Opening the Endcaps at the IP(?)

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international linear collider

ILD Workshop

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- 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

1.1 m

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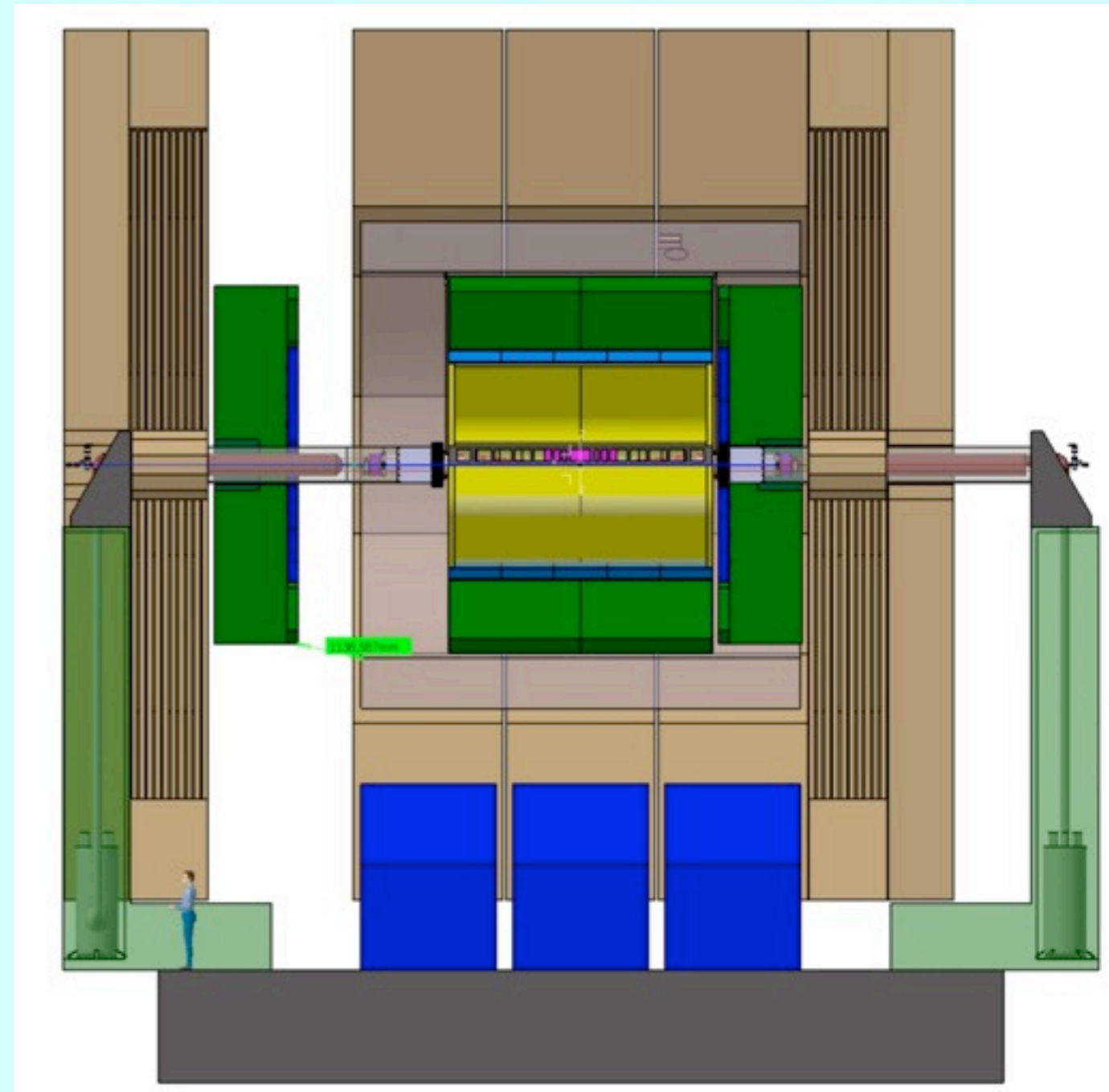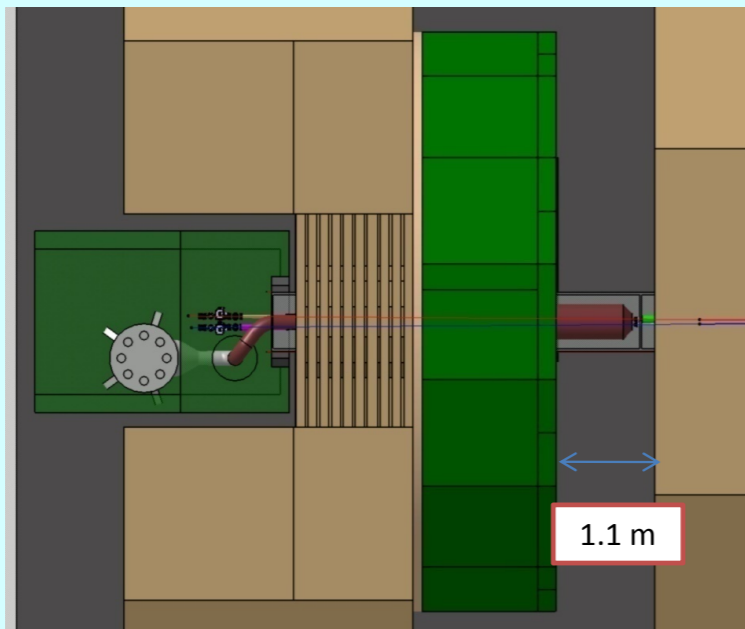
CMS Experience: it is not trivial to access a 1m wide space several meters above the floor (beam height is at 9m).

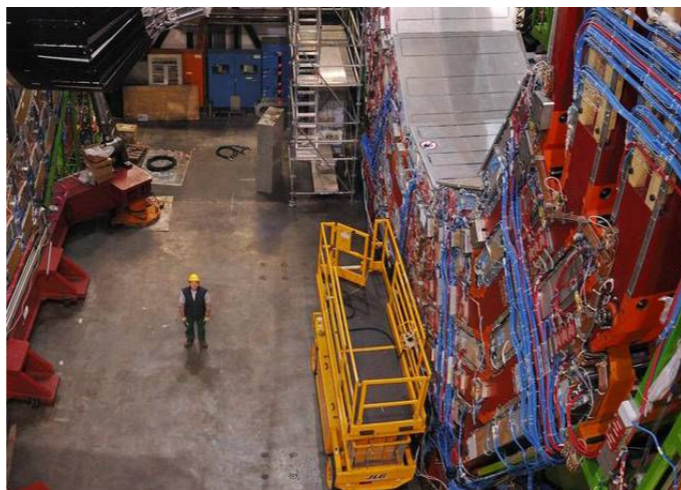➢Small size cradle elevator (used for small interventions) :

   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 :
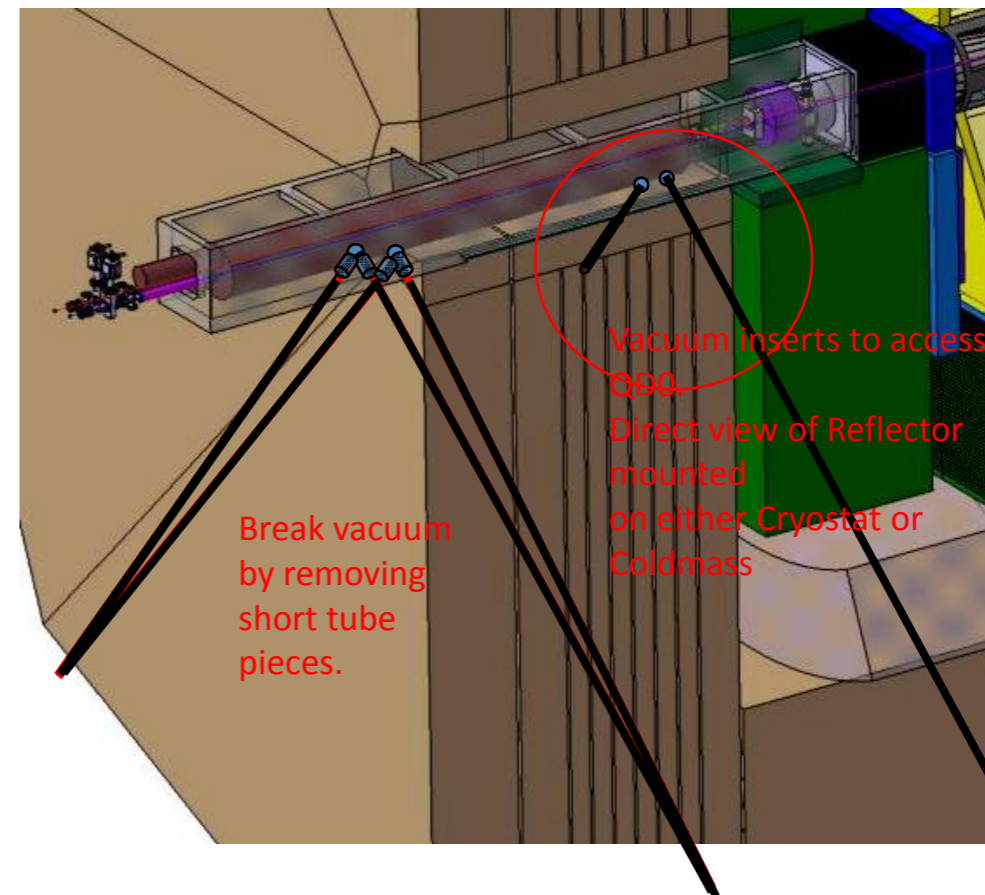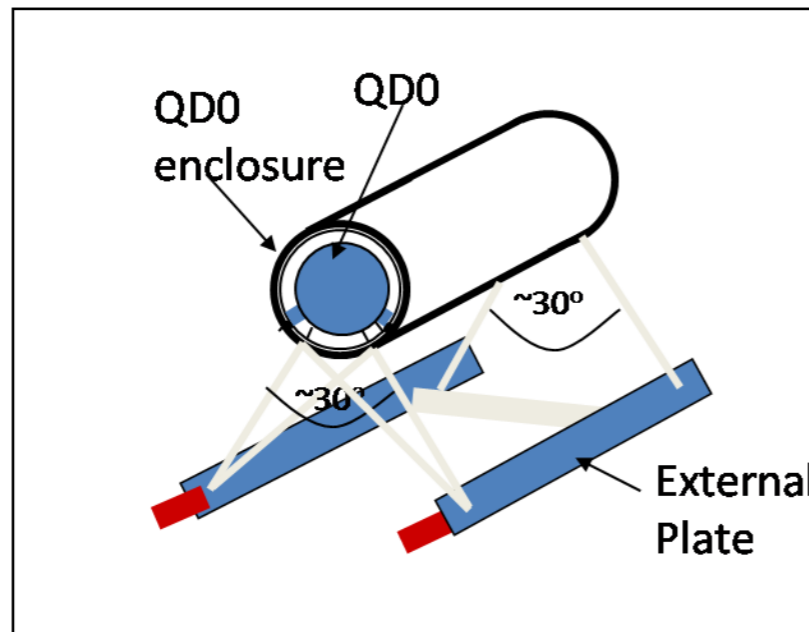Scaffolding
Fixed and
moveable

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

- Alternative QD0 support ideas are under study

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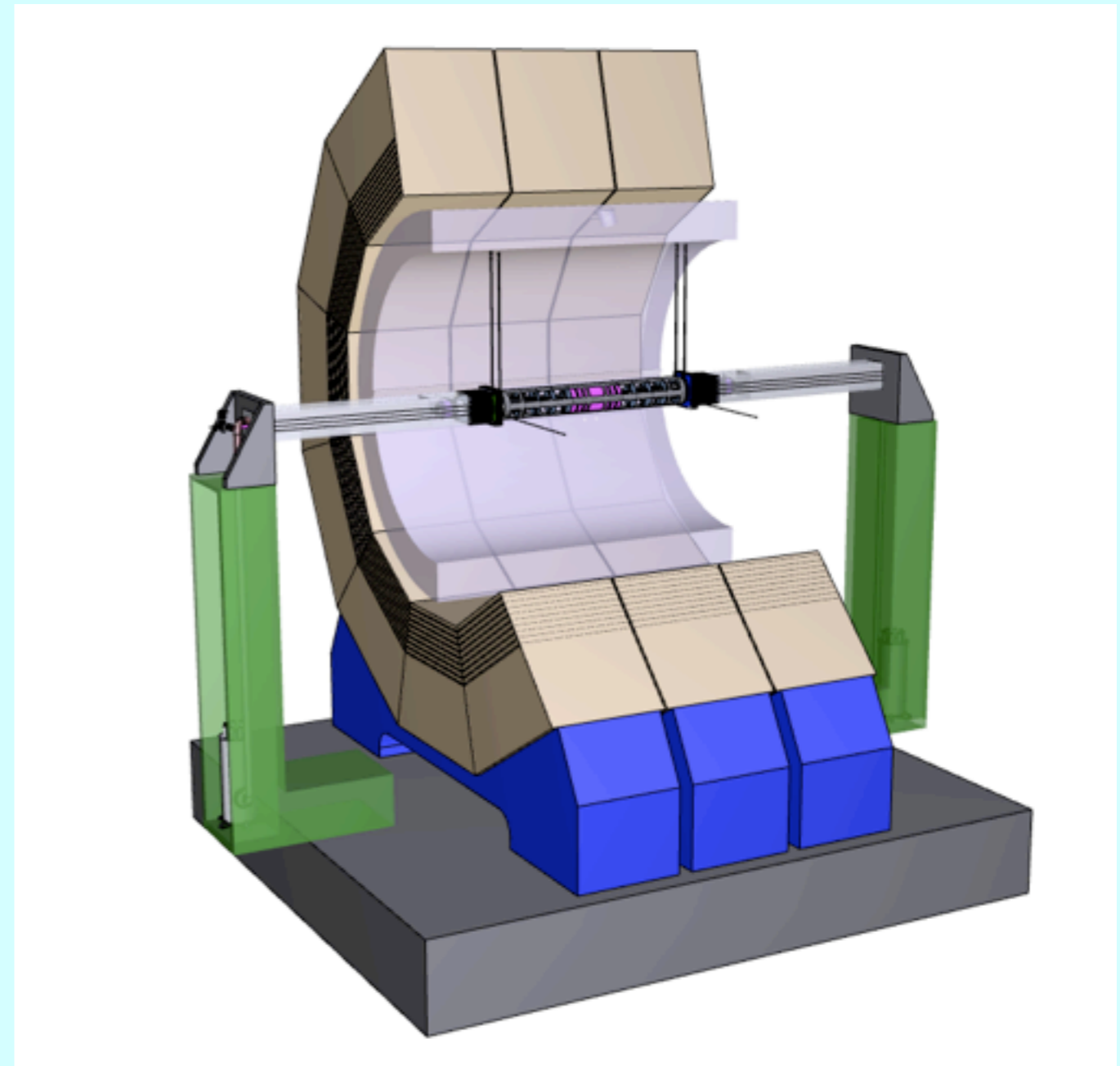
- MONALISA requires vacuum pipes for laser beams attached to QD0
- Need to be disconnected remotely controlled when the endcap is opened
- Needs a lot of engineering work

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

Vacuum inserts to access QD0
Direct view of Reflector mounted
on either Cryostat or Coldmass

Break vacuum by removing short tube pieces.

QD0
QD0 enclosure

~30°

~30°

External Plate

- 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

- 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 effect is visible.

- Moving 3000t pieces in a delicate environment (beam pipe is 1mm) is not trivial and needs throrough engineering

Barrel+ coil

20mm

endcap

> bending up to **17 mm**
Then the needed gap between barrel and Calo nose is to be >20 mm
> the longitudinal mouvement of the nose because of magnetic field is here of **17** mm

✓ Vertical deformation ≈ **3 mrad** , i.e. 45 mm at 15 m
✓ Possible lateral misalignement : **13 mm**

During the closing of endcaps , the position is controled by laser monitoring (4 points) / beam tube
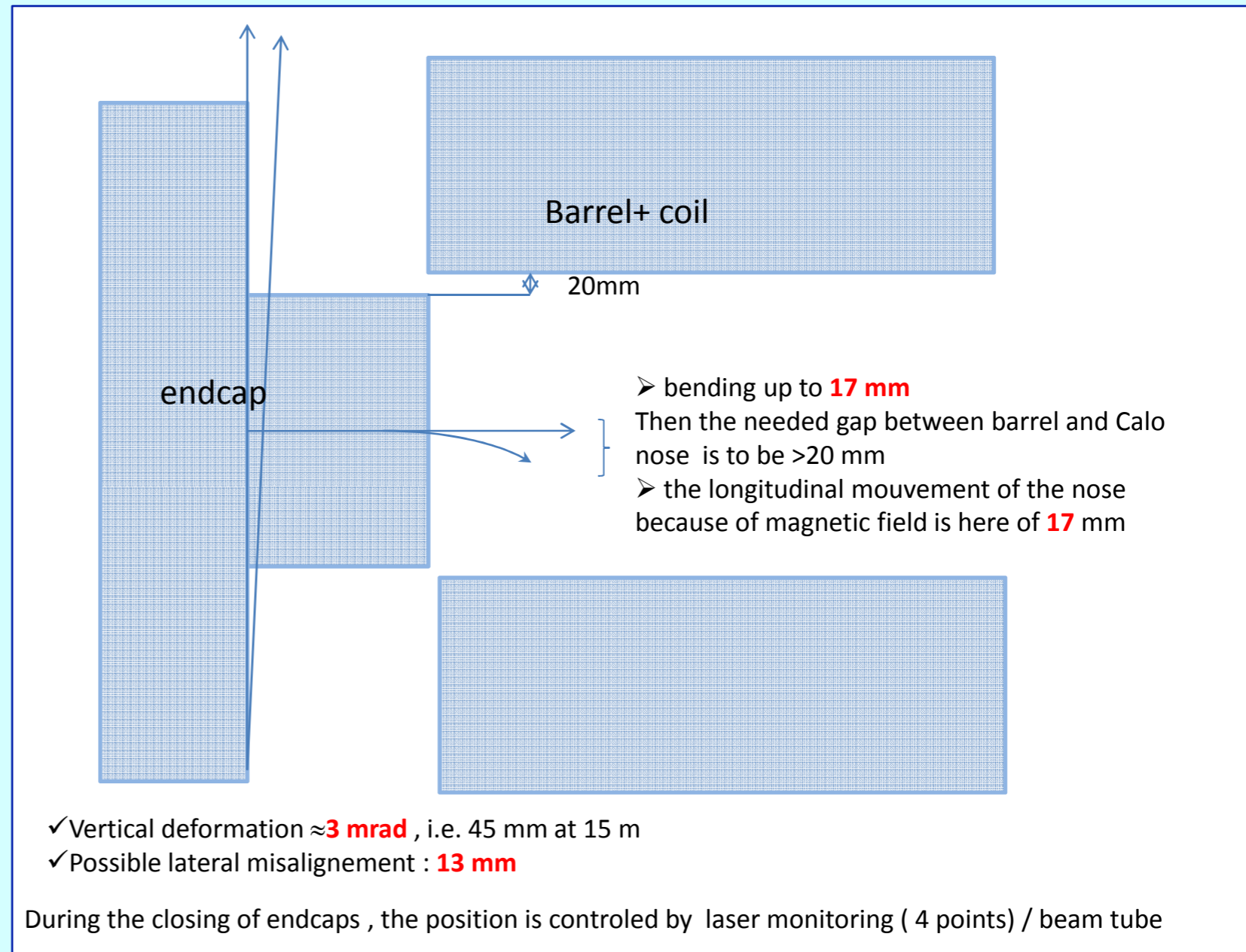
- From the engineering point of view it would be much simpler to do maintenance on the detector only in the parking position
  - Push-pull will bring the detector to the parking position in one day
- Question to all of us:
  - What do we really gain if we design the detector for the opening of the end-cap 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?

The Far Side....

- The art of engineering design seems sometimes to be miraculous to the outsider

- What looks like a good idea at some time might prove to be superfluous later

- Sometimes you need to know the history behind the visible....

- 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."

  - What do you need?

- Biggest problem: how do we decide on this or other topics?