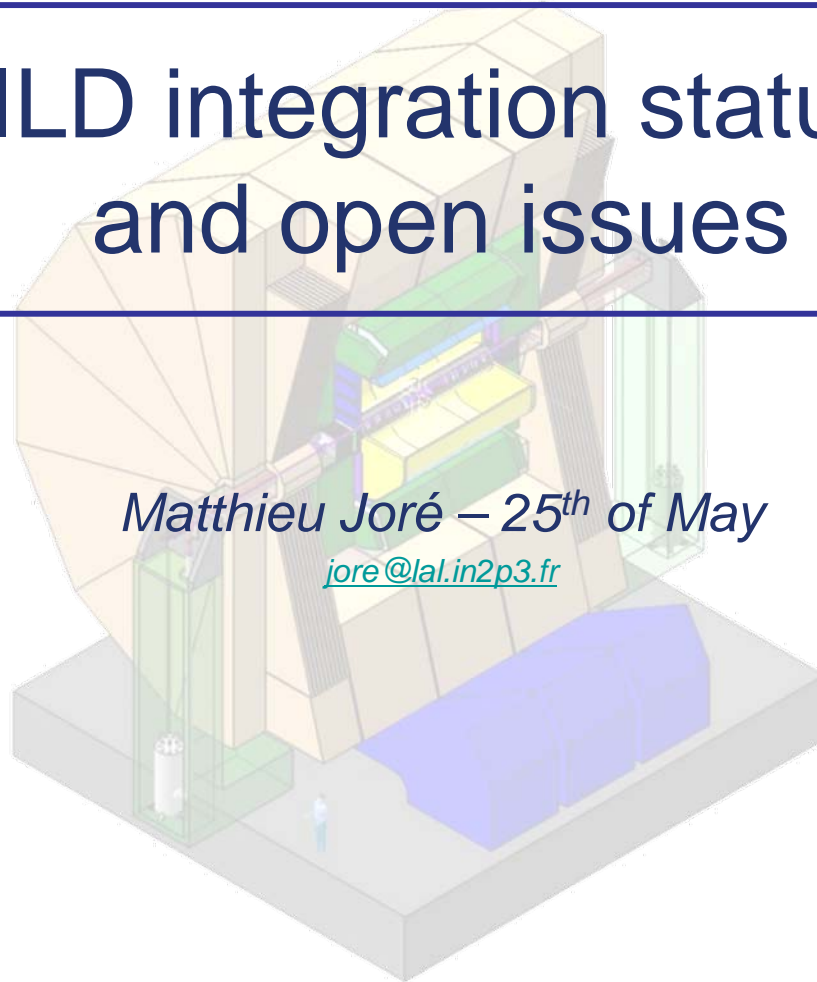




ILD integration status and open issues

Matthieu Joré – 25th of May

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Outline

- Introduction
- Overview of each sub detector integration :
 - **VTX : FPCCD and CMOS**
 - **FTD : 1/2 and 3->7**
 - **SIT**
 - **TPC**
 - **SET and ETD**
 - **Ecal : Scintillator and Silicium**
 - **Hcal : Analog and Semi Digital**
 - **Forward region : LumiCal, Ecal ring, LHCaI**
- Conclusions

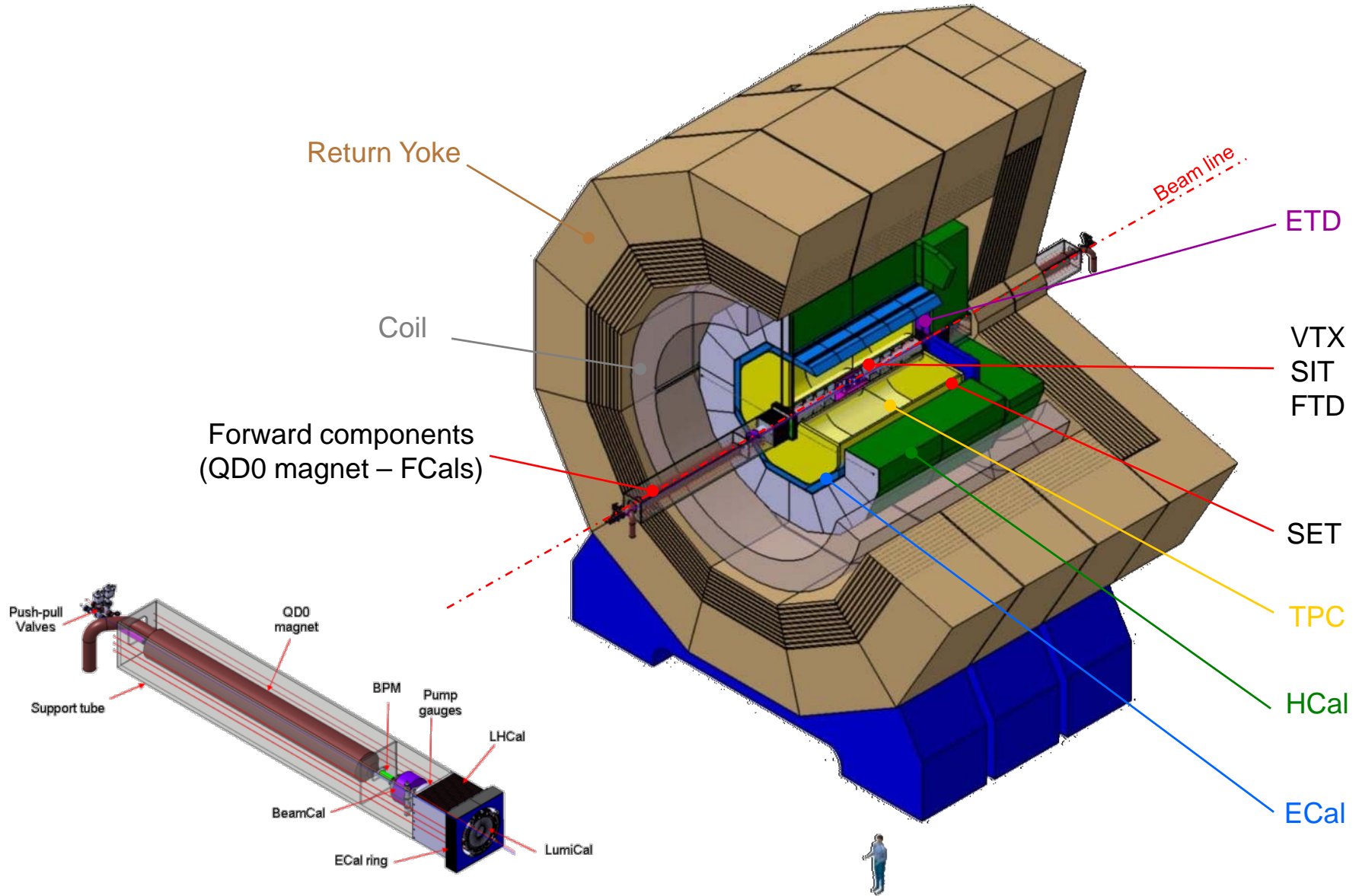


Goals for the integration studies

- For 2012 :
 - **Complete basic mechanical integration of the baseline design accounting for insensitive zones such as the beam holes, support structure, cables, gaps or inner detector material**
 - **Develop a realistic simulation model of the baseline design, including the identified faults and limitations**
- Goals for this ILD workshop :
 - **Define a software baseline for mass production**
 - Each sub detector must show that they could be integrated in ILD
 - **Estimate as much as possible the insensitive material**
 - Especially for the inner region !

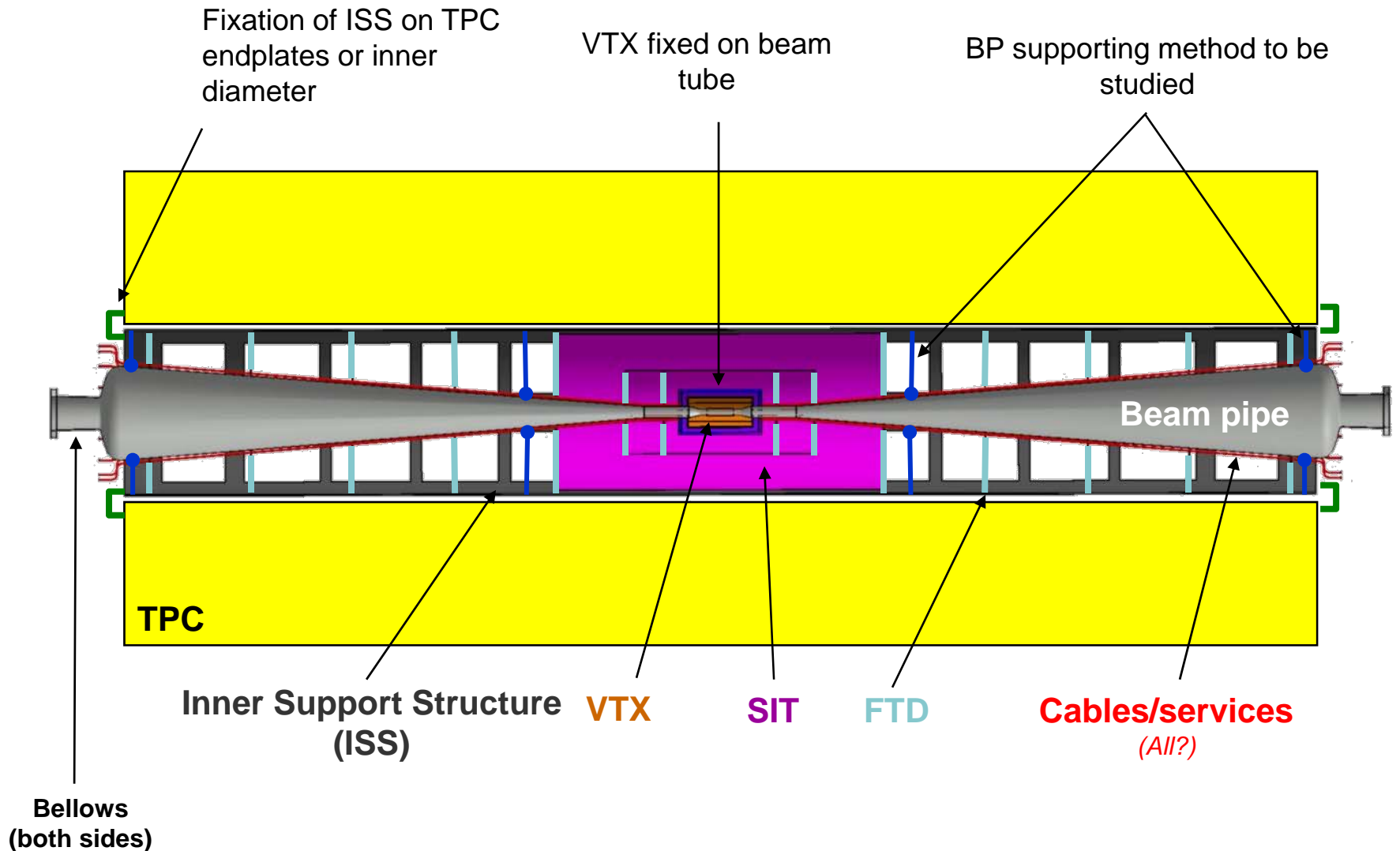


ILD overview





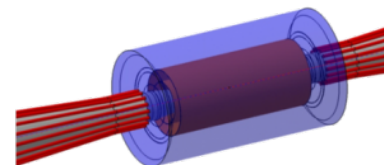
Inner region - reminder



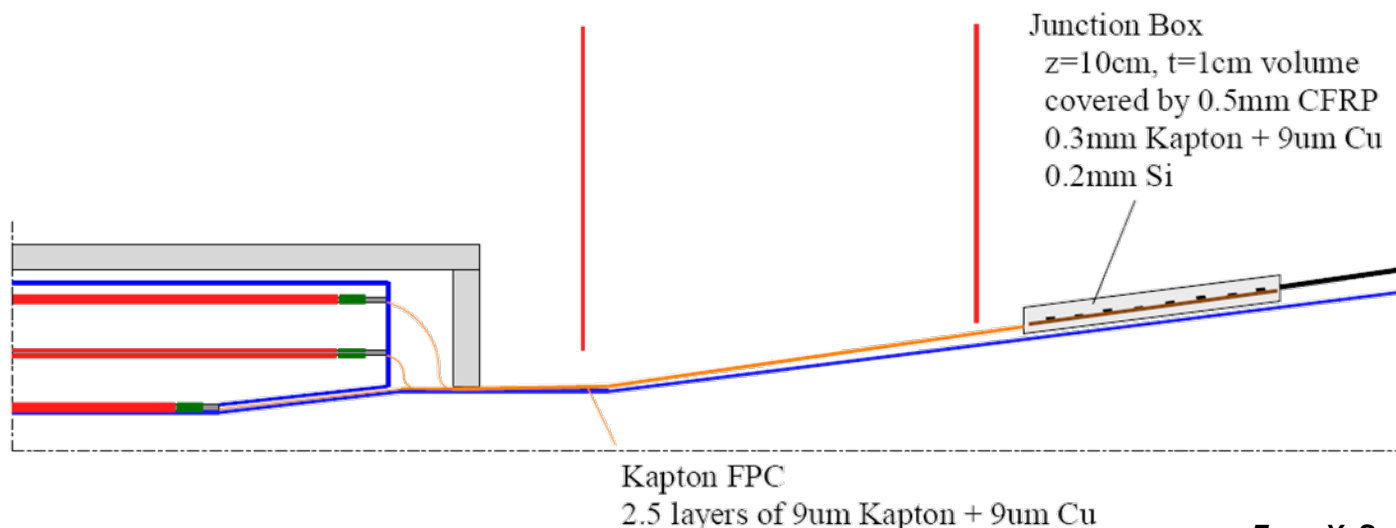


FPCCD Vertex

- Placeholder implemented in the ILD CAD model
 - **Mechanical design extrapolated from SLD**
- Supported by the beam pipe
- Cables amount and paths have been estimated
- Cooling is foreseen to be CO₂ with small SUS pipes
 - **100W and -30/-40°C**



VTX in the ILD CAD model

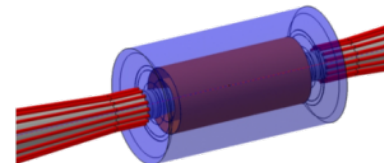


From Y. Sugimoto and al.

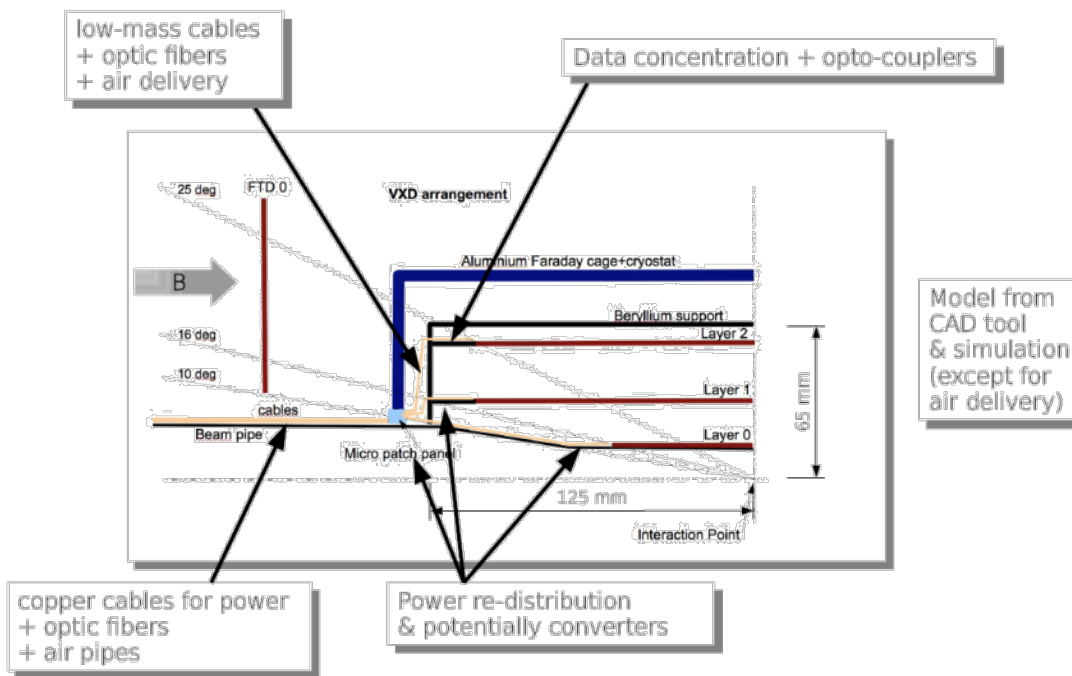


CMOS Vertex

- Placeholder implemented in the ILD CAD model
 - **Mechanical design extrapolated from SLD**
- Supported by the beam pipe
- Cables amount and paths have been estimated
 - **Different from FPCCD technology**
- To be checked if Air cooling could work
 - **20/30W and 10/30°C - vibration**

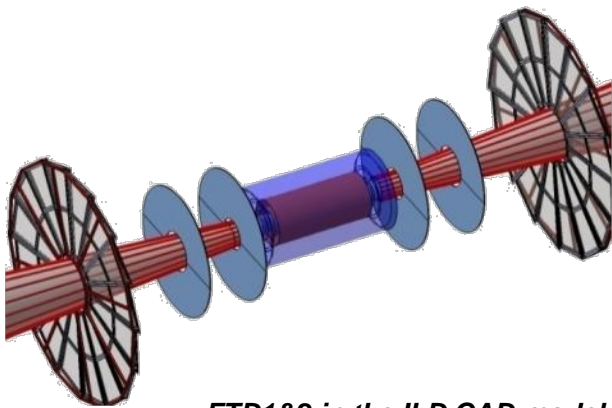


VTX in the ILD CAD model

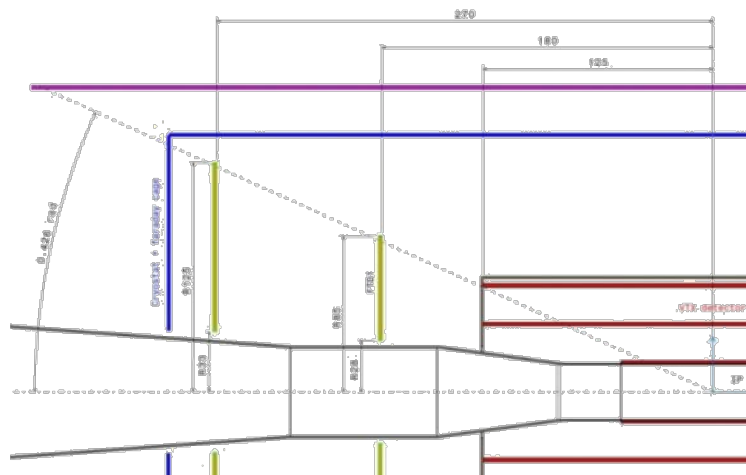


From J. Baudot and al.

- Placeholder implemented
 - **No mechanical design**
- Supported by the Inner Supporting Structure
- No estimation concerning the cables
- No information concerning the cooling
 - **Air cooling?**
- Alternative integration inside the VTX cryostat
 - **Might need to share the same Faraday cage**

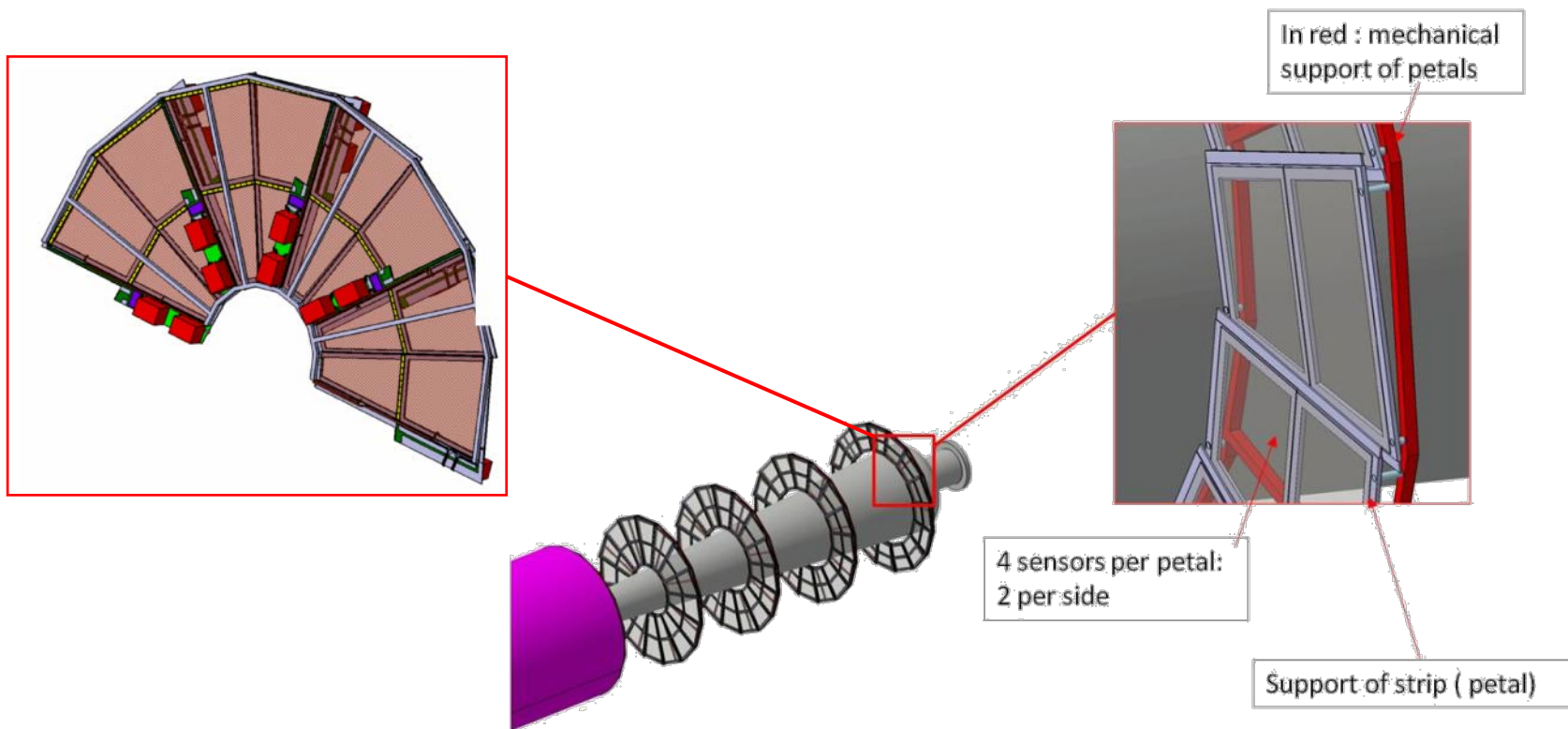


FTD1&2 in the ILD CAD model



Proposal for new integration

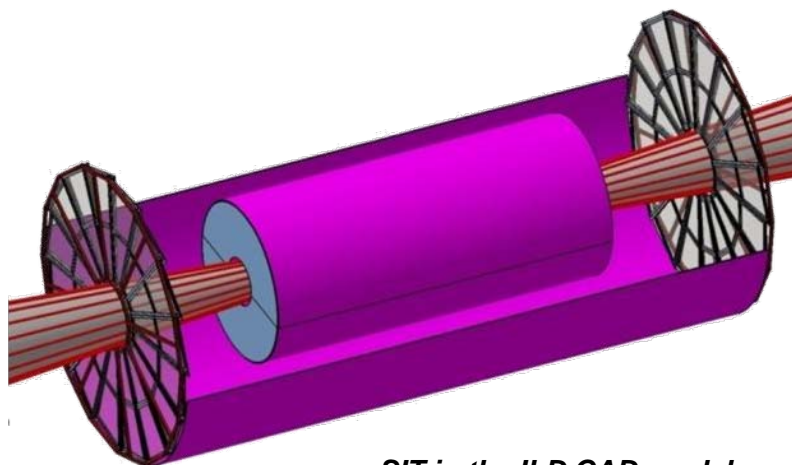
- Mechanical design has been provided
- Supported by the Inner Supporting Structure
- Electronics, cables amount and path have been estimated
- Air cooling to be checked



From D. Moya, I. Villa and al.



- Placeholder implemented
 - **No mechanical design**
- Supported by the Inner Supporting Structure
- No estimation concerning the cables
- No information concerning the cooling
 - **Air cooling?**

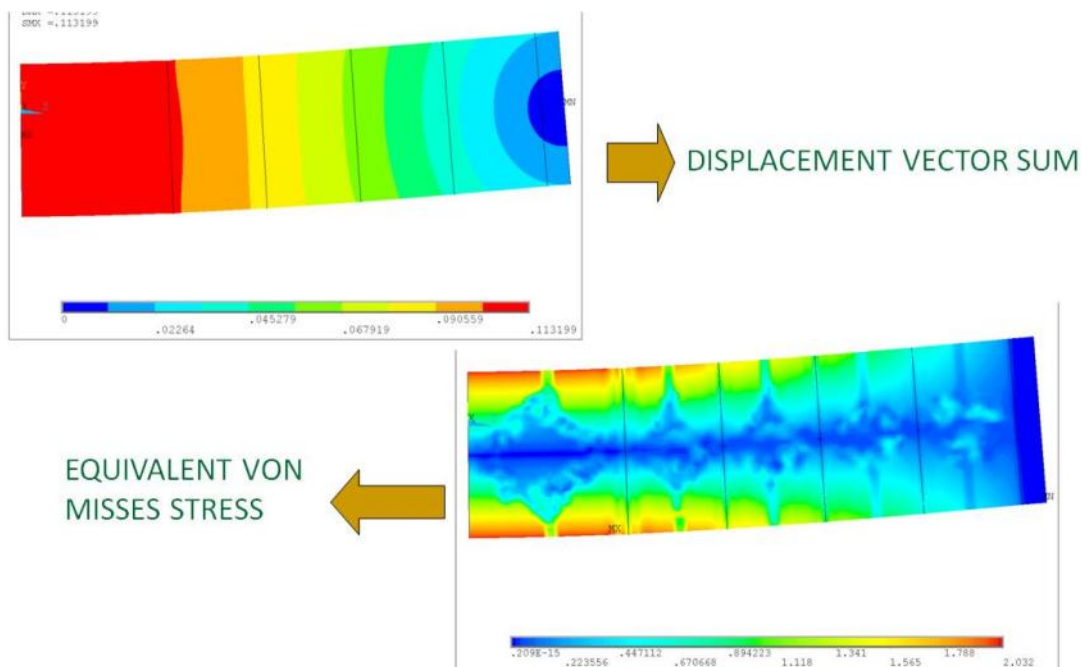


SIT in the ILD CAD model



Inner supporting tube

- FEA calculations has been performed on the tube
- Results :
 - **Material used for the composite: MTM45/IM7**
 - **Cylinder eight Layers 1,04 mm thickness with 0°/90°/45°/-45° config.**
 - **Rings four Layers 0,52 mm thickness**
- Could be implemented in the simulation model

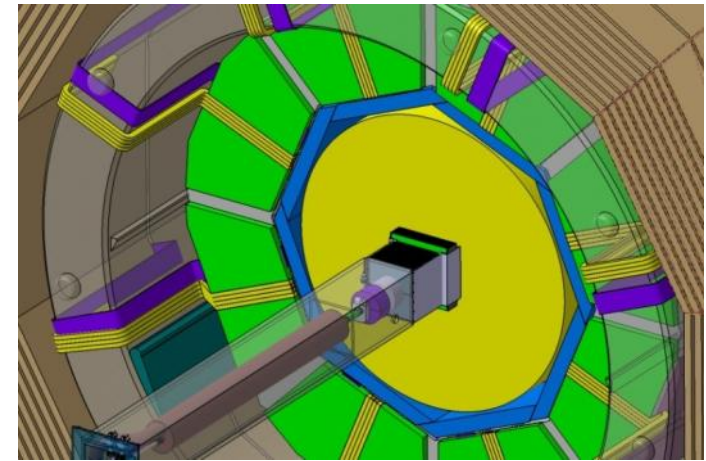


From D. Moya

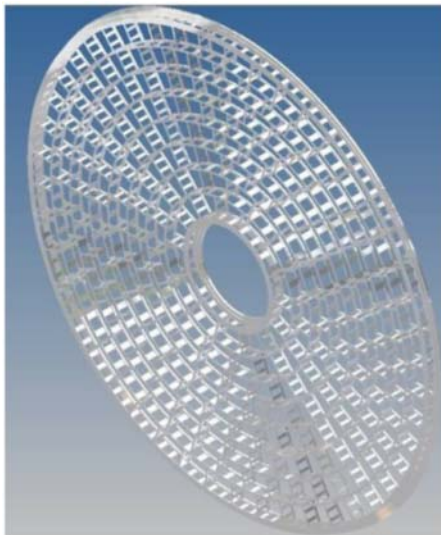


TPC

- Placeholder implemented
 - There is a mechanical design
 - Not yet implemented in the ILD CAD model
- Fixation to Coil or Hcal to be designed
- Cables amount estimated and routed
- CO2 cooling



TPC in the ILD CAD model

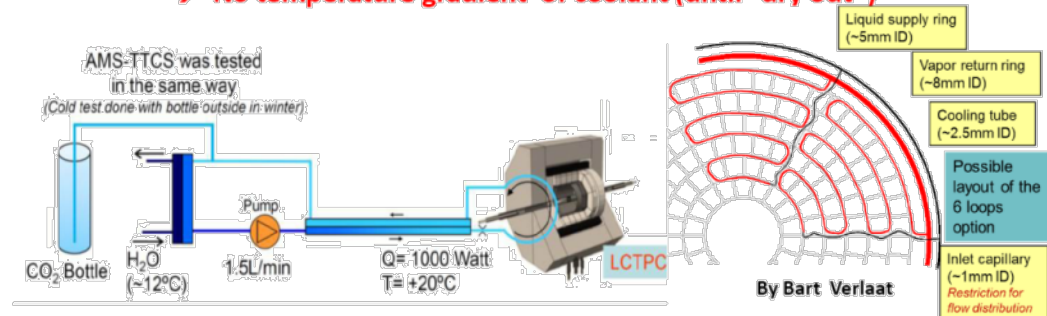


TPC endplate design

Advantages of 2 Phase CO2 cooling:

Large latent heat of liquid CO2 (300J/g), and
High Pressure operation (5MPa @+15°C)

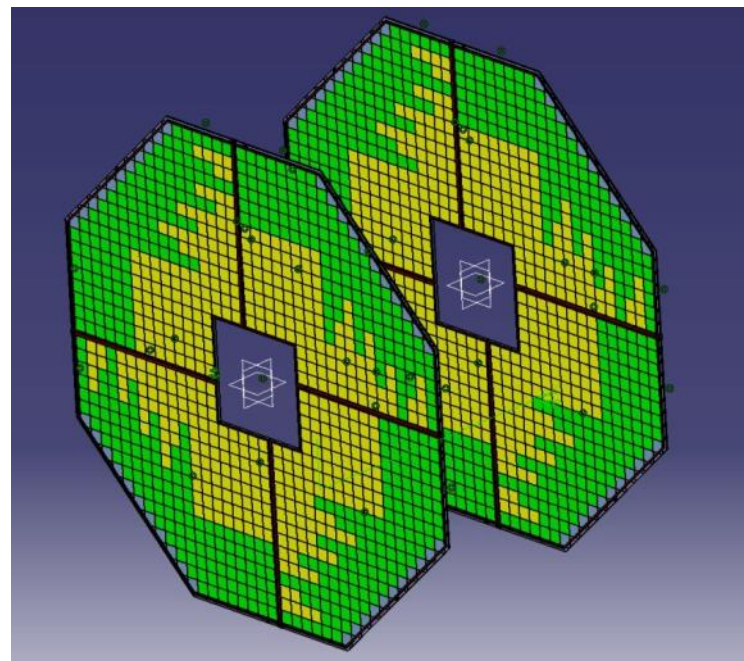
- Minimum amount of coolant and thin pipes
- No temperature gradient of coolant (until "dry out")



From Y. Timmermans and al.



- SET
 - Placeholder exists
 - No mechanical design neither cables or services estimation
- ETD :
 - Placeholder exists
 - Mechanical design under study
 - Fixation on Ecal EndCap defined
 - Cables and services under estimation
 - Water cooling : could use the Ecal loop

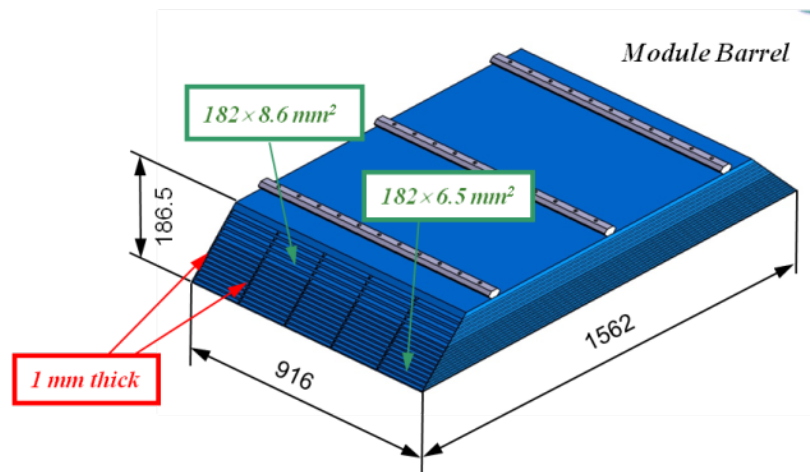
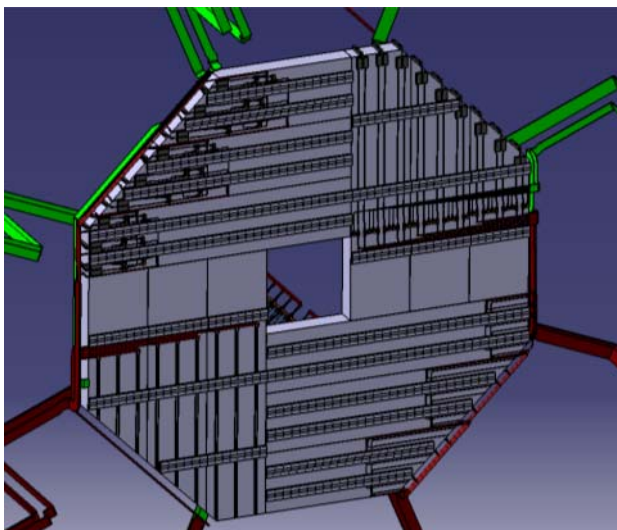


From P. Ghislain and al.



Si/W Ecal and Sci/WEcal

- Both share the same structure
- Placeholder implemented
 - **Mechanical design performed for both barrel and EndCap**
 - **Rail fixation to HCal barrel and EC under design**
 - 2 rails for Barrel seem feasible



From M. Anduze, D. Grondin and al.

- Cables amount and path well defined
- Leakless cooling system ($P_{\text{water}} < P_{\text{atm}}$) under study and test

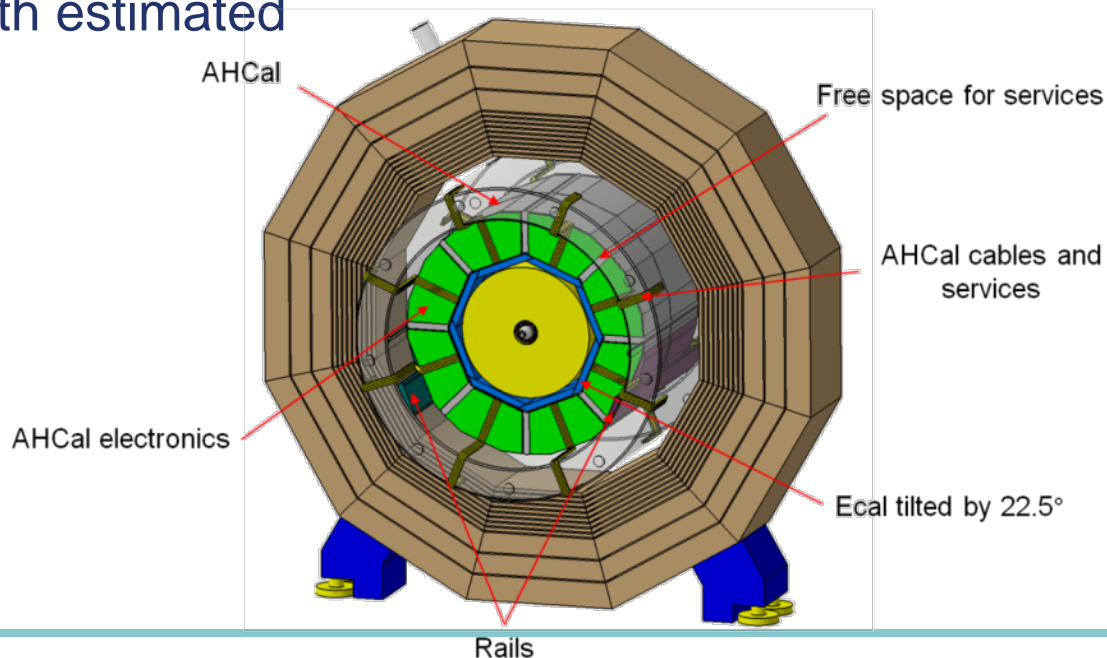


Analog HCal

- Place holder implemented
 - Mechanical design performed for barrel
 - Not for the EndCap
- Barrel slit inside the TPC rail system at 22.5°
 - Detail design of the rail system to be performed
 - Impact on the Ecal EndCap to be checked carefully – Not obvious !
 - New design of the Ecal leakless system
- EndCap fixation to the Yoke FSP to be studied
- Cables amount and path estimated
- Water cooling



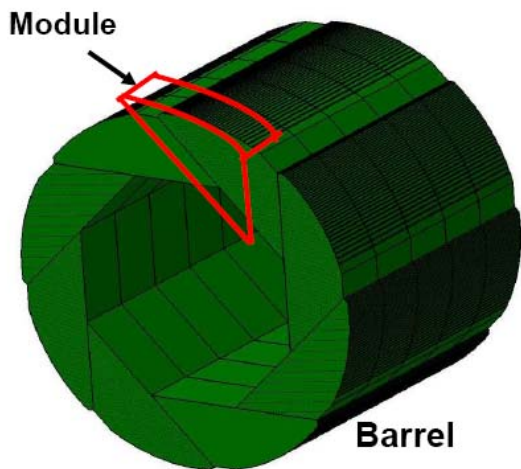
AHCAL mechanical design – K. Gadow and al.



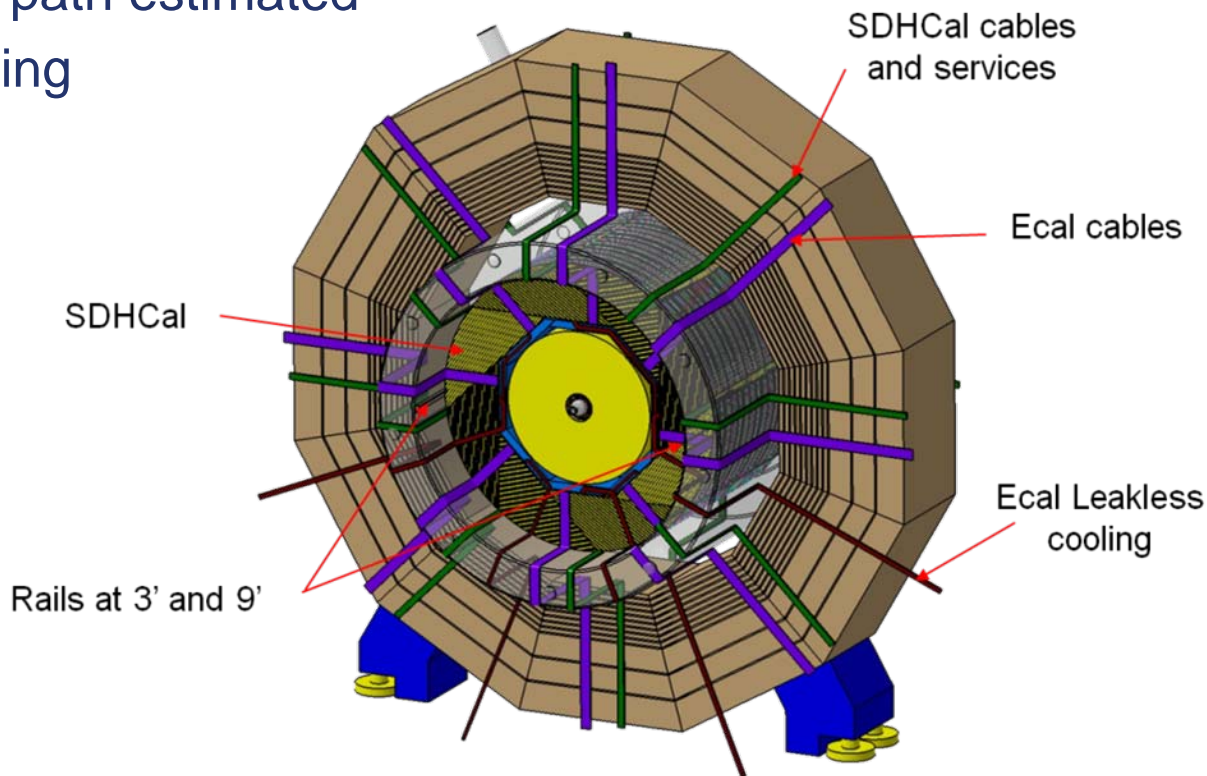


Semi Digital HCal

- Place holder implemented
 - **Mechanical design performed for barrel**
 - **Ongoing for the EndCap**
- Detail design of the rail system to be performed
- EndCap fixation to the Yoke FSP to be studied
- Cables amount and path estimated
- Might use CO2 cooling



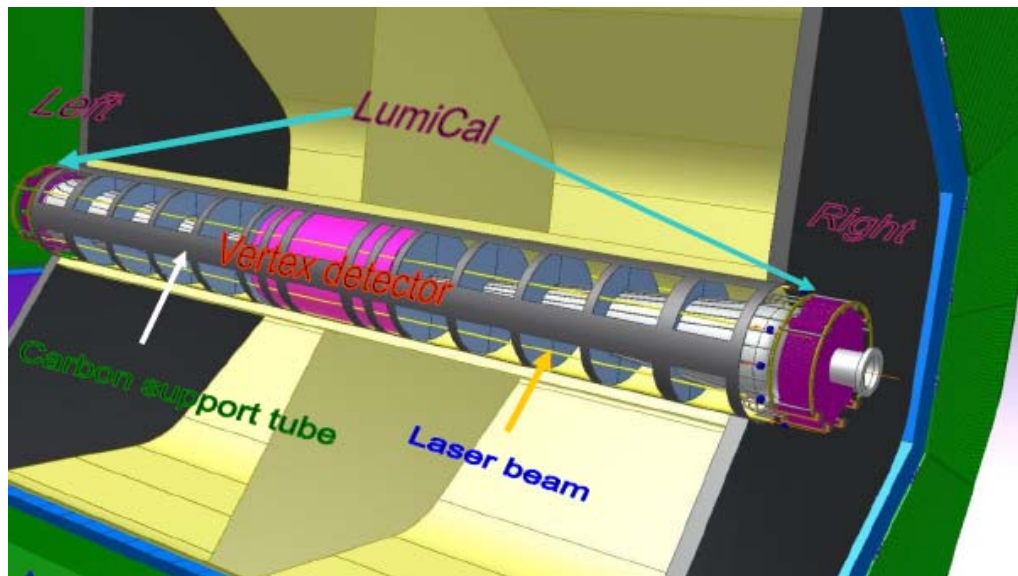
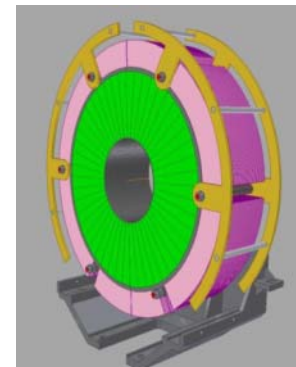
SDHCAL mechanical design – I.Laktineh and al.





Forward Region

- Big integration effort was done in the past years
- LHCal and Ecal ring : no real mechanical design
- LumiCal :
 - **New model to be implemented**
 - **Cables under estimation**
 - **Water cooling**
 - **Laser alignment system to be integrated**



From W. Wierba and al.



Conclusions

- Important effort have been done recently :
 - **On both Hcals proposal that are now integrated in the ILD CAD model**
 - Effort needs to continue on the EndCap design
 - **On inner region especially the Vertex and the FTD3->7**
 - Some informations could be implemented into the simulation model
- We have now a better understanding of the integration of ILD
- But still a long way toward the DBD :
 - **Hcal rails system design**
 - **Hcal endcap fixation to the Yoke**
 - **TPC fixation**
 - **Inner Supporting Tube design**
 - **SIT and FTD1&2 integration : How could we proceed ?**
 - ...



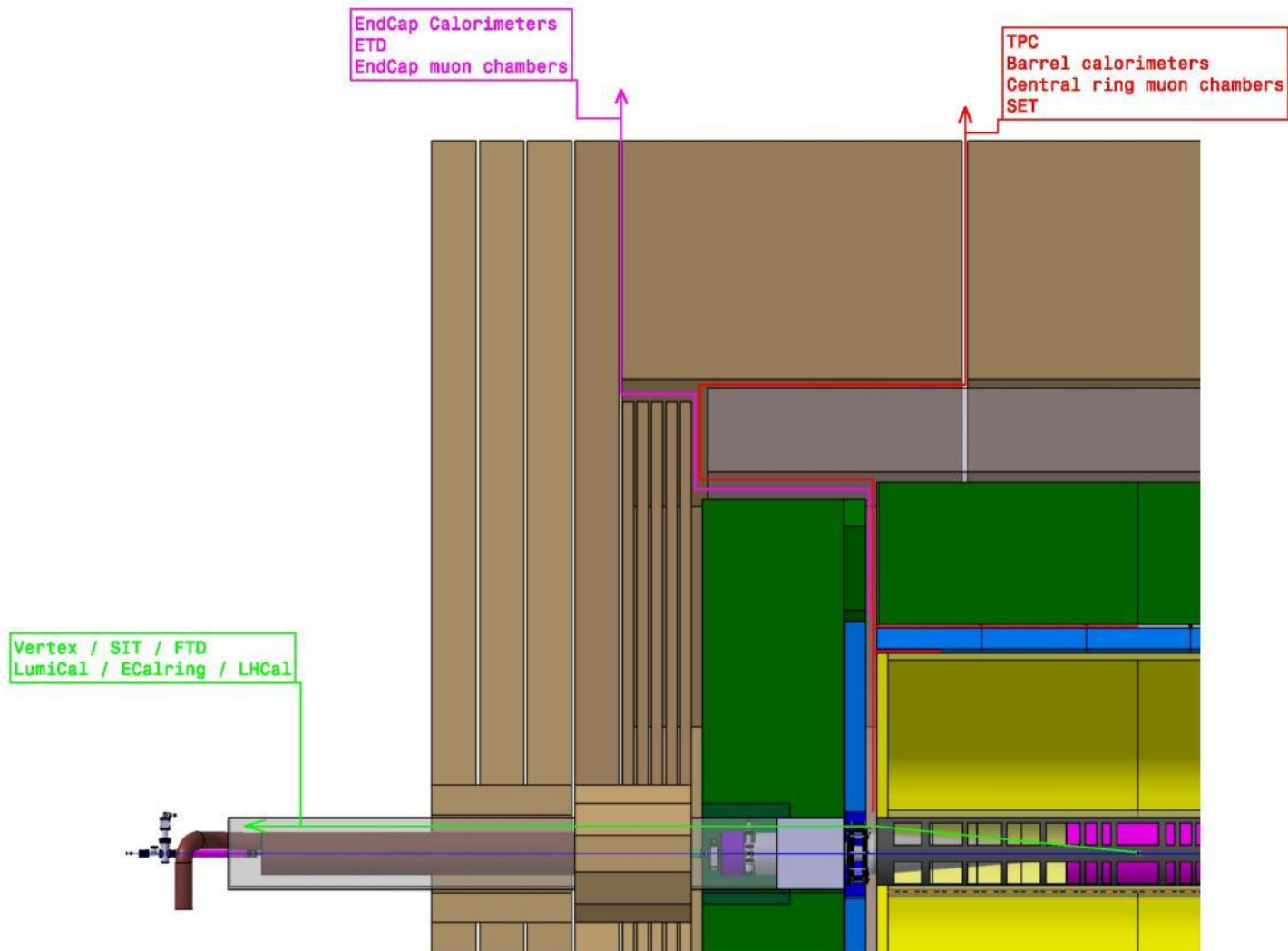
- We mainly focused on the mechanical and cabling aspects of the integration
- But it's now time to start thinking about the other issues :
 - **Cooling**
 - We need to put all the needs together and find how we can integrate them properly
 - Some cooling systems could be shared by different subdetectors
 - **Alignment needs and strategies**
 - Toward a global position monitoring system ? (eg. QD0, LumiCal, Inner detectors, etc...)
 - **Maintenance that is needed by each sub detector**
 - Could have an impact on the opening of the detector



Backup slides

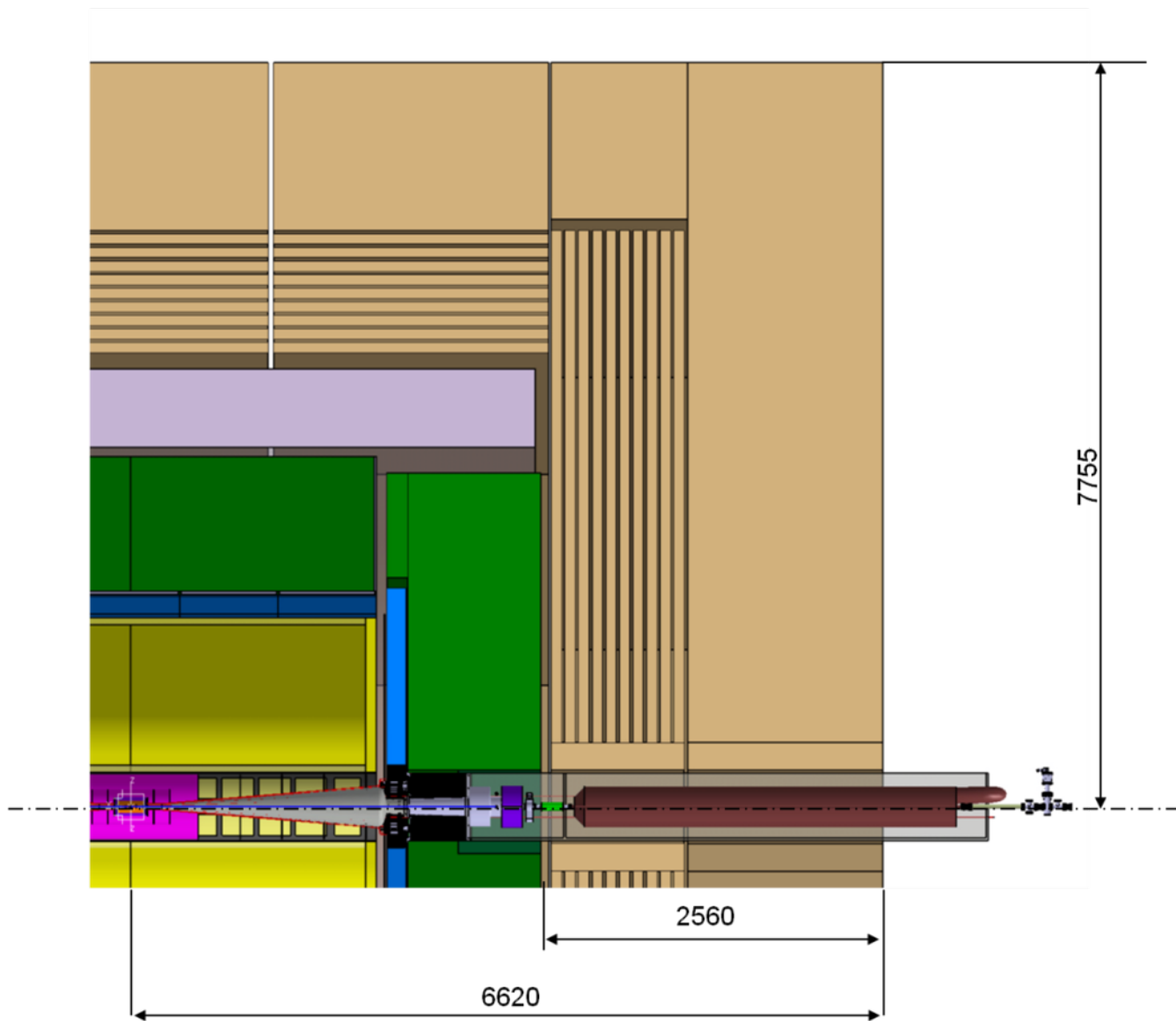


Cables paths





ILD dimensions



ECAL – 2 vs 3 rails

3 rails design

ECAL-8-3

Fixing line
(3 rails)

$e_{max} = 0.07 \text{ mm}$

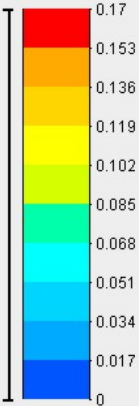
ECAL-8-2

Fixing line
(2 rails)

$e_{max} = 0.17 \text{ mm}$

Global Results
Potential energy 0.84487744 J

Unit: mm



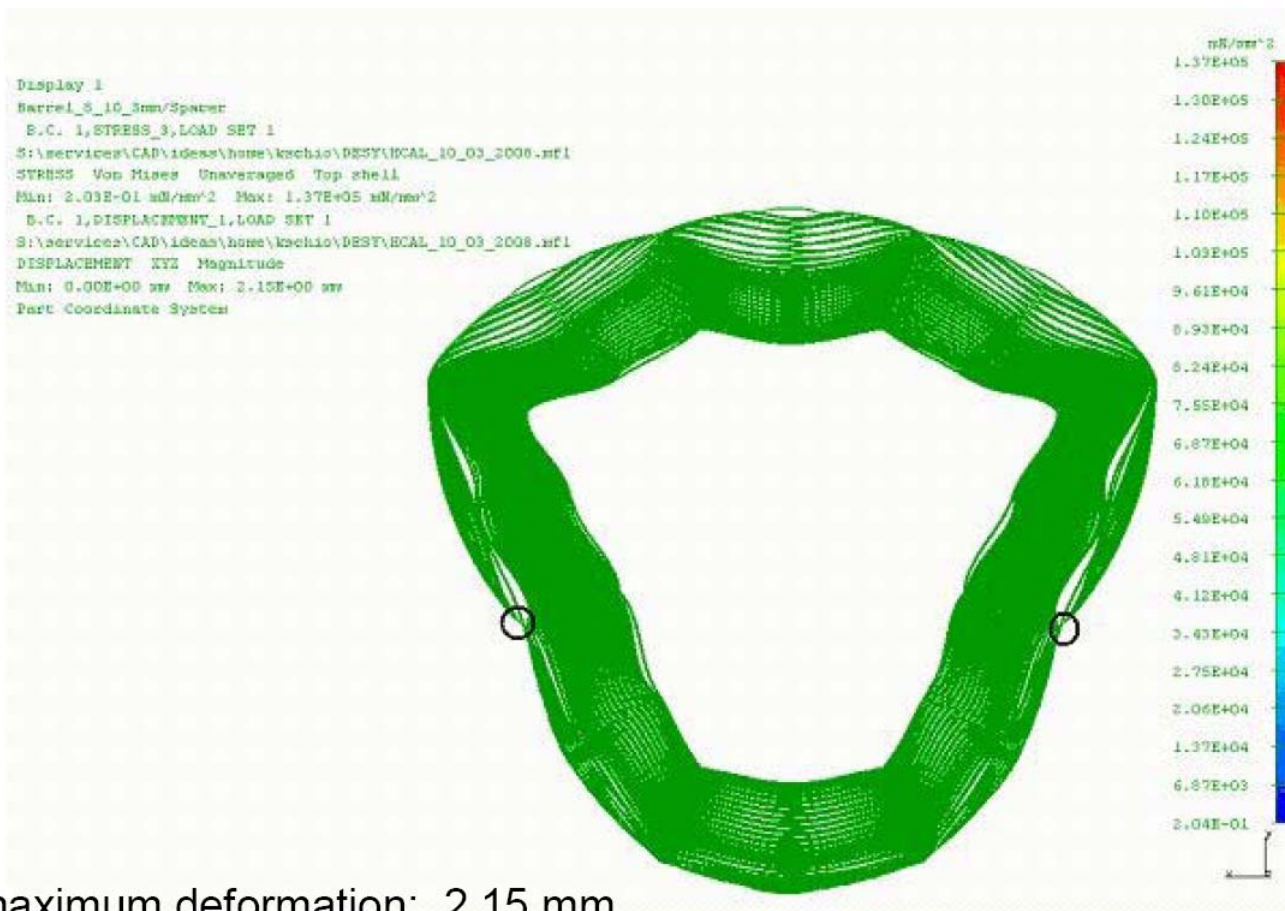
g

g

2 rails design



AHCAL barrel deformation



maximum deformation: 2.15 mm

maximum stress (von Mises): 137 N/mm²

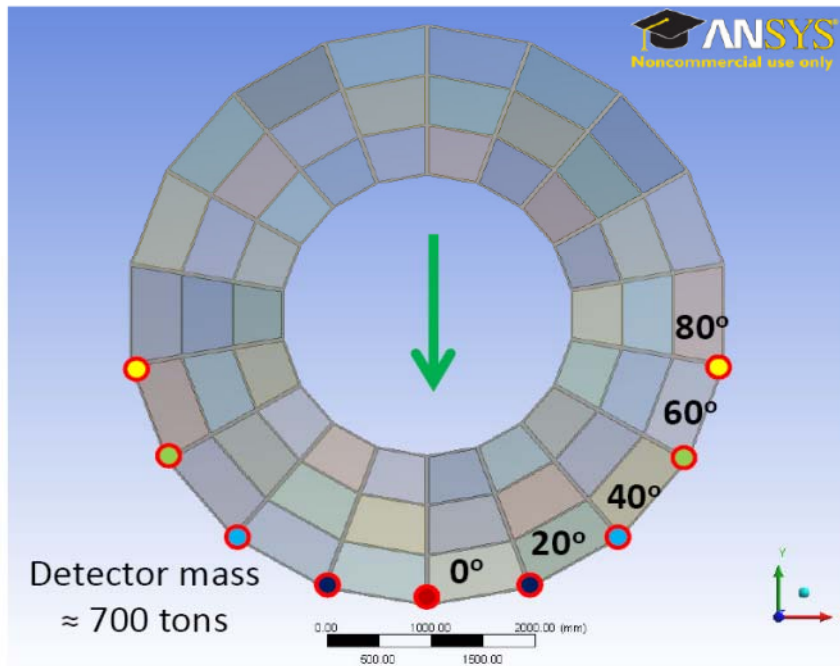
14/05/2008

ILD HCAL - mechanical concept

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I. Support Position



1. Choose different support configurations at 20° intervals
2. Apply earth gravity
3. Calculate deformation for each support configuration

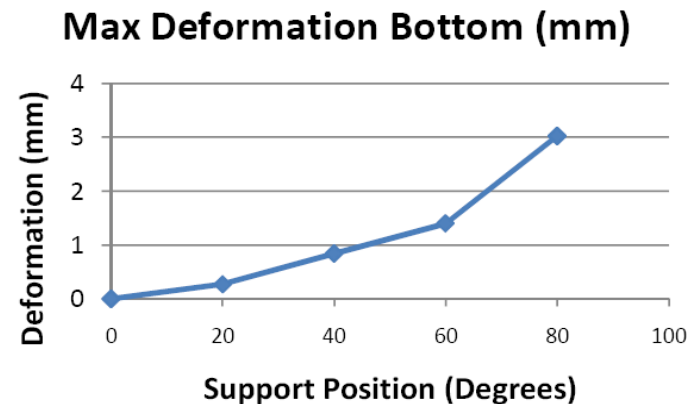
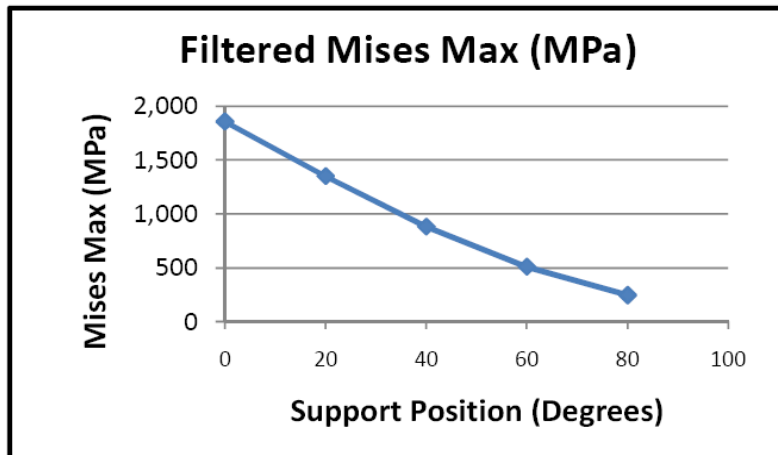
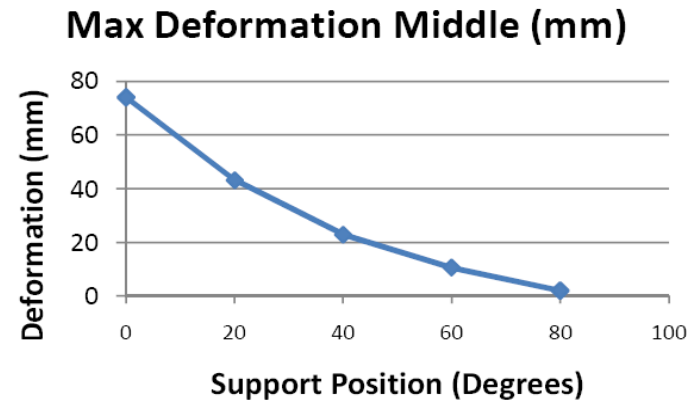
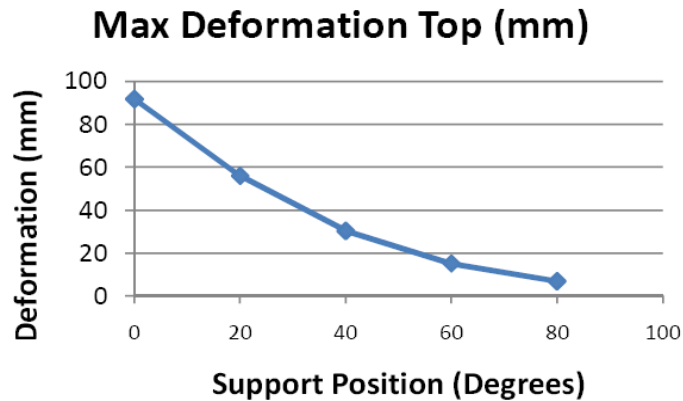
18/09/2009

LCD - HCal Mechanics

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Support Position





Conclusion - Support

- Optimal Support Position is at 3 and 9 o'clock
- Note, for this configuration:
 - Top sectors – compression
 - Force passes by face to face contact between sectors
 - Bottom sectors – traction
 - Force passes solely through bolts in tension

