

# Report from Integration Sessions

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DESY



ILD Software and Integration Workshop  
DESY  
08.07.2010

# ILD-DBD Work Breakdown Structure

- Proposal for an ILD Work Breakdown Structure for the ILD DBD
- For the DBD preparation, not more!
- Concise Project Information
  - Will NOT link all possibly available information
  - But any possible information could be stored in EDMS
- Relates everything which is needed to realise the ILD DBD
- Only ILD relevant R&D activities belong here
  - R&D collaboration results relevant for ILD could be linked to the WBS
  - R&D collaborations should have their own WBS describing their testbeam and other activities
- Proposal for discussion

1	ILD			
	1.1	Yoke		
			Iron	
			Muons Chambers	
			Support Feet	
	1.2	Solenoid		
			Solenoid	
				Coil
				Tank
				DID
			Ancillaries	
	1.3	Calorimeters		
			Barrel	
				Ecal
				Hcal
			Endcaps	
				Ecal
				Hcal
	1.4	Outer Tracking		
			TPC	
			SET	
			ETD	
	1.5	Inner Region		
			Beam pipe inner part	
			VTX	
			Forward disks	
			SIT	
	1.6	Forward Region		
			Beam Tubes	
			Vacuum System	
			Ecal Ring	
			LHCAL	
			Lumical	
			Beamcal	
			QD0	
			Mechanical Support	
			Mona Lisa	
			Beam Diagnostics	
	1.7	Integration		
	1.8	Physics & Optimization		
			Simulation	
			Reconstruction	
			Analysis	
	1.9	Documentations		
	1.10	Liaison Office		
	1.11	Project Management		
	1.12	System Tests & R&D		

# ILD-DBD Work Breakdown Structure

- Responsible person needed for each node (and maybe also for sub-nodes)
- Agreement on list of necessary documents per node
- Agreement on list of deliverables per node
- Proposal for discussion under preparation

1	ILD			
	1.1	Yoke		
			Iron	
			Muons Chambers	
			Support Feet	
	1.2	Solenoid		
			Solenoid	
				Coil
				Tank
				DID
			Ancillaries	
	1.3	Calorimeters		
			Barrel	
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			Ecal Ring	
			LHCAL	
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			Simulation	
			Reconstruction	
			Analysis	
	1.9	Documentations		
	1.10	Liaison Office		
	1.11	Project Management		
	1.12	System Tests & R&D		

- Subdetector Nodes:
  - Physics Requirements
  - CAD Models (Placeholder, detailed)
  - Specifications of Interfaces
  - List of responsible persons
- Integration
  - Detector Integration Model
- Services
  - Specifications and model for push-pull system
  - Specifications and model of detector supplies (cryo, water, energy, electronic trailers, counting rooms, etc.)
- Physics and Optimisation
  - Physics performance
- Documentation
  - The DBD
- Liaison Office
  - MDI Specifications
  - Interface to other detector (SiD)
- Project Management
  - The ILD WBS
- System Tests and R&D
  - Proof of feasibility for technology options
- **Note: This is now much more than „only“ detector integration. It's about project management. Who will take care of it? The EB, the integration group, the ILD project management (if any)?**

Elementinformationen

https://teamcenter.desy.de/TC70PRD/controller/home

Suchen [ ] [ ] Home Beenden DESY  
Erweiterte Suche... Karsten Buesser

Main Menu Klassifikation

Select View: ILC

- Accelerator Systems
- CFS & Global
- Detectors
- ILD
  - Calorimeters
  - ILD Barrel Calorimet
  - ILD Barrel ECal
  - ILD Barrel HCal
  - ILD Endcaps Calorimeters
  - Forward Region
  - Beam Diagnostics
  - Beam Tubes
  - Beamcal
  - Ecal Ring
  - LHCAL
  - Lumical
  - Mechanical Support
  - Mona Lisa
  - QDO

Checkout Submit Elementberichte Lesezeichen Historie Weitere Aktionen...

**Generic Part , D00000000523907,A,2,1 , Objektinformation : Baugruppenstruktur**

Zusammenfassung Baugruppenstruktur **Eigenschaften** Relationen Dateien Zuweisung Classification Prüfer/Genehmiger Alle Versionen Zugriff

EDMS-ID	Name	Arbeitsstatus	Menge	Einheit	Pos.-Nr	Präziser Änderungsstand - Operator	Präziser Änderungsstand
D00000000523907,A,2,1	ILD	In Arbeit (in Vault)					
D00000000524017,A,1,1	Calorimeters	In Arbeit (in Vault)	1	je	0	=	
D00000000524177,A,1,1	Forward Region	In Arbeit (in Vault)	1	je	0	=	
D00000000524337,A,1,1	ILD Documentation	In Arbeit (in Vault)	1	je	0	=	
D00000000524127,A,1,1	Inner Region	In Arbeit (in Vault)	1	je	0	=	
D00000000524287,A,1,1	Integration	In Arbeit (in Vault)	1	je	0	=	
D00000000524347,A,1,1	Liaison Office	In Arbeit (in Vault)	1	je	0	=	
D00000000524087,A,1,1	Outer Tracking	In Arbeit (in Vault)	1	je	0	=	
D00000000524297,A,1,1	Physics & Optimization	In Arbeit (in Vault)	1	je	0	=	
D00000000524357,A,1,1	Project Management	In Arbeit (in Vault)	1	je	0	=	
D00000000523957,A,1,1	Solenoid	In Arbeit (in Vault)	1	je	0	=	
D00000000524367,A,1,1	System Tests & R&D	In Arbeit (in Vault)	1	je	0	=	
D00000000523917,A,1,1	Yoke	In Arbeit (in Vault)	1	je	0	=	

Expansionstiefe: 2 **Expansionstiefe speichern** **Expansionstiefe zurücksetzen**

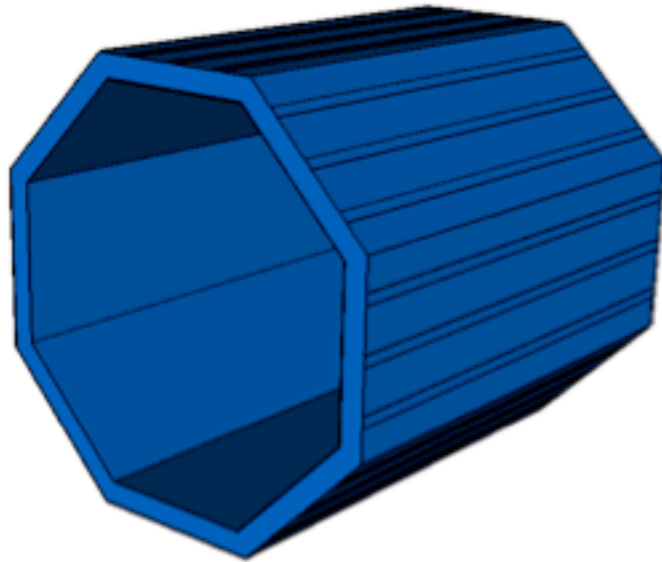
**Kontext einstellen** **Aktualisieren** **Baseline-Stückliste** **Spaltenanzeigeeinstellungen ändern**

System Status: OK

2 Elemente in der Liste der angehefteten Dateien.  
2 Elemente in der Liste der angehefteten Dateien.  
2 Elemente in der Liste der angehefteten Dateien.  
Voreinstellungen für Expandieren angewendet

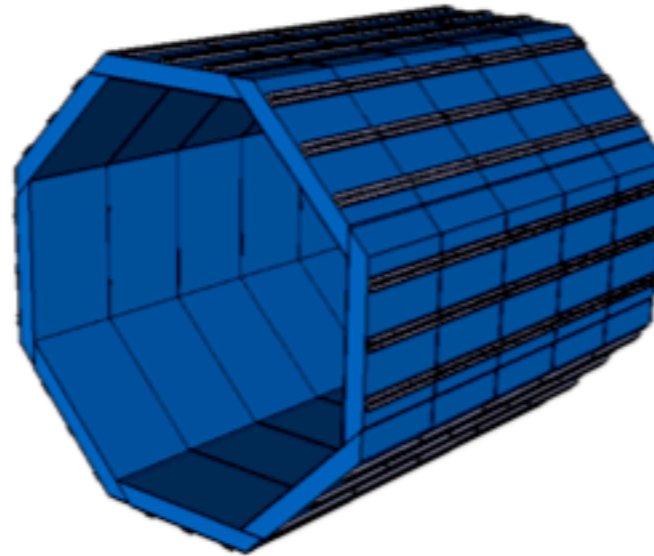
## Different Models for Different Purposes

**Placeholder**



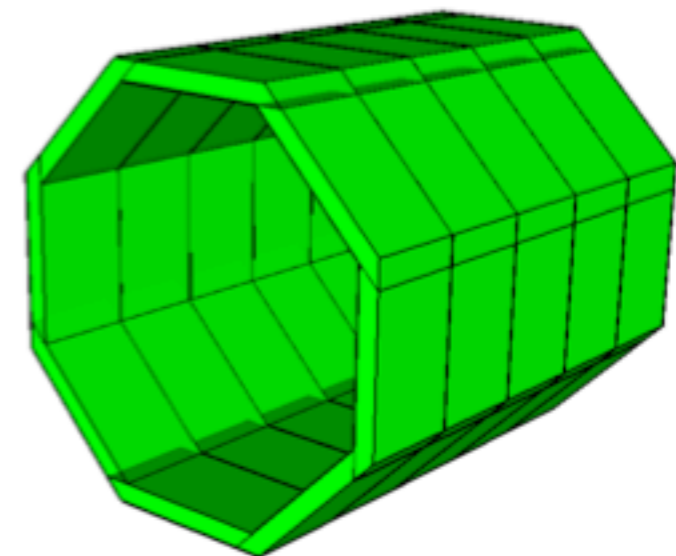
**Placeholder** model enables integration and checks for collisions and compliance of interfacing components; Contains e.g. reserved space and interface details.

**Detailed Design**



**Detailed Design** model is basis for construction; Defines how to assemble a component from parts, and provides their exact geometry and material properties

**Physics Simulation**

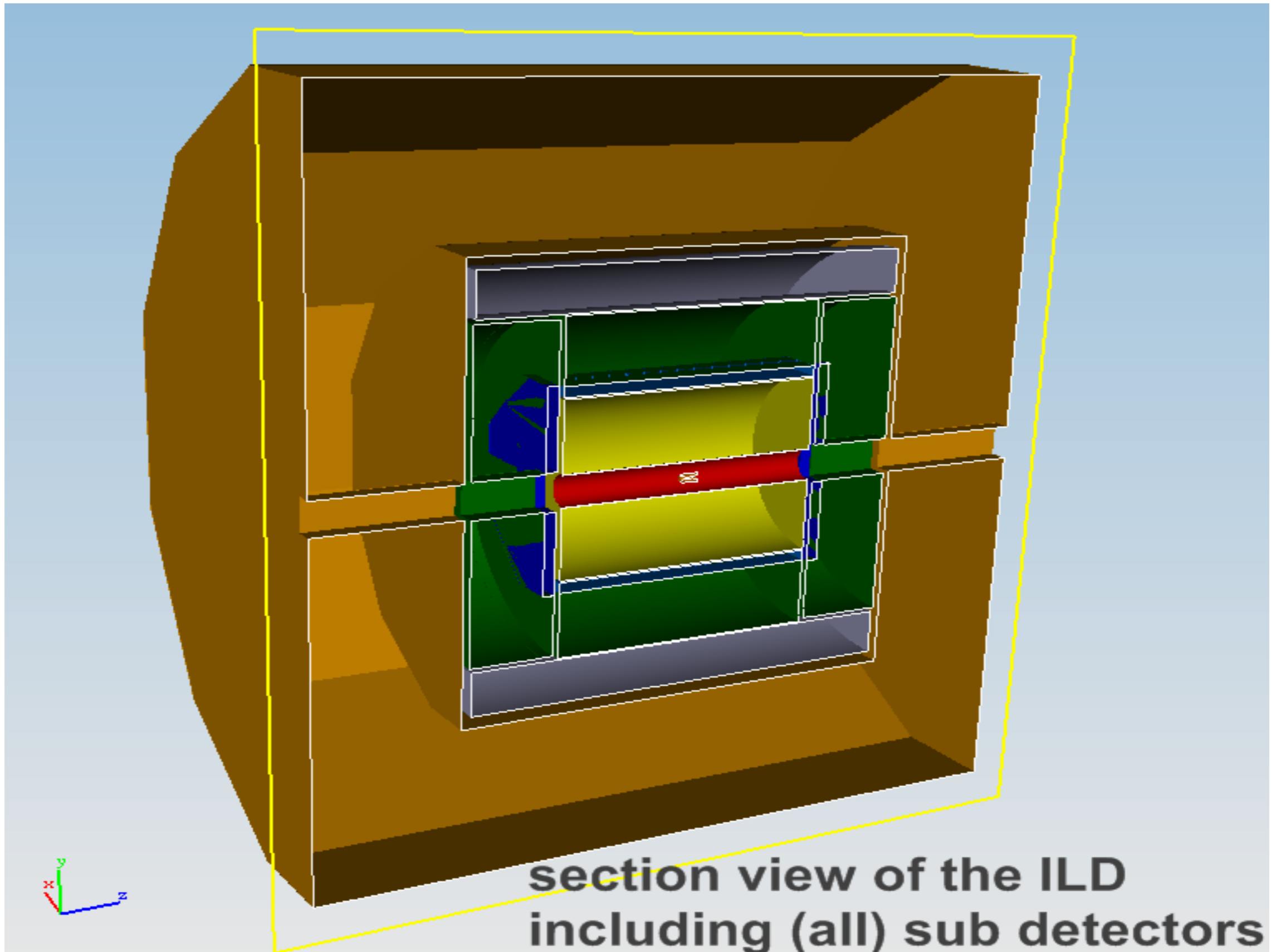


**Physics Simulation** model enables MC simulation and detector optimization; Describes e.g. segmentation, shape and physics behavior of components

**Example: ILD Barrel ECal**

## Introduction of the "Placeholder model"

- ▶ In EDMS a placeholder-model is a very simplified CAD model of each sub detector
- ▶ CAD models of all sub detectors have to match their given "cross-section"
- ▶ Each placeholder represents the cross-section for every sub detector (max. inner and outer geometry)
- ▶ Each placeholder should will be adjustable in respect to an efficient ILD-model
- ▶ Via EDMS each on a sub detector working engineer / scientist will have access to the placeholder model of his/her detector component





## Collision check

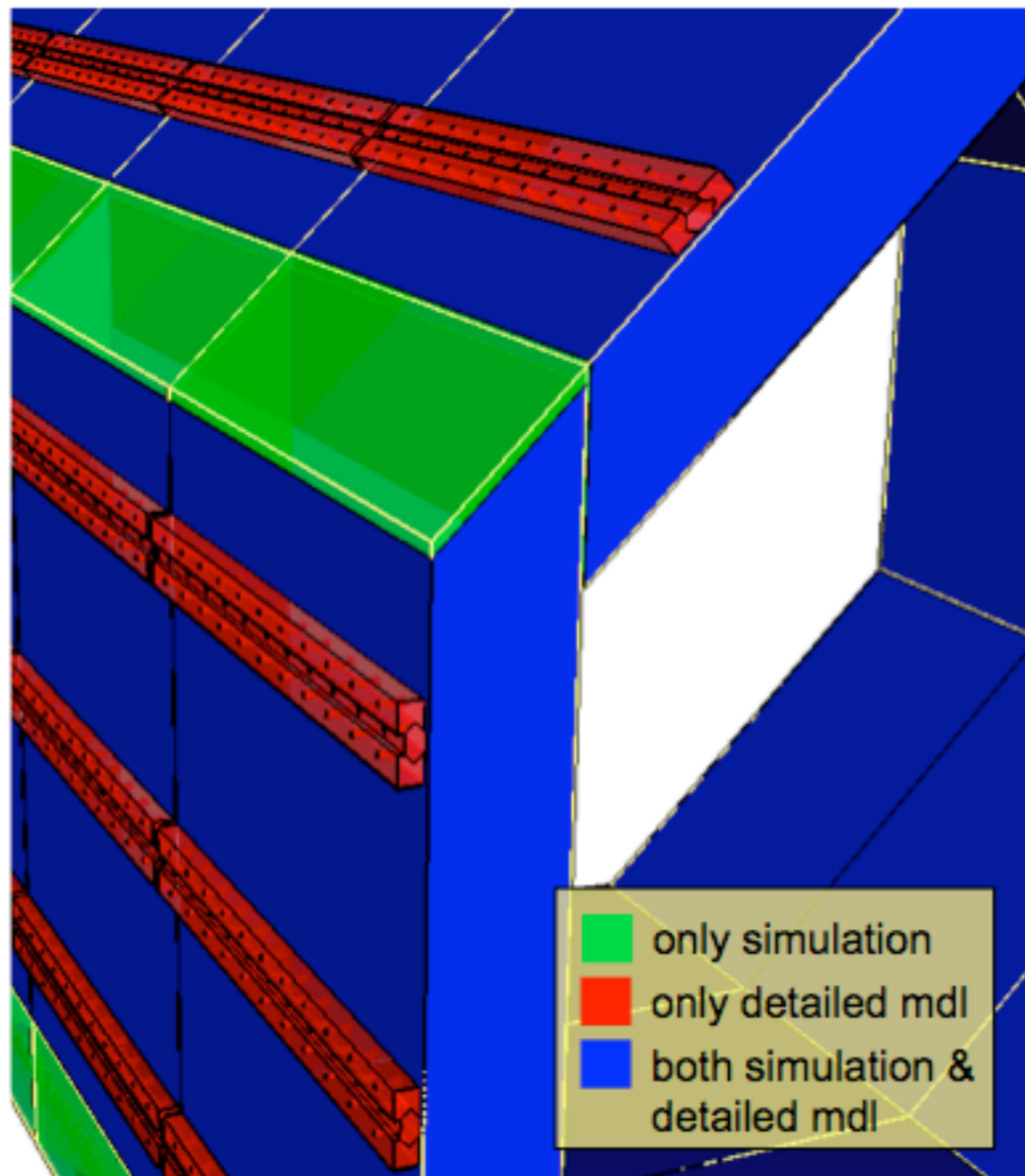
- There will be a continuous collision check of all current CAD models

Possible scenario: CAD model of the TPC is not fitting into its placeholder

→ TPC model interferes with the ECAL model, shown during placeholder collision check

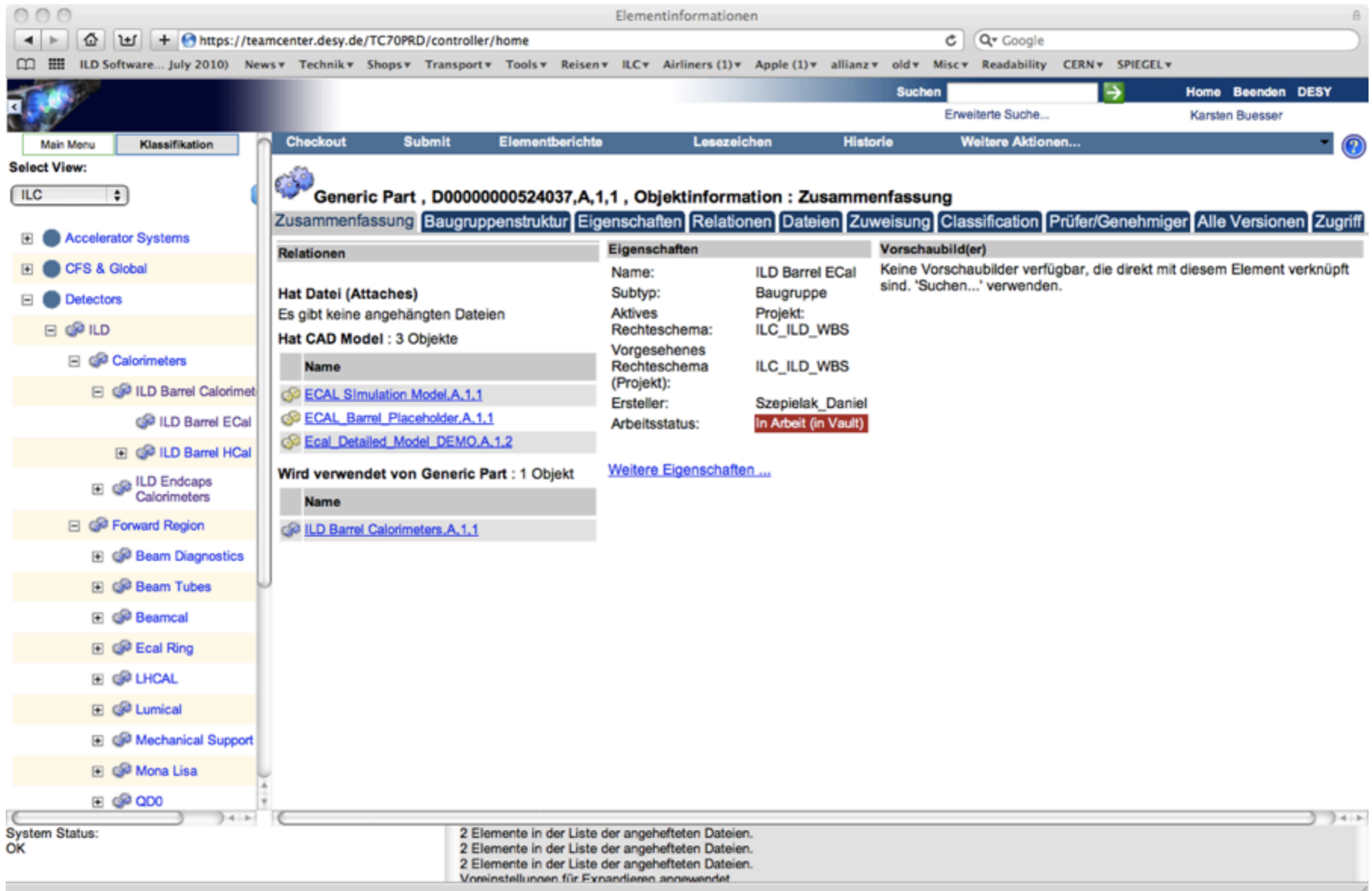
**TPC-** and **ECAL group** have to discuss AND solve this issue

## Comparing Simulation and Detailed Model (2)



- > After re-orienting detailed model, shapes of active material generally in good accordance
- > Some extra space in simulation model at ends of modules
- > Rails not accounted for in simulation model
- > Again discussion: How to treat dead material?
- > Note: If detailed model gets fully detailed, comparison needs to be made for smaller units, e.g. per module  
→ requires compatible structures of simulation and detailed models

## Example ECAL-Barrel in WBS:



The screenshot shows the Teamcenter EDMS interface for a 'Generic Part'. The browser address bar indicates the URL: <https://teamcenter.desy.de/TC70PRD/controller/home>. The page title is 'Elementinformationen'. The main content area displays the following information:

**Generic Part , D00000000524037,A,1,1 , Objektinformation : Zusammenfassung**

Navigation tabs: Zusammenfassung, Baugruppenstruktur, Eigenschaften, Relationen, Dateien, Zuweisung, Classification, Prüfer/Genehmiger, Alle Versionen, Zugriff.

Relationen	Eigenschaften	Vorschaubild(er)						
<p><b>Hat Datei (Attaches)</b> Es gibt keine angehängten Dateien</p> <p><b>Hat CAD Model : 3 Objekte</b></p> <table border="1"> <thead> <tr> <th>Name</th> </tr> </thead> <tbody> <tr> <td><a href="#">ECAL Simulation Model.A.1.1</a></td> </tr> <tr> <td><a href="#">ECAL Barrel Placeholder.A.1.1</a></td> </tr> <tr> <td><a href="#">Ecal Detailed Model DEMO.A.1.2</a></td> </tr> </tbody> </table> <p><b>Wird verwendet von Generic Part : 1 Objekt</b></p> <table border="1"> <thead> <tr> <th>Name</th> </tr> </thead> <tbody> <tr> <td><a href="#">ILD Barrel Calorimeters.A.1.1</a></td> </tr> </tbody> </table>	Name	<a href="#">ECAL Simulation Model.A.1.1</a>	<a href="#">ECAL Barrel Placeholder.A.1.1</a>	<a href="#">Ecal Detailed Model DEMO.A.1.2</a>	Name	<a href="#">ILD Barrel Calorimeters.A.1.1</a>	<p>Name: ILD Barrel ECal                  Subtyp: Baugruppe                  Aktives Recheschema: ILC_ILD_WBS                  Vorgesehenes Recheschema (Projekt): ILC_ILD_WBS                  Ersteller: Szepielak_Daniel                  Arbeitsstatus: <b>In Arbeit (in Vault)</b></p> <p><a href="#">Weitere Eigenschaften ...</a></p>	<p>Keine Vorschaubilder verfügbar, die direkt mit diesem Element verknüpft sind. 'Suchen...' verwenden.</p>
Name								
<a href="#">ECAL Simulation Model.A.1.1</a>								
<a href="#">ECAL Barrel Placeholder.A.1.1</a>								
<a href="#">Ecal Detailed Model DEMO.A.1.2</a>								
Name								
<a href="#">ILD Barrel Calorimeters.A.1.1</a>								

System Status: OK

2 Elemente in der Liste der angehefteten Dateien.  
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 2 Elemente in der Liste der angehefteten Dateien.  
 Voreinstellungen für Expandieren angewendet

## Detailed ECAL-Barrel Model:

The screenshot shows a web browser window displaying a CAD system interface. The browser address bar shows the URL: <https://teamcenter.desy.de/TC70PRD/controller/home>. The page title is "Elementinformationen".

The main content area displays information for a CAD assembly:

- Baugruppe , D0000000873663,A,1,2 , Objektinformation : Zusammenfassung**
- Navigation tabs: Zusammenfassung, CAD Baugruppenstruktur, Eigenschaften, Relationen, Zuweisung, Classification, Prüfer/Genehmiger, Alle Versionen
- Relationen**
  - Hat Datei (Attaches): Es gibt keine angehängten Dateien
  - In Team-Ordner : 1 Objekt
    - Name: CAD Main Assemblies...
  - Ist CAD Model für Generic Part : 1 Objekt
    - Name: ILD Barrel ECal.A.1.1
- Eigenschaften**
  - Name: Ecal\_Detailed\_Model\_DEMO
  - Aktives Team: ILD\_CAD\_Integration\_Team
  - Vorgesehenes Rechteschema (Projekt):
  - Ersteller: Suehl\_Stefan
  - Arbeitsstatus: **In Arbeit**
- VorschauBild(er)**: A 3D model of the ECAL barrel assembly, showing a blue octagonal structure with internal components.

System Status: OK

2 Elemente in der Liste der angehefteten Dateien.  
2 Elemente in der Liste der angehefteten Dateien.  
2 Elemente in der Liste der angehefteten Dateien.  
Voreinstellungen für Expandieren angewendet

## ECAL-Barrel Placeholder:

The screenshot shows a web browser window displaying the 'Elementinformationen' (Element Information) page for a CAD model. The browser address bar shows the URL: <https://teamcenter.desy.de/TC70PRD/controller/home>. The page title is 'Elementinformationen'. The main content area displays the following information:

**Baugruppe , D0000000873843,A,1,1 , Objektinformation : Zusammenfassung**

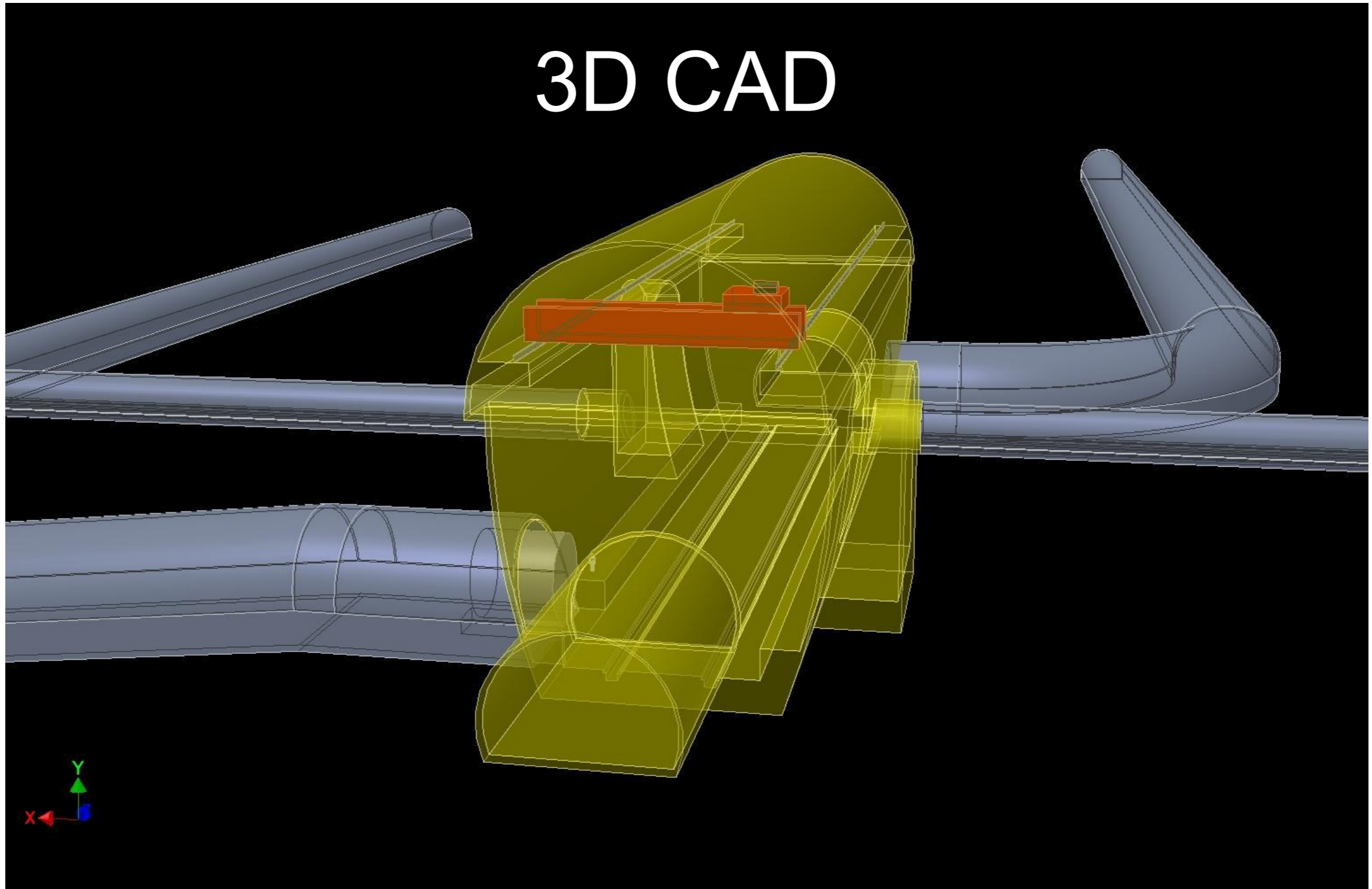
Navigation tabs: Zusammenfassung | **CAD Baugruppenstruktur** | Eigenschaften | Relationen | Zuweisung | Classification | Prüfer/Genehmiger | Alle Versionen

Relationen	Eigenschaften	Vorschaubild(er)		
<b>Hat Datei (Attaches)</b> Es gibt keine angehängten Dateien	Name: ECAL_Barrel_Placeholder			
<b>In Team-Ordner : 1 Objekt</b>	Aktives Team: ILD_CAD_Integration_Team			
<table border="1"><thead><tr><th>Name</th></tr></thead><tbody><tr><td><a href="#">CAD Working Data...</a></td></tr></tbody></table>	Name		<a href="#">CAD Working Data...</a>	Vorgesehenes Rechteschema (Projekt):
Name				
<a href="#">CAD Working Data...</a>				
<b>Ist CAD Model für Generic Part : 1 Objekt</b>	Ersteller: Welle_Norbert			
<table border="1"><thead><tr><th>Name</th></tr></thead><tbody><tr><td><a href="#">ILD_Barrel_ECal.A.1.1</a></td></tr></tbody></table>	Name	<a href="#">ILD_Barrel_ECal.A.1.1</a>	Arbeitsstatus: <b>In Arbeit</b>	
Name				
<a href="#">ILD_Barrel_ECal.A.1.1</a>				
	<a href="#">Weitere Eigenschaften...</a>			

System Status: OK

2 Elemente in der Liste der angehefteten Dateien.  
2 Elemente in der Liste der angehefteten Dateien.  
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Voreinstellungen für Expandieren angewendet

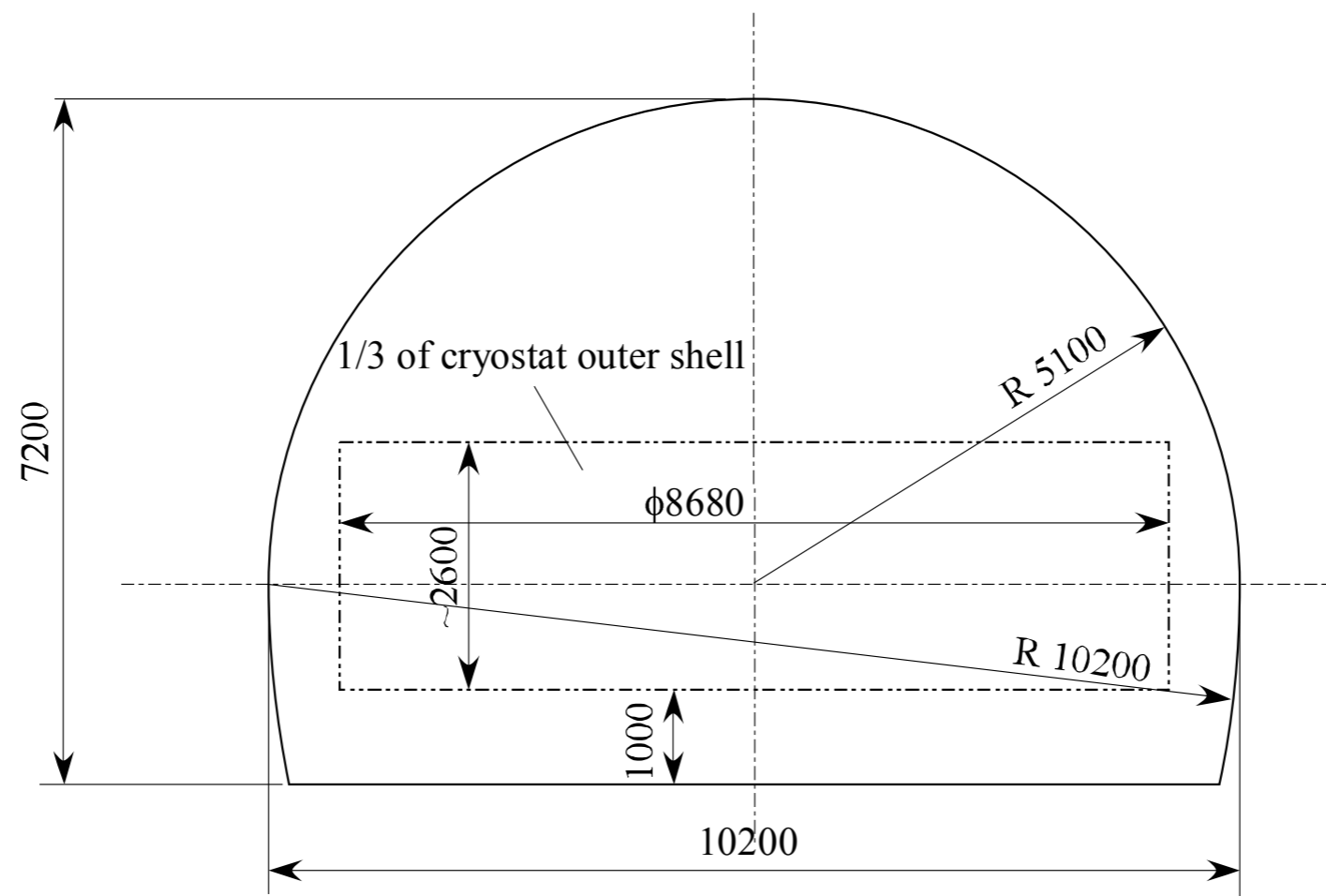
- No vertical shafts, access via tunnel



# Implications on Detector Assembly

- CMS-type of surface assembly not possible
- Need a study on underground assembly
- Time-scales need to be checked (reason for surface assembly in RDR)
- Relevant for the DBD?

## Access tunnel

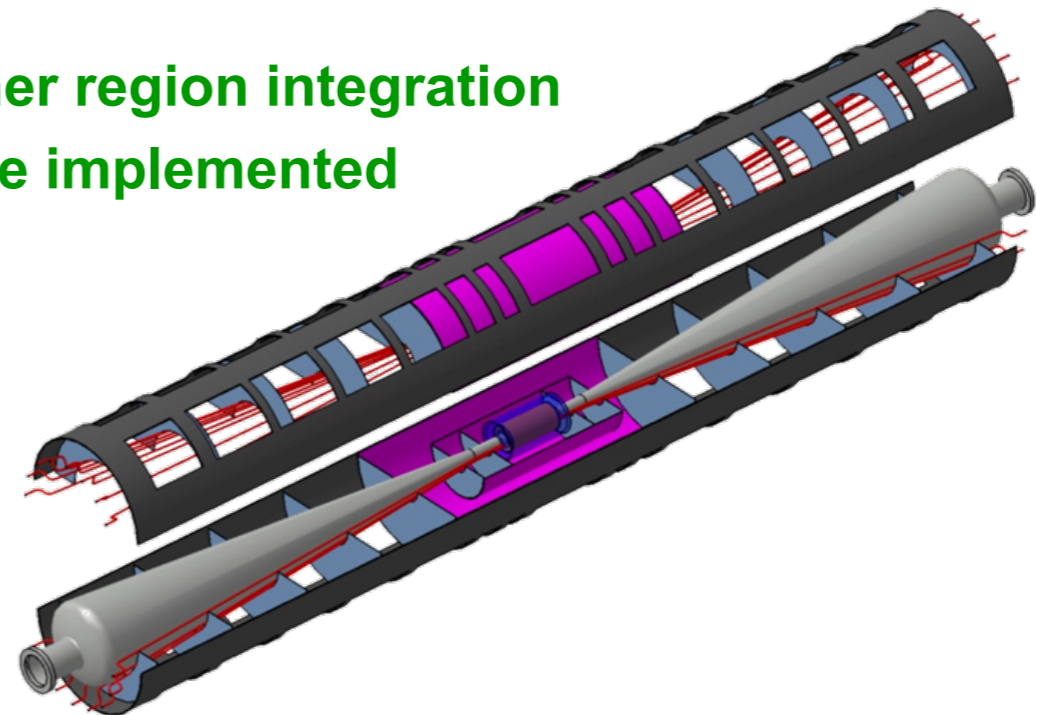




## Aims of the meeting



- Focus on several aspects of these sub detectors :
  - **Mechanical design**
  - **Cooling**
  - **Cabling**
  - **Integration of all the components**
- The goals were to
  - **Sketch first solution for the inner region integration**
  - **Define the material budget to be implemented in the simulation model**



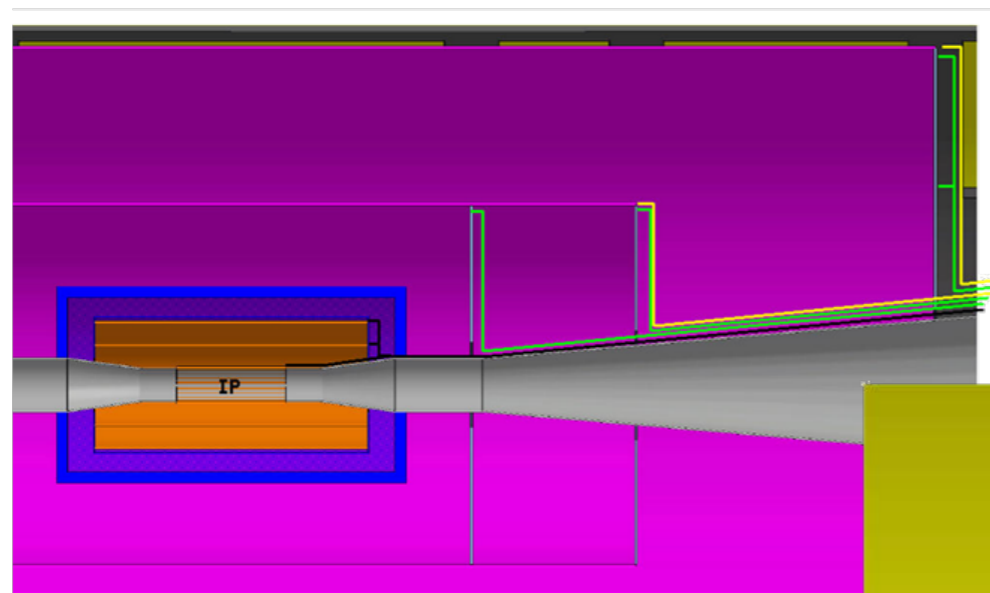




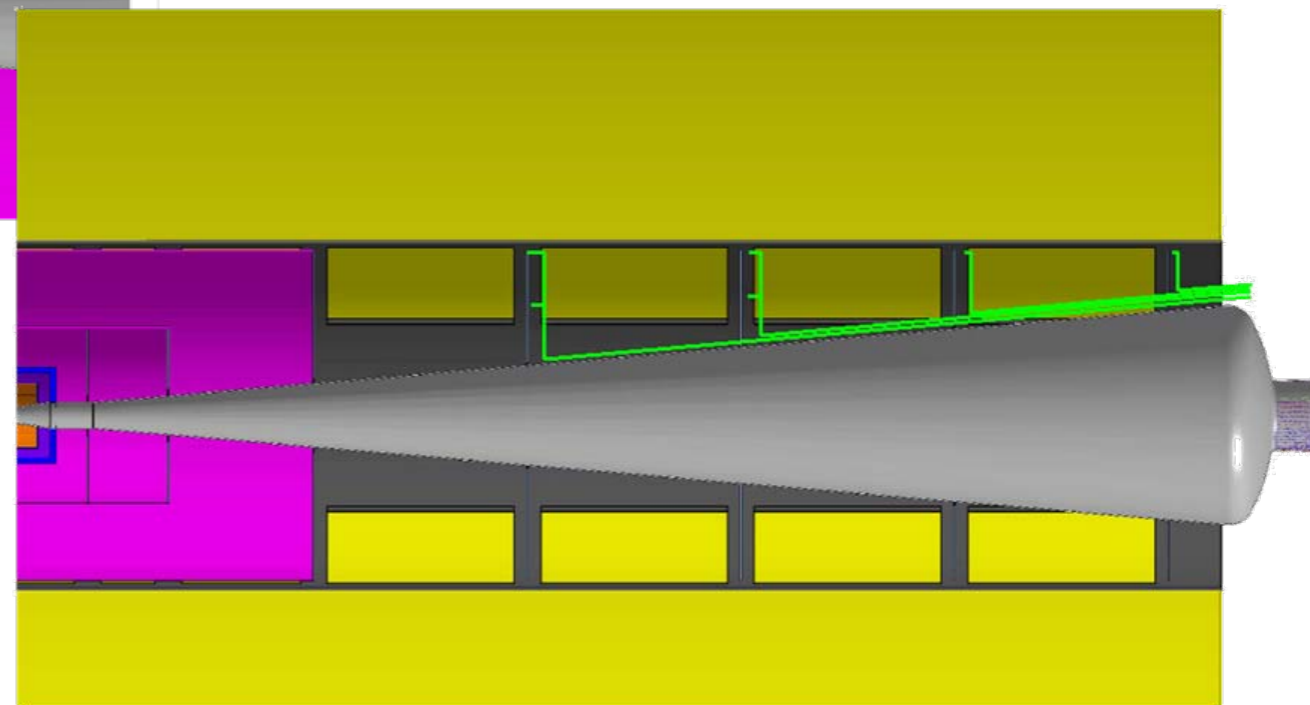
## The cabling paths in that region



- We agreed to keep the first concept along the beam tube
  - Cable amount to be estimated to check needed gaps



VTX/SIT/FTD1,2,3



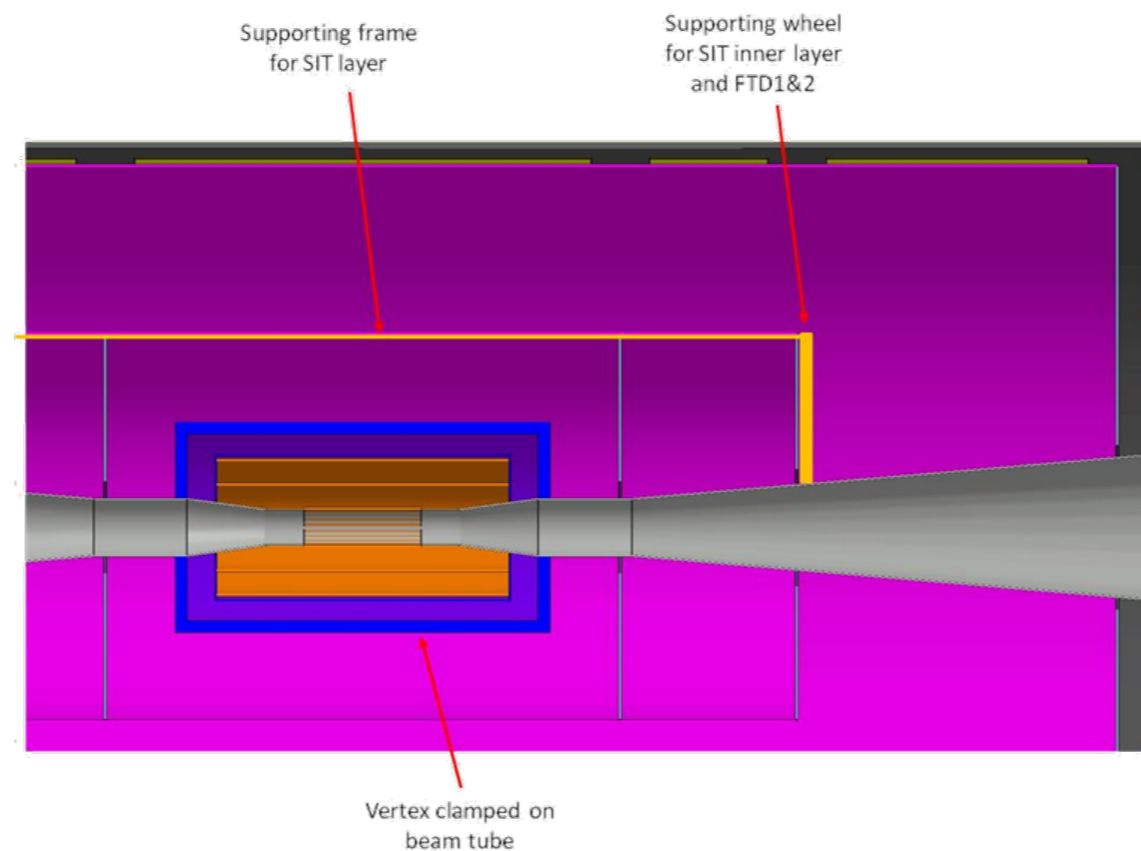
FTD4->7



## Mechanical integration



- First concept approved by sub detectors groups
  - **VTX clamped on beam pipe**
  - **FTD 3-7, beam pipe and SIT outer layer on Inner Support Structure**
  - **SIT layers are assembled on an end cap wheel**
- Different solution for SIT inner layer and FTD1&2
  - **1 : supporting on beam pipe**

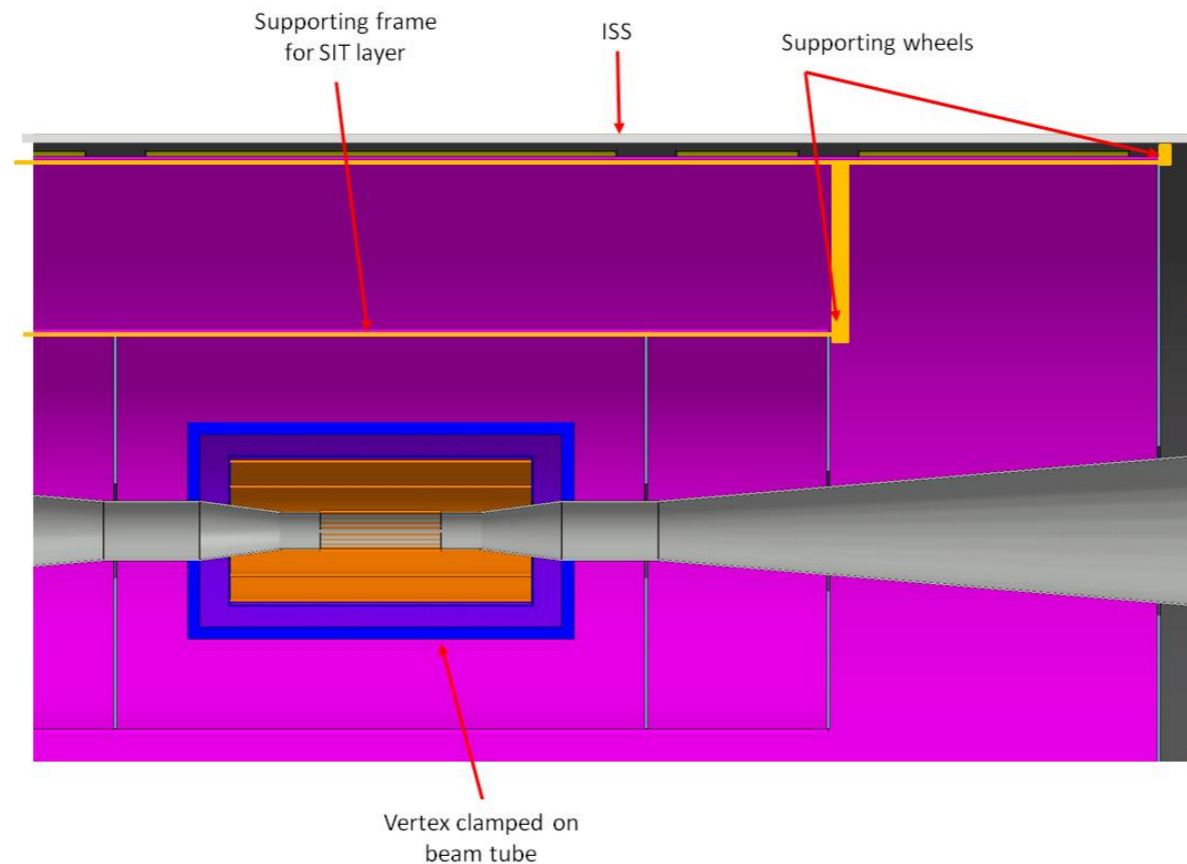




## Mechanical integration (2)

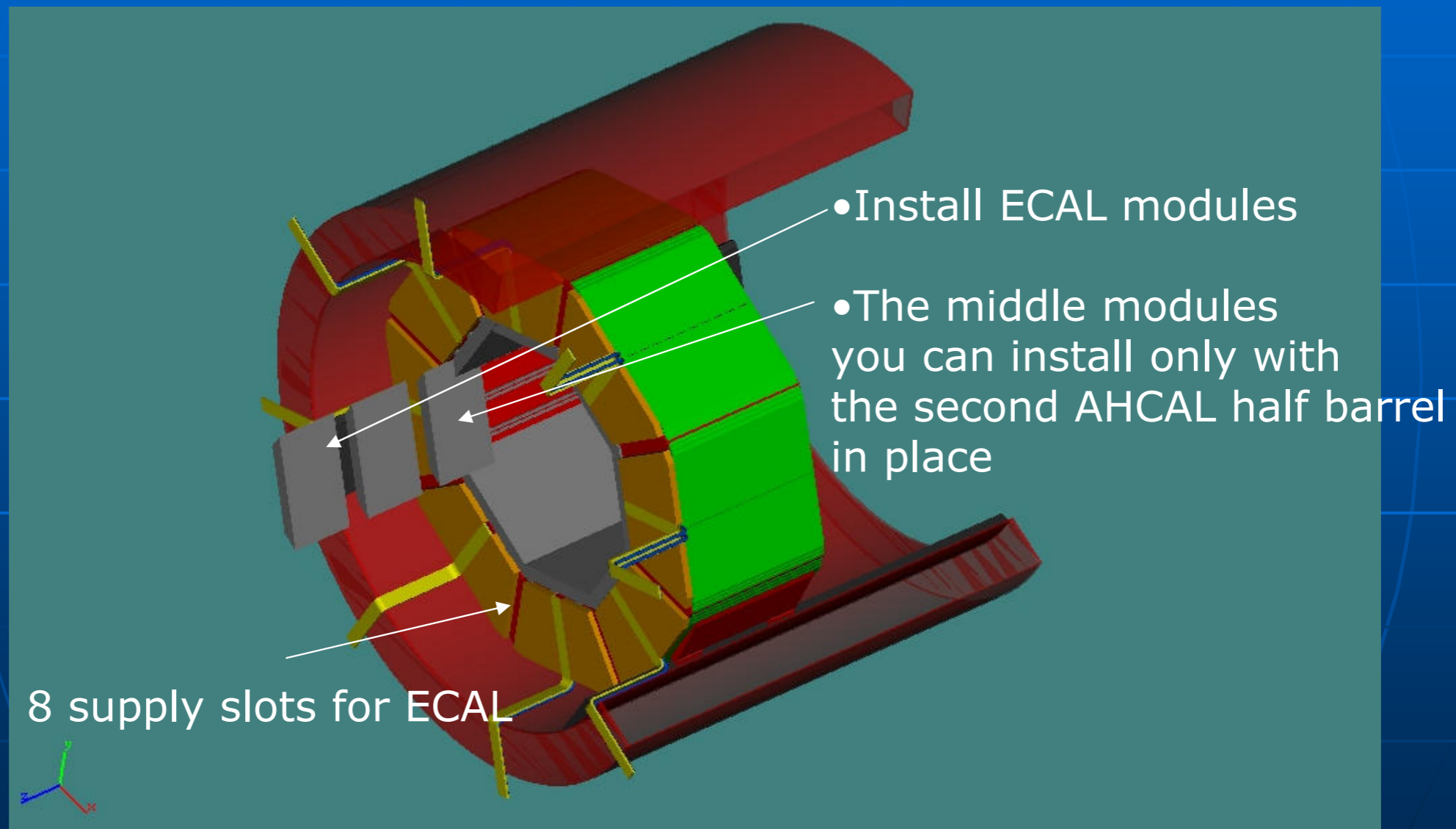


- **2 : supporting on SIT outer layer**



- The best compromise must be found between
  - **Less material budget (solution 1?)**
  - **Best mechanical behaviour (solution 2)**
    - Decoupled SIT and FTD1&2 from beam tube

## ECAL barrel integration in ILD

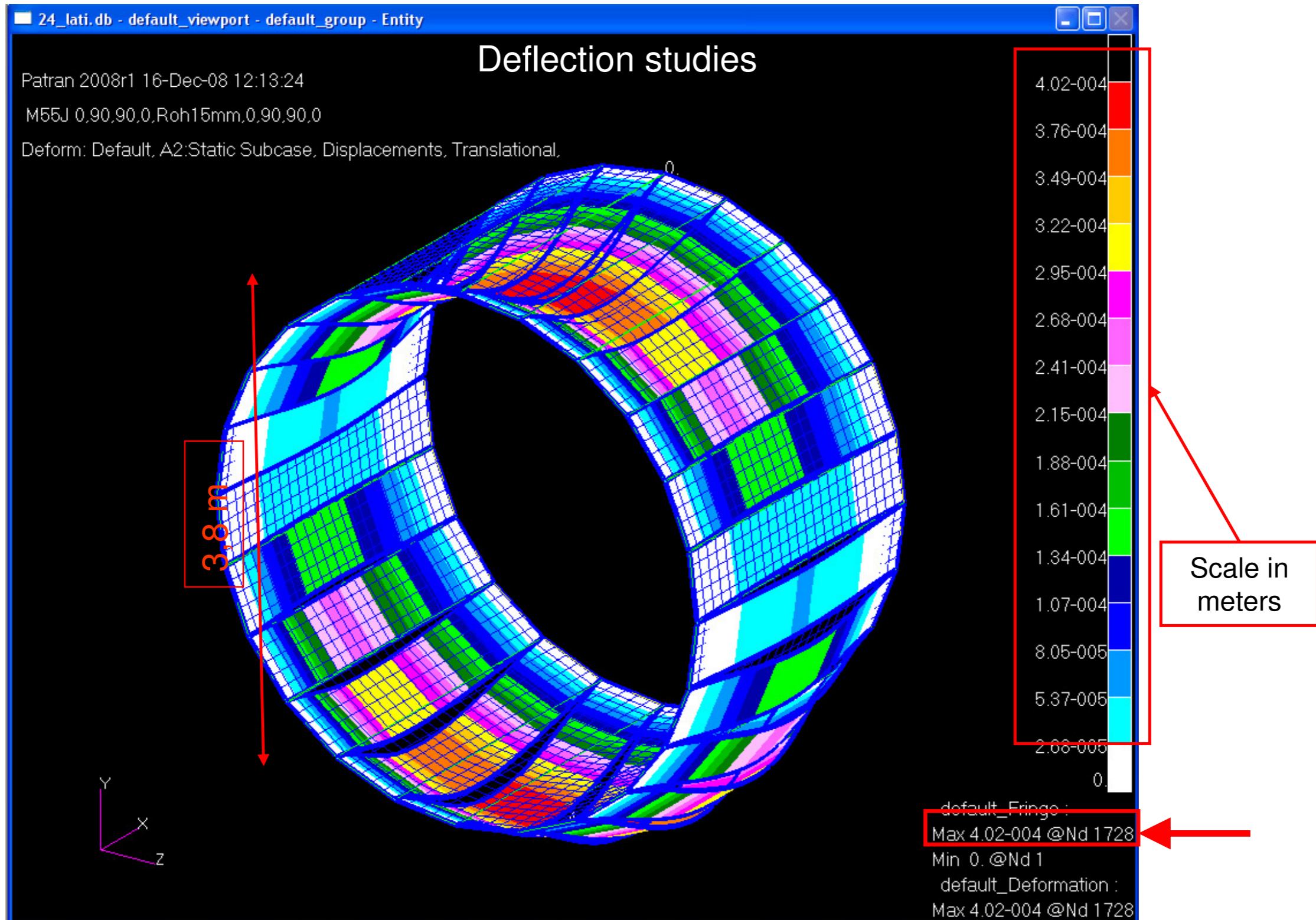


06.07.2010

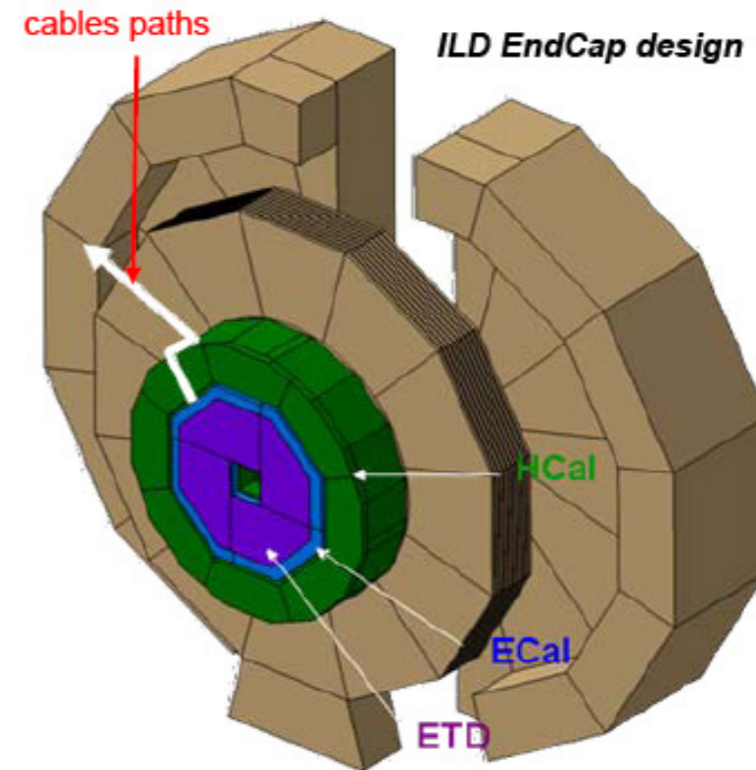
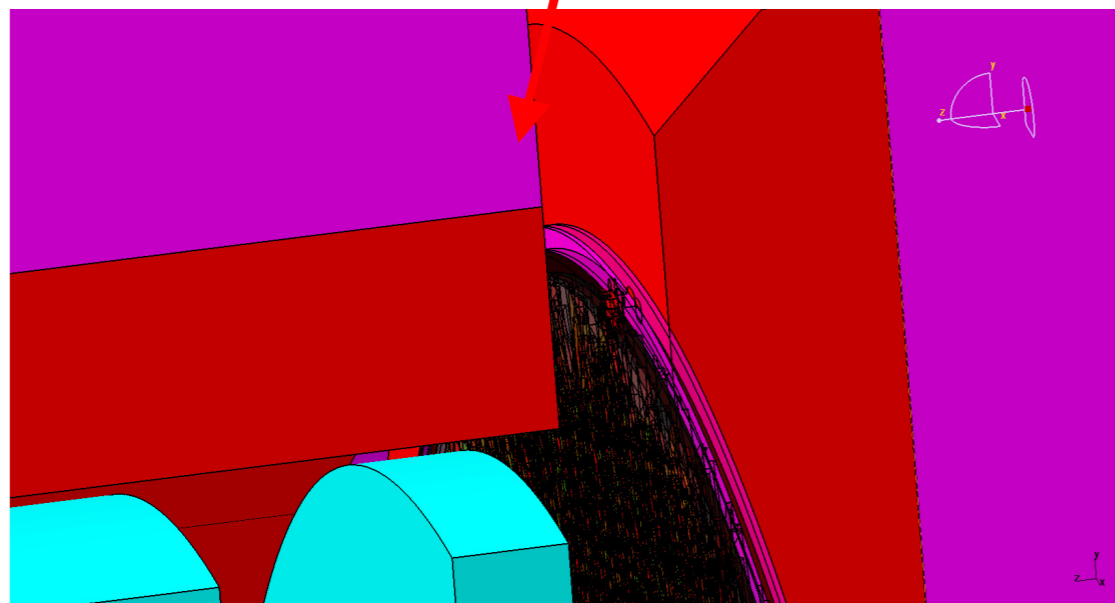
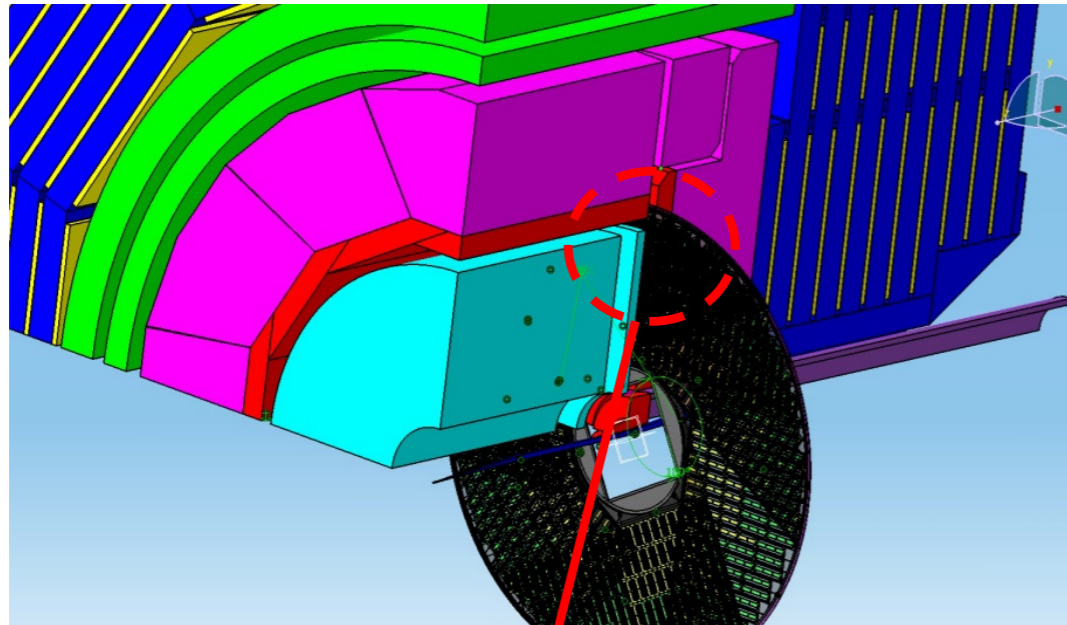
K.Gadow - DESY

16

## 24 panels (final scenario)

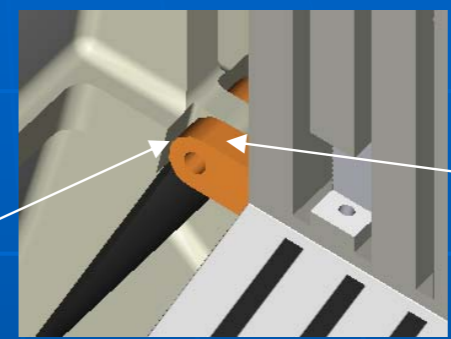
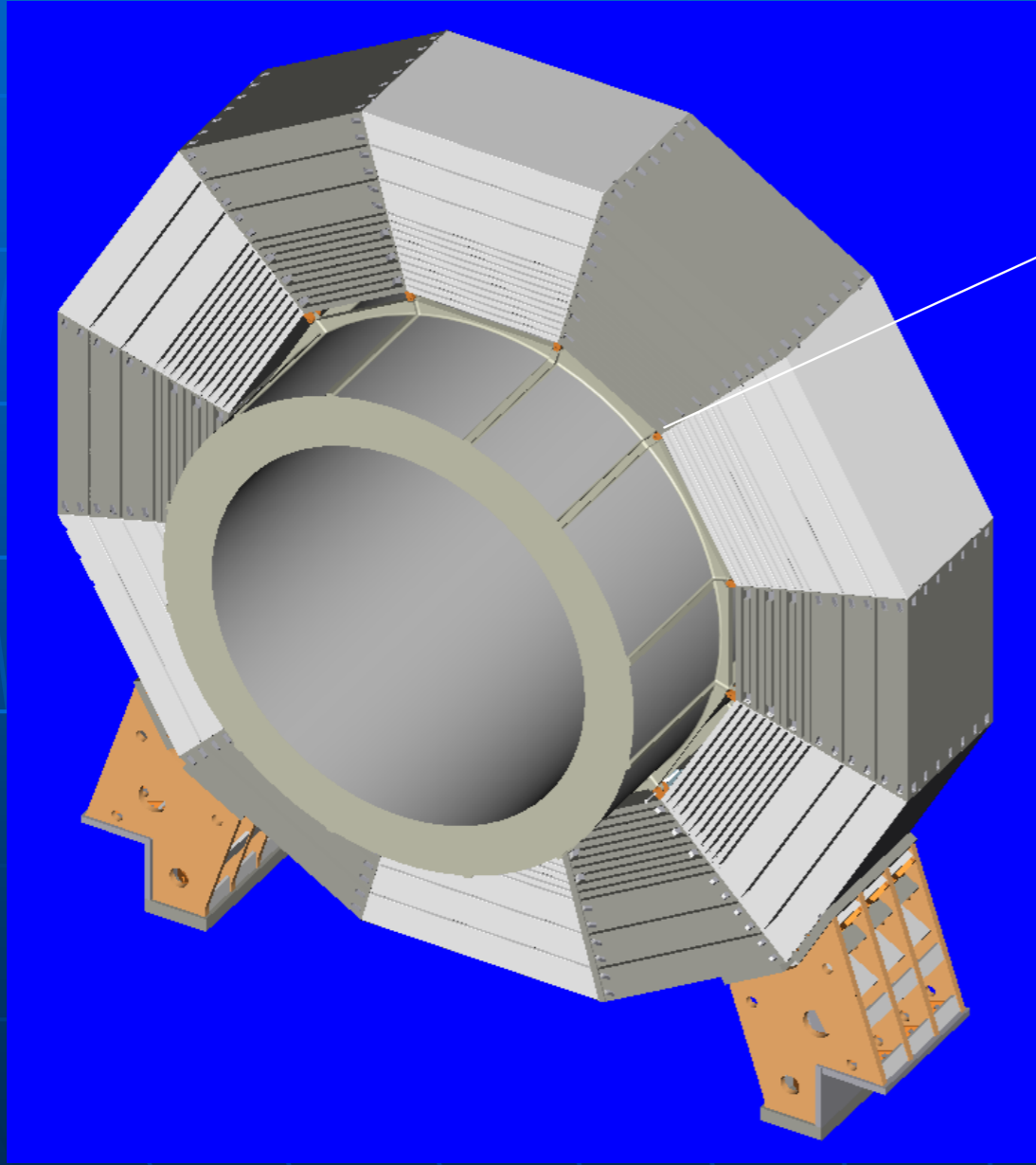


## ETD: EnDCap Tracking Detector



Work in progress on the mechanical side at LPNHE by P. Ghislain & D. Imbault in collaboration with LPSC (D. Grondin), LAL (M. Jore), LLR (P. Anduze).

## 5.0 Cryostat integration in central barrel, final installation - outer vacuum vessel end fixing in central barrel -

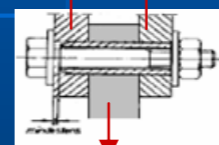


Assembly boring of  $\varnothing 50H^{12}$  mm  
bracket in combination with  
Cryostat eye



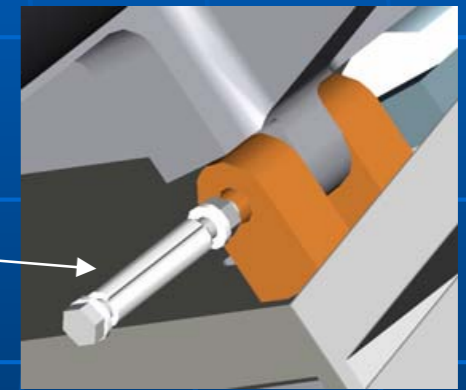
fix with friction bolt DIN 1481 -  $\varnothing 50 \times 240$  lg.  
hexagon head bolts with large head (HV)  
DIN 6914 - M30 x 300 comply with washers  
and nuts

Fa ~ 300000 N      Fb ~ 300000 N



Fr theory ~ 600000 N  
Fr applied under 600000 N!  
Surface pressure 65 N/mm<sup>2</sup>

friction bolt DIN 1481  
shearing force max ~ 1685000 N  
Account: 20 friction bolt to lift 1200 t

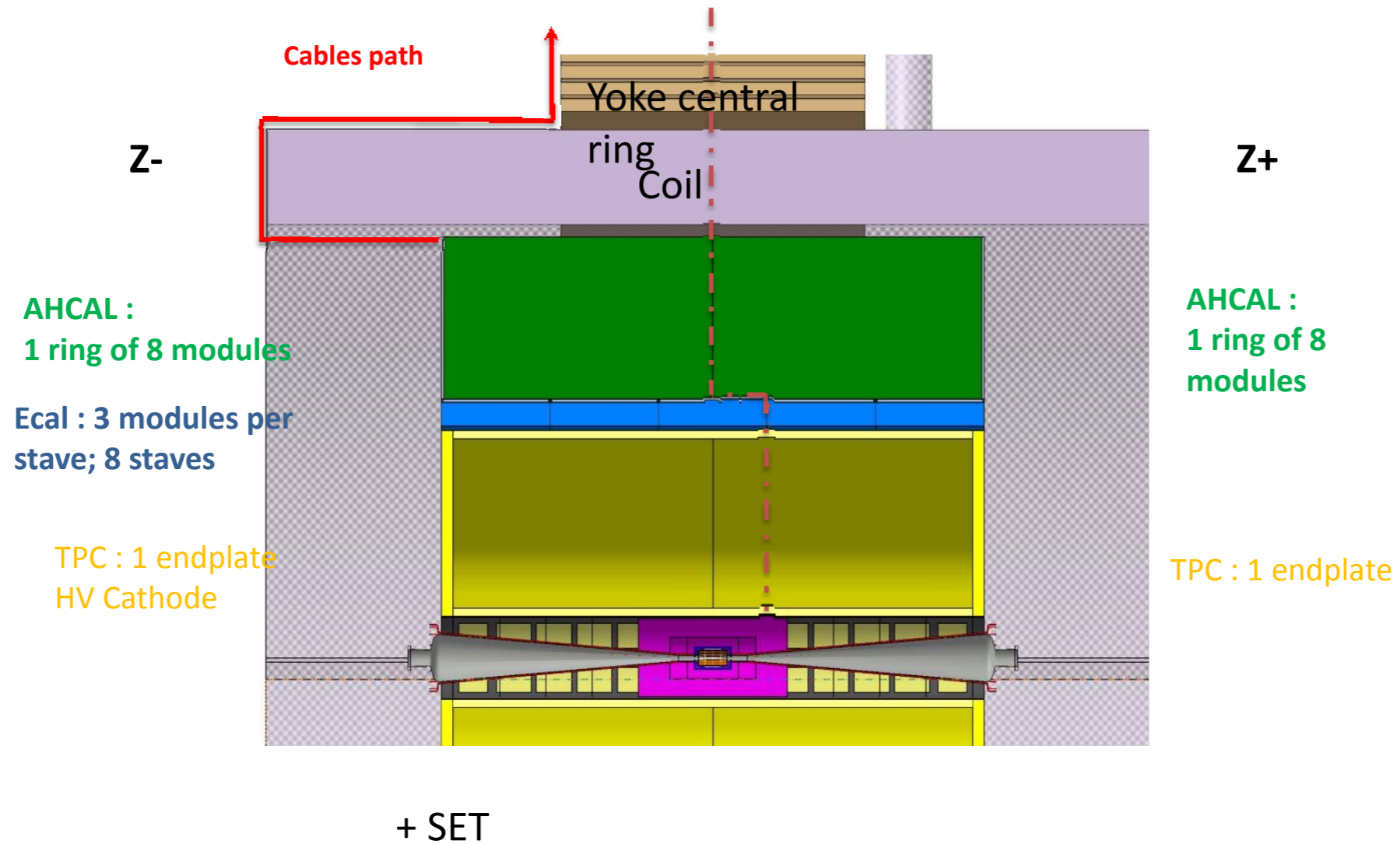


shear stress factor ~ 2,5 (1,2 is ok)  
surface pressure 125 N / mm<sup>2</sup>  
S235JR ~ 235 N/mm<sup>2</sup> > 125 N/mm<sup>2</sup>  
pressure factor ~ 1,8 (1,2 is ok)



tightening screw condition:  
hydraulically operated in  
sequence for 24 bolt  
DIN 6914 - M30 x 300  
M ~ 1650 Nm, Fv ~ 350 kN

## Barrel services



C.Clerc

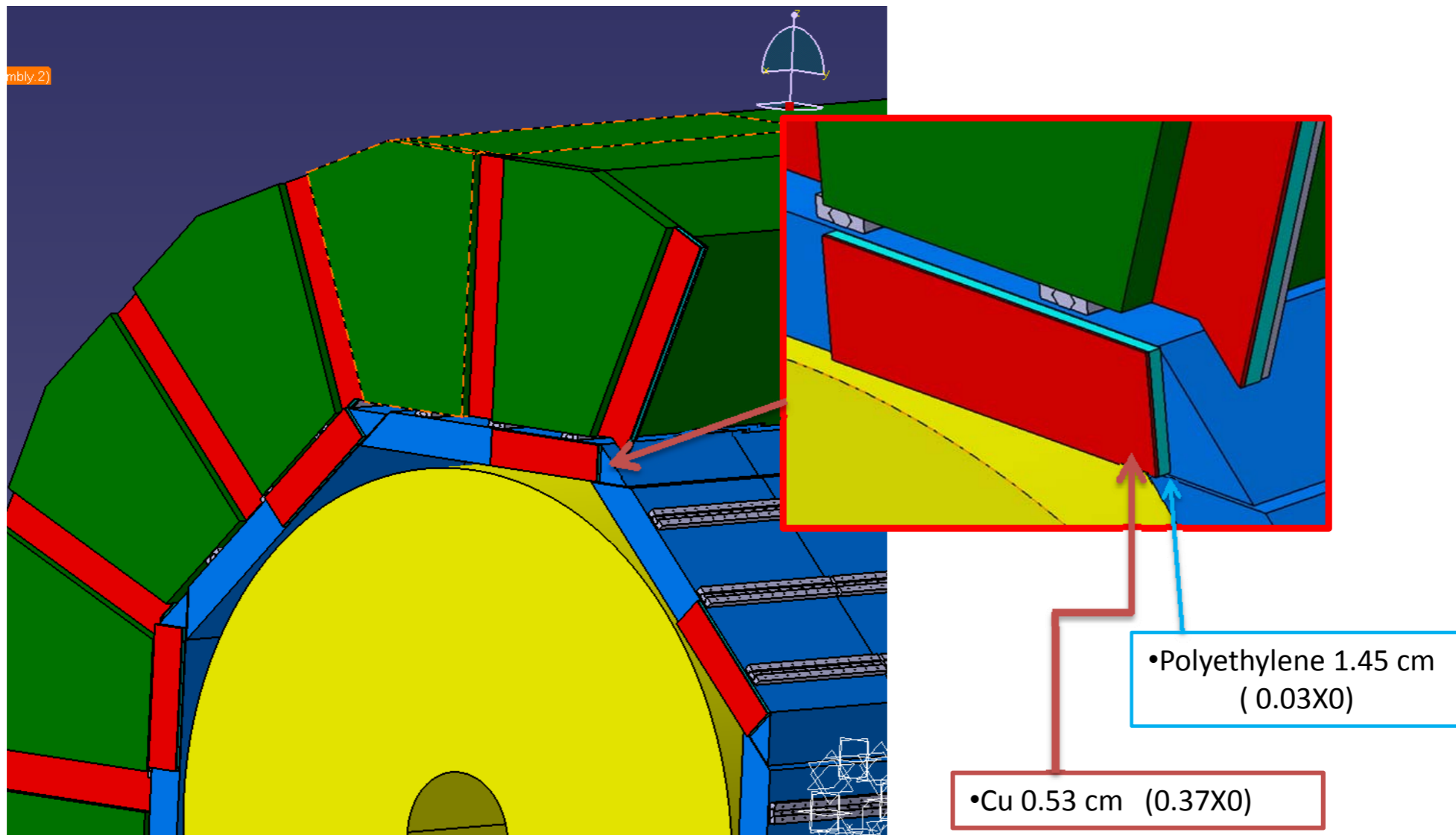
ILD software & MDI, DESY

06/07/2010



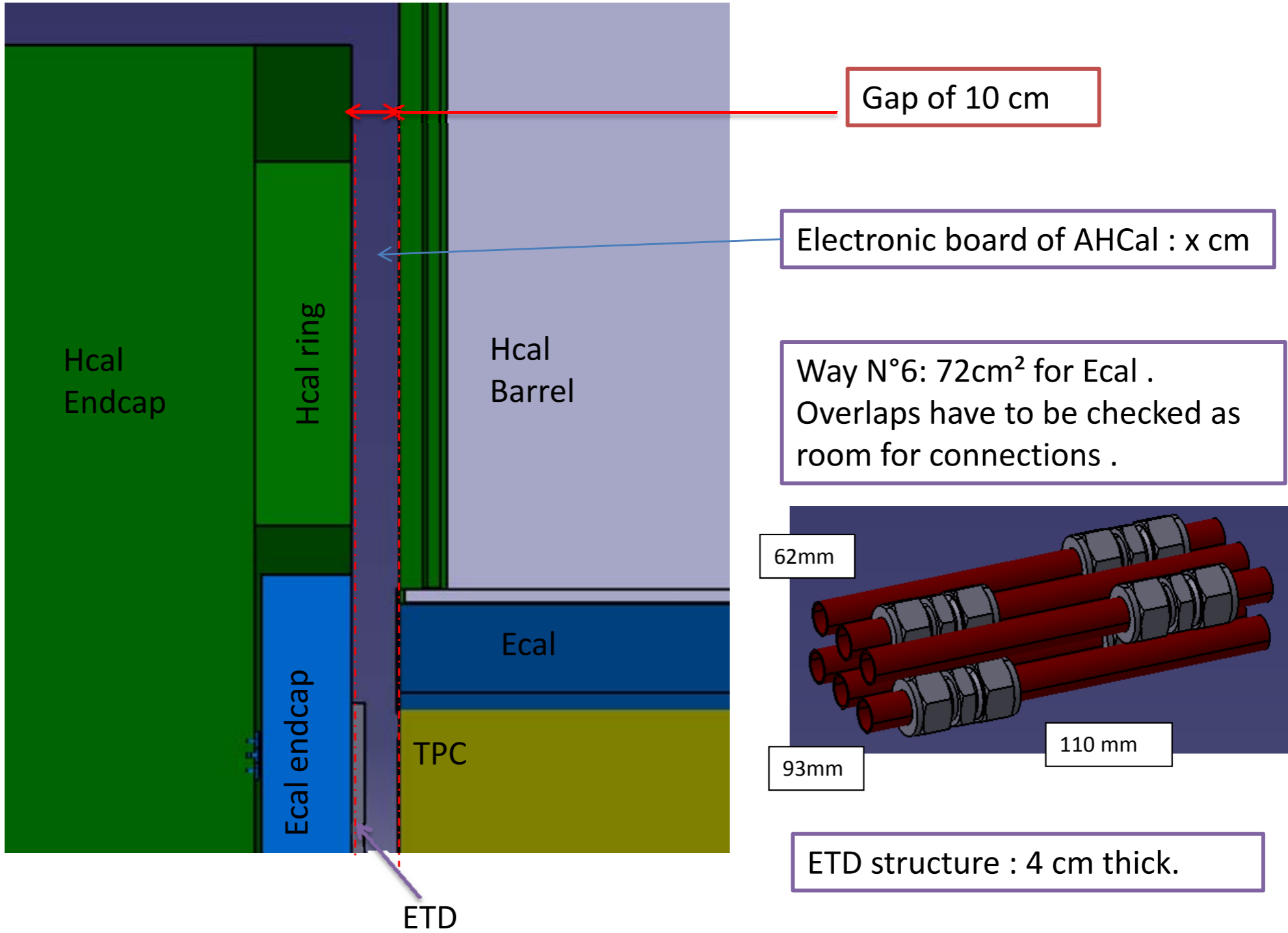
*Barrel services : dead materials (Ecal)*

For simulation, same for Ecal?  
Coverage of half of the surface of each supermodule edge  
Here, only 8 ways-in for ECAL



Reminder : this is for Z- face : in Z+ numbers are minorized By 2/3 for ECAL

# Barrel-Endcap Gap



C.Clerc

ILD software & MDI, DESY

06/07/2010

- Some detector parameters (sizes, radii, available space) being used in the engineering design of the sub-detector integration are not corresponding to the actual ILD model
  - communication problem
  - clear use case for the ILD placeholder model
    - if it is not in the ILD placeholder, it will not be in ILD!
- We are trying to enter a real engineering effort now
  - The use of appropriate tools (WBS, EDMS) is needed
  - More important: the processes need to be defined and followed-up!
    - e.g. make sure that ALL changes to sub-detector models make it to the ILD integration team and into the placeholder model
  - Some overhead work now, but will save time later
  - Not sure whether we have enough person-power available
- Try to continue the series of face-to-face integration meetings:
  - 01/2010 Paris
  - 07/2010 DESY
  - should have one additional day at CERN WS in 10/2010
  - regular remote meetings in-between

Rule: If it is not in the ILD placeholder model, it is not ILD!

- Definition of configuration change process is essential
- Proposal:
  - Group of experts:
    - Sub-detector technical contacts
      - or WBS sub-node managers (?)
    - Representatives from physics and simulations
    - Global integration experts
    - ILD management representatives
  - Discuss proposed changes to the configuration
  - Sends suggestion to ILD-EB for approval
- Biggest problem:
  - Make sure that the actual ILD configuration and any subsequent changes are communicated to the relevant people