Quo Vadis ?

N.Siegrist, H. Gerwig, A. Gaddi
CERN, PH Department

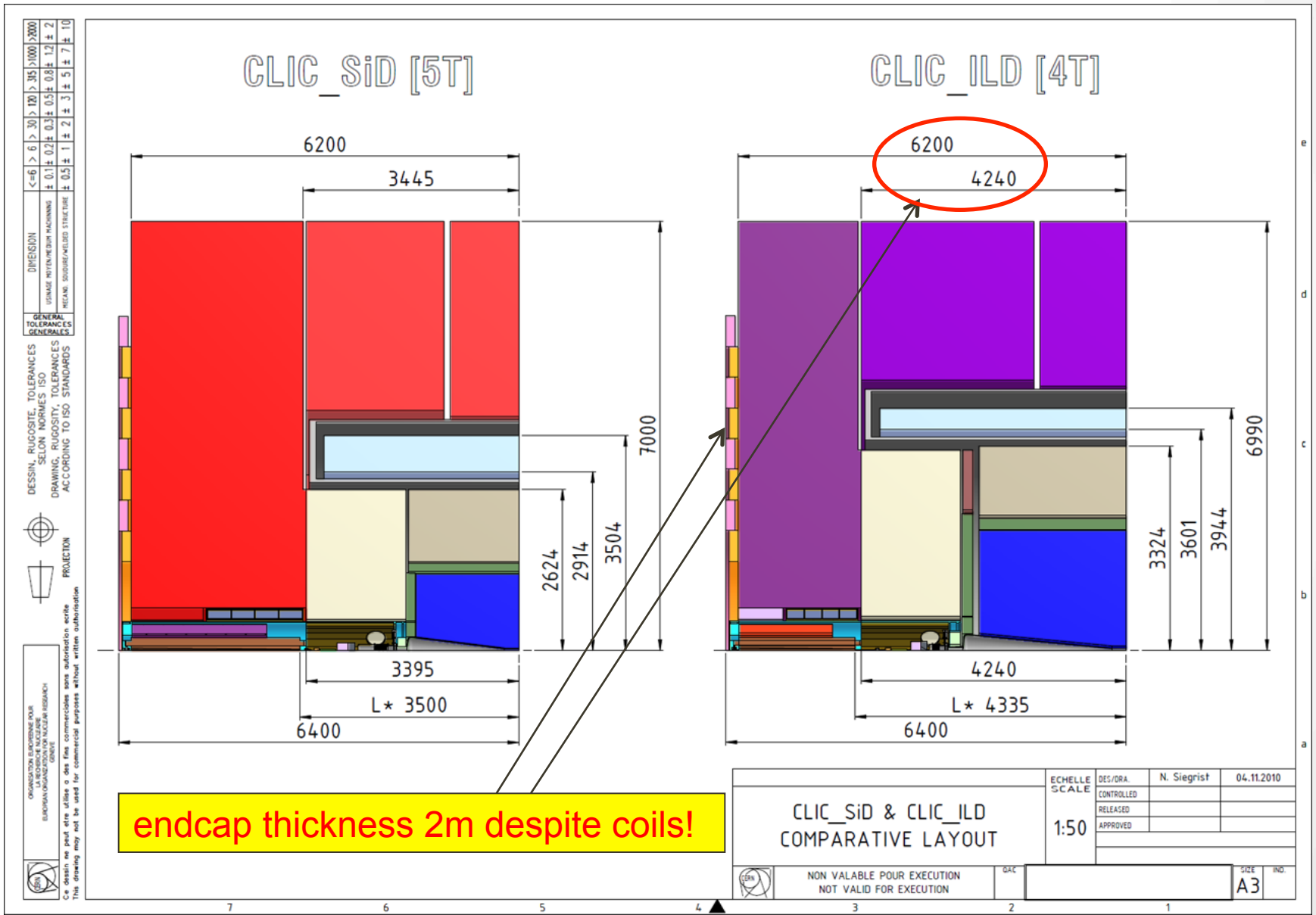
Outline

- Historical Review
- Practical Implications as a single detector
- Keeping unique engineering features
- Summary

Former boundary conditions

- Very short L* with qdo inside detector
- Two Detectors in push-pull mode
- Stringent requirements on fringe field
- Radiation self-shielding
- Similar length for both detectors needed

Former detector layouts



Former main dimensions

Table 11.1: Main dimensions and weights of both detectors

Parameter	CLIC_SiD	CLIC_ILD with end-coils
Magnetic Yoke length	12400 mm	12400 mm
Detector overall length	12800 mm	12800 mm
Detector diameter	14000 mm	14000 mm
Free bore inside vacuum tank	5488 mm	6852 mm
Coil inner diameter	5828 mm	7202 mm
Coil outer diameter	7008 mm	7888 mm
Coil length	6230 mm	7890 mm
Coil weight	201 tons	173 tons
Vacuum Tank weight	128 tons	173 tons
Radial height vacuum tank	1020 mm	828 mm
Vacuum Tank length	6690 mm	8350 mm
L*	**3500 mm**	**4340 mm**
Free bore in Endcap for support tube and anti-solenoid	1380 mm	1380 mm
Single Endcap weight	2900 tons	2100 tons
Barrel weight	5000 tons	4700 tons
Complete return yoke	10800 tons	8900 tons
Total weight of detector	**12500 tons**	**10800 tons**

Former civil engineering

Pit diameter:18 meter

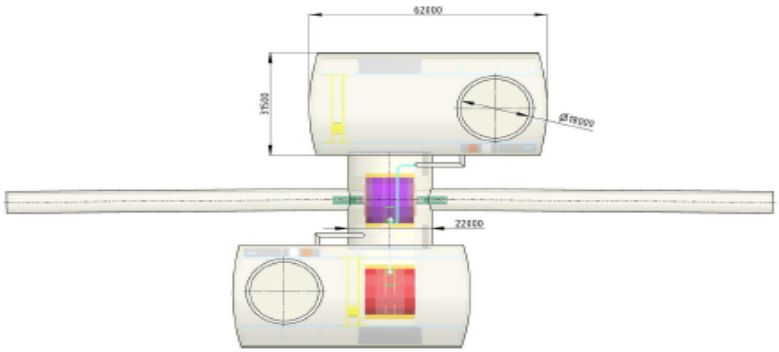


Fig. 11.11: Top view with dimensions.

UXC length: 62 meter

UXC width:31,5 meter

UXC height: 33,5 meter

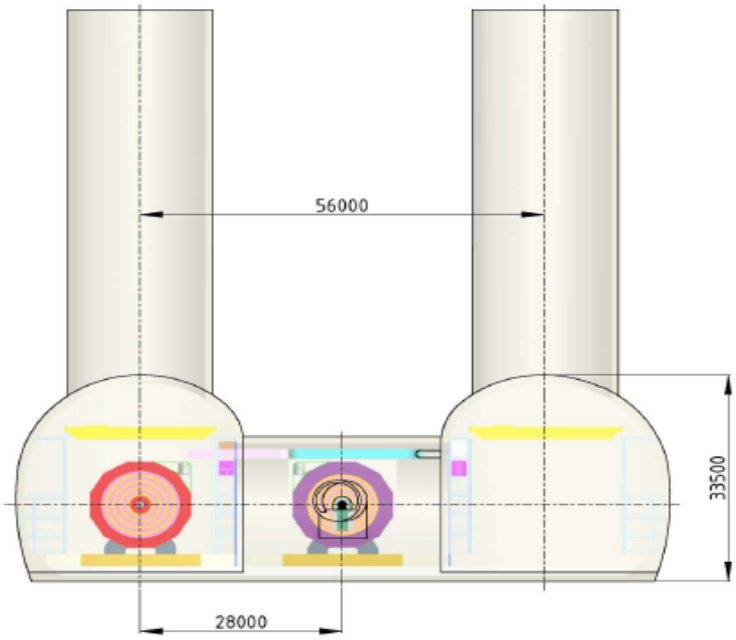


Fig. 11.12: Side view with dimensions.

Actual boundaries for a single CLIC detector

- Final quadrupole is in the tunnel
- L* fixed to be 6 m
- No stabilisation inside the detector needed
- Increase of solid angle coverage in endcap region
- No real self-shielding for personel needed
- No stringent stray field conditions
- Platform still needed? Frequency of movements lower

What now?

Not so big differences at first glance?

Take the best of each, adapt …..

For CE suppress just one cavern…

It's more complicated than that.....example? See next slide

The solution strongly depends

Close to perfect engine:

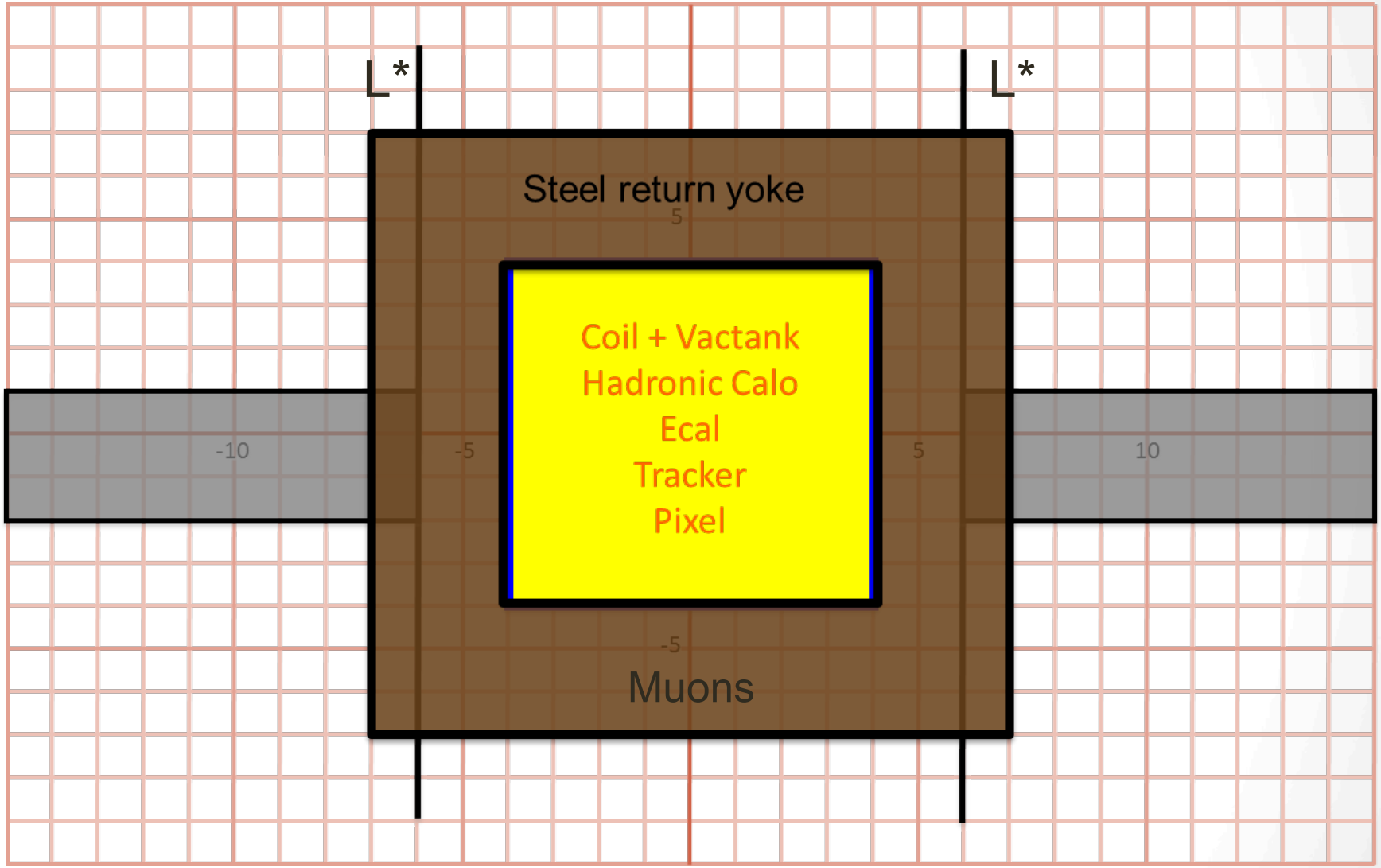
- ✓ Light
- ✓ All you need
- ✓ Cheap
- ✓ Etc. etc

.....on the priorities !

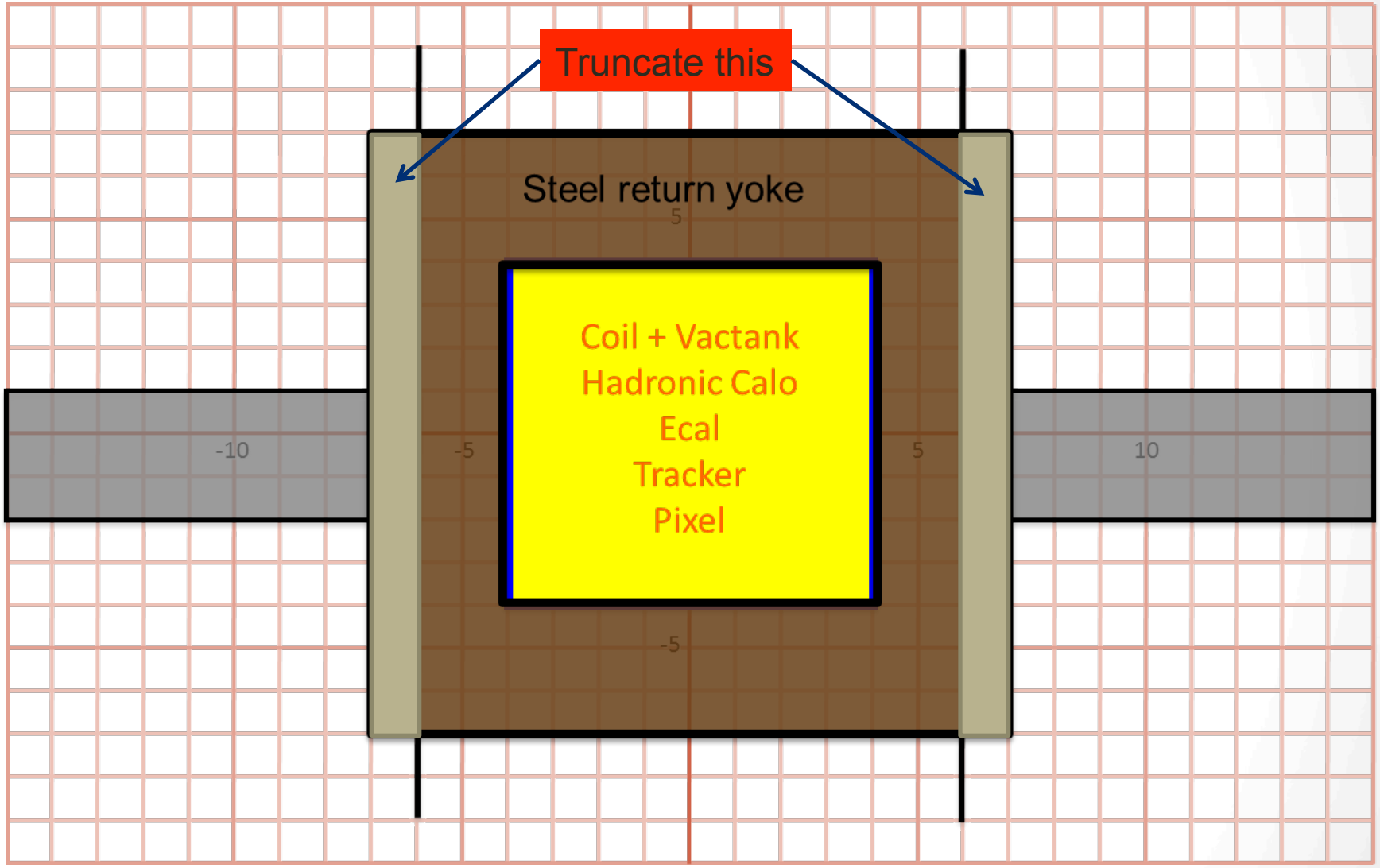
Please explain its success!

Have a thought!

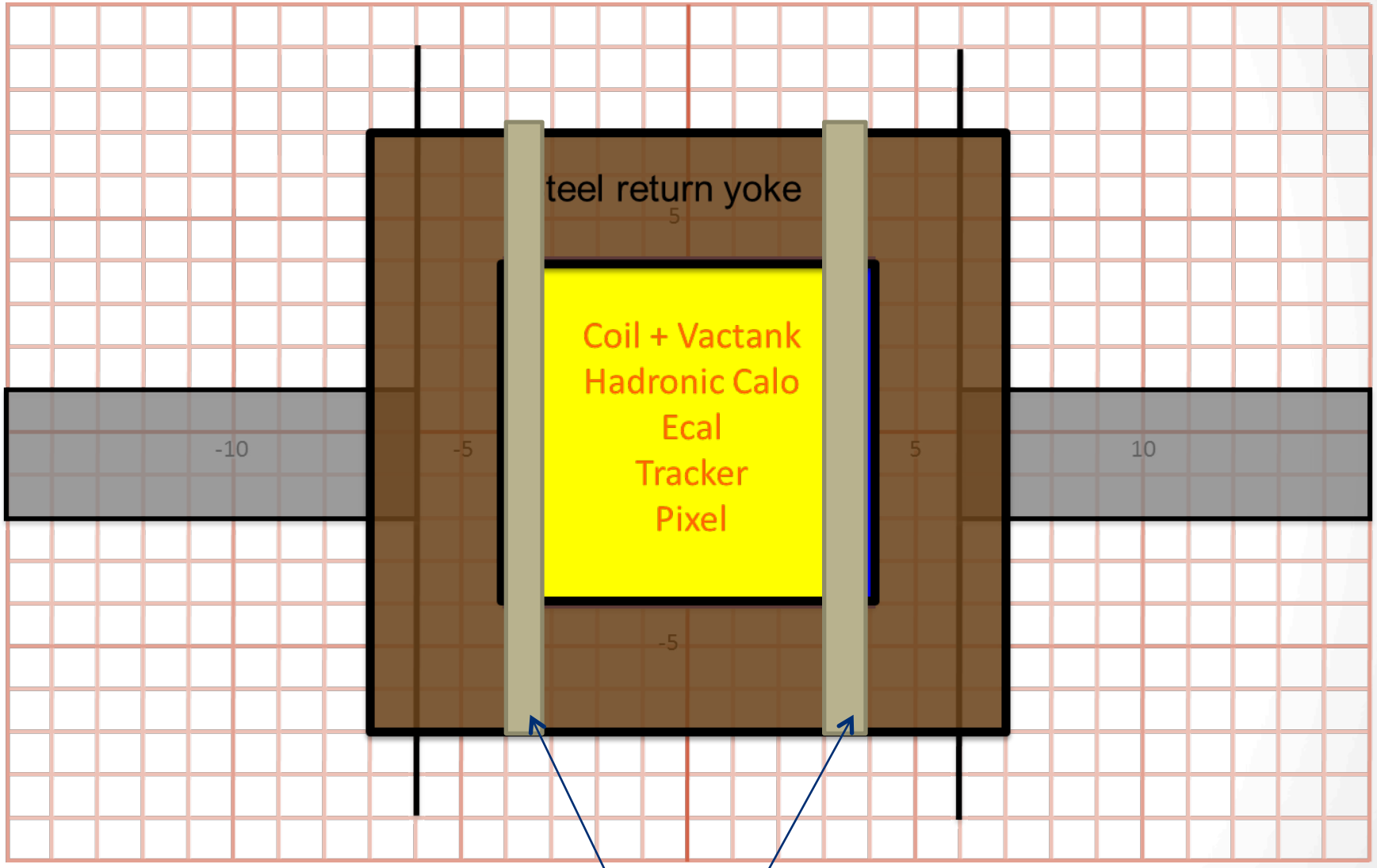
Back to CLIC


L*
L*
Steel return yoke
5
Coil + Vactank
Hadronic Calo
Ecal
Tracker
Pixel
-10
-5
5
10
-5
Muons

In graphics mode



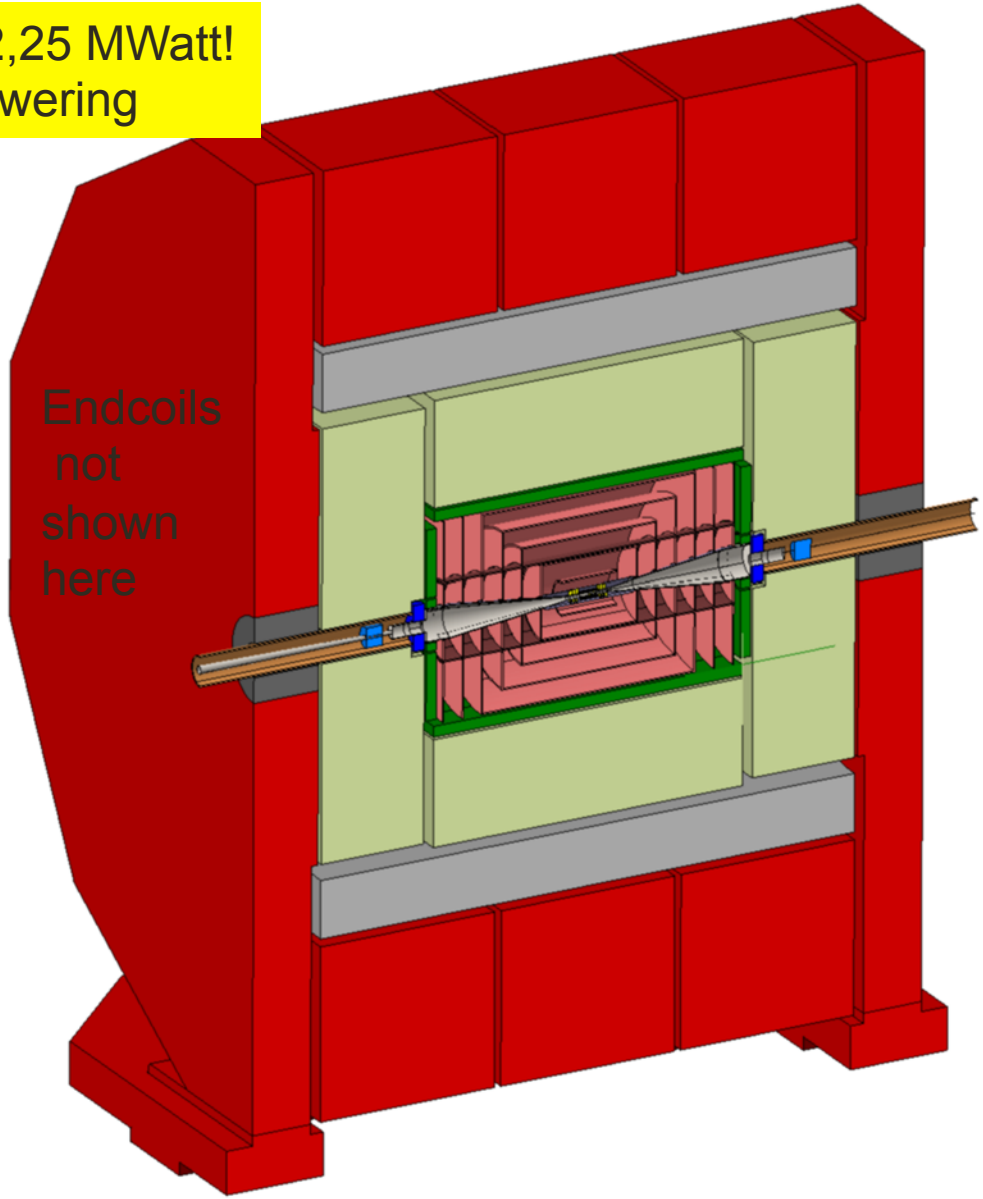
Also the barrel may be cut



Or truncate here and move end-caps in!

Truncated outside (endcap)

Implying 2 x 2,25 MWatt!
for endcoil powering



Magnetic flux has increased 17 % w.r.t CLIC_ILD

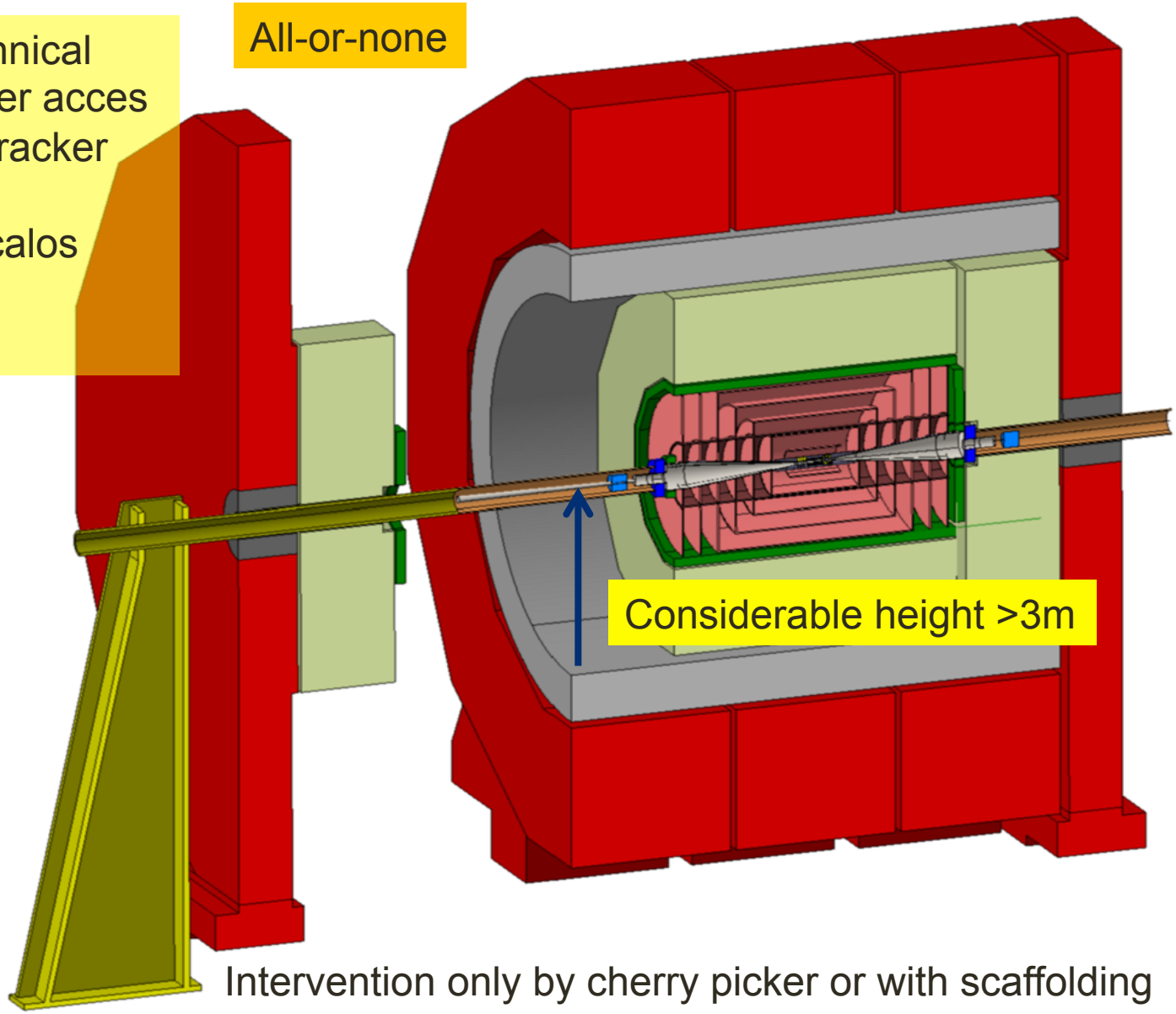
And CLIC_ILD iron part had a length of 6,20m (!) whereas now we have to fit within ca. 5,75m

➔increased current in endcoils

Another point: short beam stops

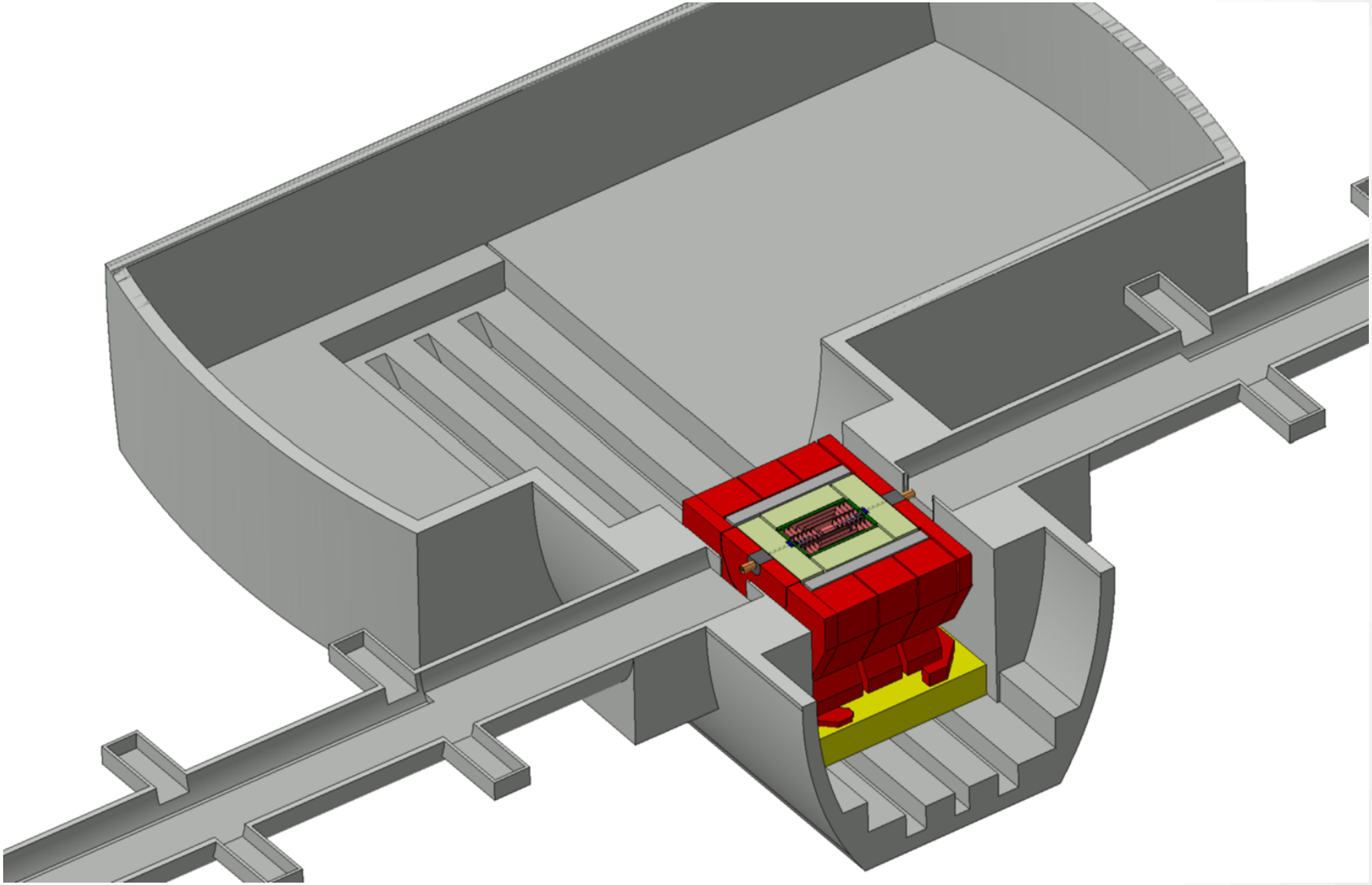
For short technical stops a quicker acces mode to the tracker bulkhead and forward calos would be preferable

All-or-none



Intervention only by cherry picker or with scaffolding

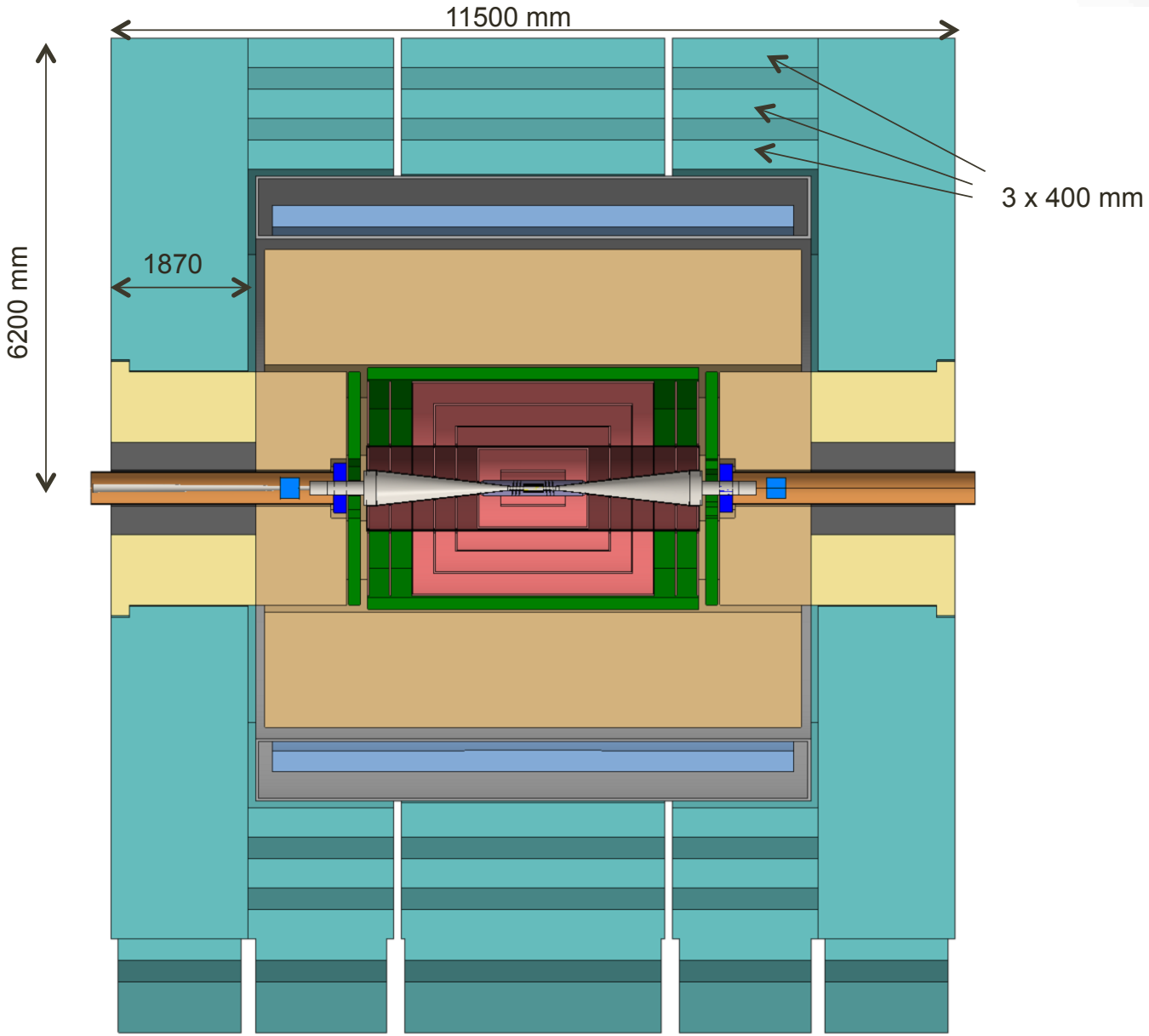
Still need for a 4500t platform?



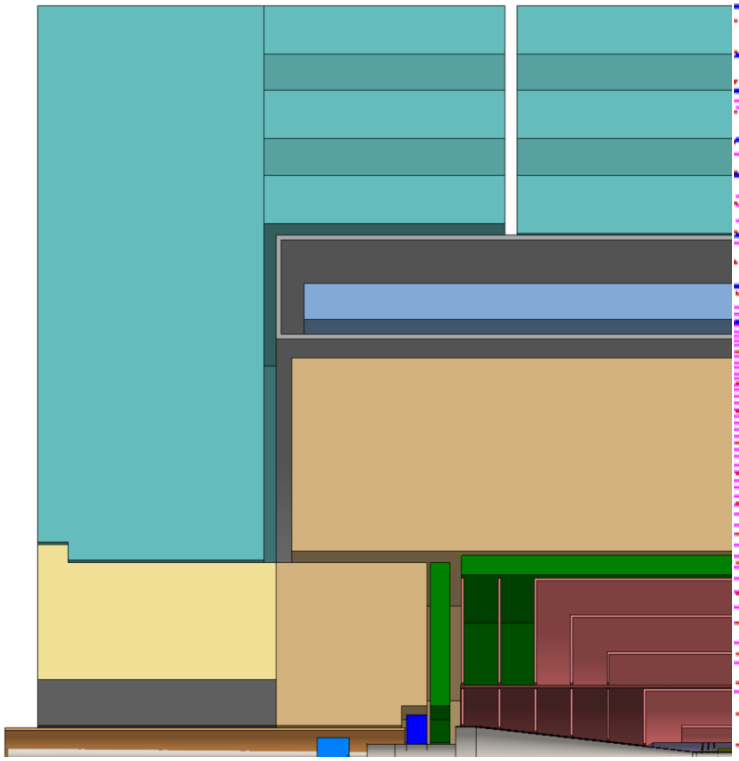
Proposal for modifications

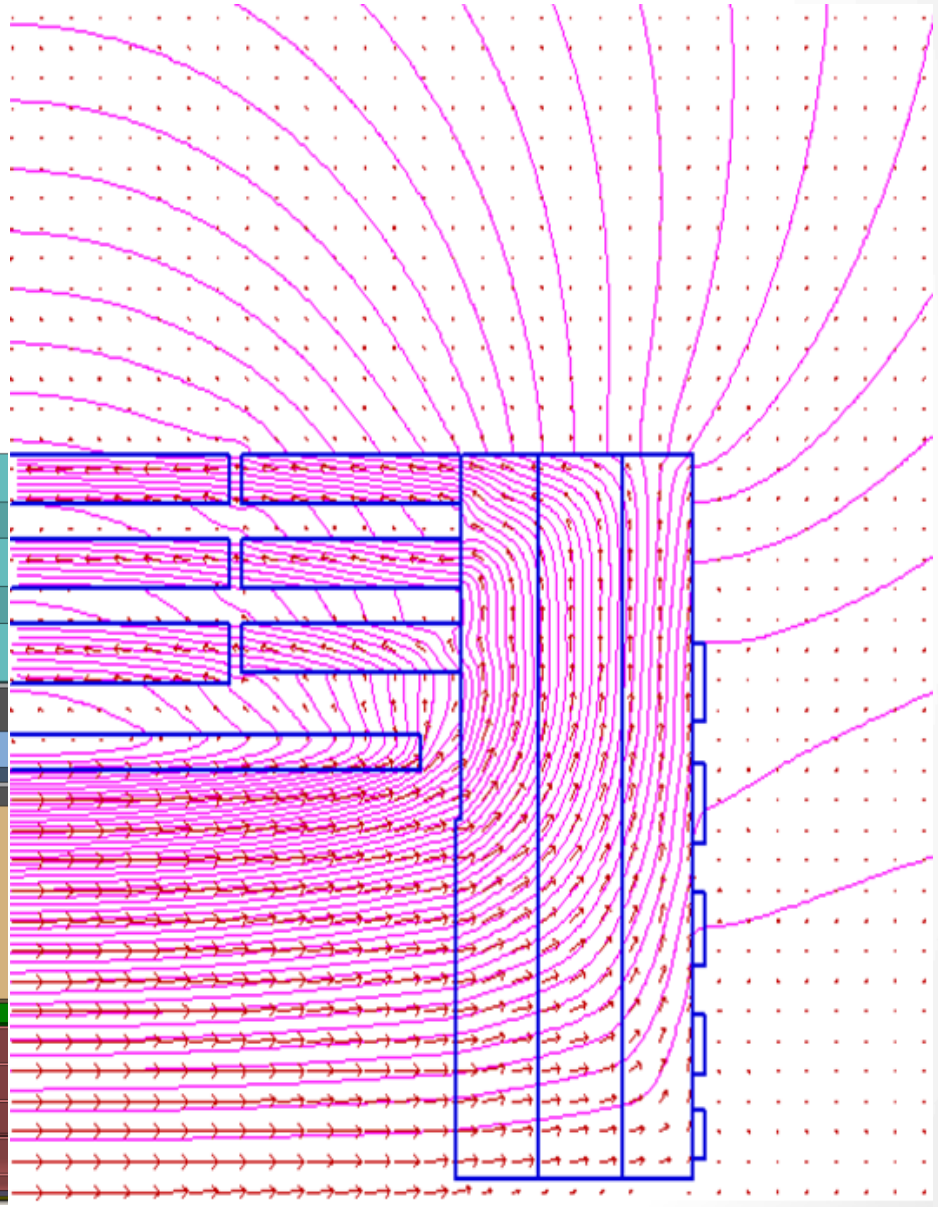
- Save weight by accepting stray field
- Introduce a 'minibouchon' in the endcap
- Truncate barrel part by using tungsten in the HE part
- Recuperated length to be put as iron in the endcap
- Reduce number of muon layers to max 6 better 4
- Suppress the platform (may serve as fall back solution)
- Reduce diameter in pit and UXC

A possible new layout

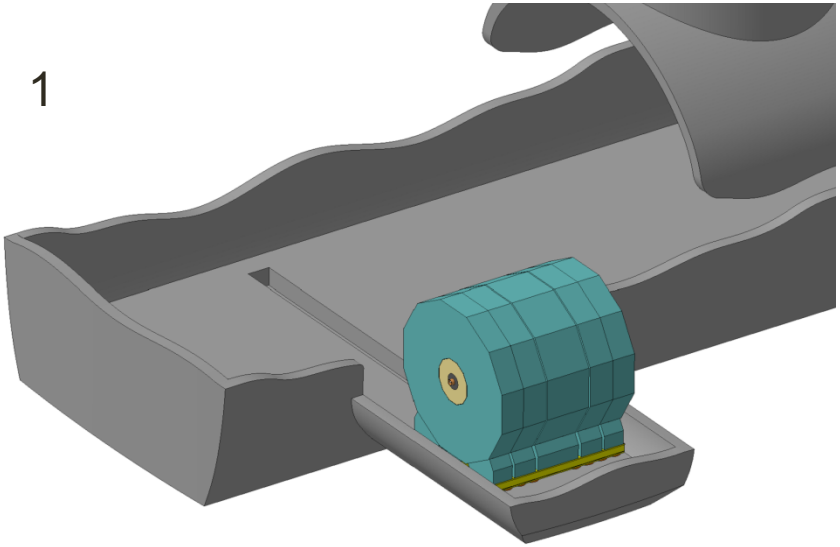


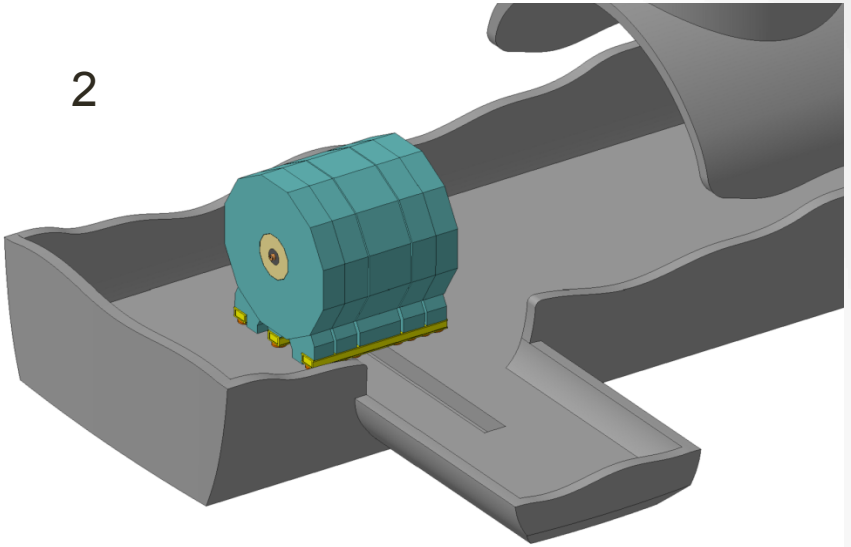
A possible new layout

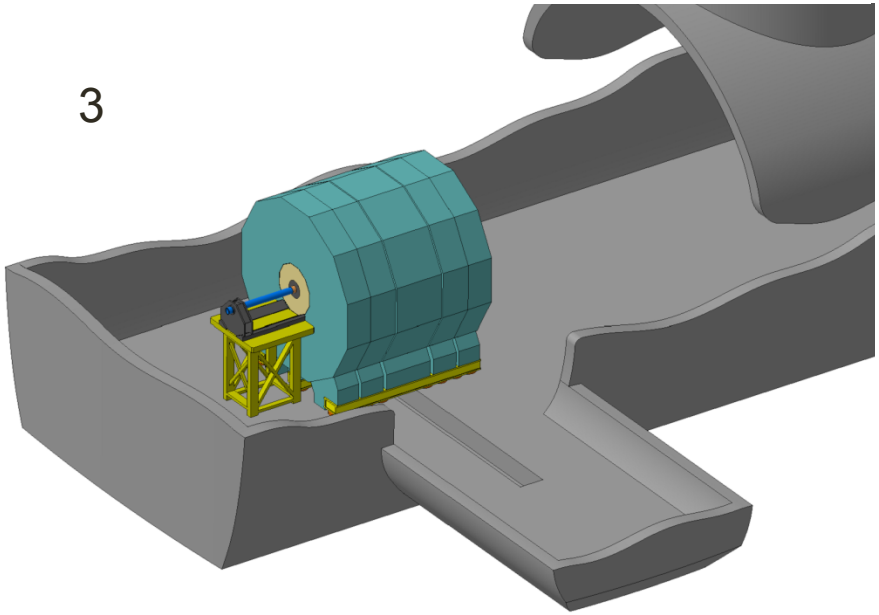


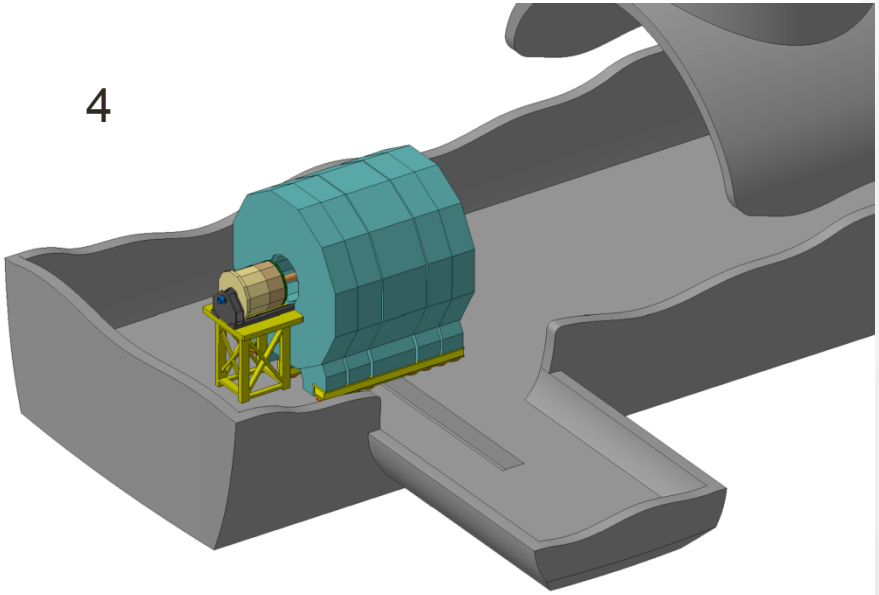


Move away from IP, TS

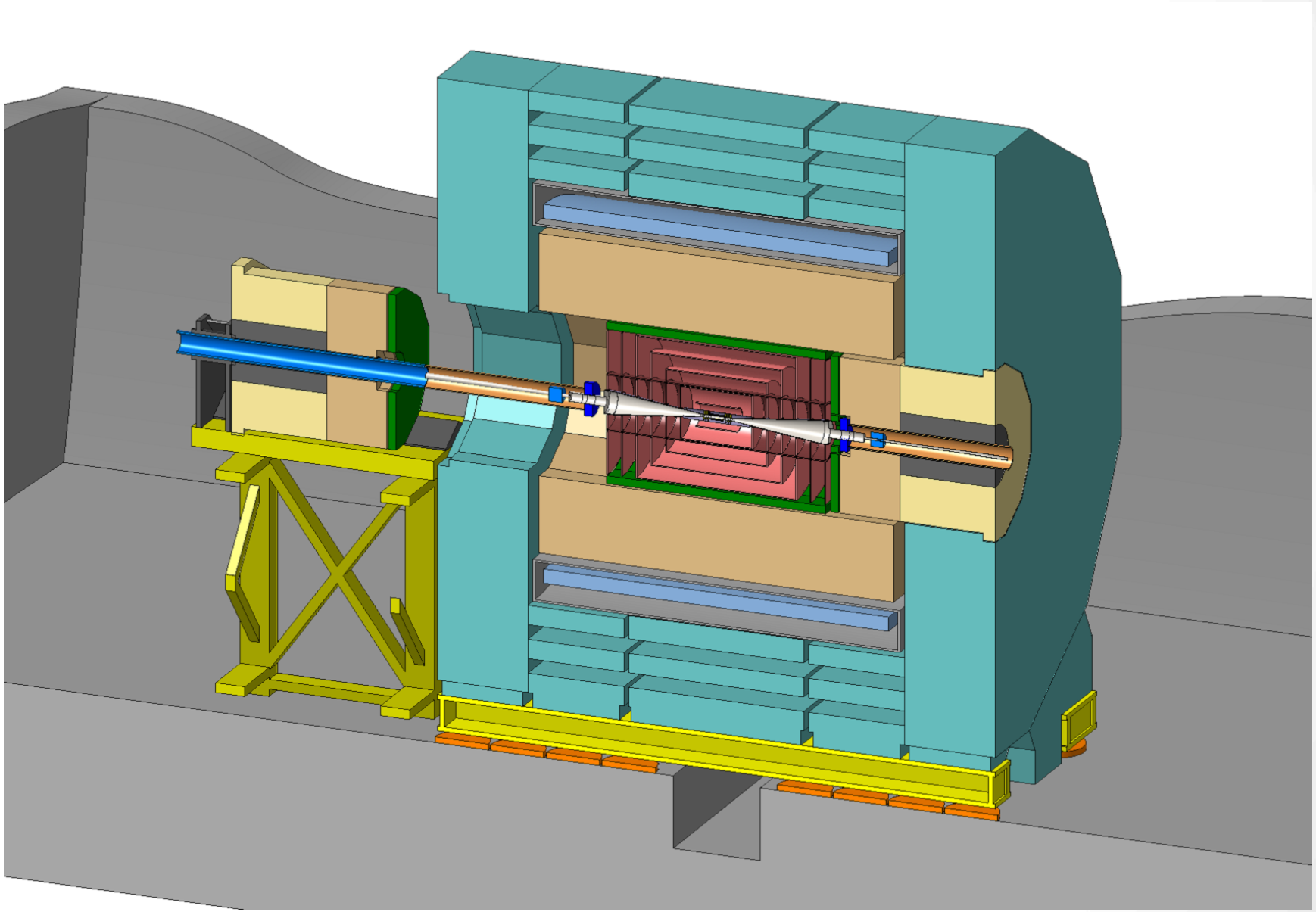




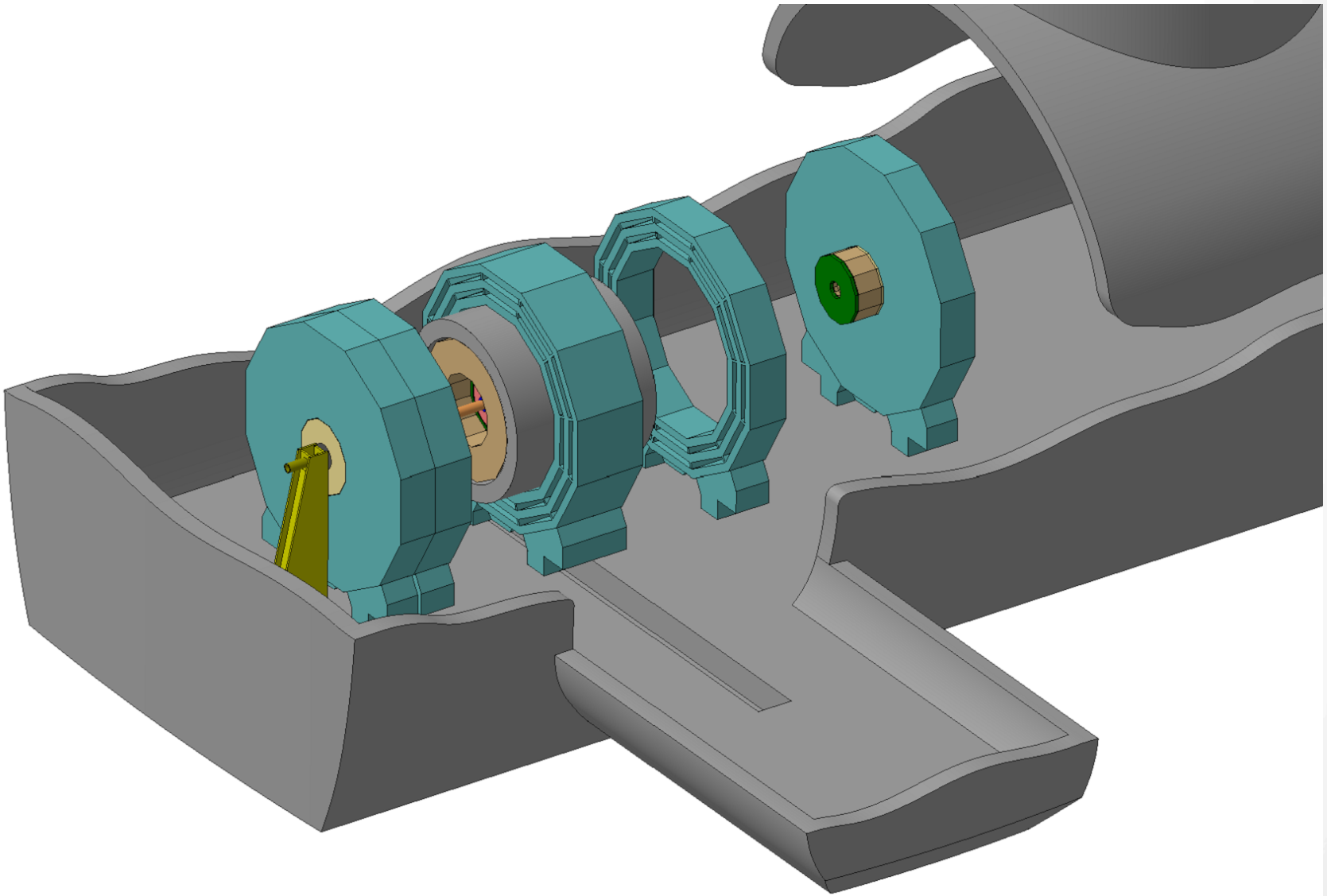




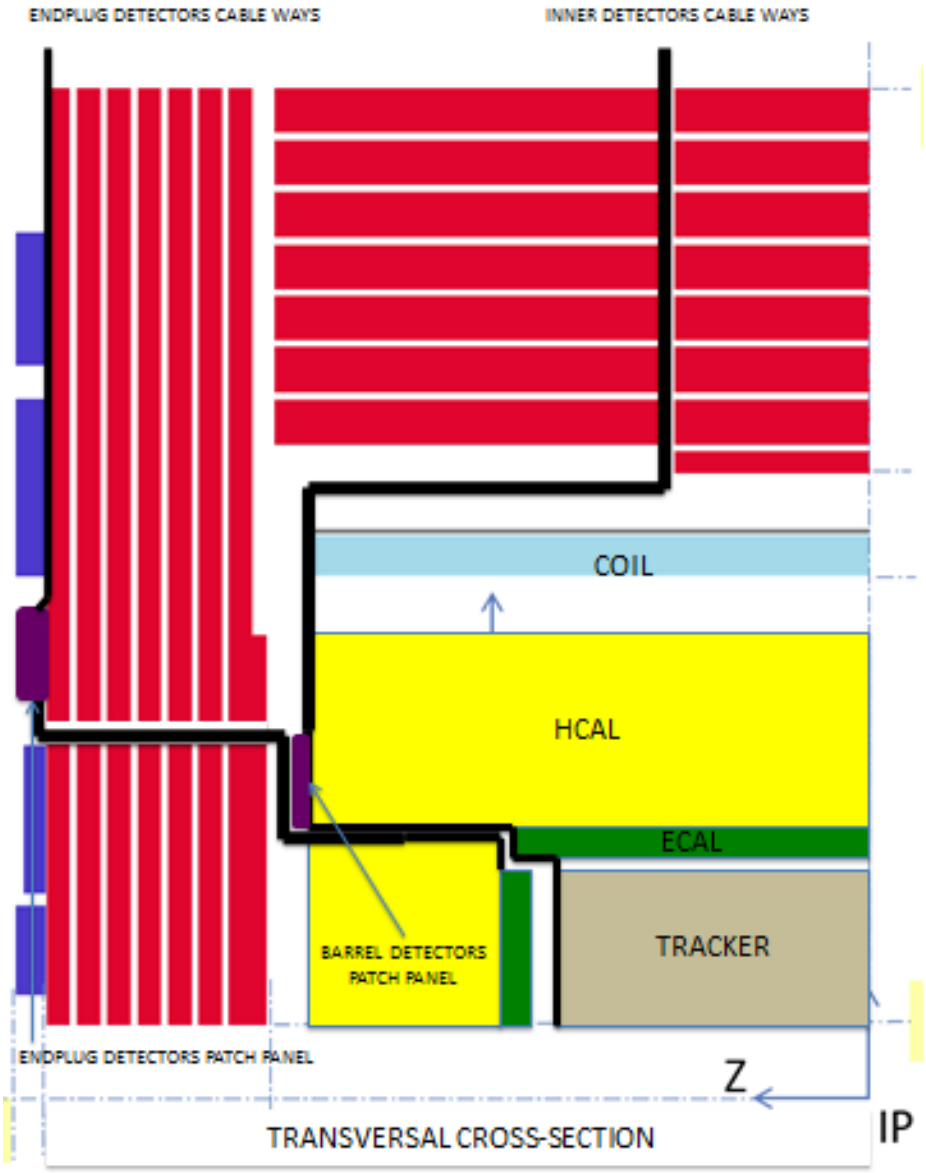
Short technical stop



Normal shut down, full opening



Service routing, patch panels



Keeping unique features

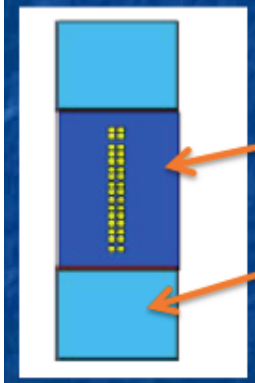
- Keep state-of-the-art engineering solutions
- Like the air - cooled pixel detector
- Ring end-coils to fine tune magnetic leaks
- Check use of nickel-doped aluminium for the coil
- See A.Yamamoto's talk at 13th Pisameeting last week

Nickel-doped Aluminium

Courtesy A. Yamamoto at 13th Pisameet

Further Possible Development on Strength and RRR

CMS structure and ATLAS-CS alloy may be combined



	Rein-force	Feature	Al Y. S. (MPa)	Full cond. Y.S.	Full cond. RRR
ATLAS-CS	Uniform	Ni-0.1% Al	110 MPa	146 MPa	590
CMS	Hybrid	Pure-Al & A6082-T6	26/428	258	1400
Future	**Hybrid**	**Ni-Al & A6082-T6**	**110/428**	**300**	**300**
Future	**Hybrid**	**Ni-Al & A7020-T6**	**110/677**	**400**	**300**

A. Yamamoto, 15/05/26 Pisa-Meeting 26

Keeping unique features

- State-of-the-art engineering solutions
- Like the air - cooled pixel detector
- Ring end-coils to fine tune magnetic leaks
- Check use of nickel-doped aluminium for the coil
- See A.Yamamoto's talk at 13th Pisameeting last week
- CMS decision to build a tungsten/silicon HE

CMS latest news

- CMS chooses high granularity end-cap calorimter for HL-LHC
- Ready for Run4 in 2025

Summary

- Several new unique features have been presented:

1. Reduced weight (total detector:7800 tonnes)
2. Minibouchon for quick access
3. Tungsten in HE, this allows to equilibre endcap mass
4. Thus reducing endcoils' power needs
5. Detector moving without a platform is possible
6. Smaller shaft/cavern possible

- There is plenty of room for discussions