Integration of the LDC detector

Detector integration:

- how to fit the different subdetectors together (define stay-clear tolerances)
- how to route services from and to the detectors
- how to get the signals out
- how to assemble the detector in the first place
- how to access the components during service/ shutdown/ repair times

Detector integration
might seem a bit pre-mature to think about,

BUT

it impacts heavily on even the conceptual design of sub-detectors,
so better take it into account early on.

The Status

2001: a „complete" integration concept has been worked out for the TDR detector

2002/2003: concepts and in particular integration into a lab was much refined during the preparation phase of TESLA

2003: work stopped after the moratium on TESLA

2005: concepts groups restart the work, TESLA detector -> LDC

Use as much as possible from the earlier TESLA work,
update whereever needed and sensible

The concept

1) construct the detector in as modulare a fashion as possible

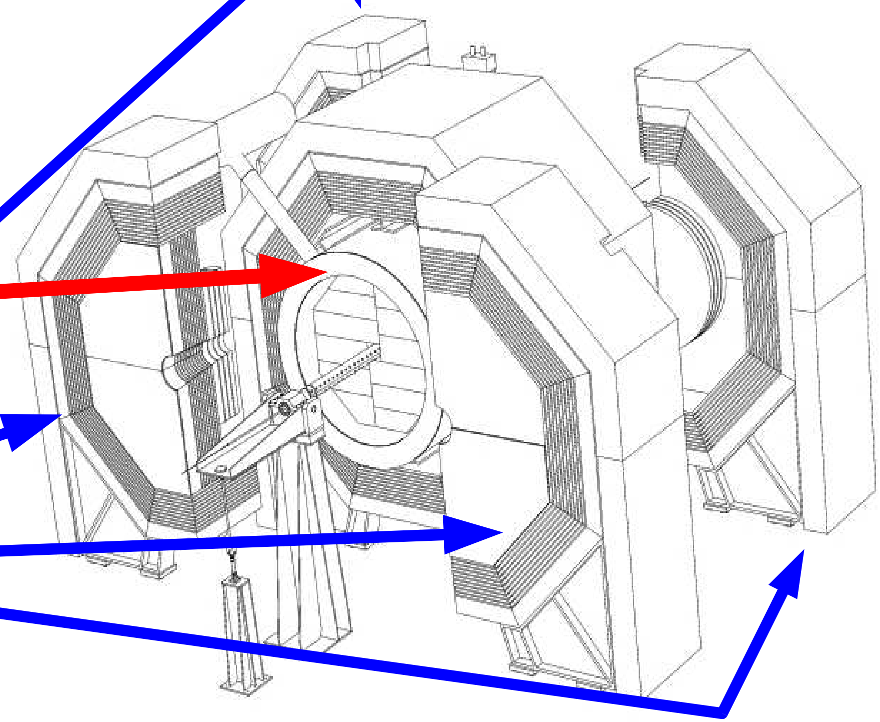
2) the opening of the detector primarily happens in the transverse direction – there is little space (BDS) longitudinally

3) „Fast“ access to the inner detectors is important (we expect that the VTX detector will be upgraded/ replaced/ repaired more than once during the lifetime of the experiment

4) mechanical backbone of the detector: the coil

one central piece around coil

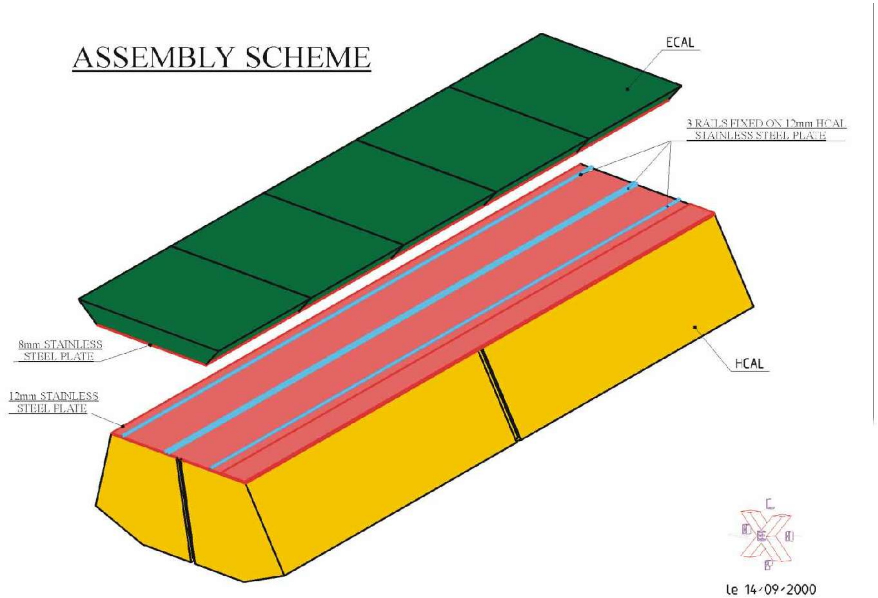
4 endcap pieces

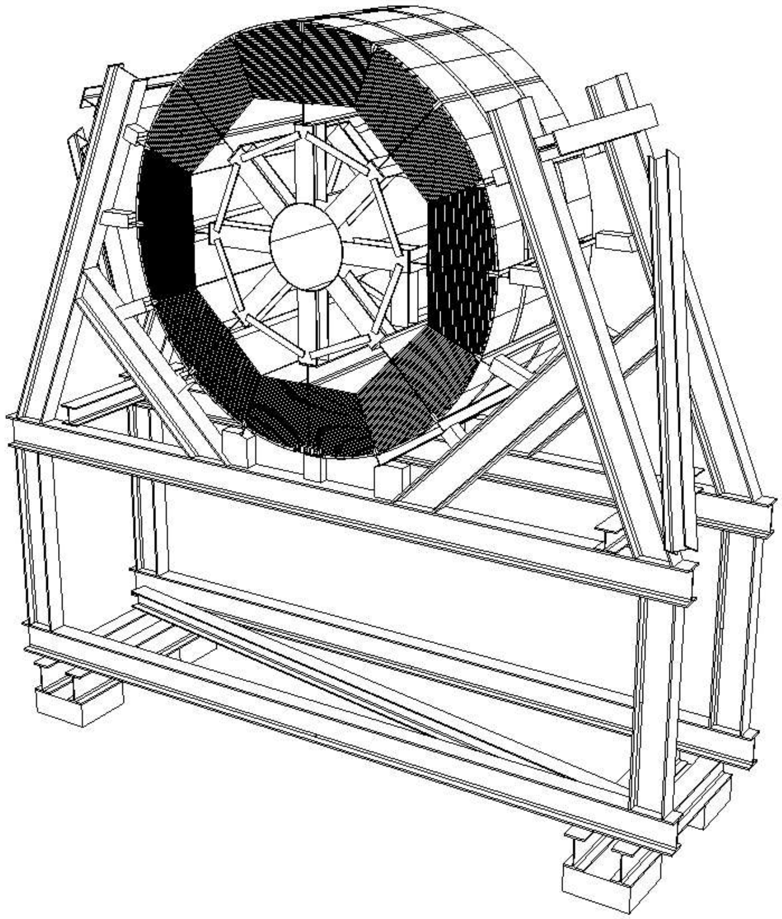


Opening the central part

inside the coil:
HCAL
ECAL

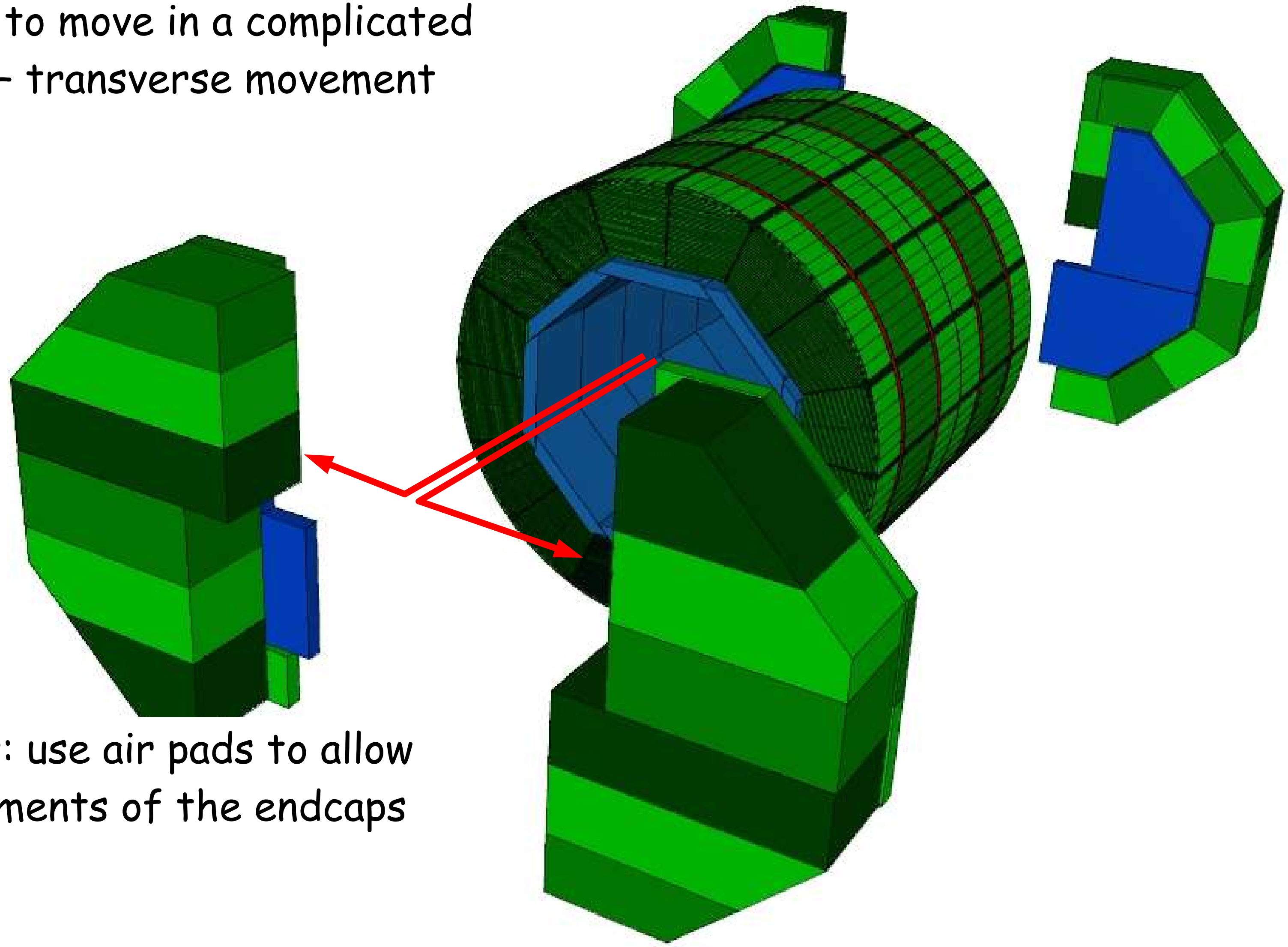
complete calo:
2 rings, assembled on a cradle,
ECAL hung from the HCAL on rails
(individual modules)
Complete rings are inserted into the coil





The opened detector

encaps have to move in a complicated longitudinal – transverse movement

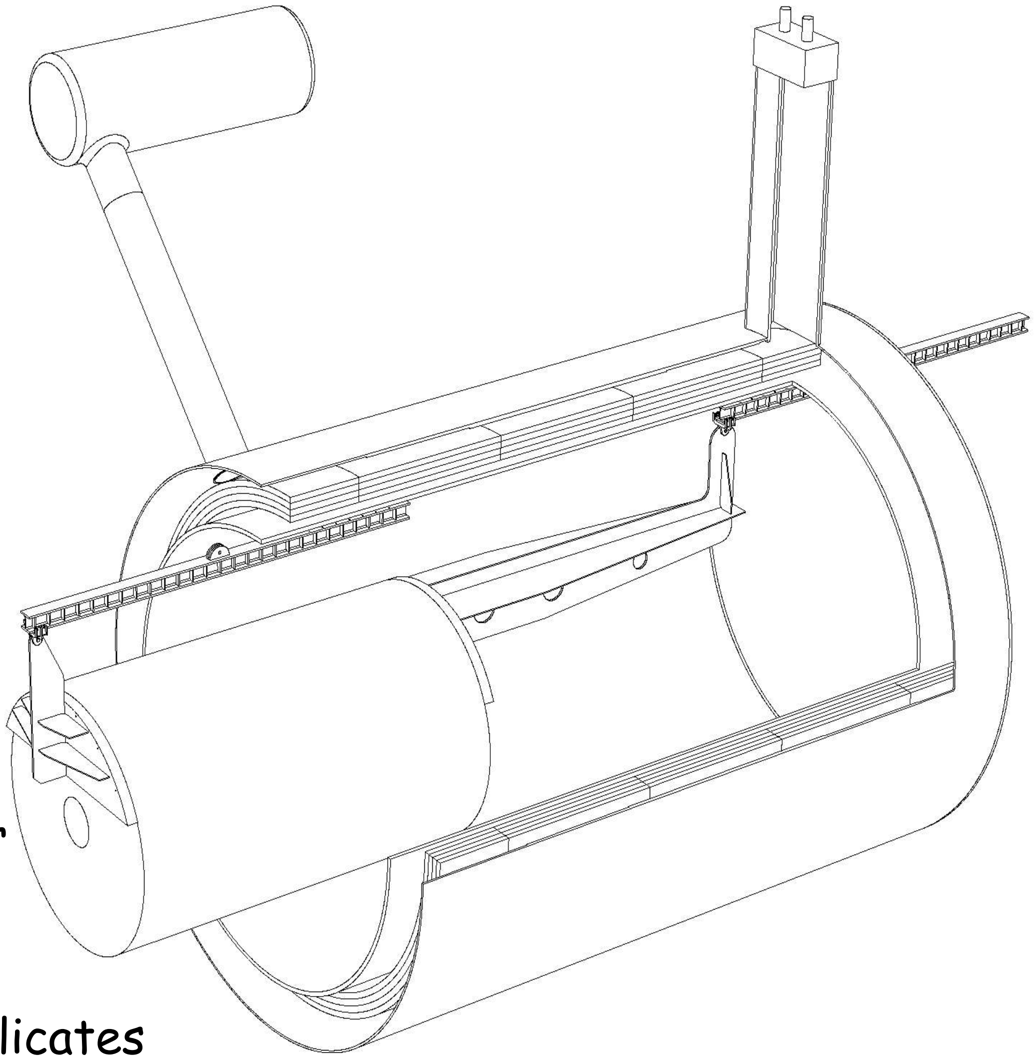


assumptions: use air pads to allow 2DIM movements of the endcaps

Access to the inner detector

TPC is suspended from coil

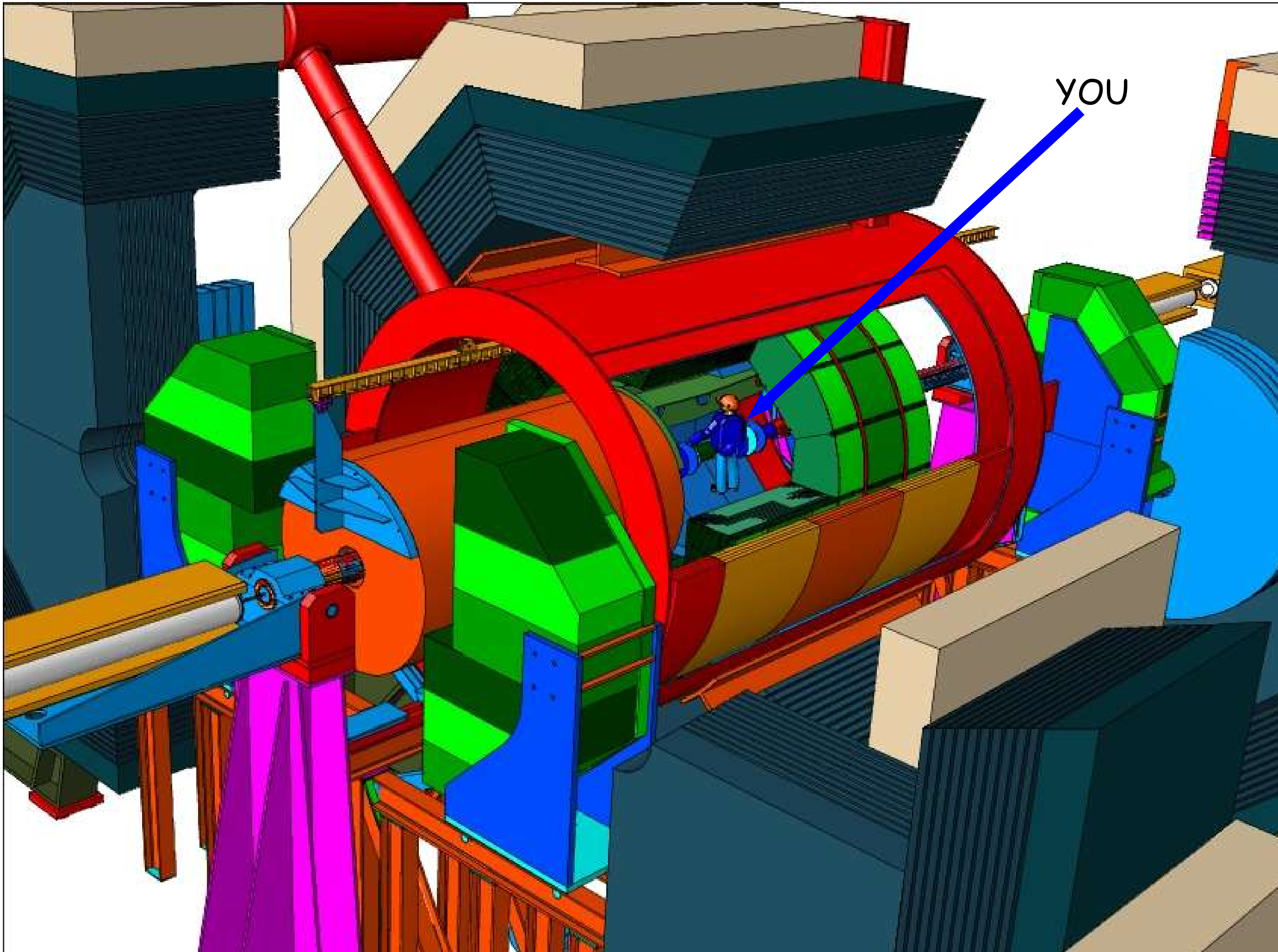
moves longitudinally over the BDS to allow access to the inner detectors (with or without calo in place)



advantage: no need to break the vacuum to access the inner detectors

disadvantage: potentially complicates services to be brought to the TPC in inner detectors

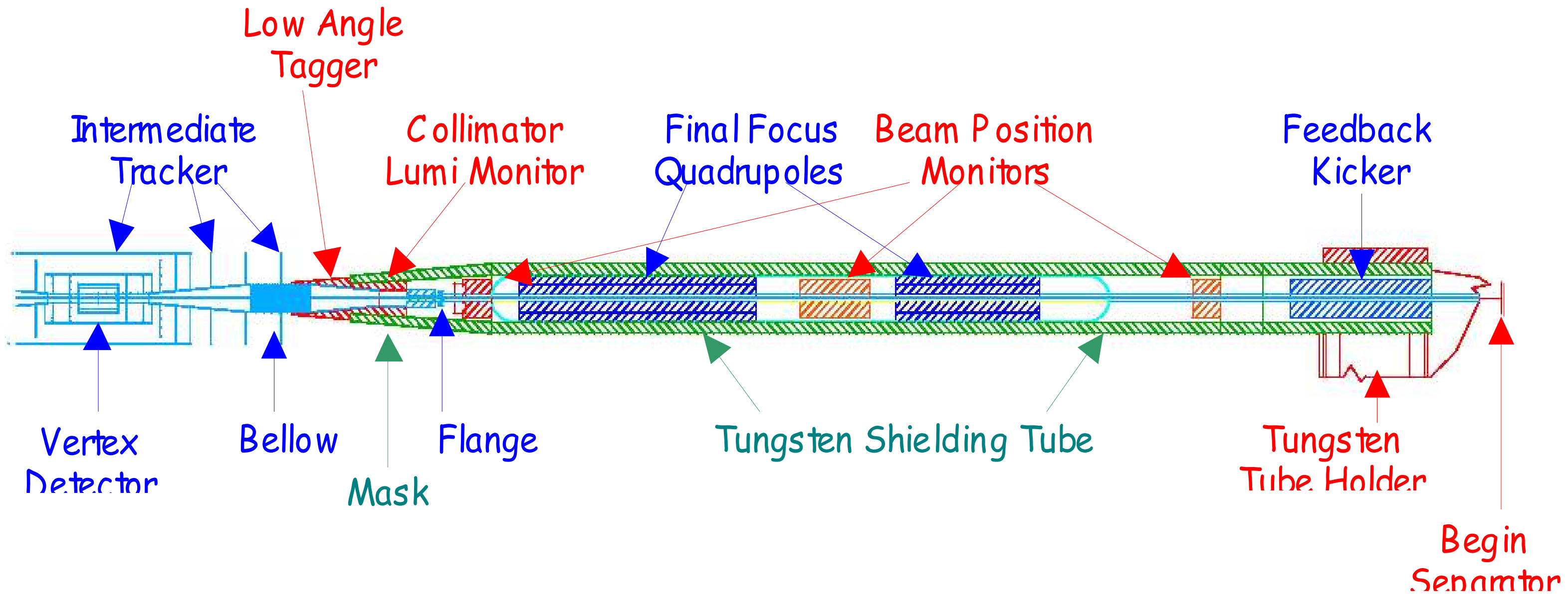
Access to the inner detector



The inner region

The inner region:

- shielding of the detector
- support for the final focussing elements
- support for the lumi-cal and beam-cal

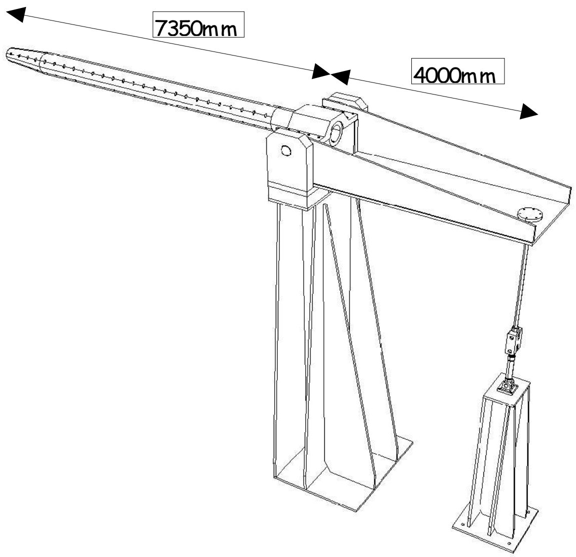


Use the shiedling tube (Tungsten) as a cantilevered systems to support and to stabilize the different components.

During running introduce additional support from the coil

During opening pre-stress to compensate bending

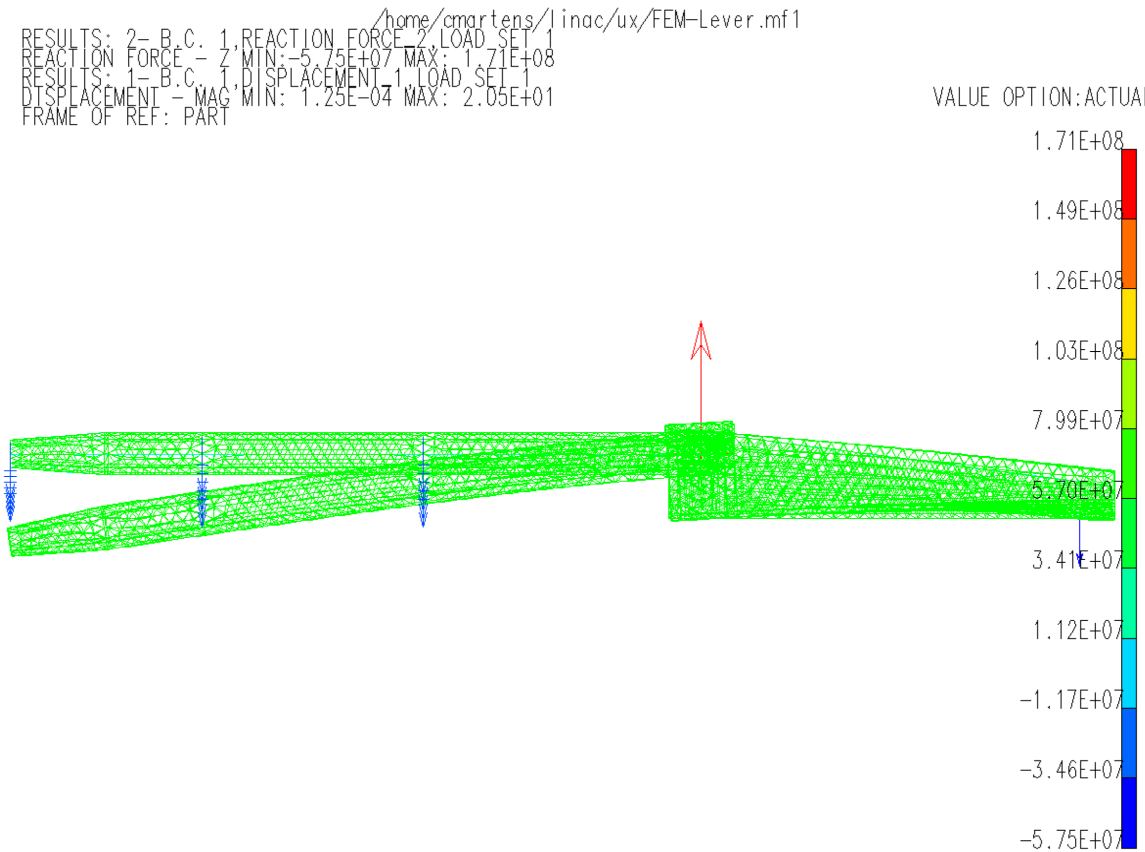
The Beam Tube



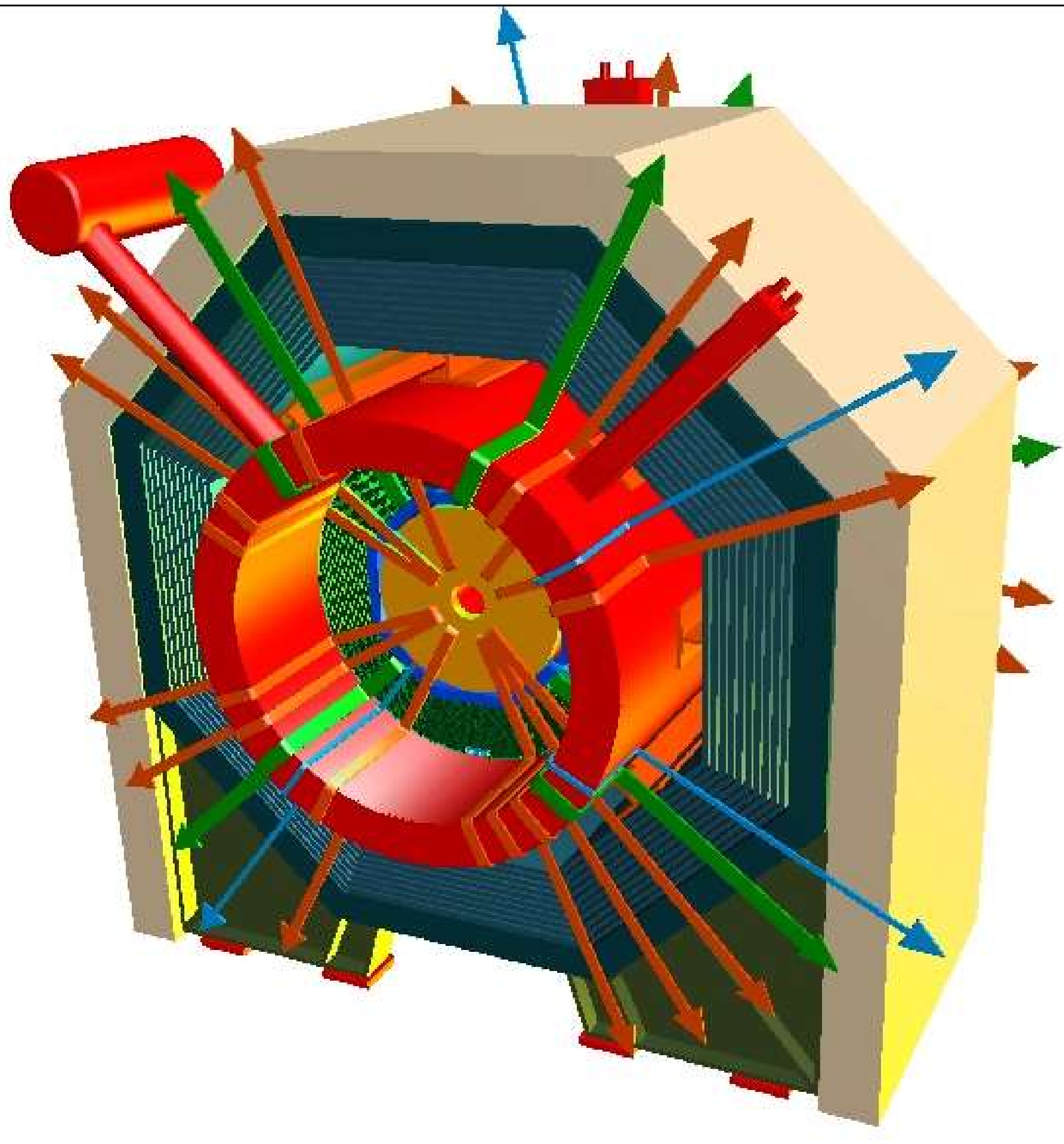
cantilevered system to support the beam tube

introduce tension here to compemsate sagging at the tip

FEM picture of the tip during opening



Cable Routing

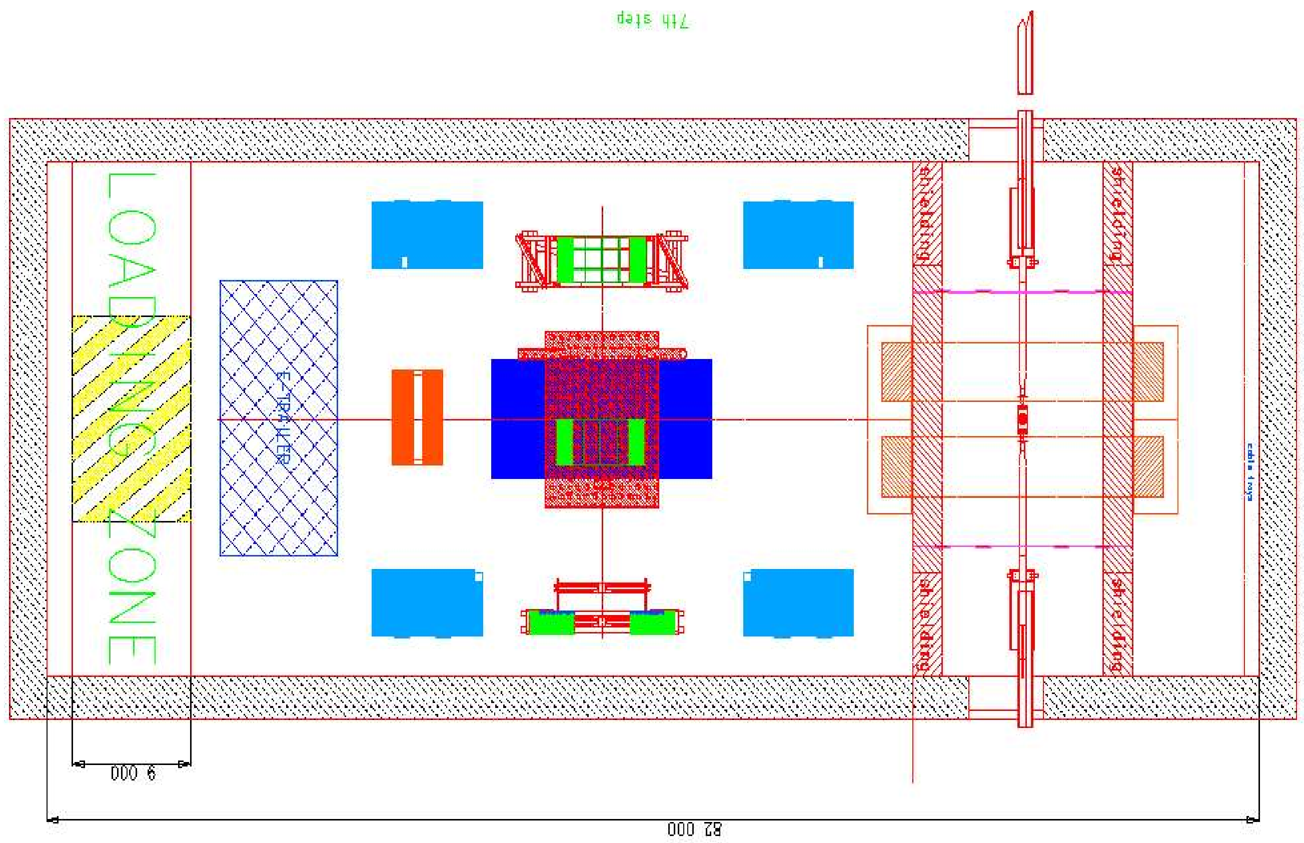


The experimental hall

approxmiate concept of the hall:

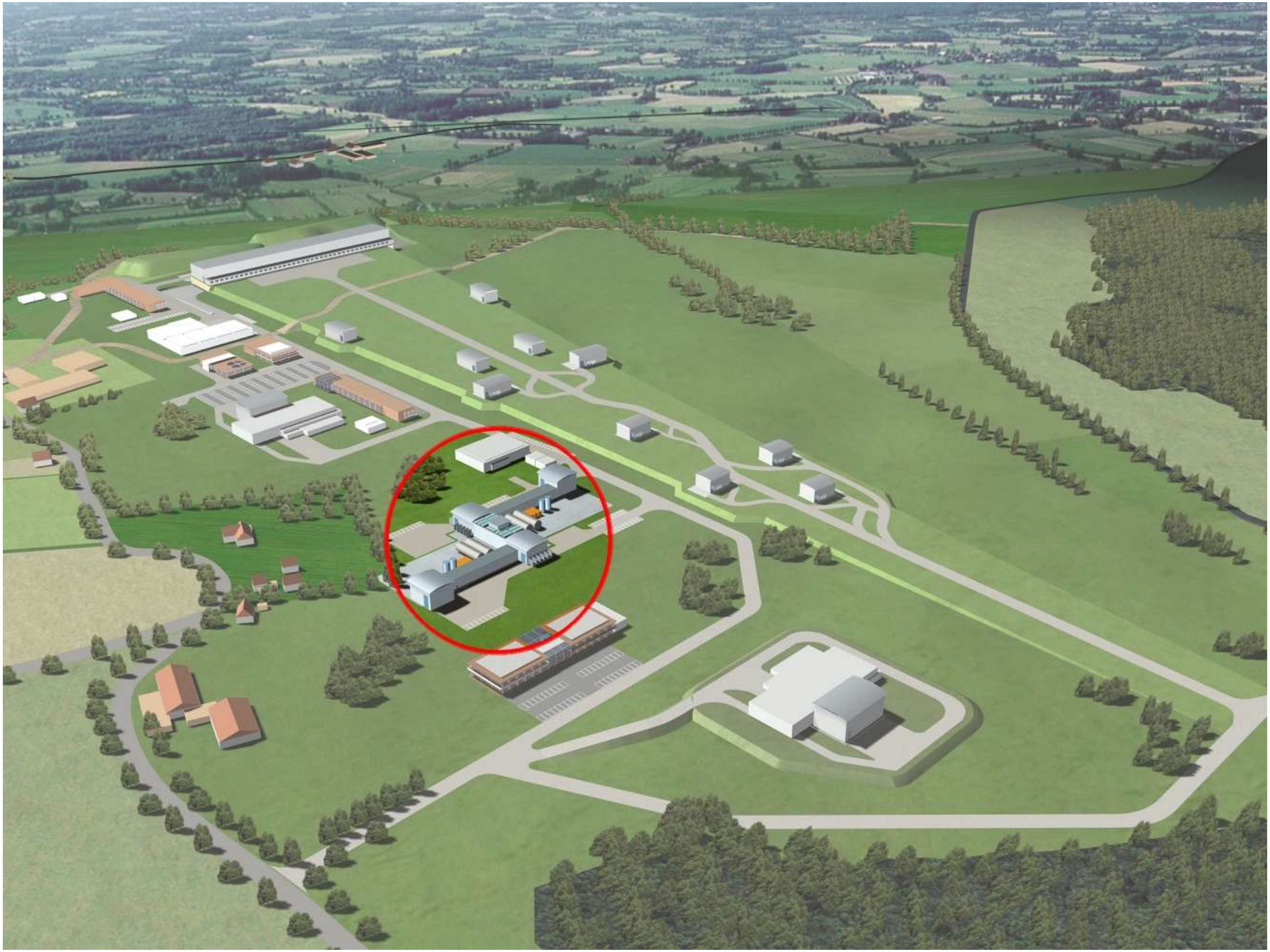
do most detector assembly in the hall,

minimise surface activity (this might be a site-dependent decision)

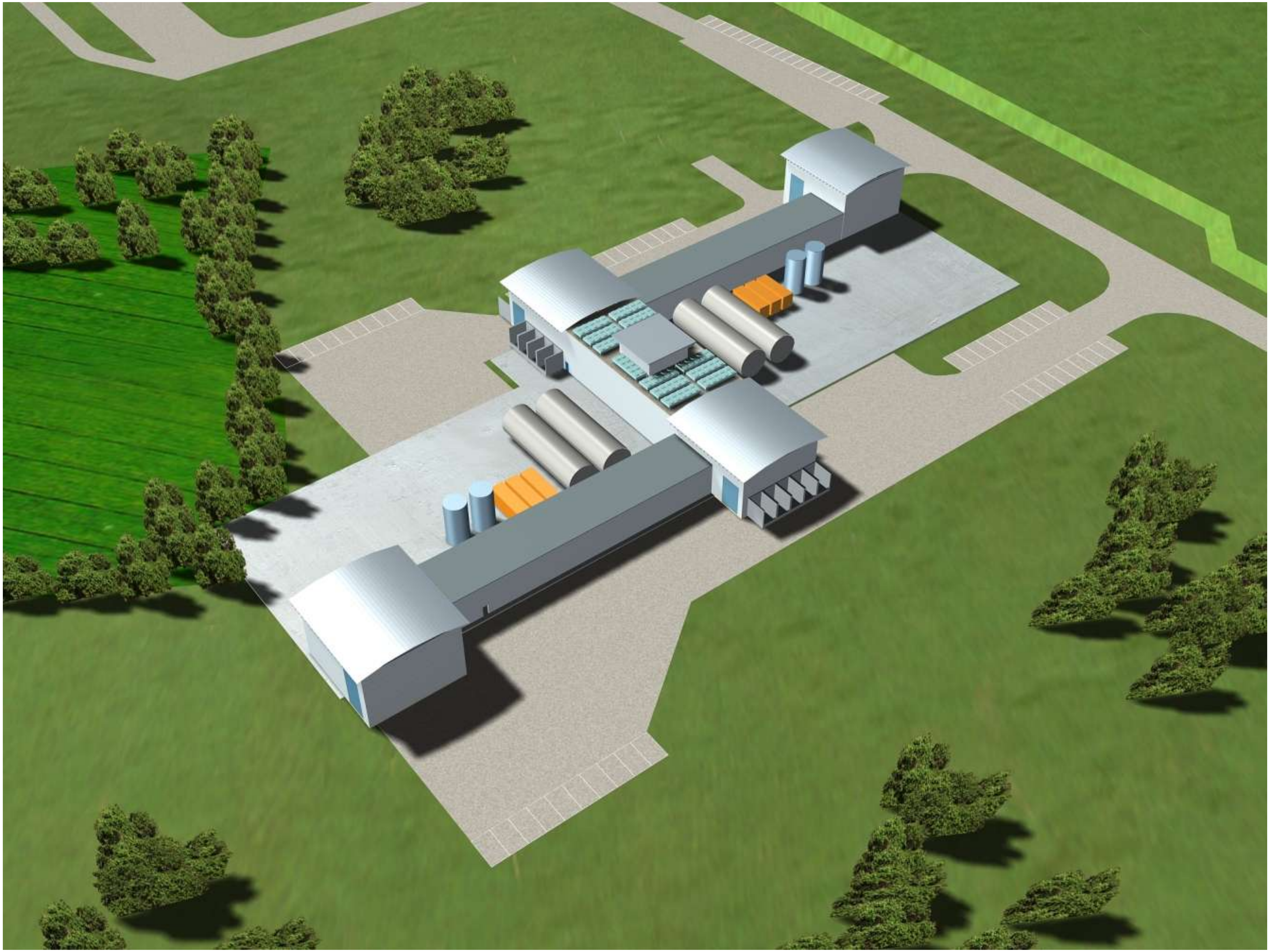


hall dimensions: 82m long, ca 25m wide

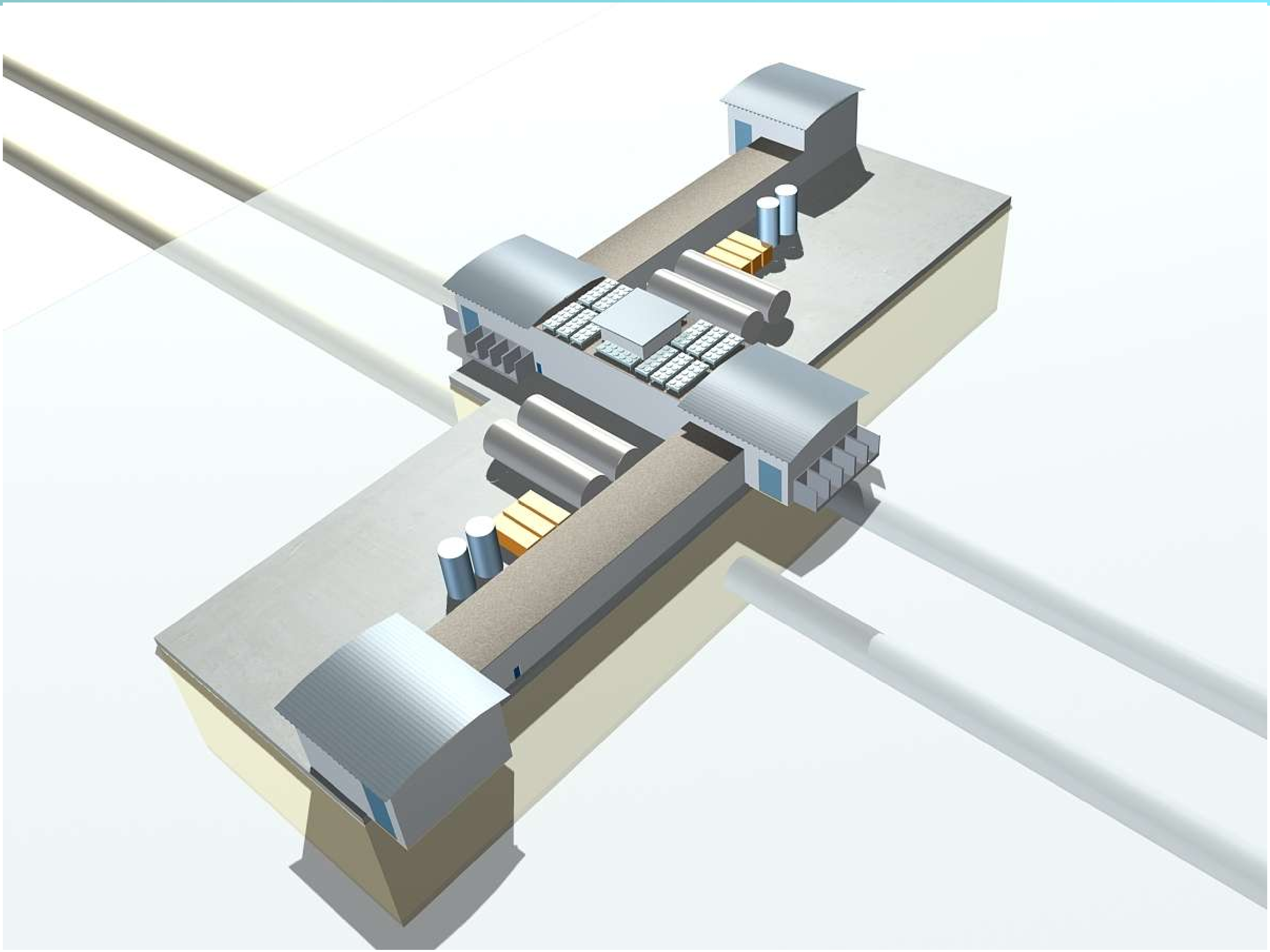
Aerial view of the TESLA site



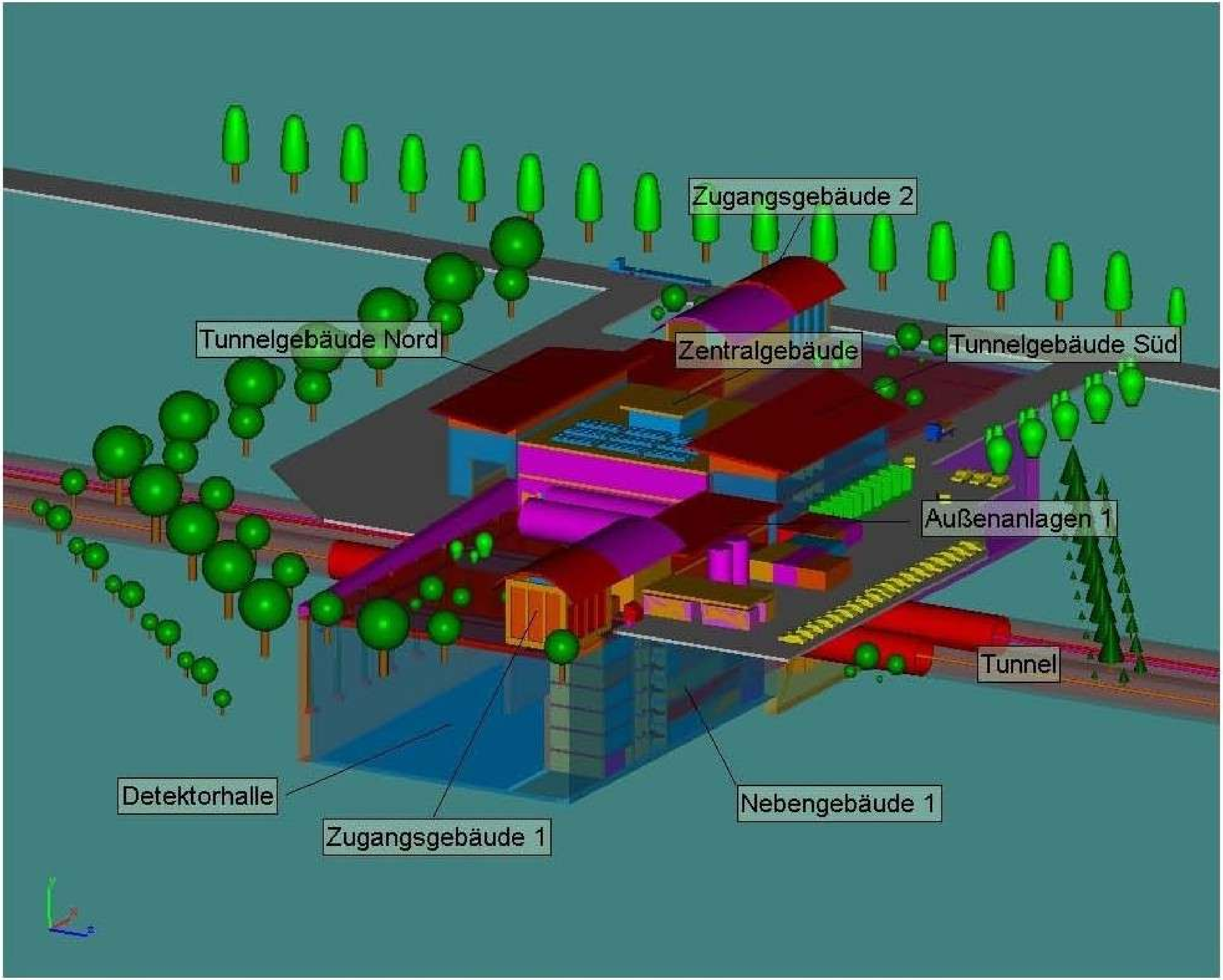
Experimental Hall Ellerhoop



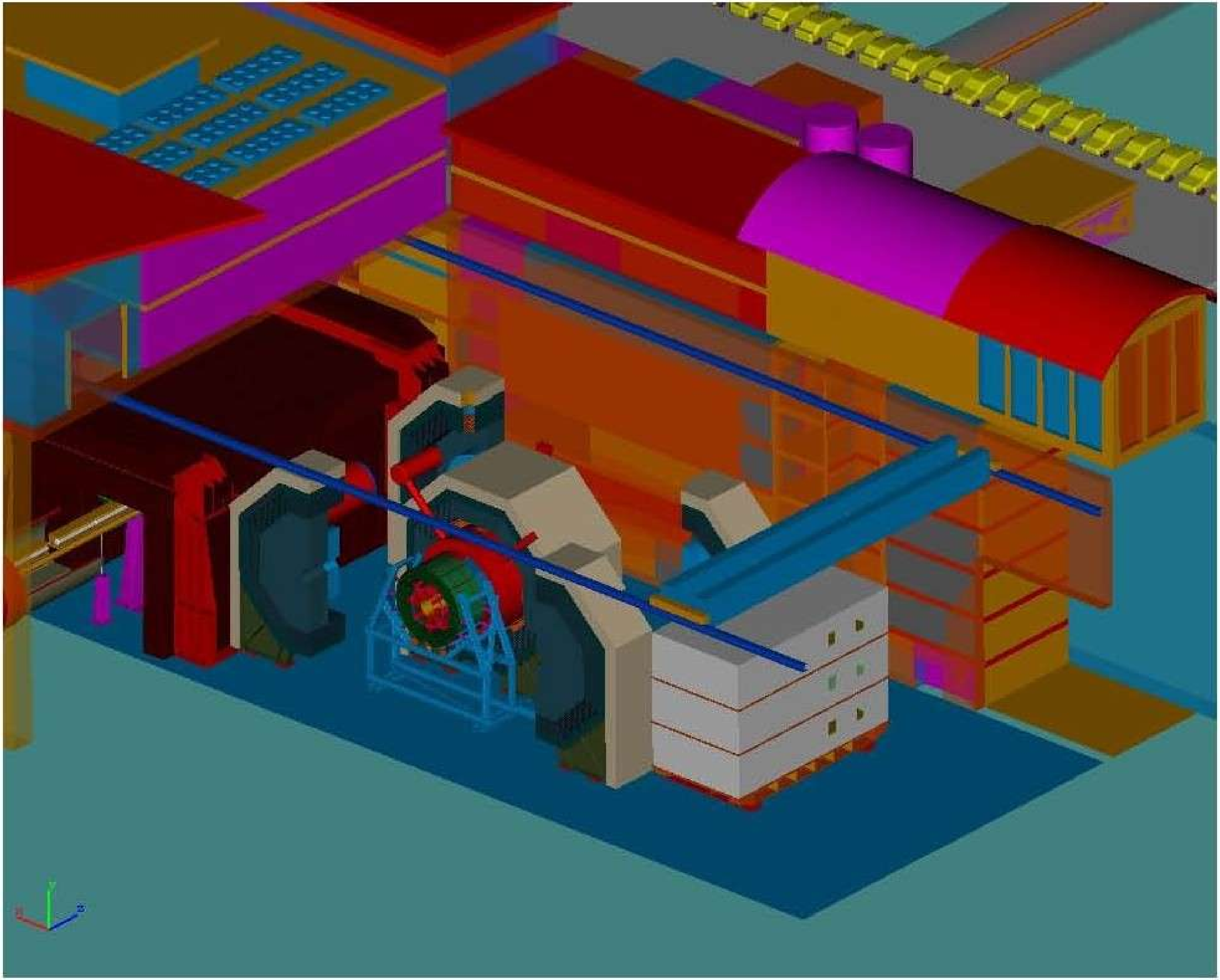
Experimental Hall Ellerhoop



HEP Experimental



Detector 1 during installation in the experimental hall



Status of the concept

The basic concept is sound is still valid

Anticipated changes to the concept:

- shorten the coil, remove the plugs:
- reduce the radius of the ECAL and HCAL, possibly of the coil
- redesign of the interaction region to accomodate a crossing angle

plus improved calorimeter systems

Generally these changes make the mechanical concept simpler
So far at least no show stopper has been identified

However some serious engineering work is needed to update the concept: personpower?

How to proceed

We have to:

- decide whether the general concept is still applicable to LDC
- re-evaluate the hall size (money!): can we live with a smaller hall
  - question of interference of second IR and crossing angle
  - installation strategy: surface (CMS like) or hall (ATLAS like)
- Access to inner detectors: how important, how frequently
- Mouting the inner (SI) detectors: how, from where, survey?
- Mounting the TPC: how, from the coil?
- Connecting the ECAL and the HCAL and the coil: need detailed concept to evaluate gap sizes etc: update needed since significant changes compared to TDR in calorimeters
- Cost the thing eventually...