MDI and Integration

Status and Future Plans

Karsten Buesser

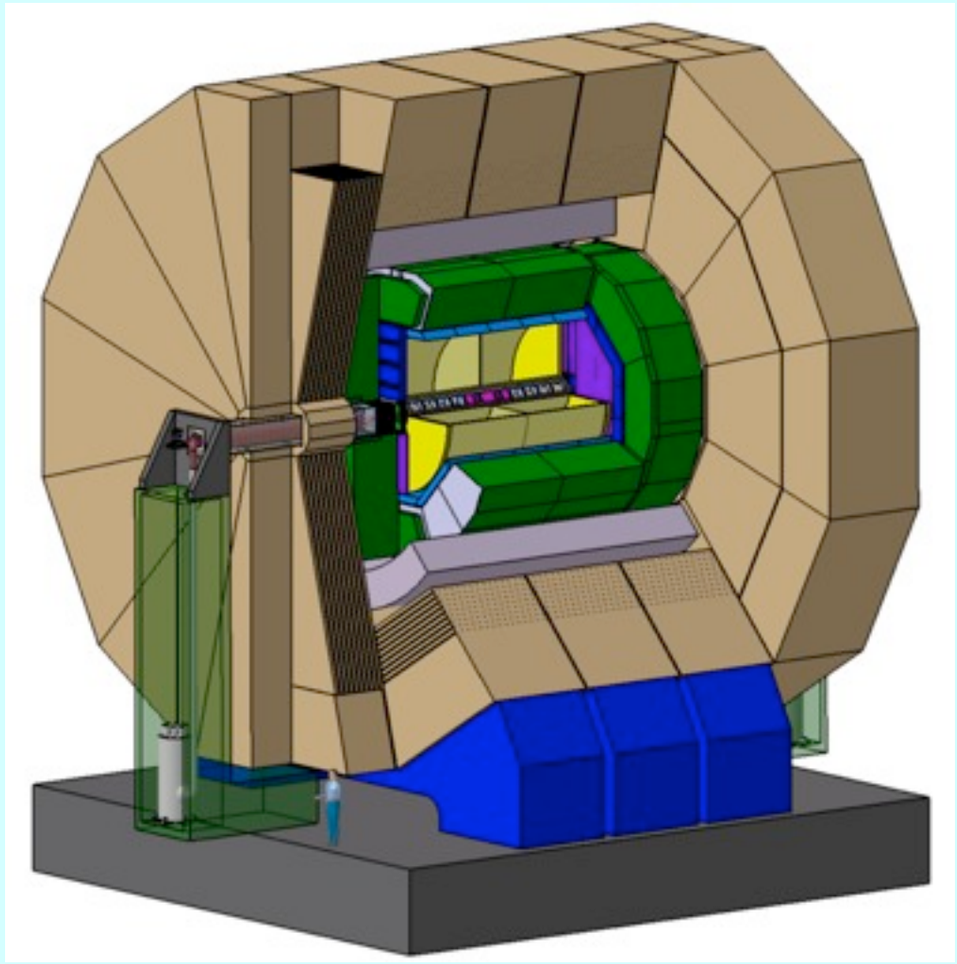
ALCPG ILD Meeting

Albuquerque

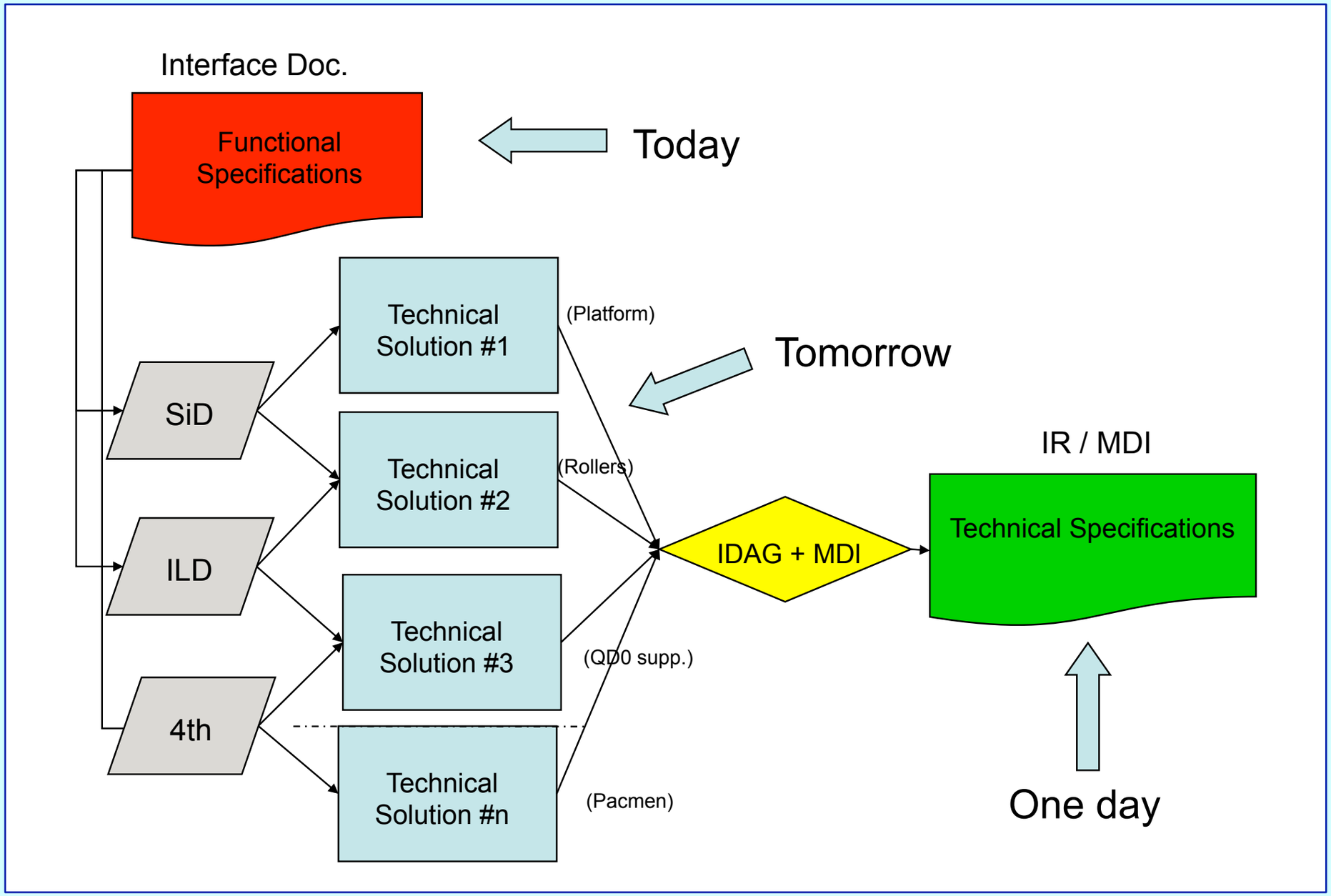
01.10.2009

ILD Mechanical Concept - as in LoI

- platform for push-pull
- 3 barrel yoke rings, 2 endcaps
- central yoke ring carries cryostat with coil and barrel calorimeters
- endcap yoke carries endcap calorimeters
- TPC and SET suspended from cryostat
- Inner silicon detectors in support structure (CFRP) supported from TPC
- QD0 magnet and forward calorimeters carried by pillar, suspended from coil cryostat with tie-rods



Bi-lateral Discussions



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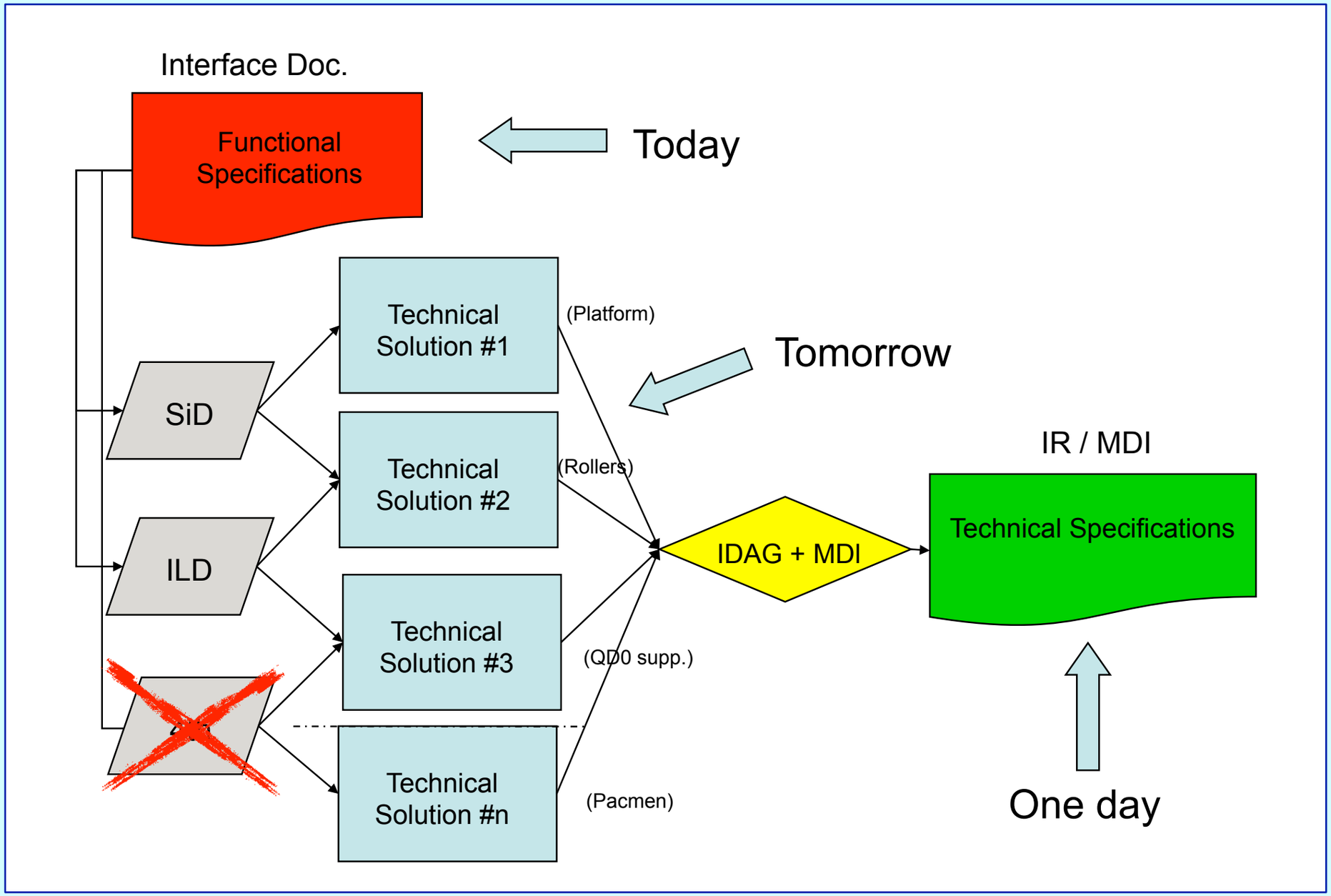


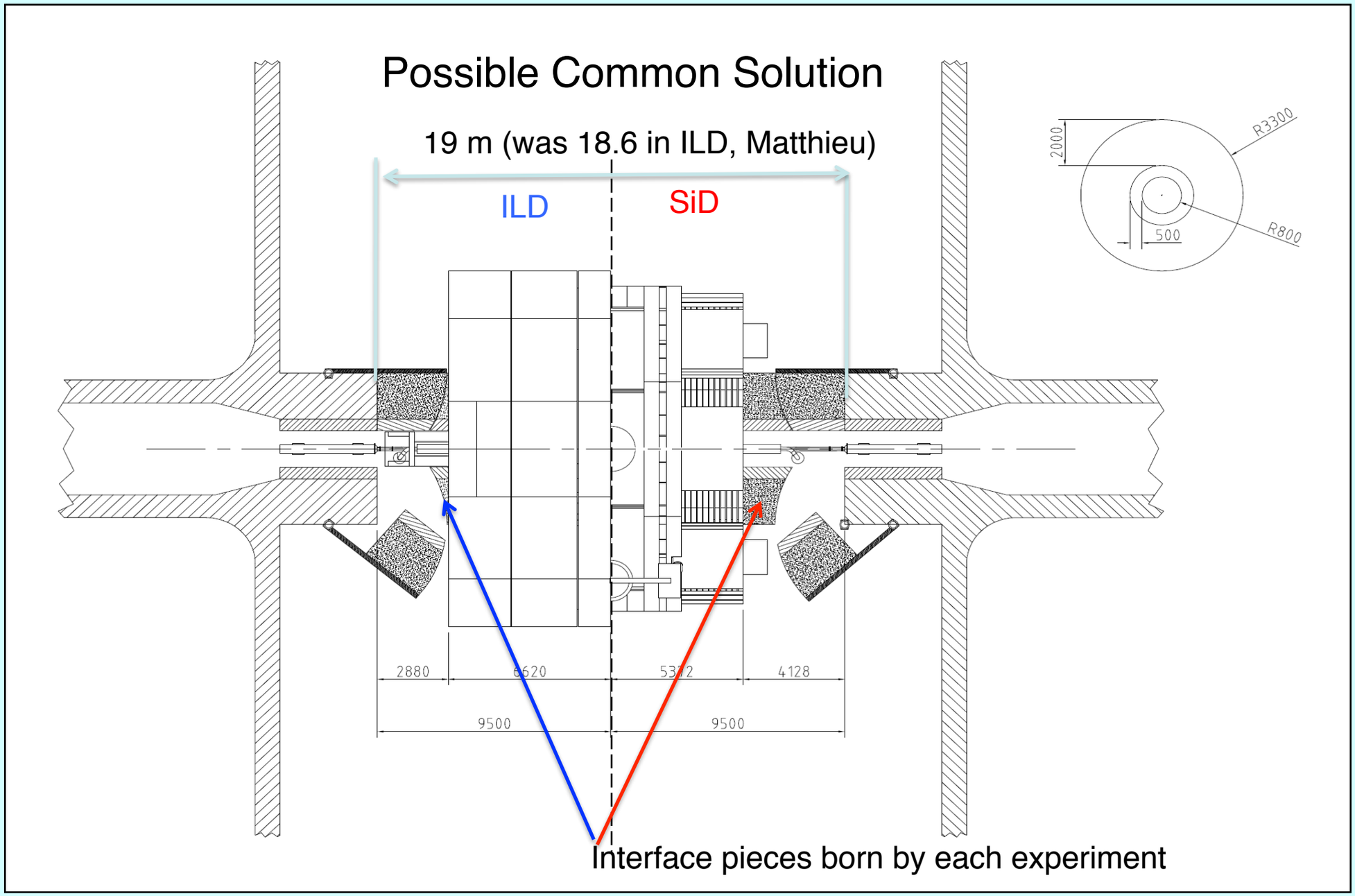
SiD-ILD-BDS Discussions

Alain Hervé spent two months this summer at SLAC to discuss with SiD and ILC-BDS people. Klaus Sinram joined them for two weeks:

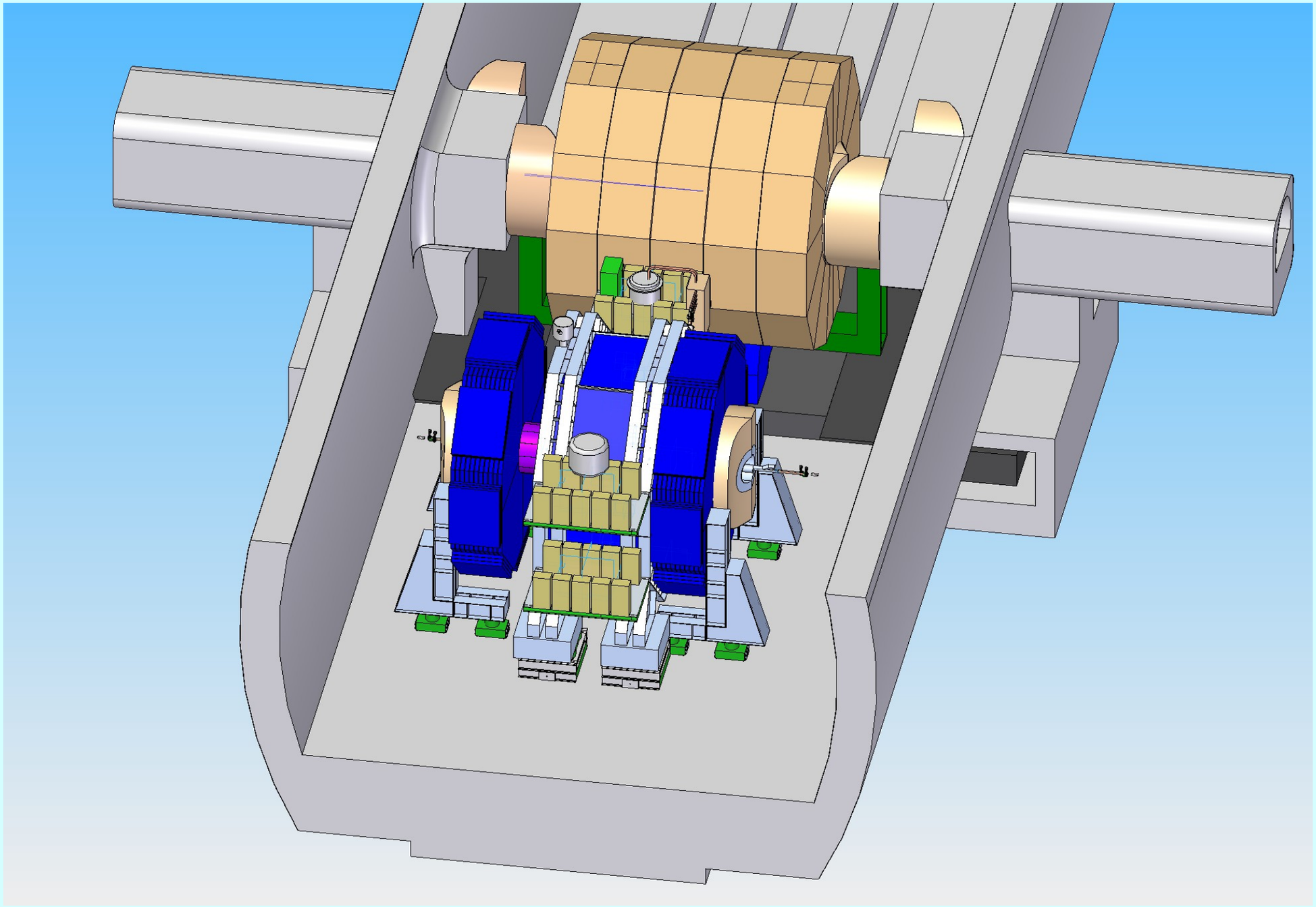
- Ways to get to a common IR hall design where
  - ILD moves on a platform
  - SiD does not
- Common push-pull system
- Common shielding („pacman“) design
- Implications on the interface with the beam delivery system
  - Final focus magnets supports and alignement
- Impressive progress in a relative short time!

Possible Common Pacman Design

A. Hervé:



Common Hall Design Study



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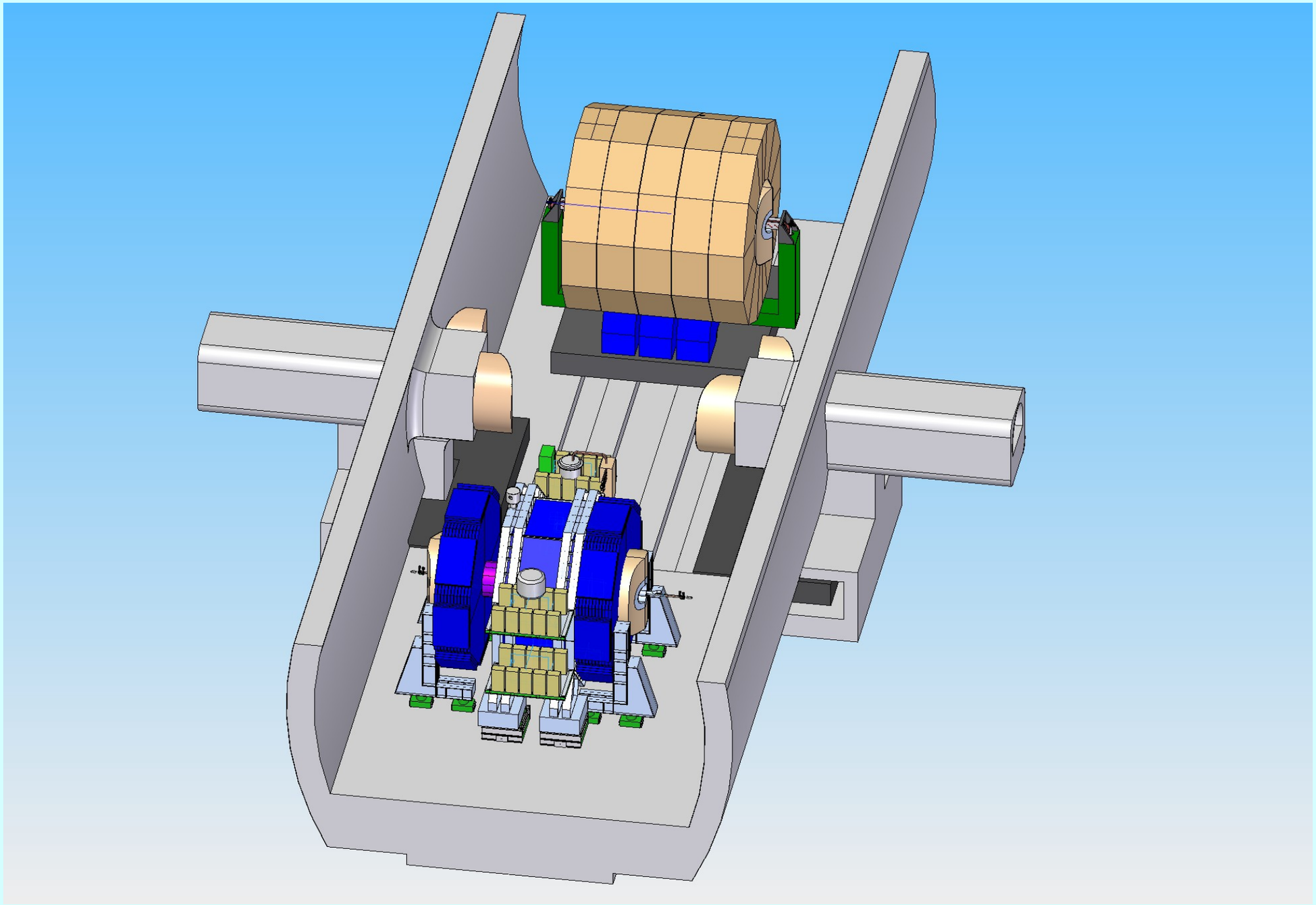

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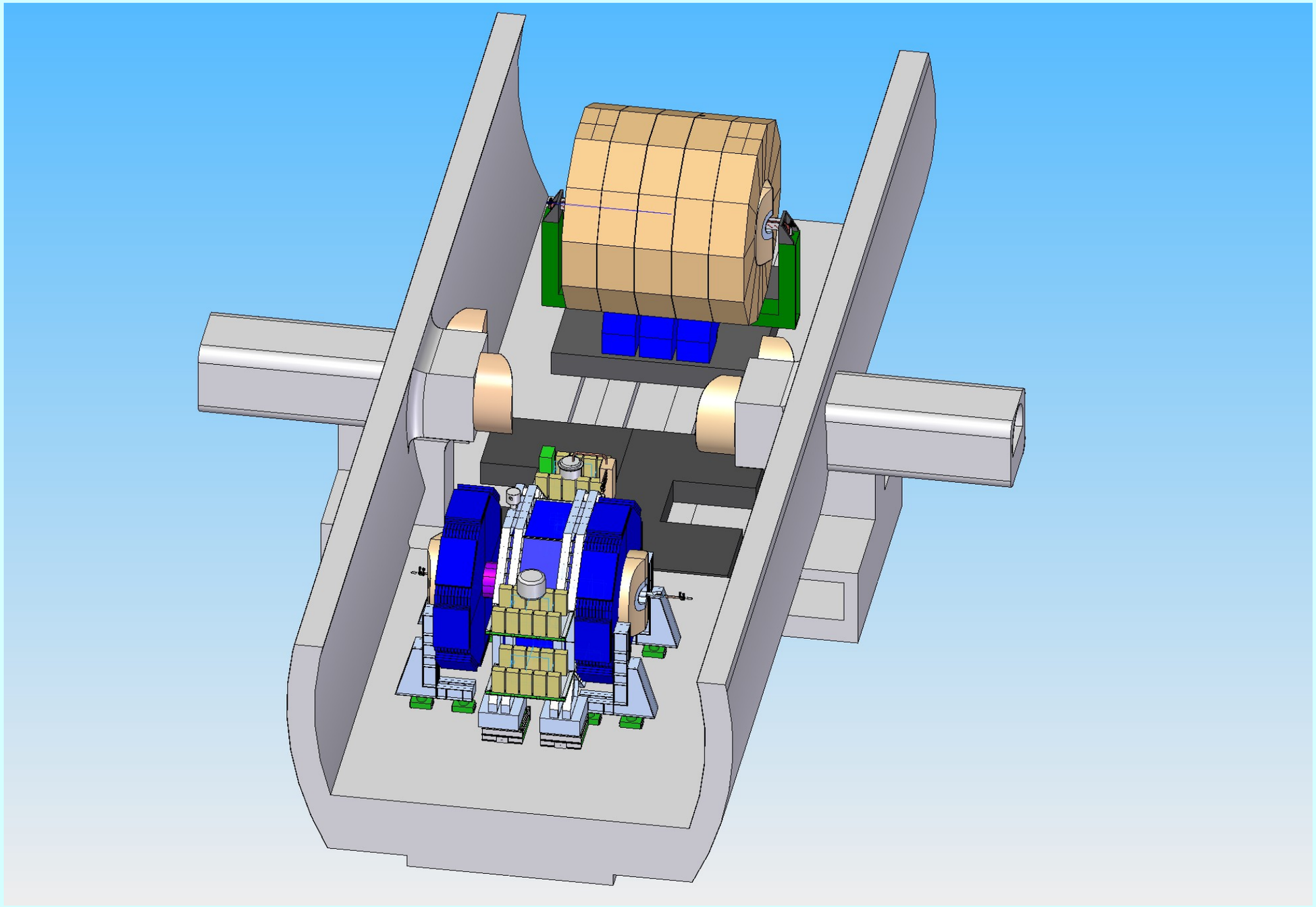

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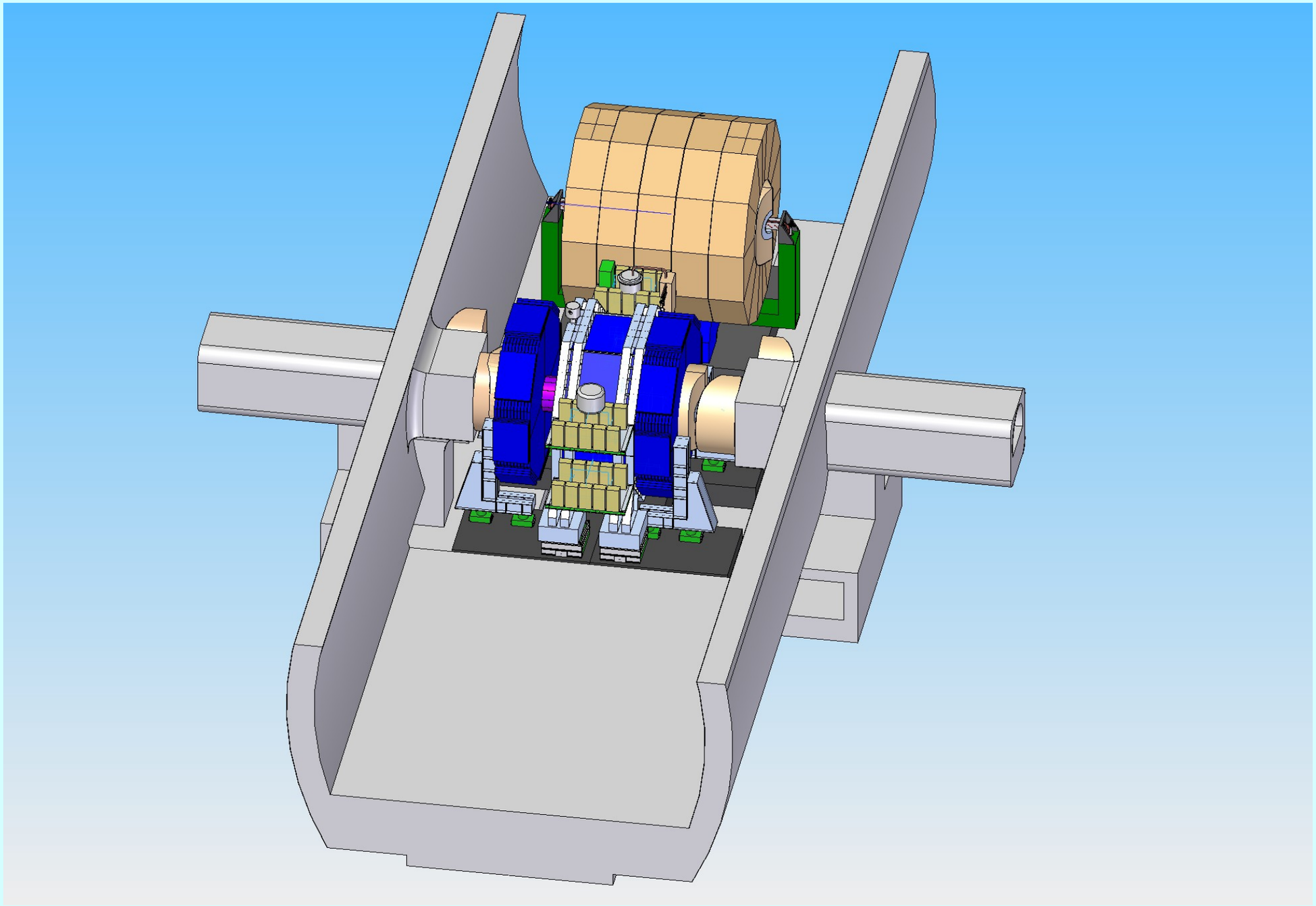


How to Proceed

- All agree that it would be easier if both experiments would choose the same push-pull vehicle: platform or not
- It needs to be studied which solution would be better in terms of vibration issues
- This is important especially for the support of the QD0 magnets
- Need to study the full stack:
  - Ground → Platform → Support→ Experiment → QD0 Support

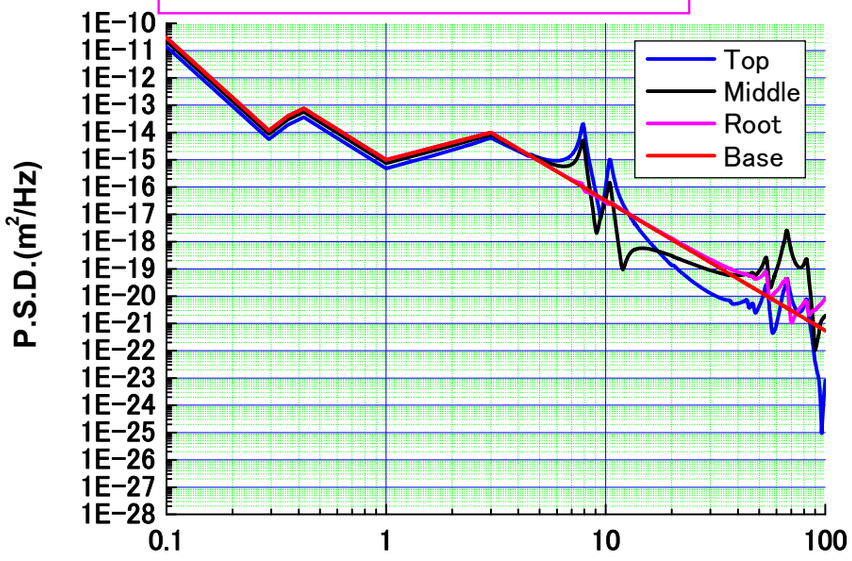
- KEK colleagues volunteered to model ILD and also CMS (for comparison) for FEM analysis
- CERN colleagues will measure vibrations around CMS (ground, floor, tunnel-to-tunnel)
- KEK colleagues will measure vibrations at KEK-B and ND280

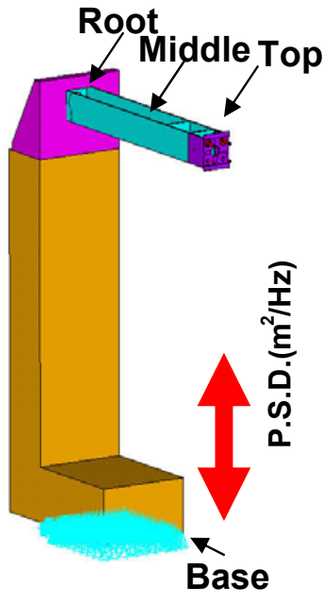
- Try to optimise the QD0 support using the results

QD0 Support Vibration Analysis

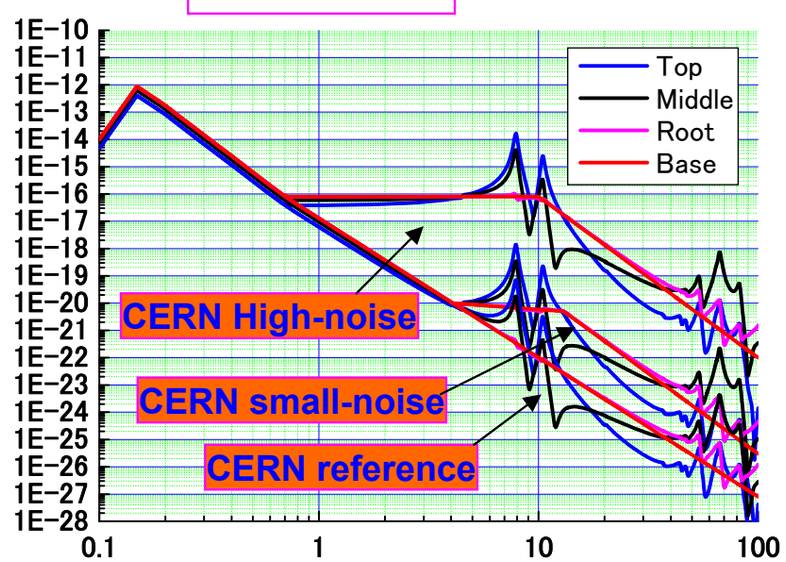
Calculation results: *Vertical direction*

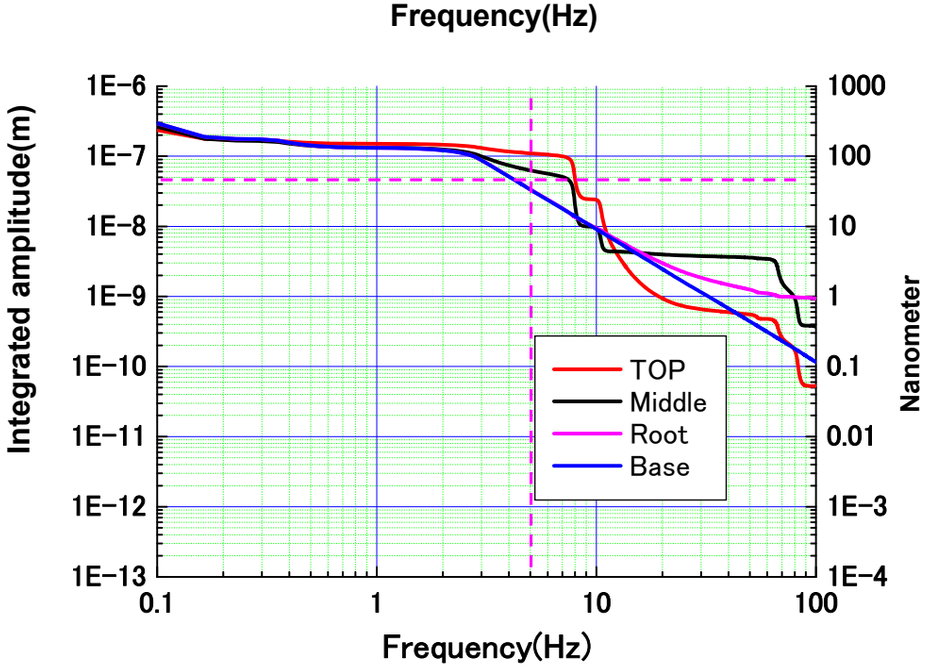
ATF-2004Feb10-17:00UD

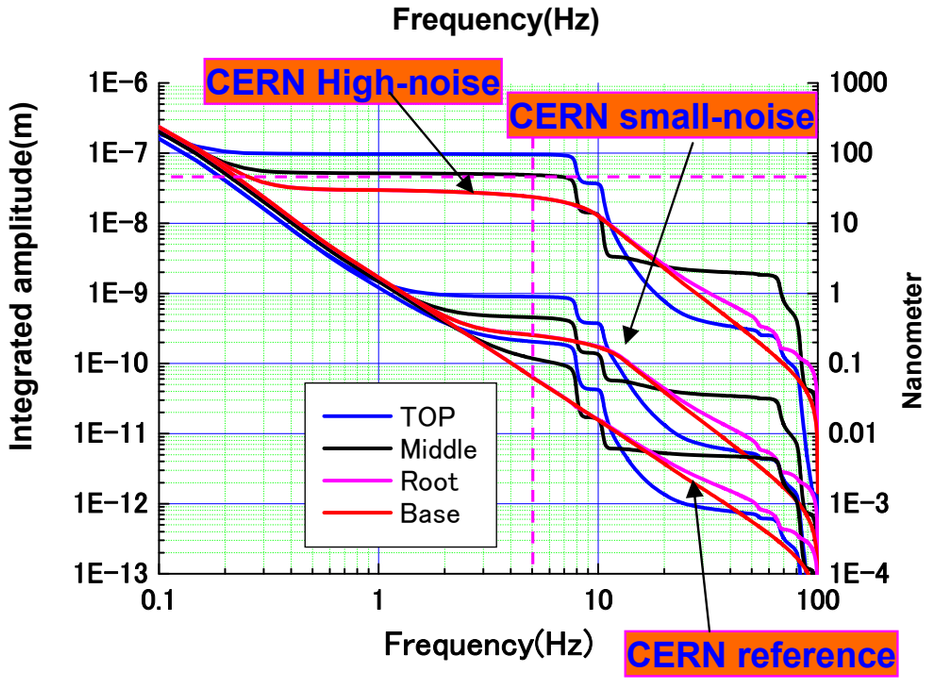




CERN-Data







➔ **Integrated amplitude at 5Hz: Larger than 50nm.(ATF, CERN High)**
Much smaller than 50nm(CERN small, Reference)

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H. Yamaoka

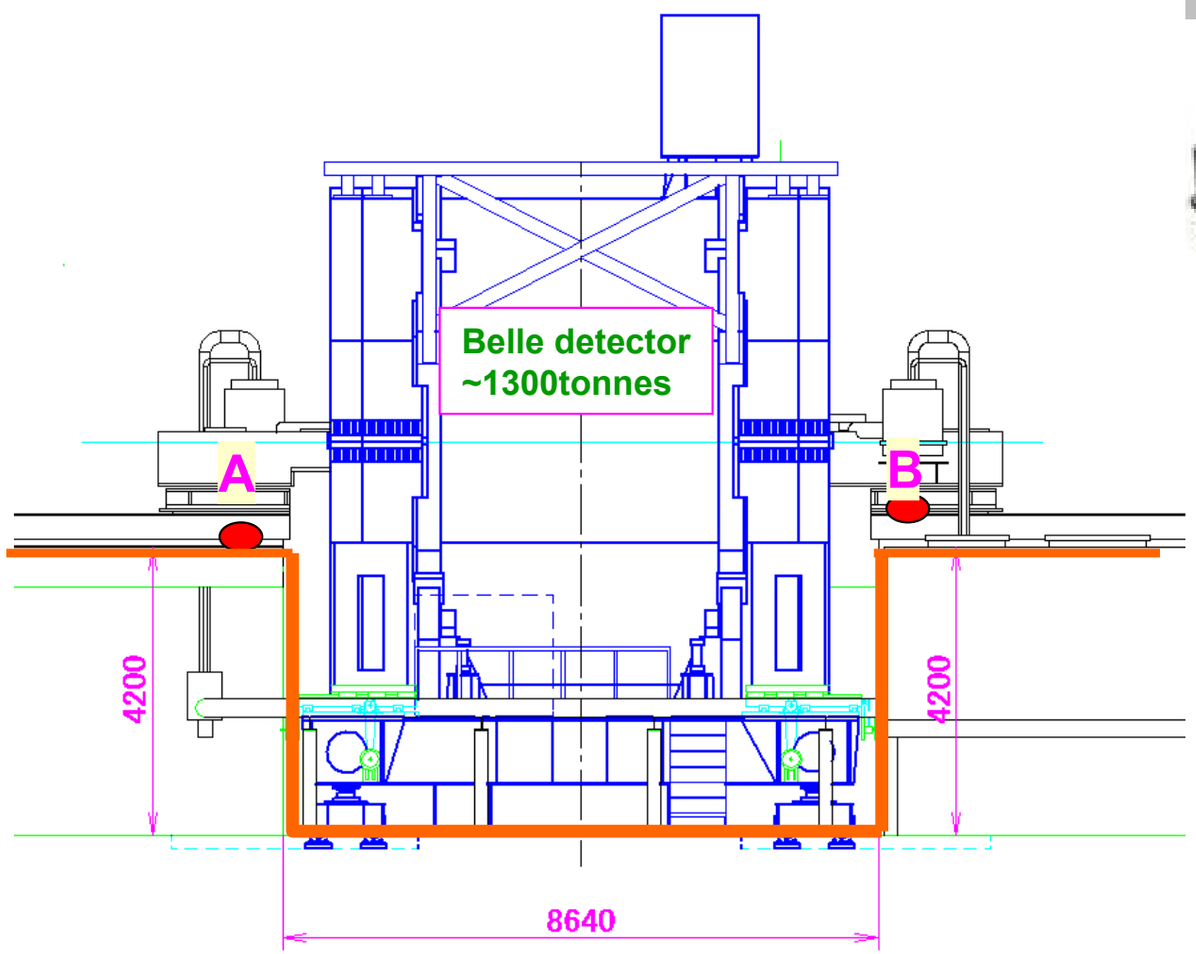
Vibration Studies Cont.

Coherency measurement at KEKB-tunnel

Measurement: A

How is the coherency between the position-A and B?

These two points keep coherency??



Servo Accelerometer MG−102	Tokkyokiki Corp.
Size	40×40×50mm
Max. input	±2G
Resolution	1／10^6G

Acc. 0.1～400Hz
Acc. 60dB = 1gal/V

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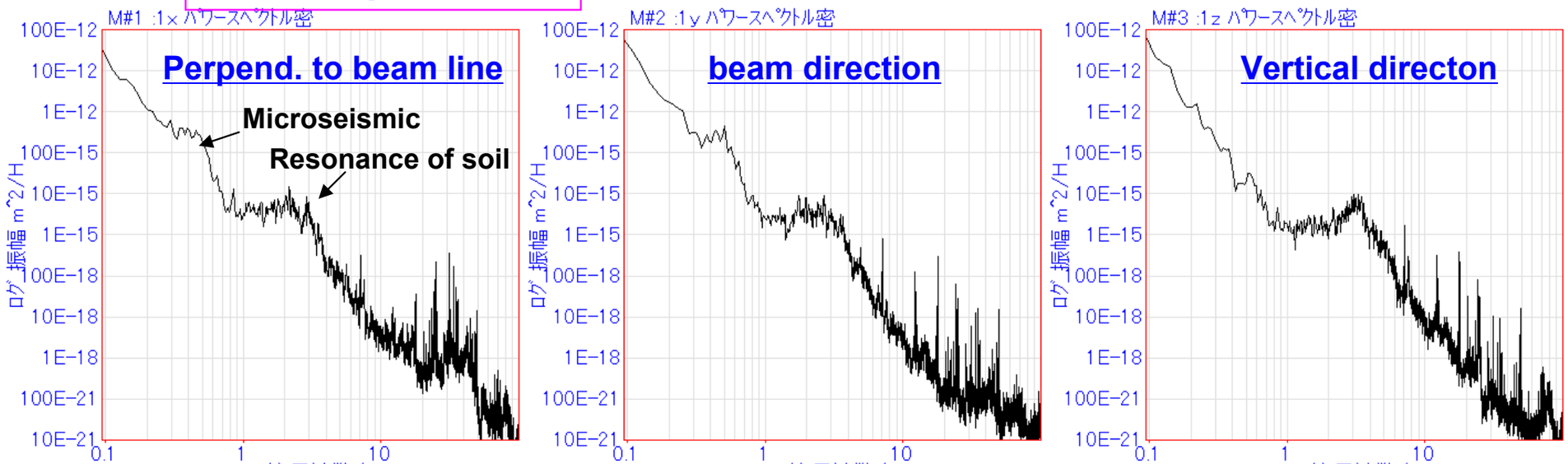
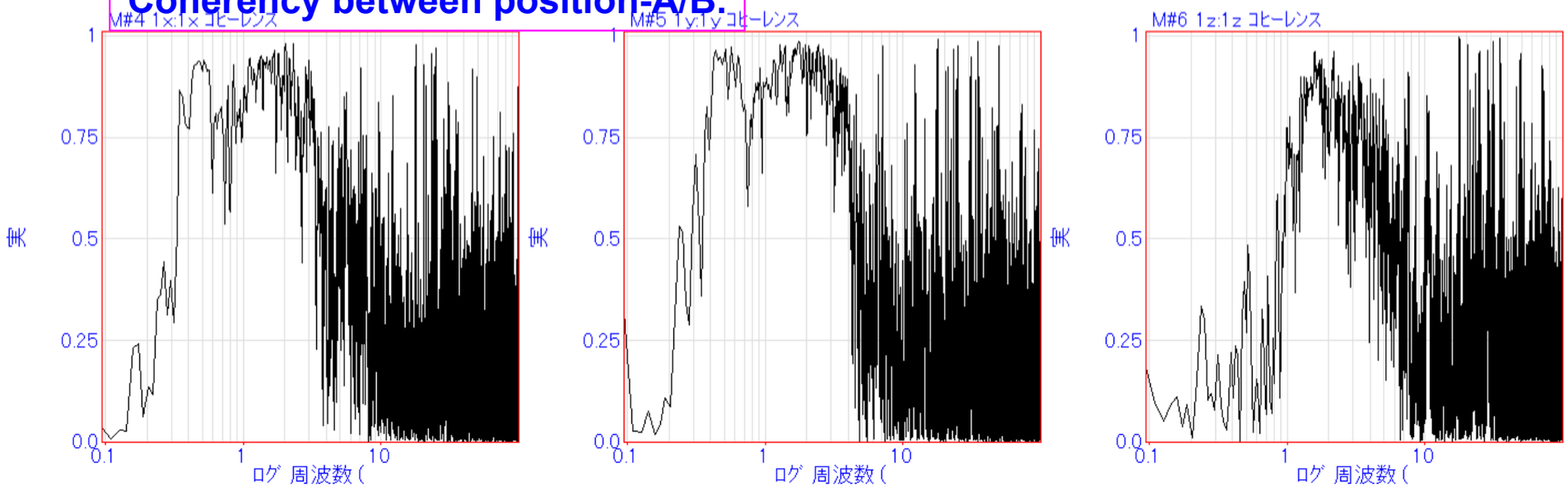
Vibration Studies Cont.

Results

P.S.D. at position-B.



Coherency between position-A/B.



➔ **It seems that there is no coherency between two positions.**

Except for the frequency of microseismic(0.XHz) and resonance of soil(~3Hz).

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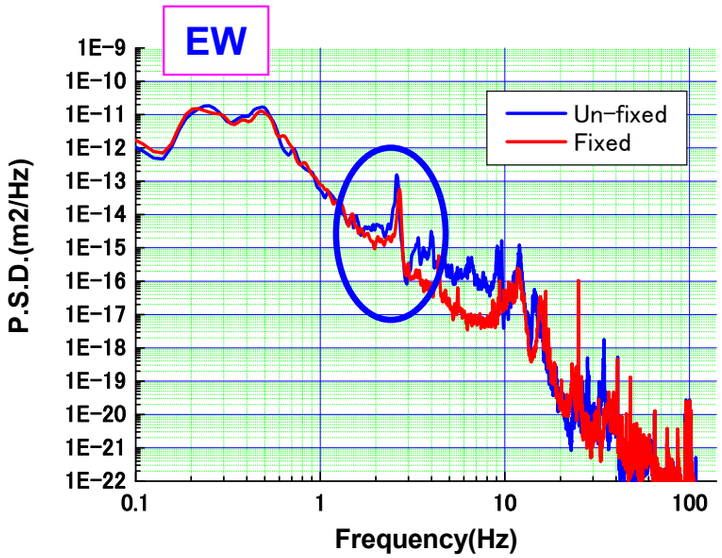
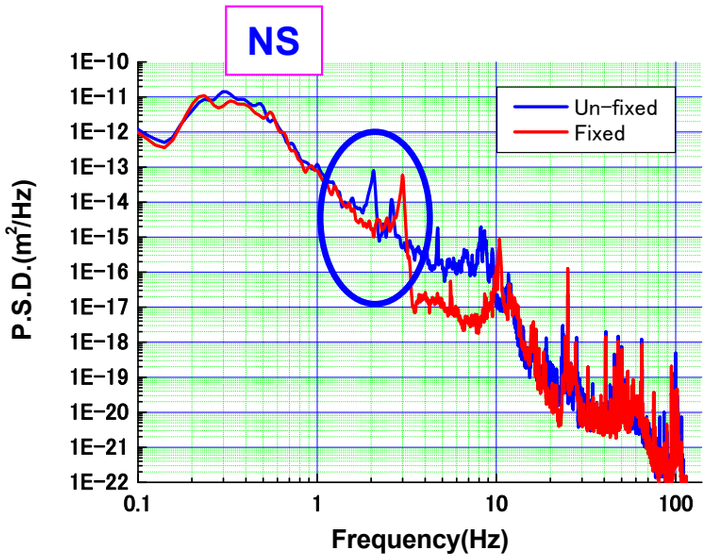
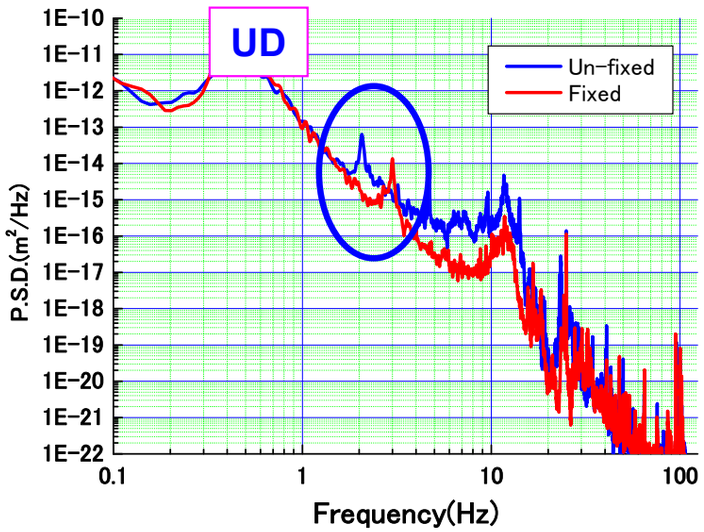
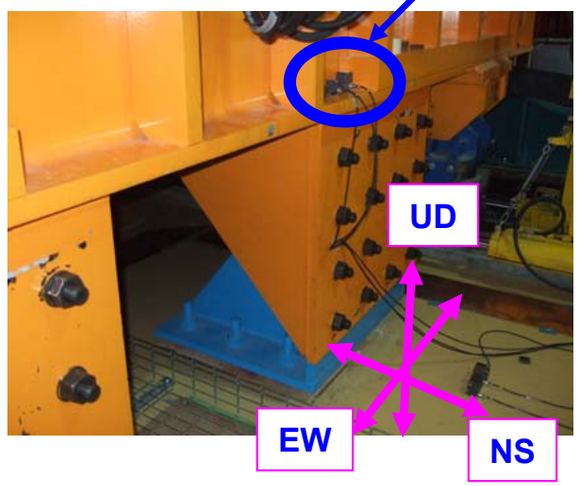
ND280 Measurements









→ - Natural frequency after fixed to the bracket is increased to ~1Hz(NS, UD).
- P.S.D. is reduced because natural frequency is increased.

➔ Support stiffness is increased.

➔ It is not so big different but it's efficient to use the support-brackets.

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It helps to fix the detector to the floor.

CERN Measurements

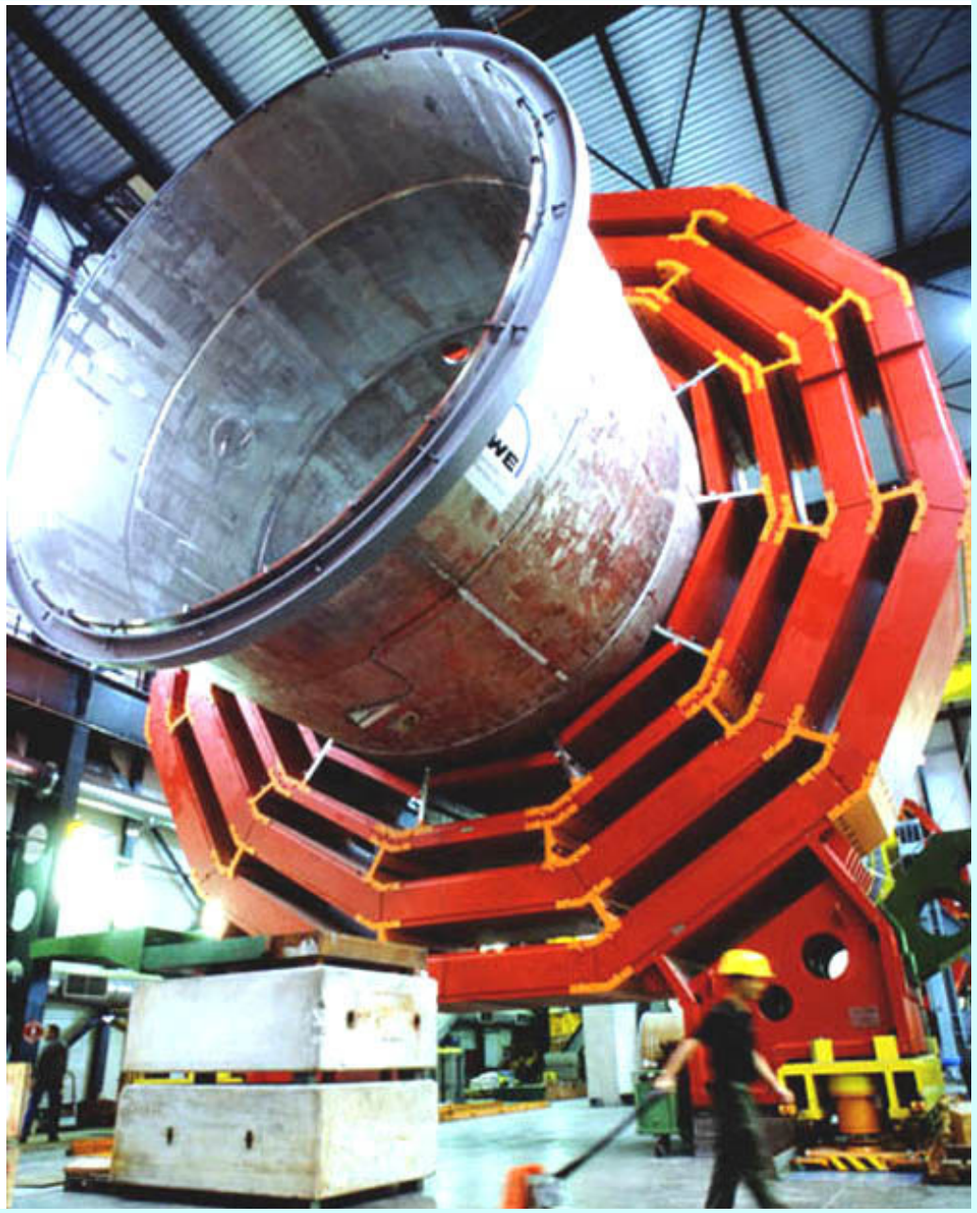
CMS Measurements:

- On top of barrel yoke ring
- On top of endcap ring
- On top of HF tower
- At the extremity of the Rotating Shielding (pacman)
- On and around the plug

- All w.r.t the local ground vibration

- Measurements on the cryostat are also important

- Results expected soon



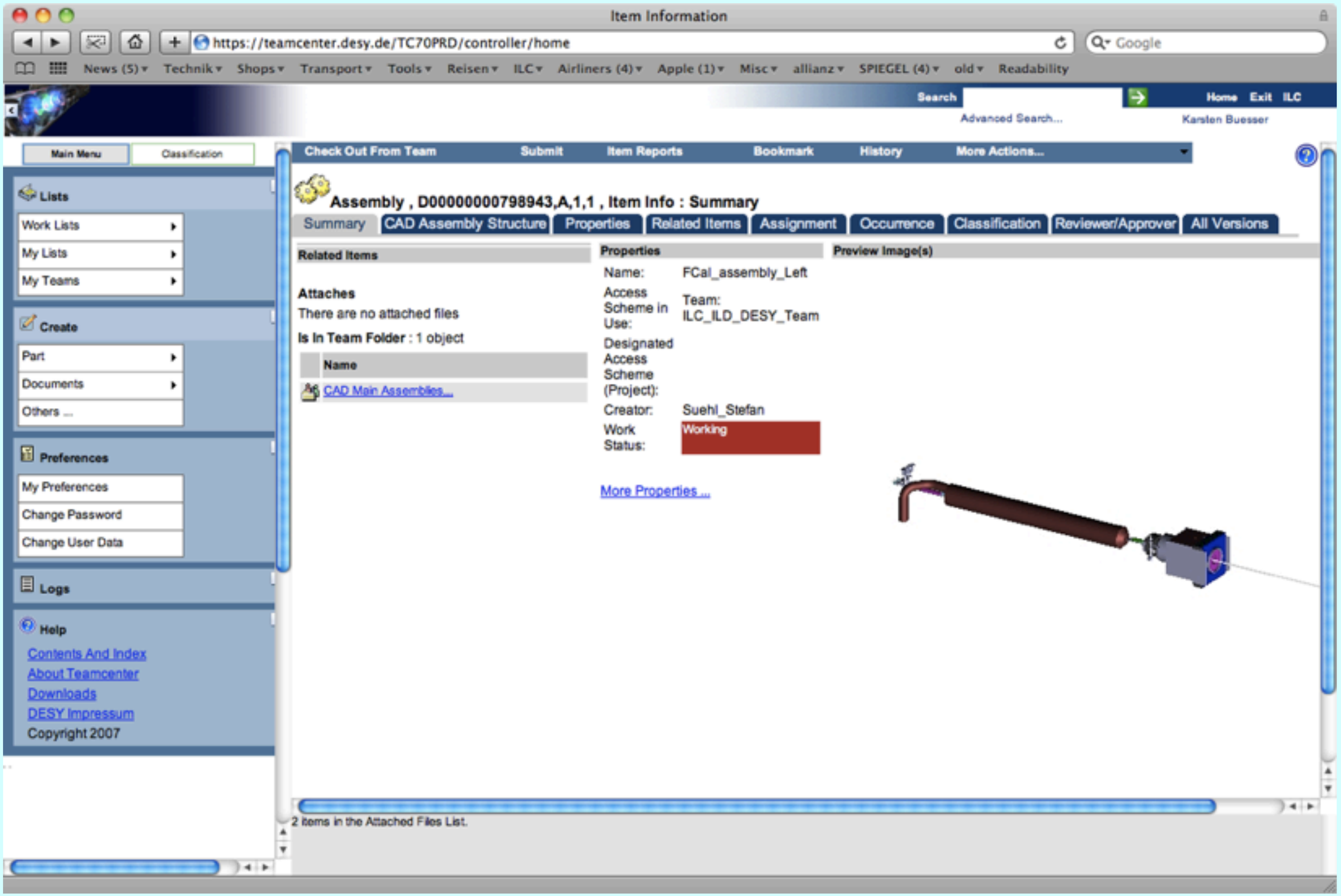
EDMS/CAD Meeting at DESY September 21/22

- Learn how to implement the ILD CAD model kept by Matthieu Joré into the ILC EDMS system
- Discussed strategies on how to share models efficiently
- Global ILD CAD model will define working space for subdetectors
- Detailed models and specifications will be linked in EDMS

- EDMS access is only really useful for experts (needs training etc.)
- Webpage interface for all in ILD will be done, e.g. on www.ilcild.org
  - Access to all released documents via EDMS-Direct

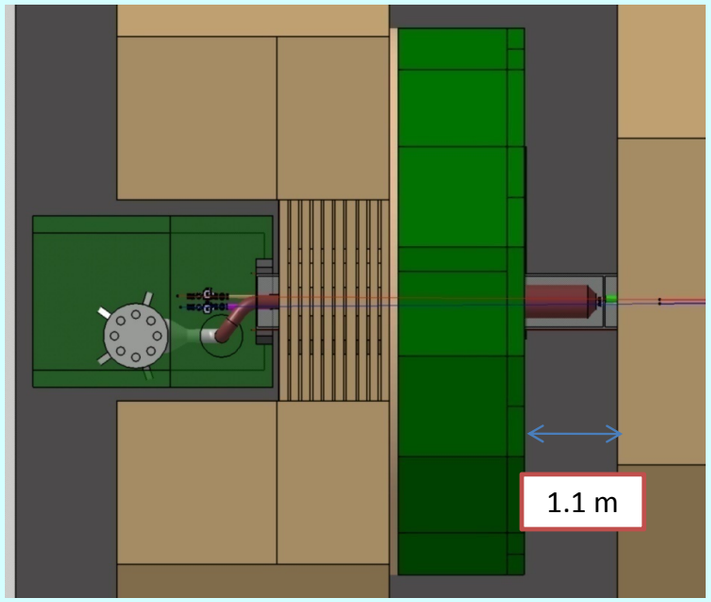
- Support from DESY experts (Lars Hagge et al.) available

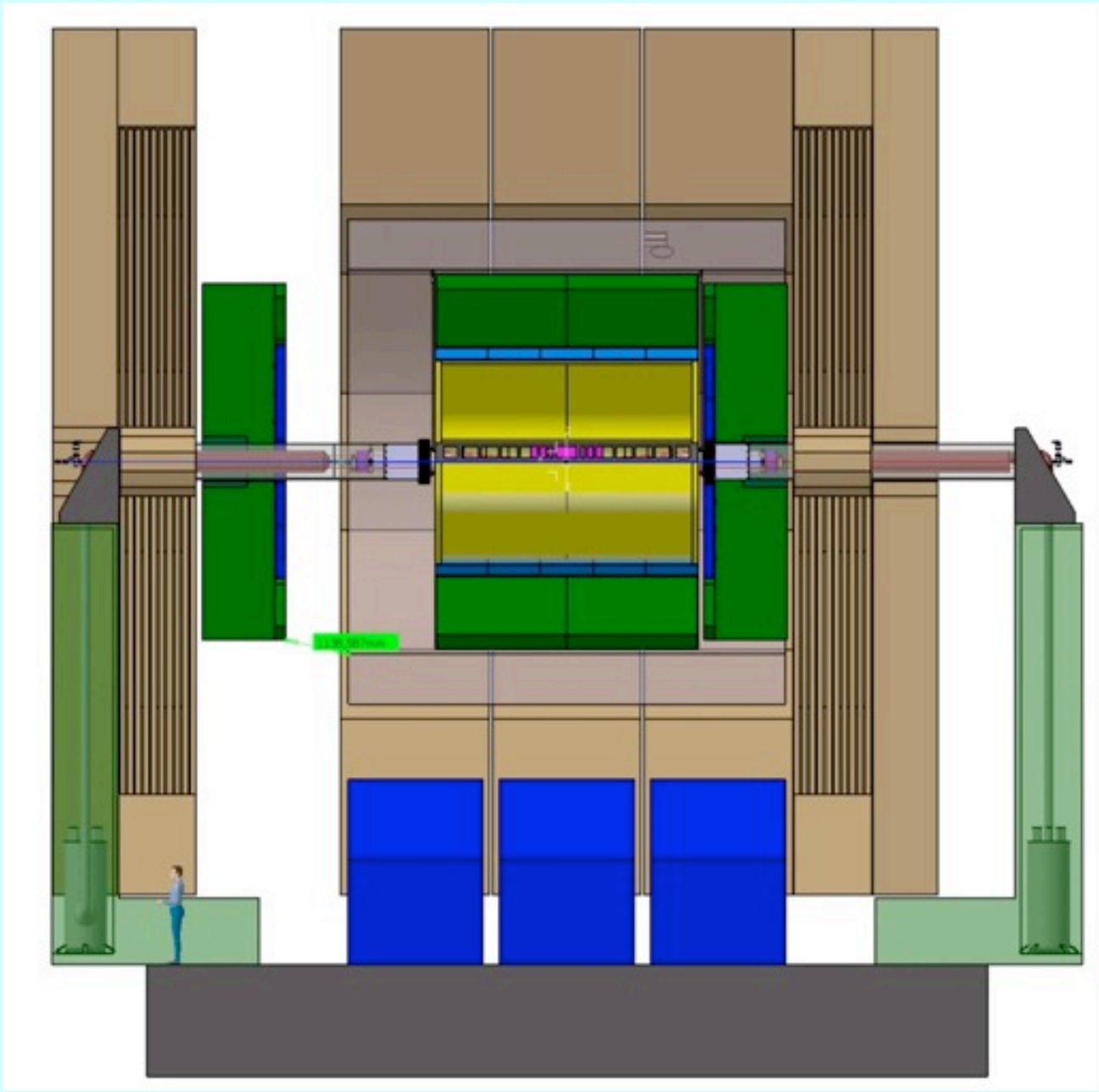
ILD CAD in ILC-EDMS



Opening on the Beam (- or not)?

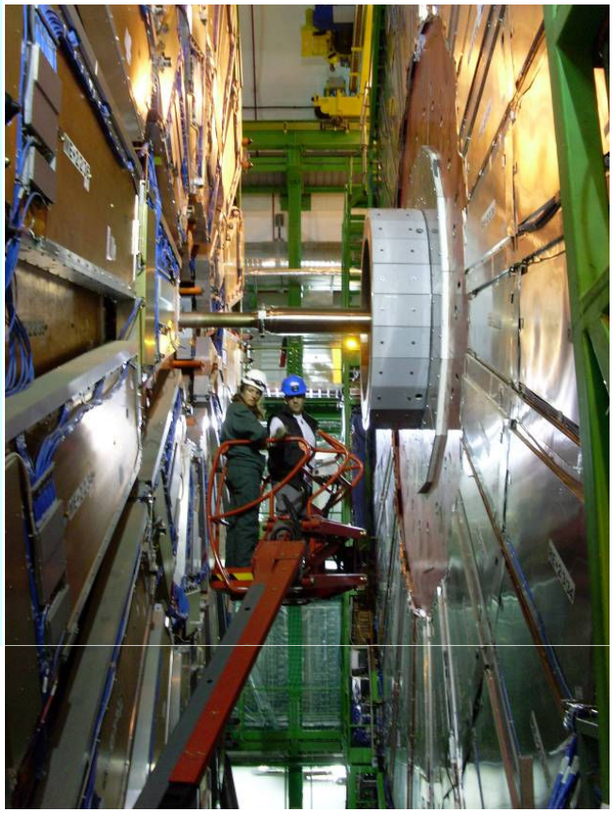
- Present design foresees opening of the detector on the beam:
  - Partially split endcap yoke allows ~1m wide access space between coil and endcap calorimeters
  - Allows for limited maintenance in the beam position(?)
  - Every major work would be done in the parking position - push pull!
- But:
  - A real engineering challenge which puts hard boundary conditions on many other things





Tools for Access

CMS Experience: it is not trivial to access a 1m wide space several meters above the floor (beam height is at 9m).



➢Small size cradle elevator (used for small interventions) :

Needed place between endcap and barrel : 1.6 m

The overall size on floor of engine is 1.3 m

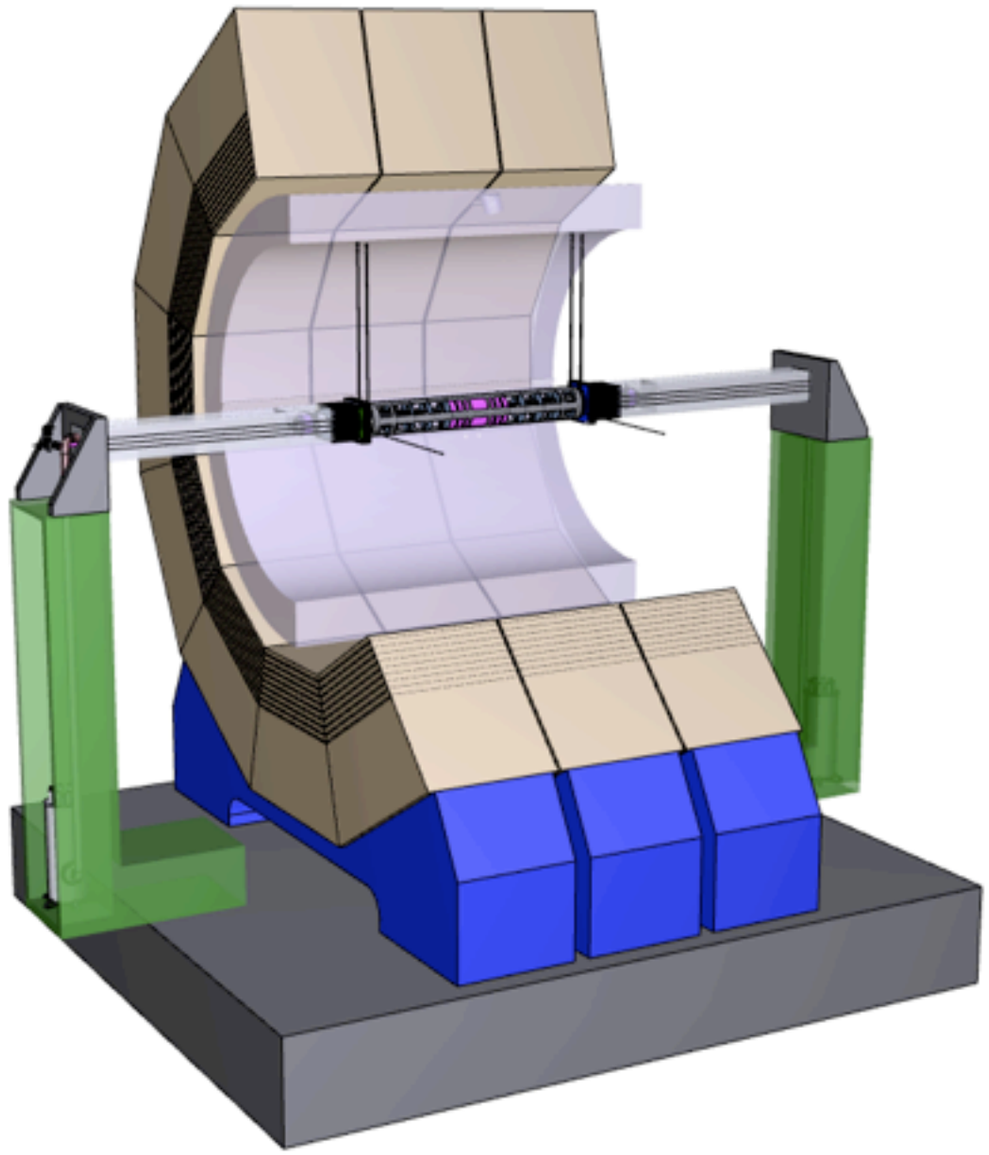
➢Crane truck (allowing heavier operation up to ≈full height) :

1.5 m on floor, 2 m needed for motion

+ On surface :
Scaffolding
Fixed and moveable

QD0 Support

- Movable yoke endcap makes QD0 support complicated
- QD0 supported by pillar outside of the detector and suspended on tie rods from the cryostat
- Monitored by MONALISA, placed on actuators for alignment
- Vibration issues are under study



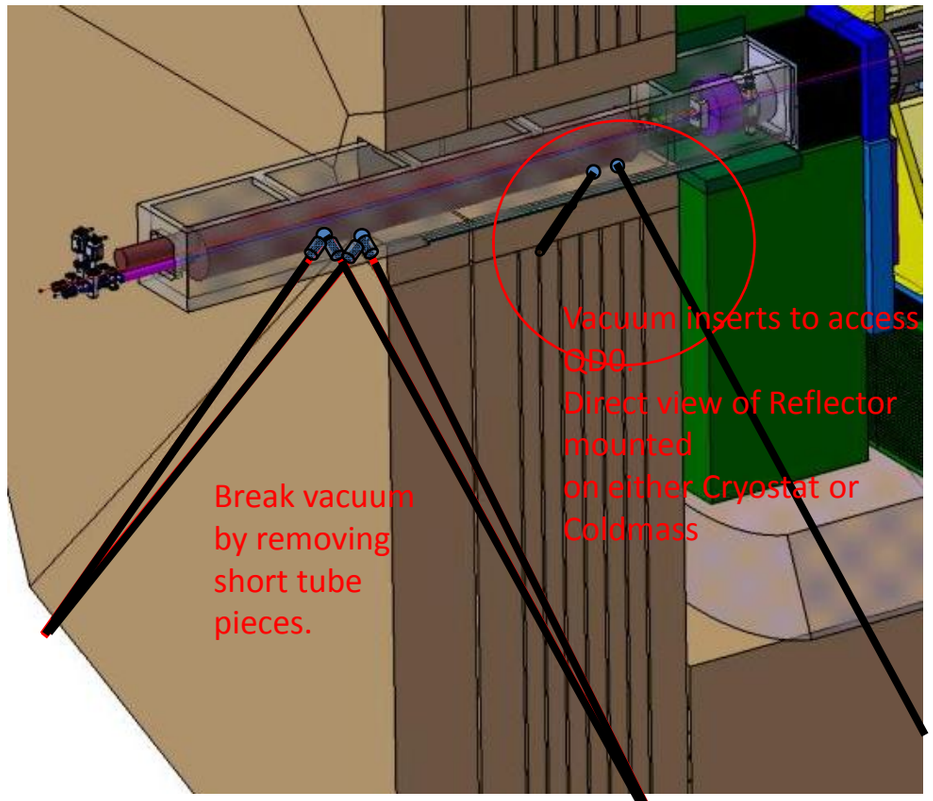
MONALISA Integration

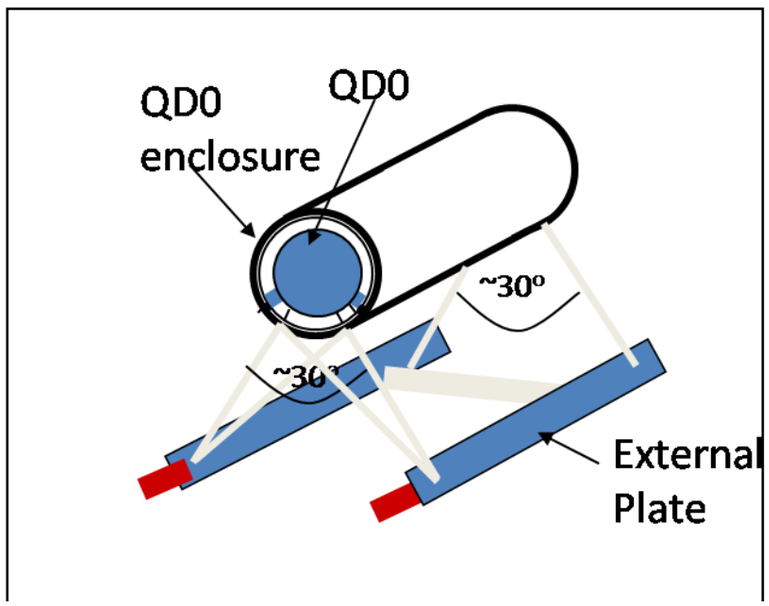
- MONALISA requires vacuum pipes for laser beams attached to QD0
- Need to be disconnected remotely controlled when the endcap is opened
- Needs a lot of engineering work

Case of Monalisa :

Final Doublet Stability and in-detector Interferometry

- 4 entries on one side,
- 2 on the other side,
- Lines going under the detector



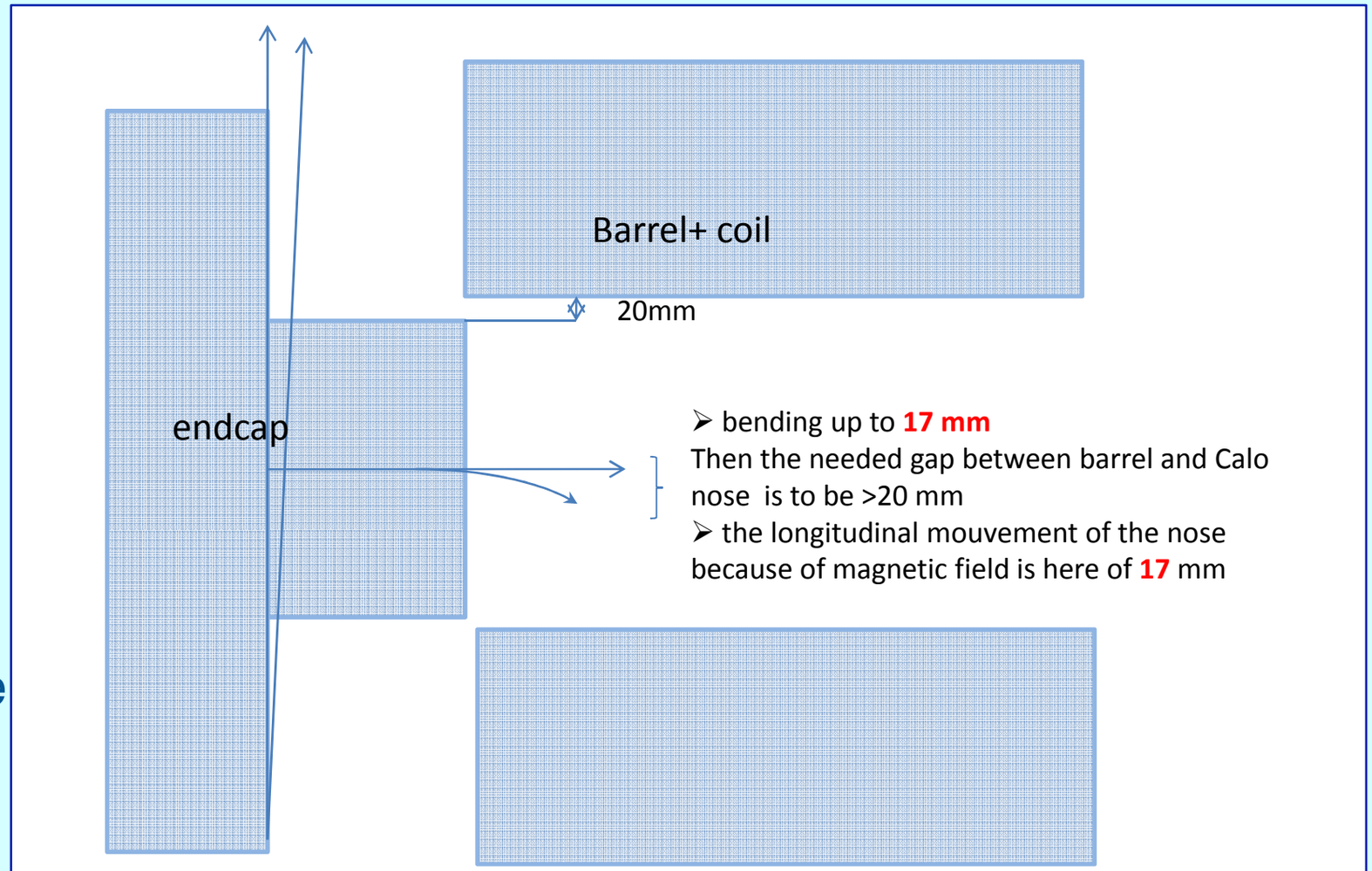


- It is an interferometric metrology system for continuous monitoring of position critical accelerator components
- Consists of a fixed network of evacuated interferometric distance meters with nanometre type resolutions over O(10m)

See David Urner's talk at LCSW08

More CMS Experience

- Endcap deformations are in the order of 15mm
  - Will be better at ILD
- Ground deformations during movements can reach 5mm at a scale of 2m.
- Time for closing of the endcap is in the order of 1.5 days (sic!)
  - Has not been done very often so far. Learning-curve effects are expected
- Moving 3000t pieces in a delicate environment (beam pipe is 1mm) is not trivial and needs throrough engineering



To Open or Not to Open (on the beam)

- From the engineering point of view it would be much simpler to do maintenance on the detector only in the parking position
  - Push-pull will bring the detector to the parking position in one day
- Question to all of us:
  - What do we really gain if we design the detector for the opening of the end-cap on the beam?
- Keep in mind:
  - Access space is VERY limited
  - Only limited access to TPC endplate, barrel and endcap calorimeters
  - No access to inner detector (VTX, SIT, FTD, etc.)
  - CMS experience: opening time for the endcaps could be in the order of one day!
  - „When people are moving heavy pieces in these conditions (...), they become extra careful as any accident has dramatic implications.“ (A. Hervé)
  - Engineering resources are EXTREMELY rare in ILD. If we spend many on the endcap we might miss them somewhere else
- Questions to be answered:
  - What maintenance could be done on your subdetector during this limited access?
  - How much luminosity would we loose if we wait with the maintenance until we pull out?
  - What is the lumi-loss risk with the more complicated opening scenario?

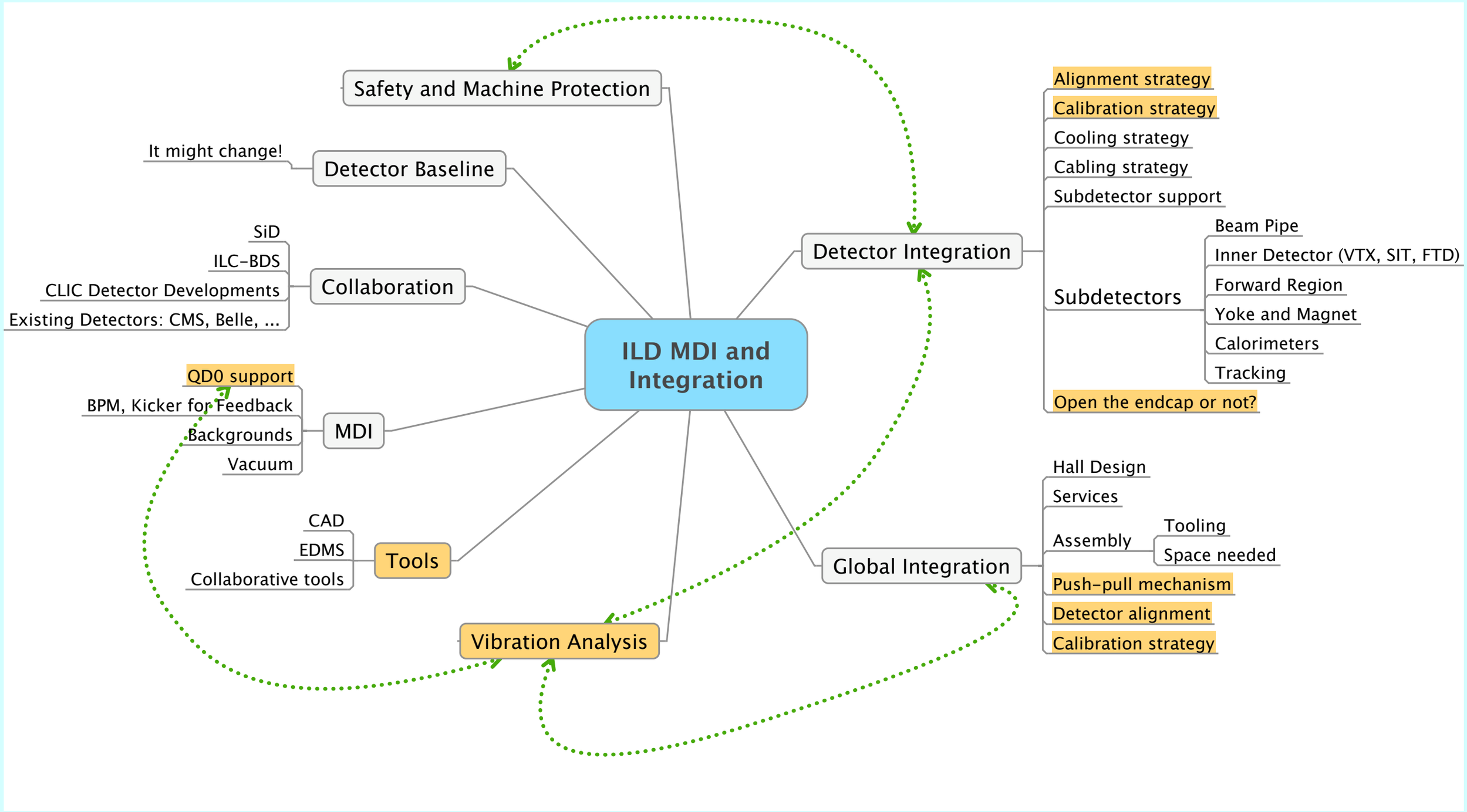
To open or not?

- Suggestion: collect arguments now and try to have a structured discussion at the ILD workshop in Paris

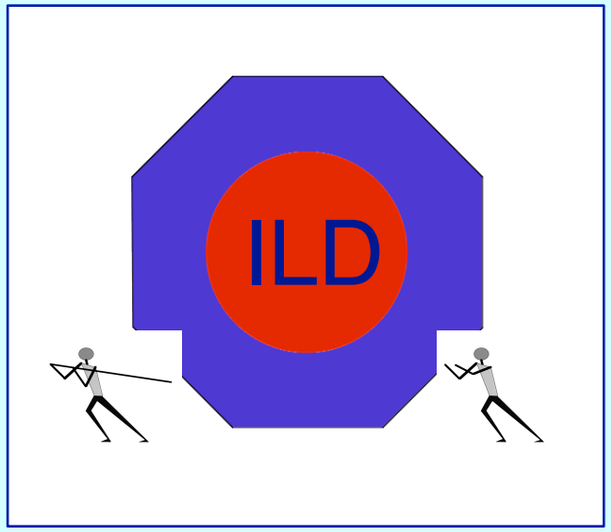
- Comments reveived so far:
  - „Keep it simple, we can get more sophisticated when the machine has been approved.“
  - „Think about the potential problems now so that they will not hit us later“
  - „Do not mix maintenance procedures with push-pull issues. Maintenance is ILD-internal, while push-pull involves the other detector as well.“

- Please continue to send comments and be prepared for Paris

The MDI/Integration MindMap (preliminary)



- Yellow: most urgent tasks from the global integration viewpoint

Summary

- We are still in the process of understanding what really needs to be done at the timescale of 2012
- ALCPG meeting should be a starting point for discussion on stabilities with BDS and SiD
- Relations of tasks is getting clearer
- Milestones have not been defined yet, first draft expected for ILD workshop in Paris
- Resources are very limited - need to concentrate on really important items
- Plan to have an MDI/Integration pre-meeting for the ILD workshop
  - Preferably one full day right in advance of the workshop, depends on availabilities of rooms, etc. Catherine Clerc volunteered to organise.