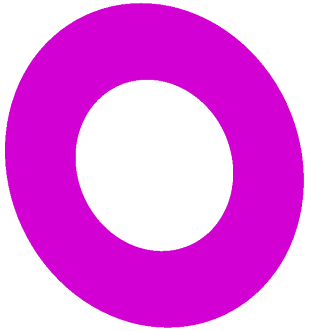
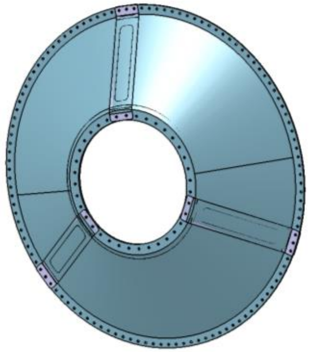
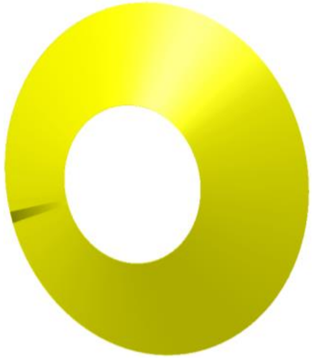
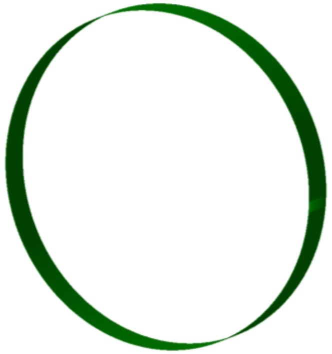


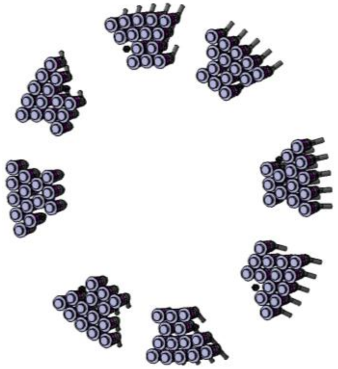
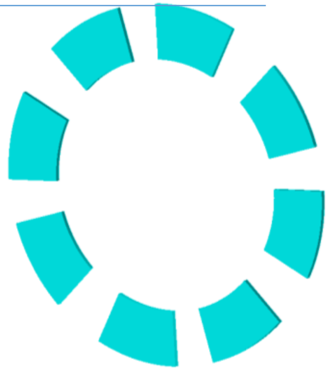
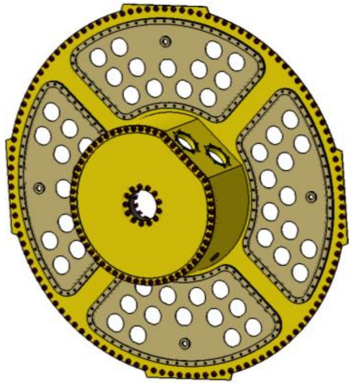
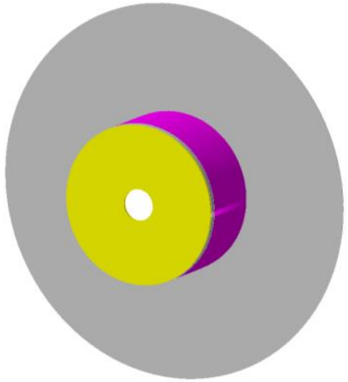
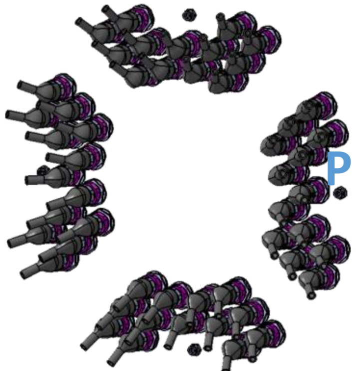
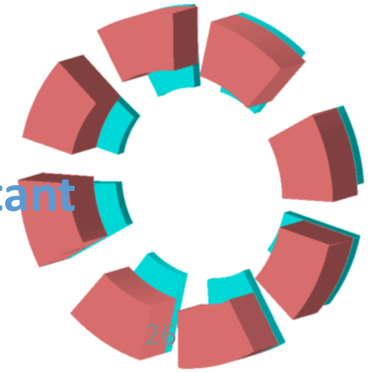
Vs.

Simulation - gmx



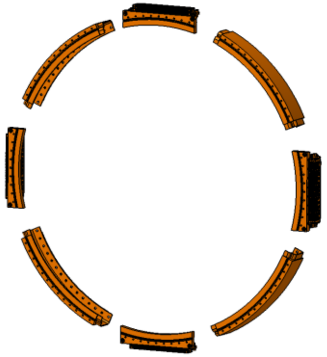
# The list of volumes that exist in both CAD models and simulation

| CAD Model | | Simulation - gmx |
|---|---|---|
|  | PP1_outerwall<br>In progress… |  |
|  | PP1_coneflange |  |
|  | PP1_outerflange |  |

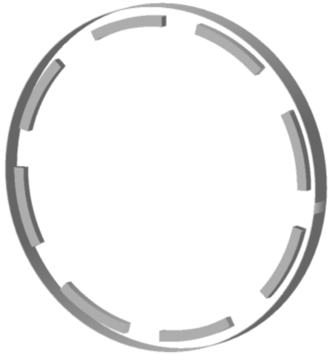
| CAD Model | | Simulation - gmx |
|---|---|---|
|  | OuterPP1Connectors |  |
|  | PP1_innerwall<br>PP1_innercylinder<br>PP1_innerclosingflange<br>PP1_innercylinderEndBlock |  |
|  | PP1_T2_power<br>PP1_T1_power connectoroctant |  |

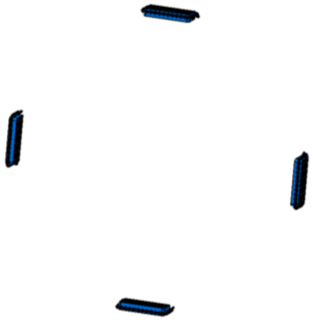
# The list of volumes that exist in both CAD models and simulation

**CAD Model** | **Simulation - gmx**

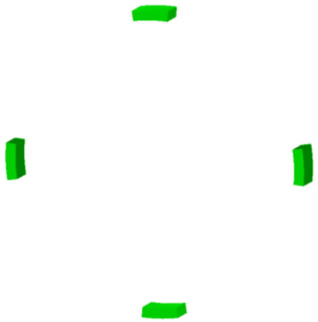


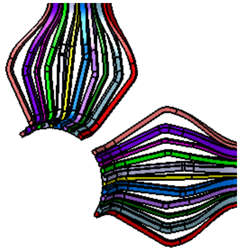
PP1_innerflange
InnerPP1Connectors



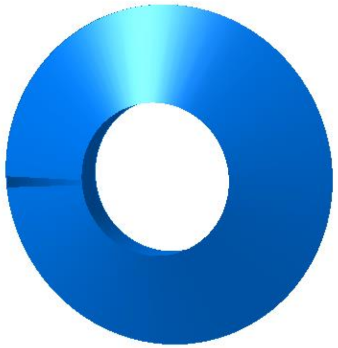


PixReadout1Wheel





PP1_T1_innercone

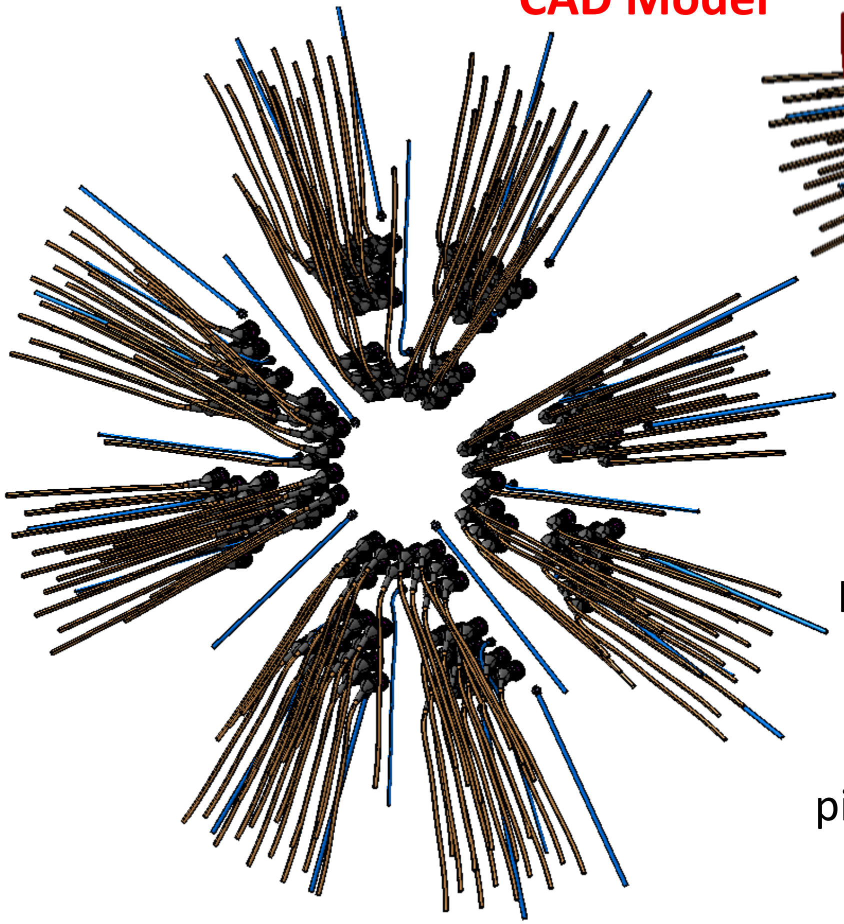


**CAD Model** | **Simulation - gmx**

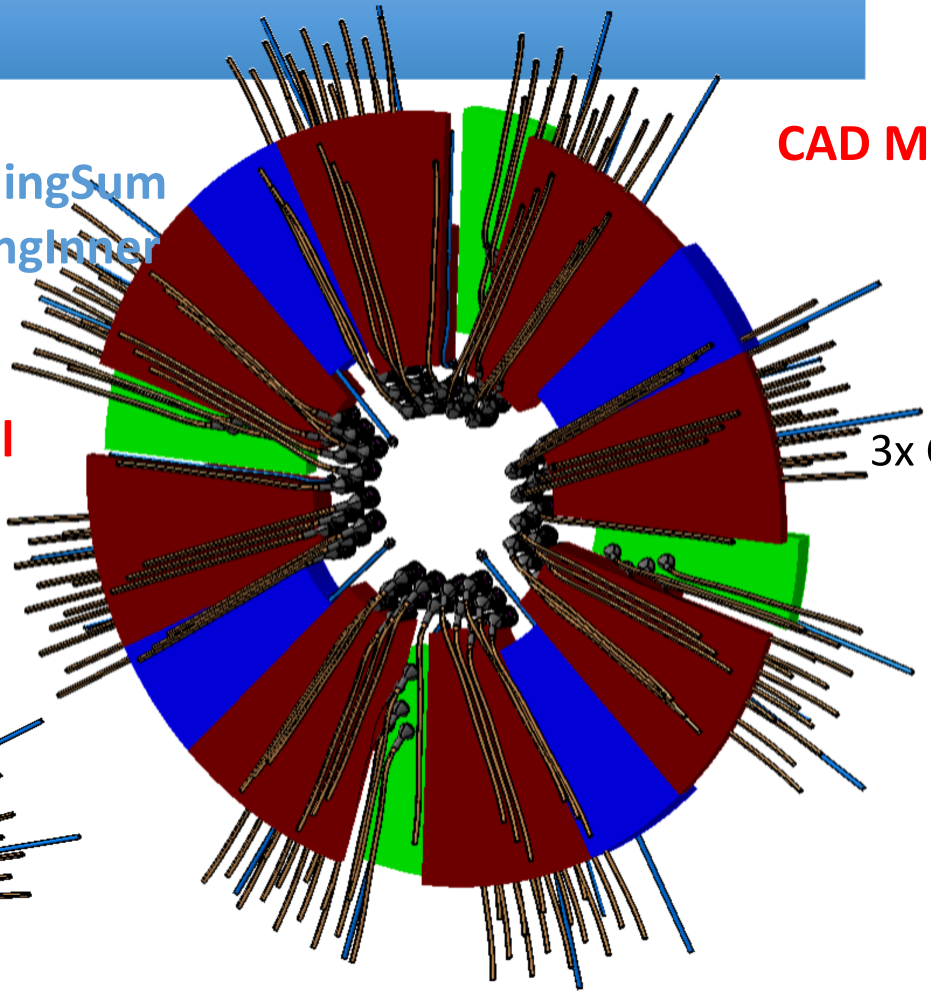
# Difficult to figure out…

CoolingOuterWheel
pixSvc_PP1_T2_R420_R1000_CoolingSum
pixSvc_PP1_T2_R347_R420_CoolingInner
PP1_T2_wheel
PixReadout2Wheel

CAD Model



CAD Model + gmx



Vs.

Simulation - gmx

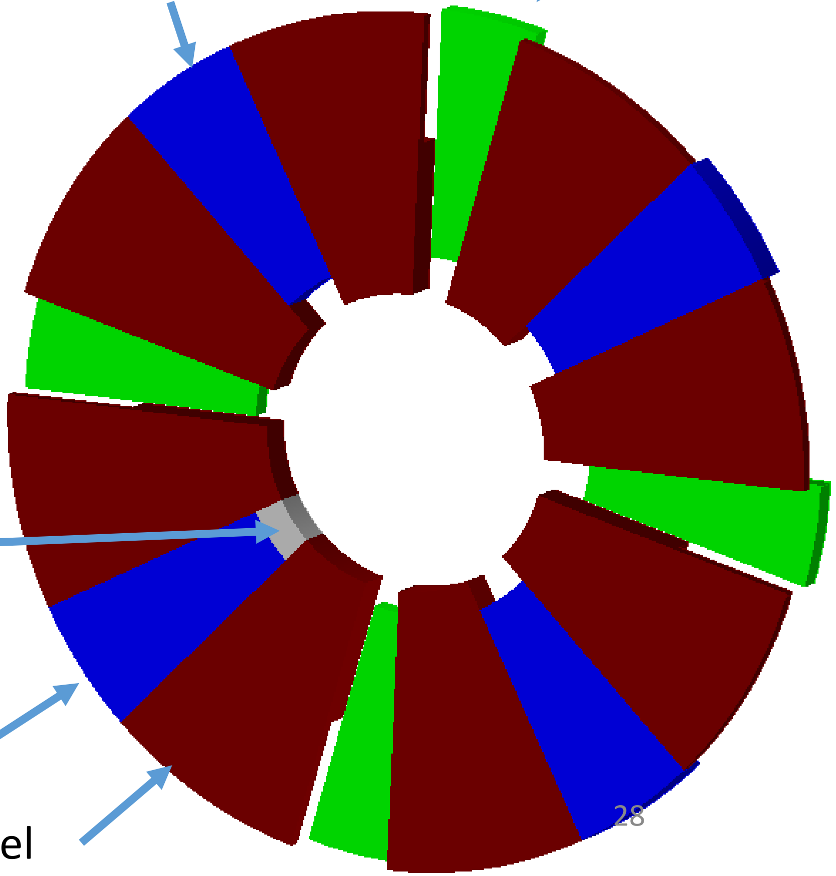
4x PixReadout2Wheel

3x CoolingOuterWheel

pixSvc_PP1_T2_R347_R420_CoolingInner

pixSvc_PP1_T2_R420_R1000_CoolingSum

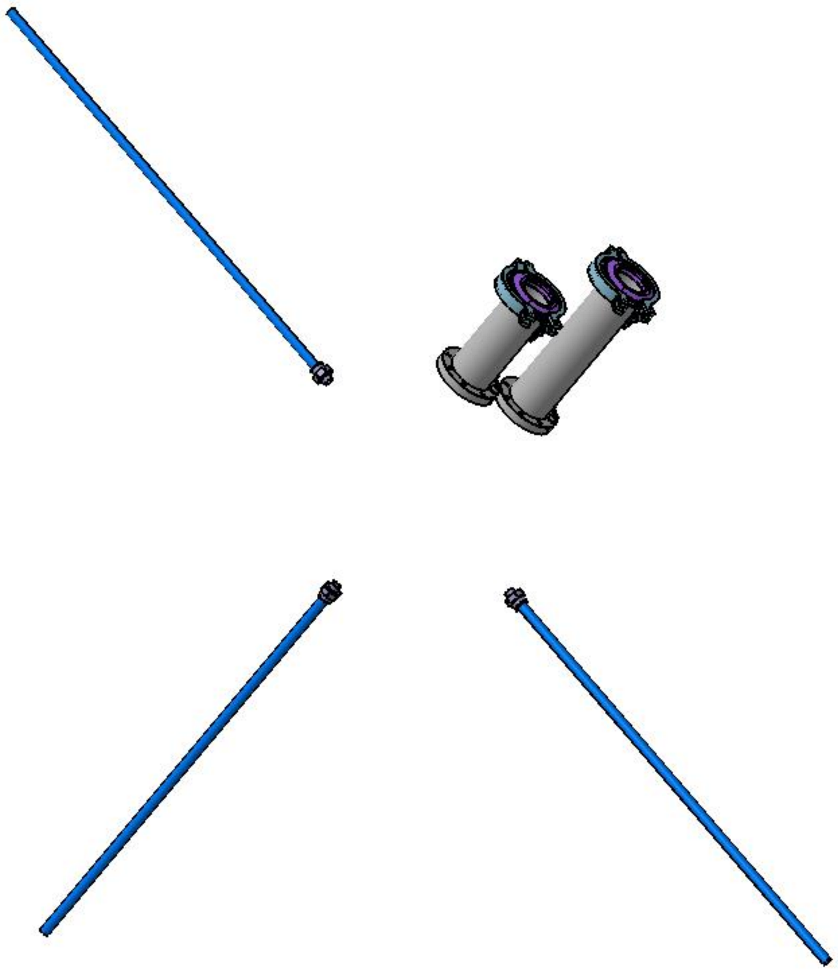
PP1_T2_wheel



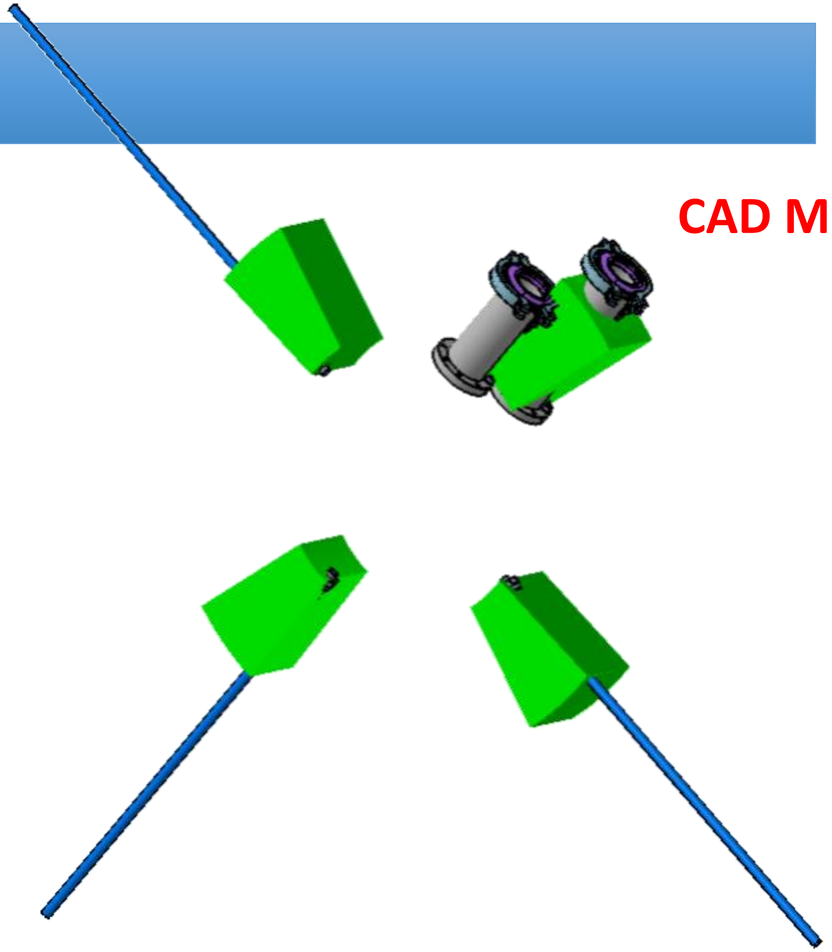
# Difficult to figure out…

**PP1_T2_cooling**

**CAD Model**

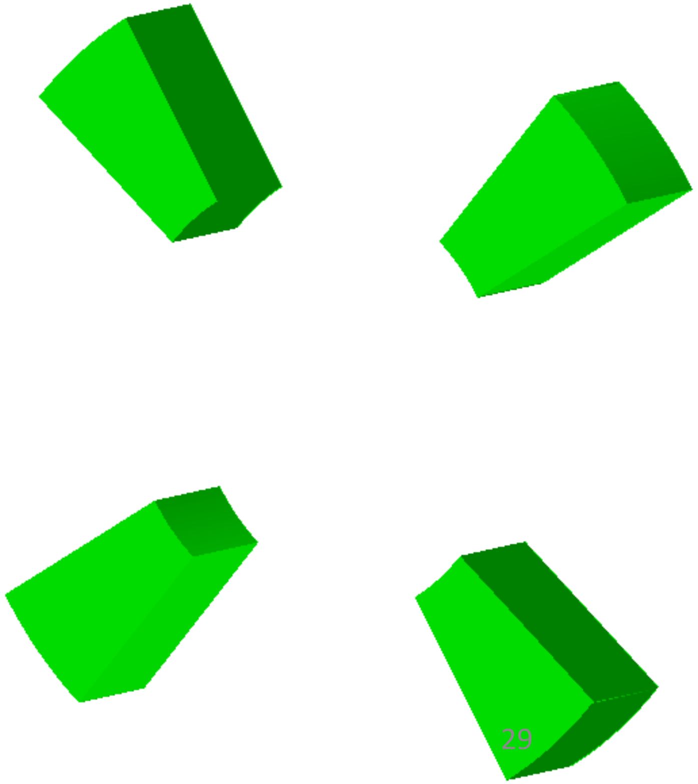


**CAD Model + gmx**



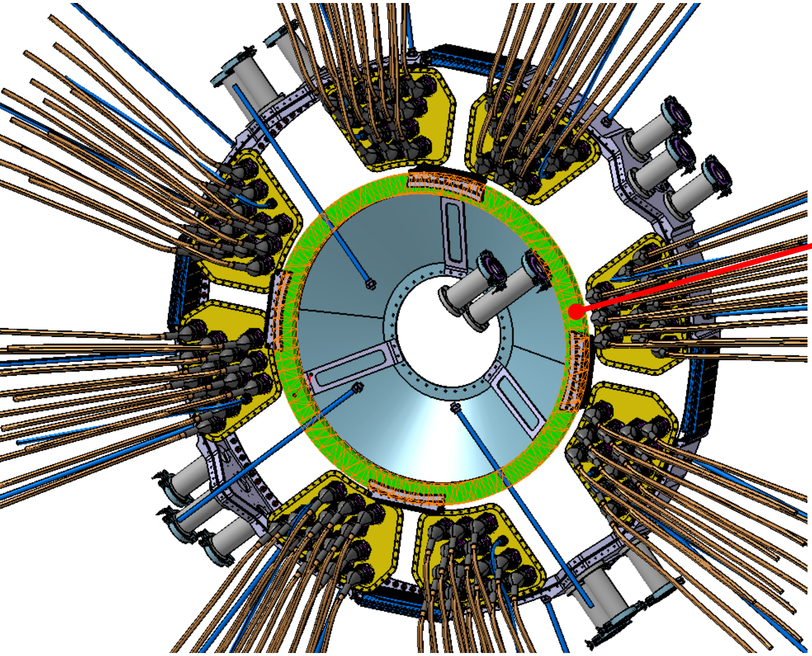
Vs.

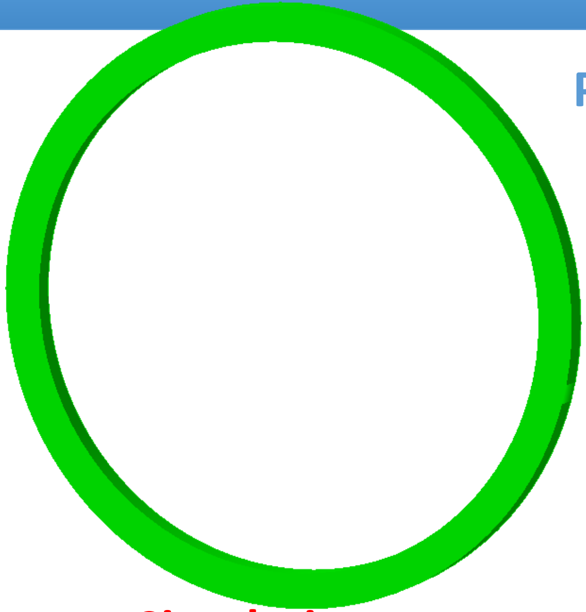
**Simulation - gmx**



# The list of volumes that do not exist in the CAD model but exist in the simulation

**CAD Model + gmx**



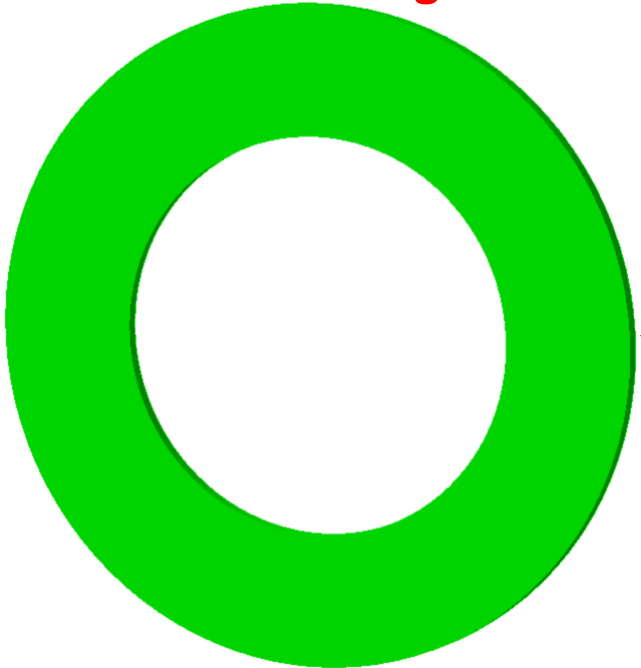


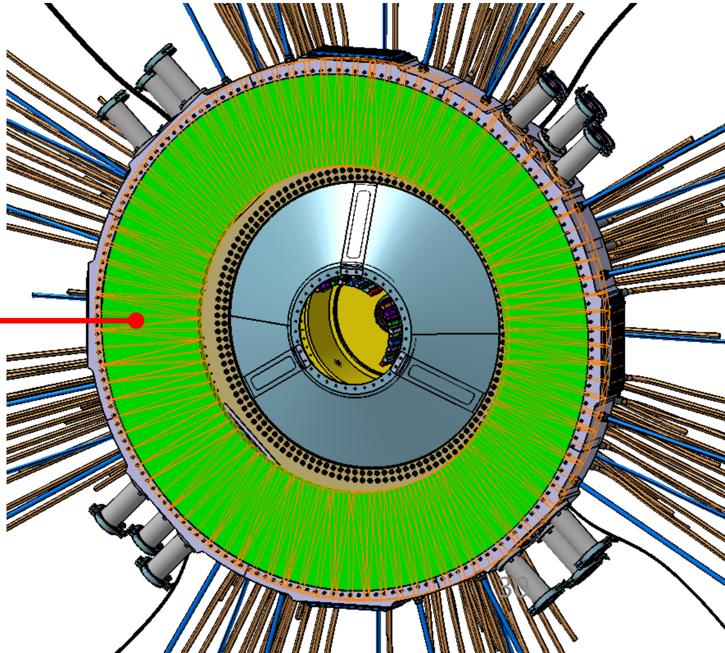
Pix_PP1InnerServices

**Simulation - gmx**

**CAD Model + gmx**

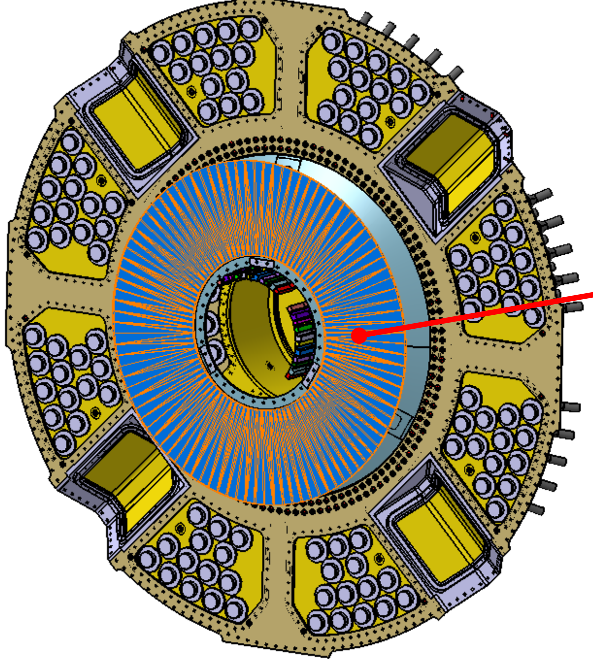
Pix_PP1OuterServices

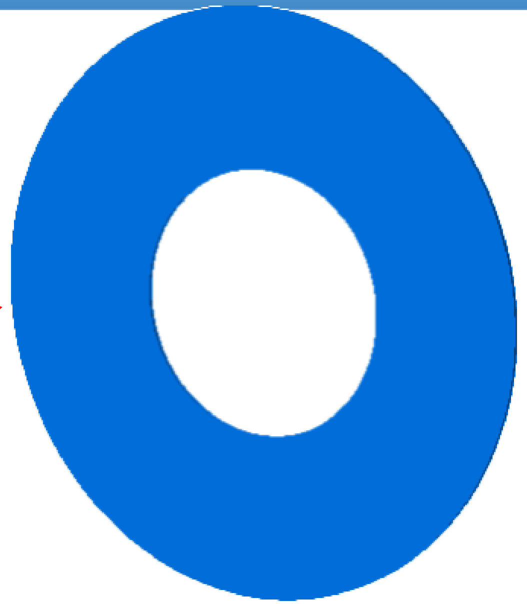




# The list of volumes that do not exist in the CAD model but exist in the simulation

**CAD Model + gmx**



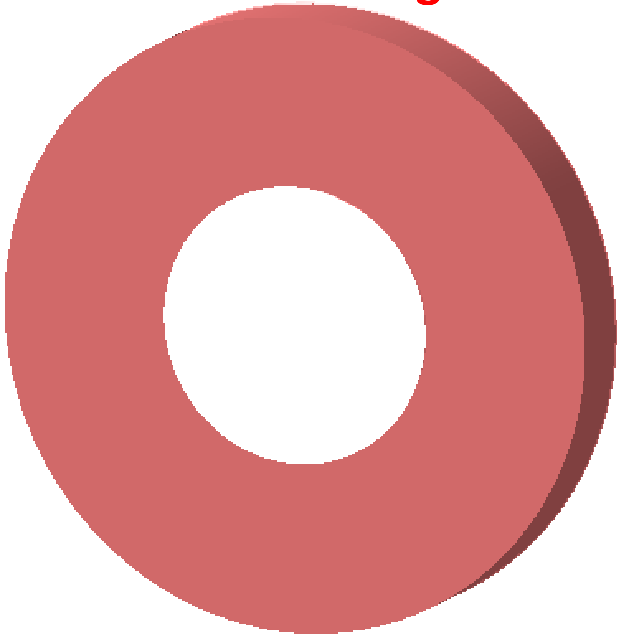


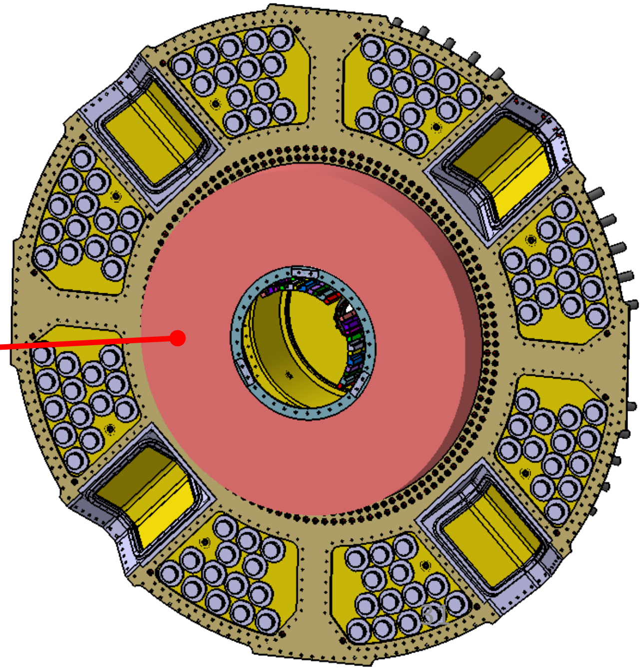
**PP1_T1_outercylinder**

**Simulation - gmx**

**CAD Model + gmx**

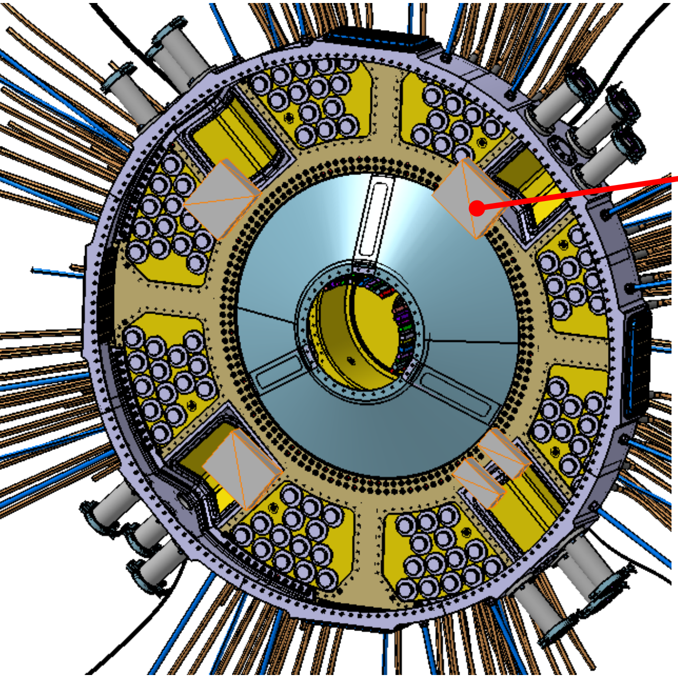
**PP1_T1_outercone**

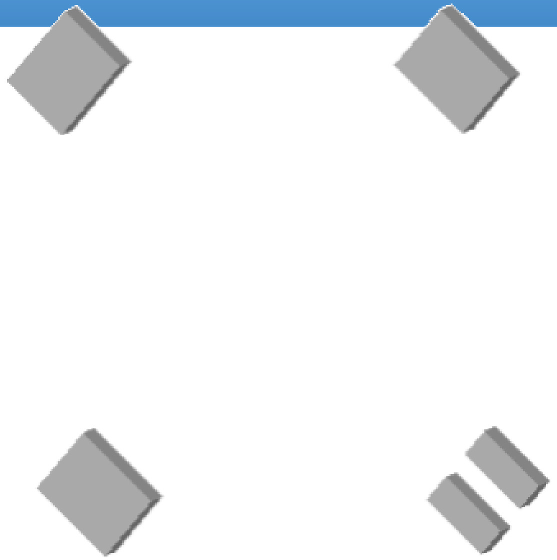




# The list of volumes that do not exist in the CAD model but exist in the simulation

**CAD Model + gmx**





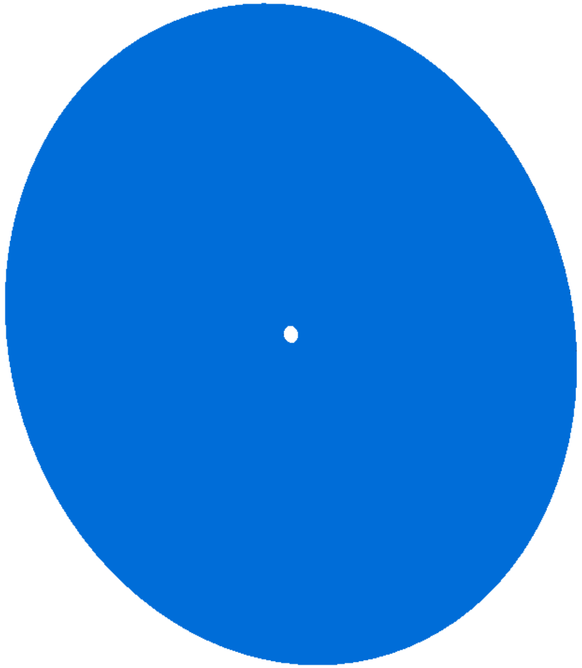
AddHeatExchangers

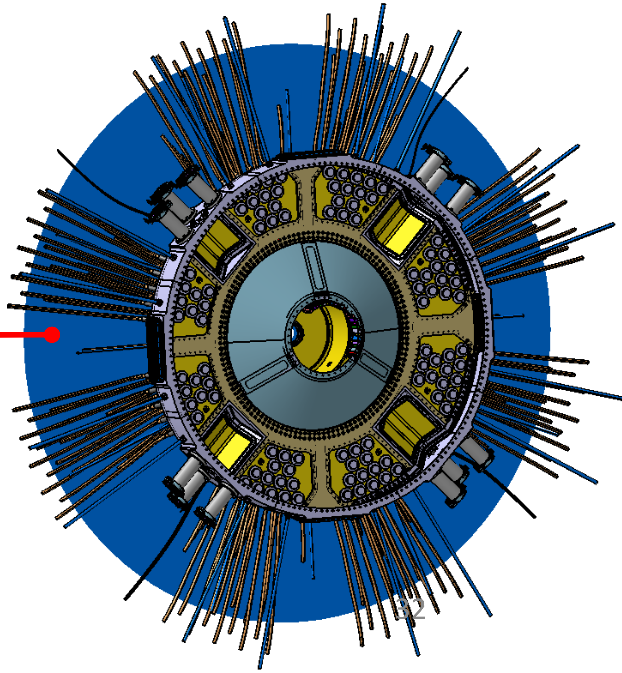
PlacedHeatExchanger_doublet

**Simulation - gmx**

**CAD Model + gmx**

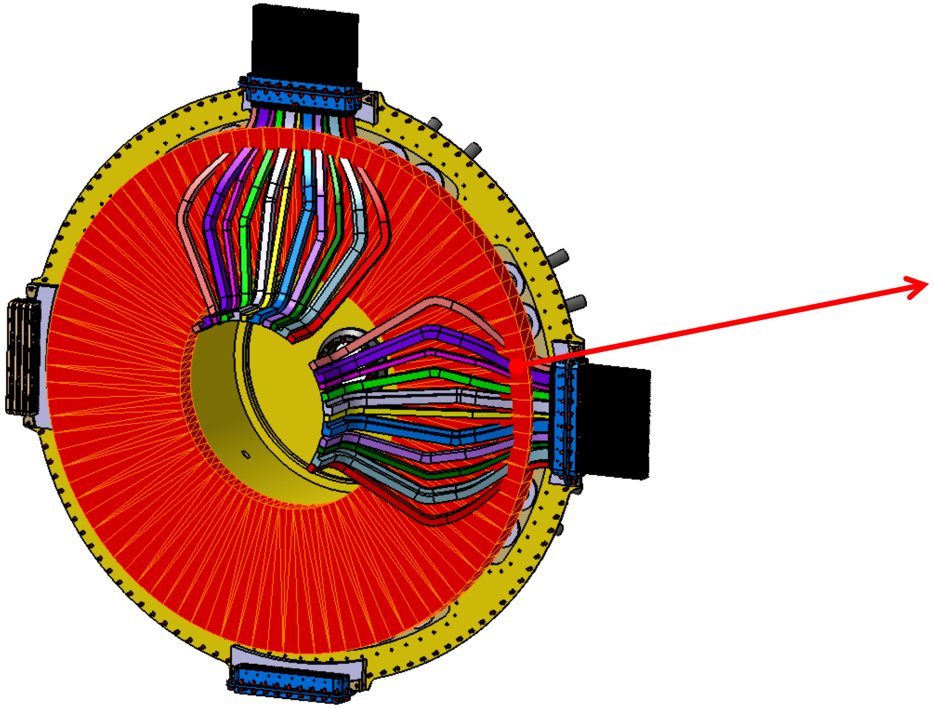
SealPlate

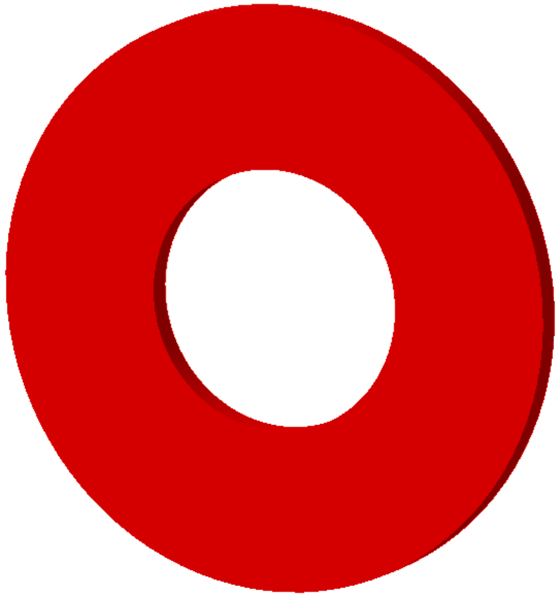




# The list of volumes that do not exist in the CAD model but exist in the simulation

**CAD Model + gmx**





**PP1_T1_innercylinder**

**Simulation - gmx**

# Thank you for your attention
## მადლობა ყურადღებისათვის

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