Various Possibilities for disposition of Experimental Area

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- Comments on Surface Assembly and Heavy Lifting
- Various dispositions of Experimental Area
  - RDR design
  - Two Large Offset Shafts
  - One Large Offset Shaft
- Possible Underground-Hall Parameters
- Conclusions

Starting Point

- Difficult to equip ILC with two independent IRs.
- Choice of Push-Pull scheme to exchange experiments frequently, say every month or so
- Exchange must be done quickly, say in three days.
- Goals are ambitious, however, I concluded that they can be met, but this cannot be for free.
- Part of the saving from doing away with a second IR will have to be invested to provide a well-engineered, efficient and safe push-pull system.

Hypotheses for this study

- Chosen site is a ‘Deep Site’, say 100 m deep or so.
- ‘Surface Assembly’ scheme followed by ‘Heavy-Lifting’ à la CMS is used.
- The ‘Larger Detector’ will drive the requirements (I have used GLDc as example here).
- If the other one is a ‘Smaller Detector’, it will benefit from improved facilitities.

Moving platform is the technically safe solution…

- To move quickly and safely a 12’000-ton (or so) large composite object is not easy and a dedicated platform would do the trick.
- The two experiments will certainly be two projects largely independent from the machine, in organization and financing.
- It is thus very important to provide a well-defined interface from which all parties can design with different time scales (Civil Engineering needs to go in construction earlier than experiments).
- The platform would allow the detector to be commissioned in the garage position and moved in a nearly working state towards IP.

.. And a clear interface for organization

- Collaboration could be responsible for opening, maintening, closing, and operating its experiment above the platform
- ILC machine could be responsible for moving the platform carrying a detector to the beam position, and from it to the garage positions.
- Mainly beam line would need to be re-connected (and re-aligned), in a common effort.

A concrete platform will be stiff enough

- **The platform project will be reviewed in detail tomorrow by John Amman at 11:50.**

A 2’500-ton load on the CMS cover : 20 m between supports and 3 mm sag

Some comments on

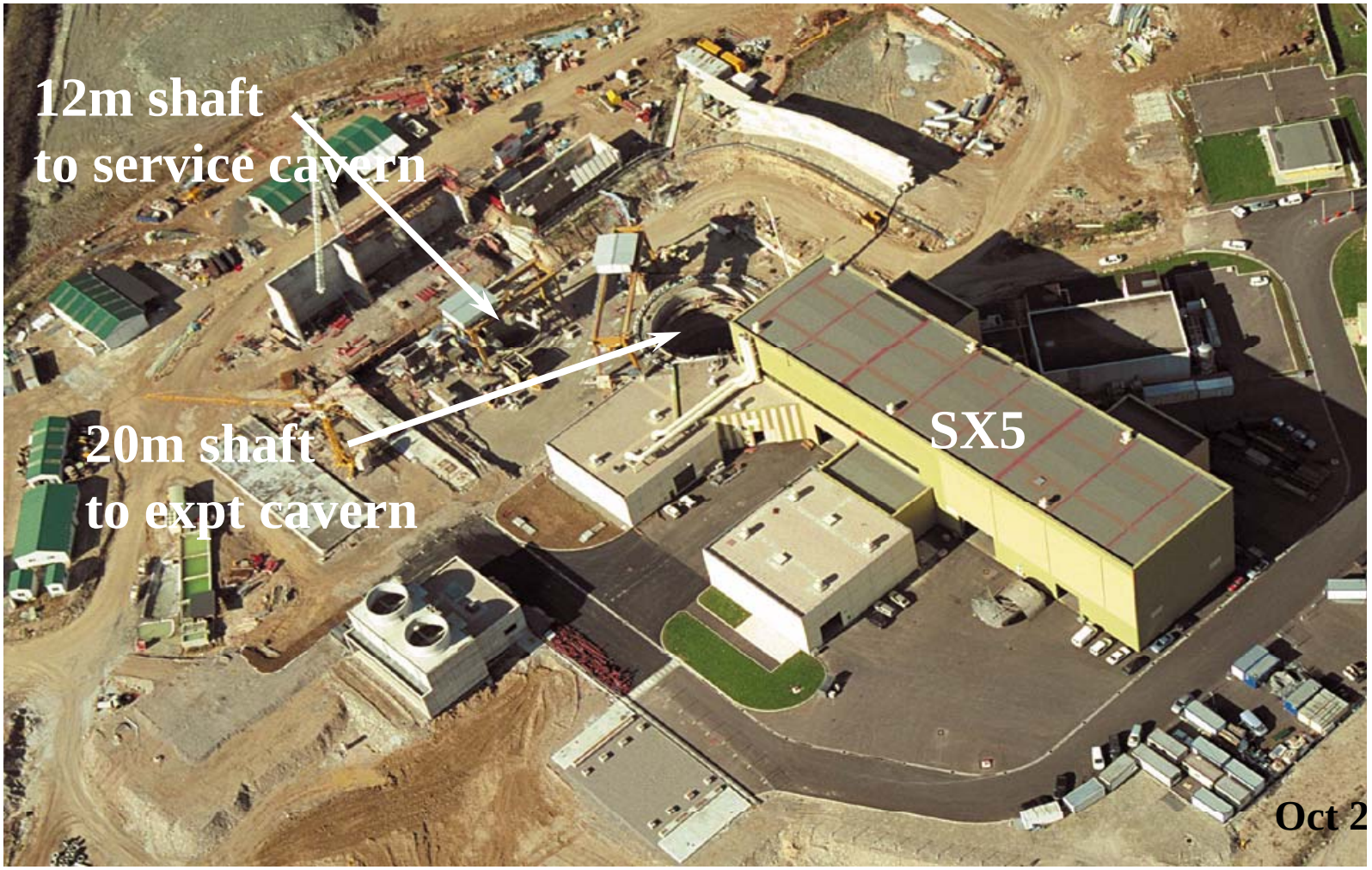
- Assembly on Surface

- Heavy Lifting

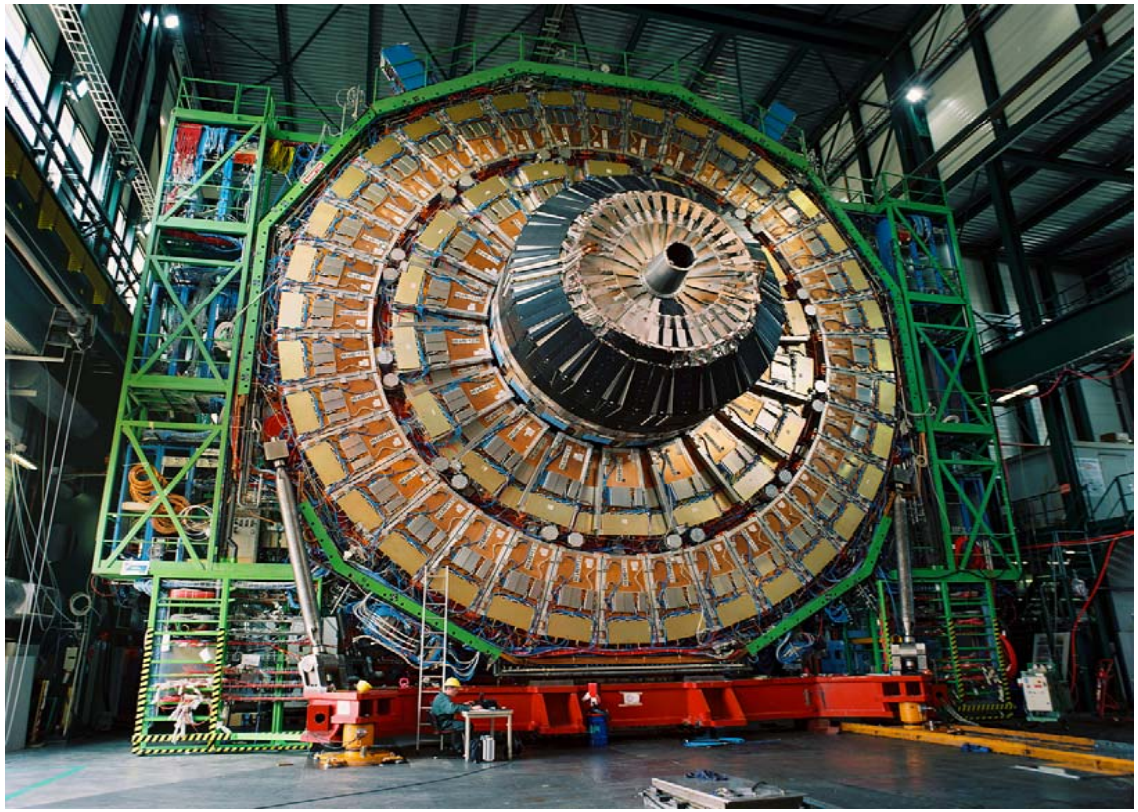
Civil engineering is going on during construction of experiment

view in Oct. 2000

Pre-assembly of CMS in SX5 has isolated us from tricky underground Civil Engin. and schedule pressures

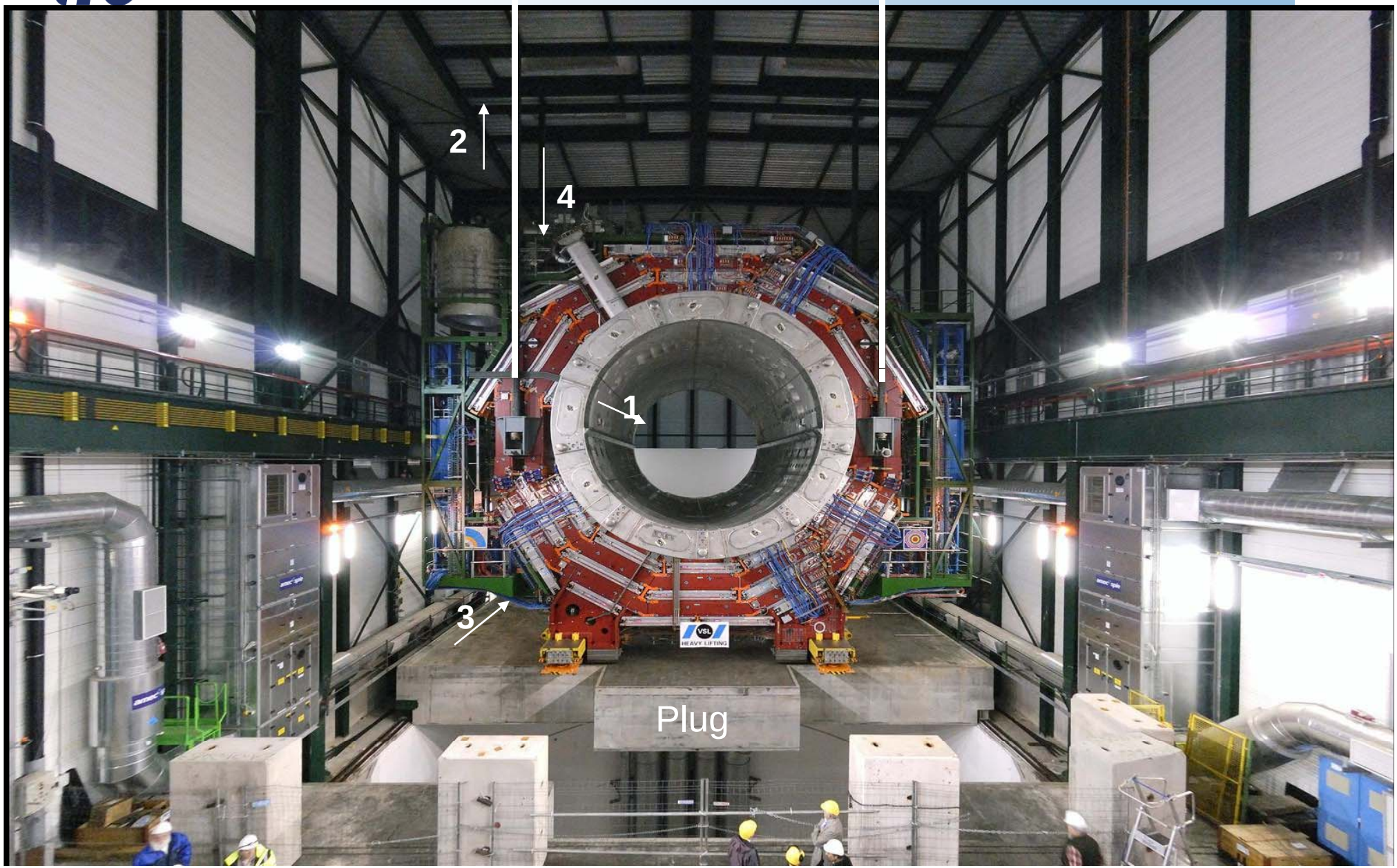


Elements fully commissioned
ready to be lowered (for example YE+1)

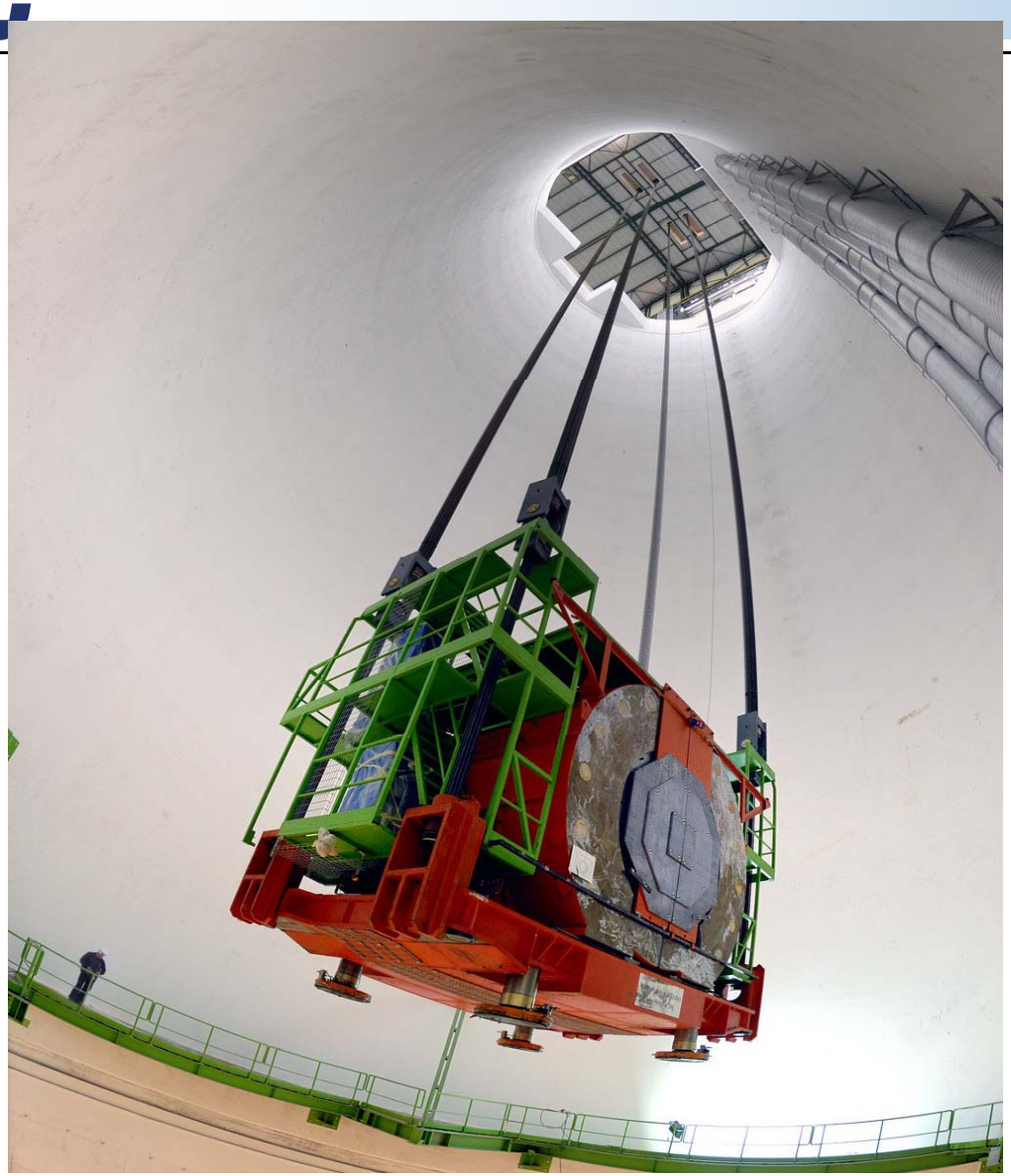


Elements are fully cabled to local racks.
All services, gas and water cooling pipes are there.
Subdetectors are fully commissioned.
Once below they can be connected to the umbilical cables going to the counting rooms through the cable chains.

Opening the plug under the 2000-ton load

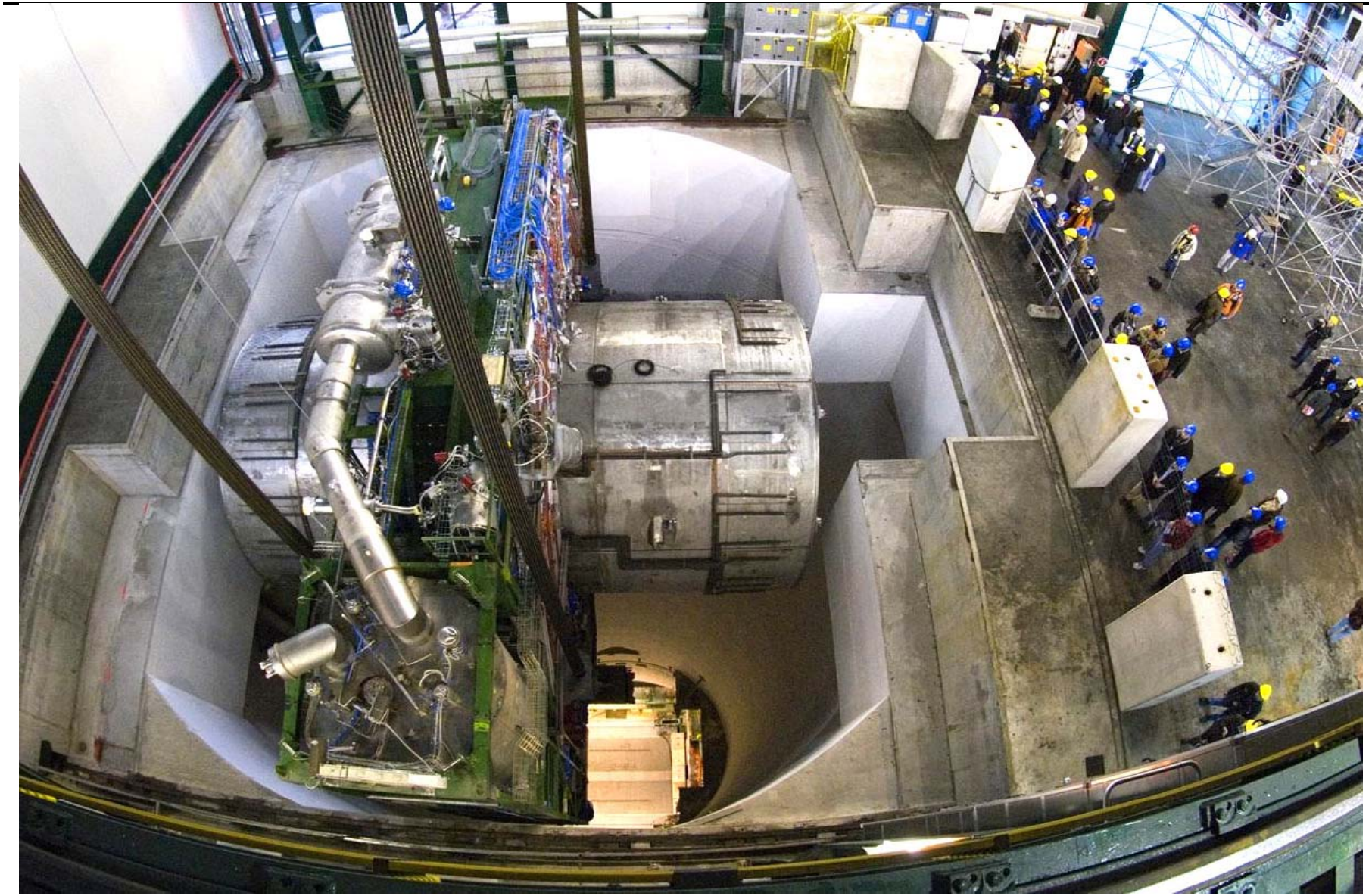


Interference with surface building roof is minimal



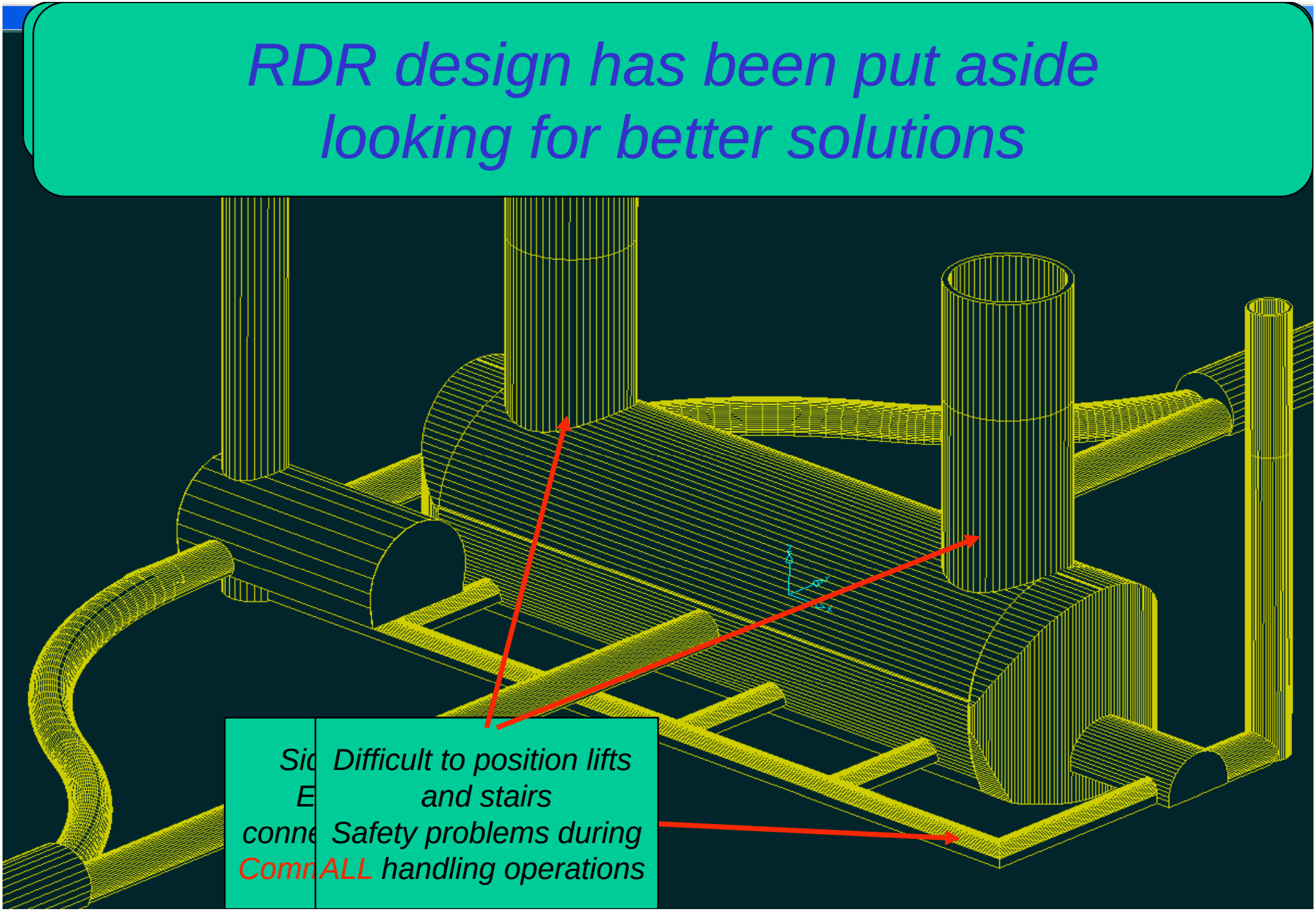
First heavy lift with the 350-ton Hadronic Forward Calorimeters Nov. 06

Heavy Lifting reviewed by Hubert Gerwig Tuesday 10:50



Experimental Area
Two Large Shafts
RDR Design

RDR design has been put aside looking for better solutions

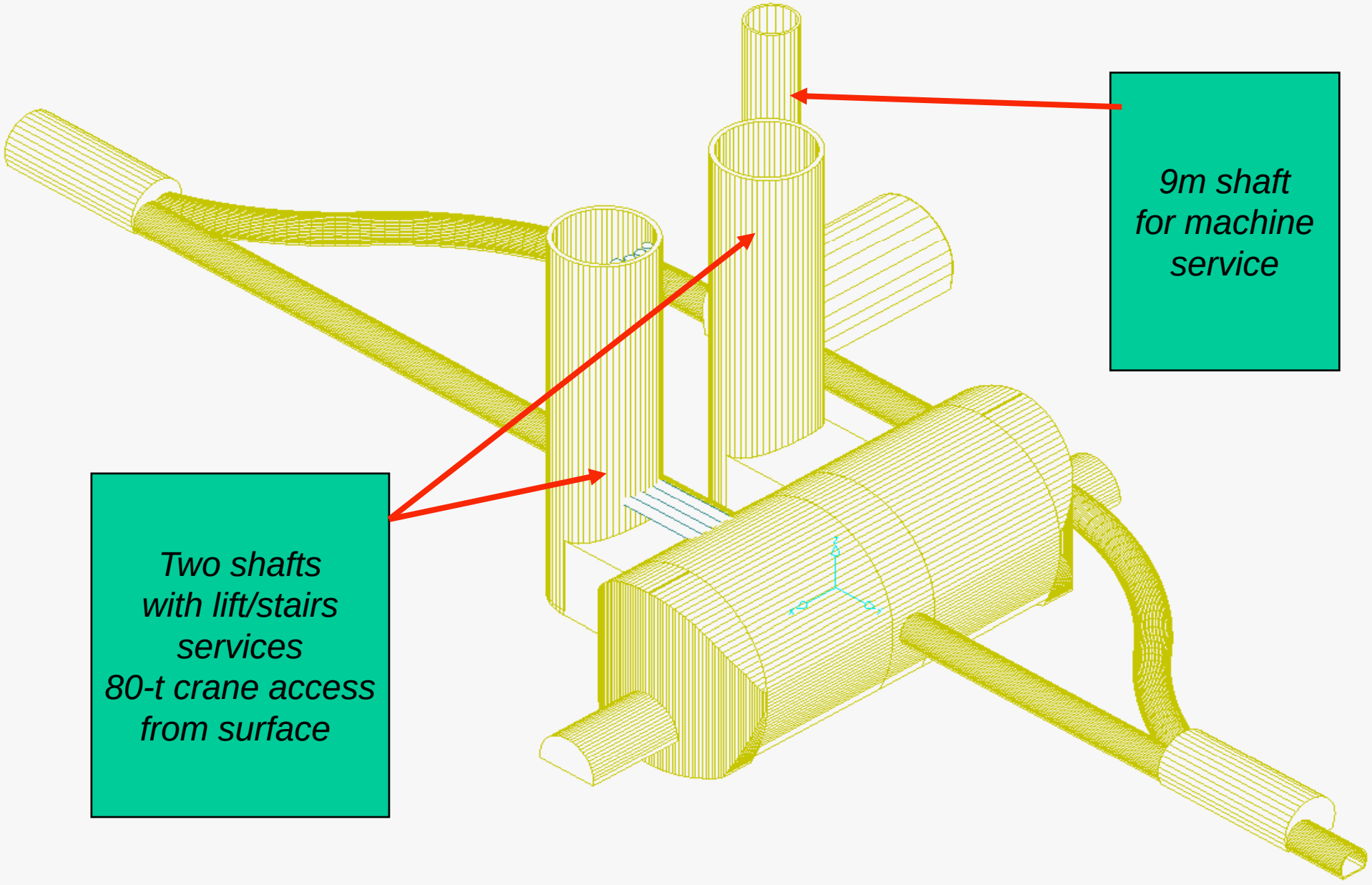


Experimental Area
Two Large Offset Shafts

The shafts are moved outside the main cavern

- The two shafts are positioned outside the footprint of the main underground hall to to do away with interferences (in safety and schedule) between loading/unloading areas and working areas.
- This solution has been used for 3 of the 4 LEP experiments, Aleph, Delphi, Opal.
- It needs horizontal transfer of loads but this is well adapted to the full surface assembly scheme.

Two Large Shafts outside the Footprint

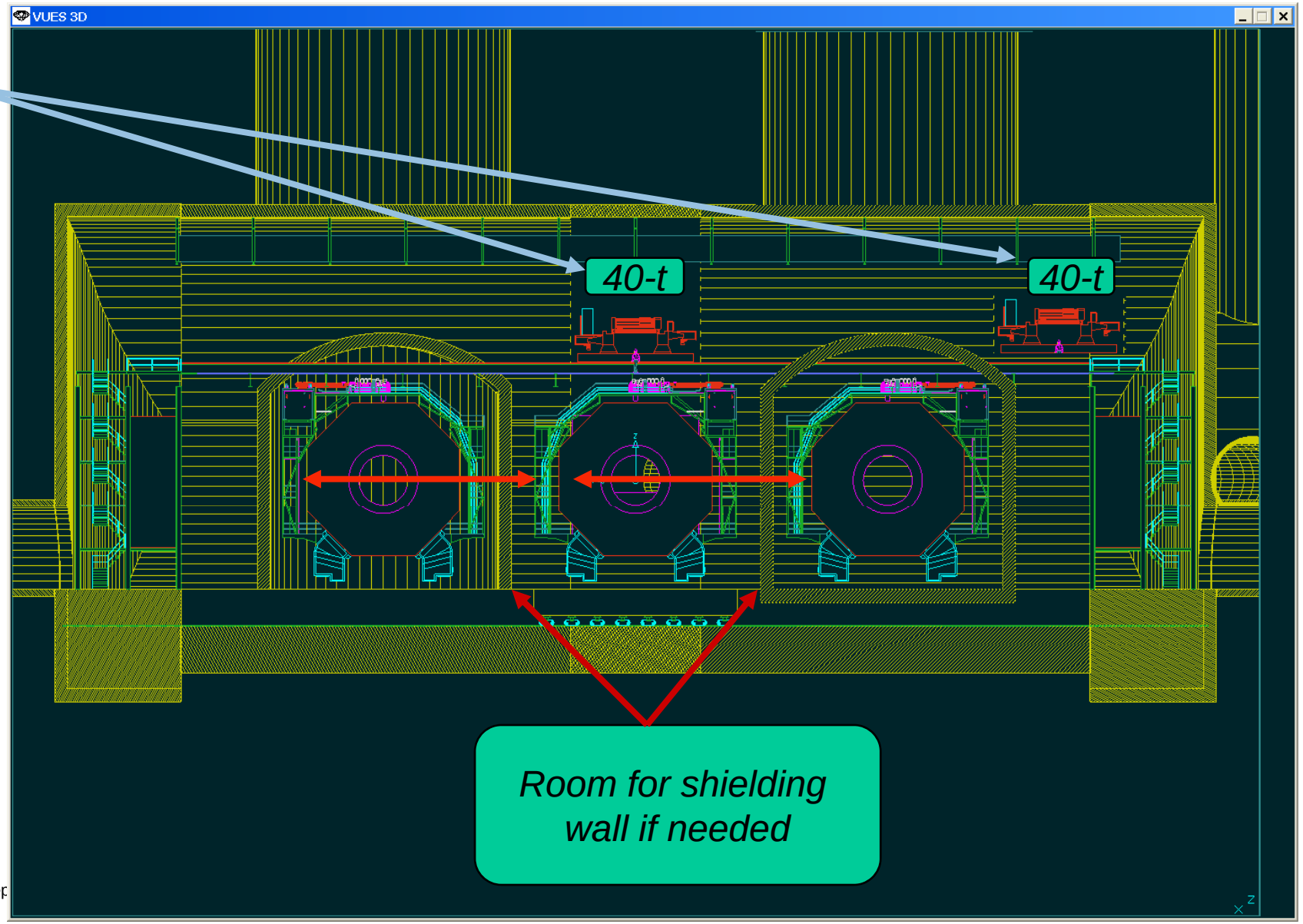


9m shaft for machine service

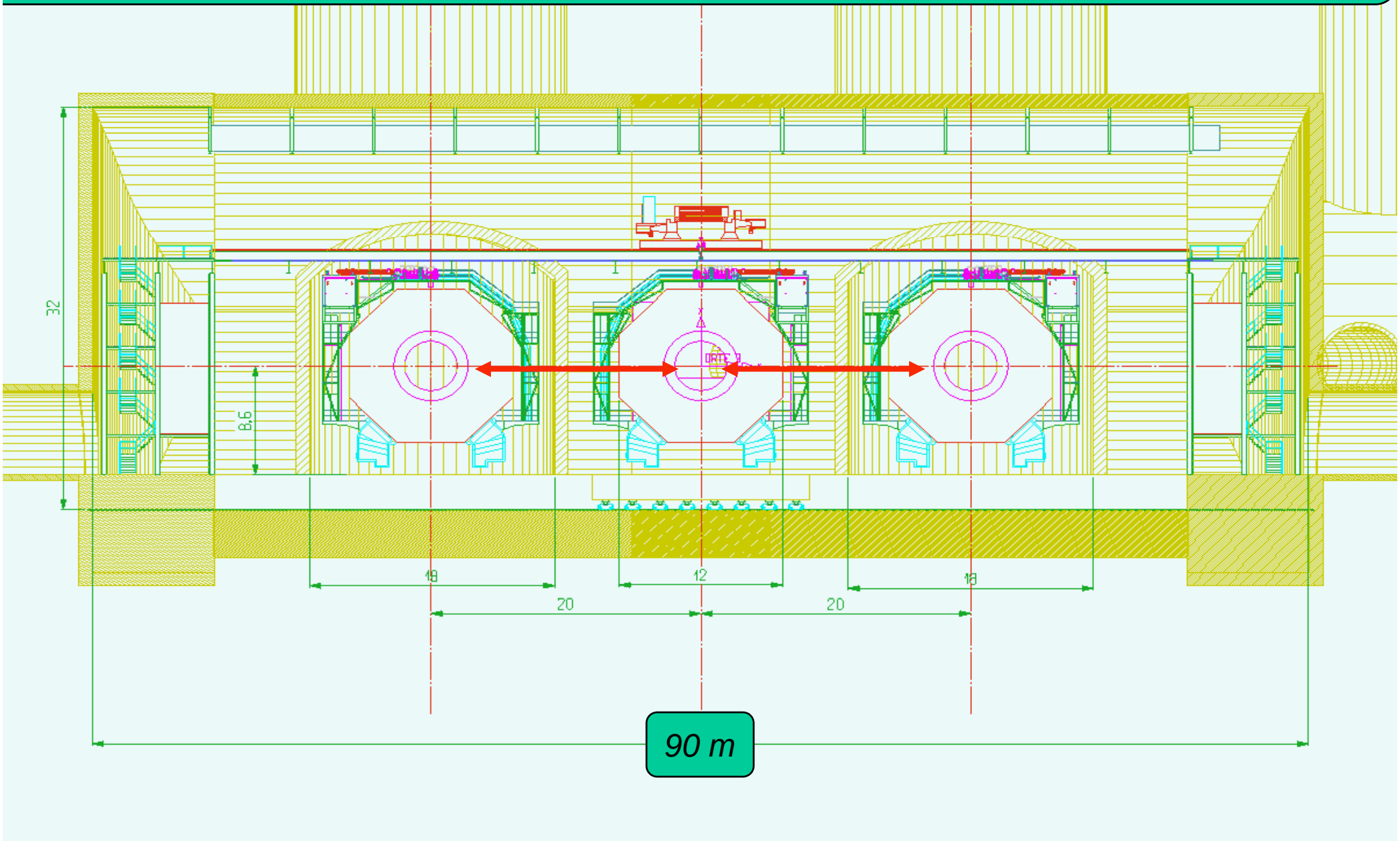
Two shafts with lift/stairs services 80-t crane access from surface

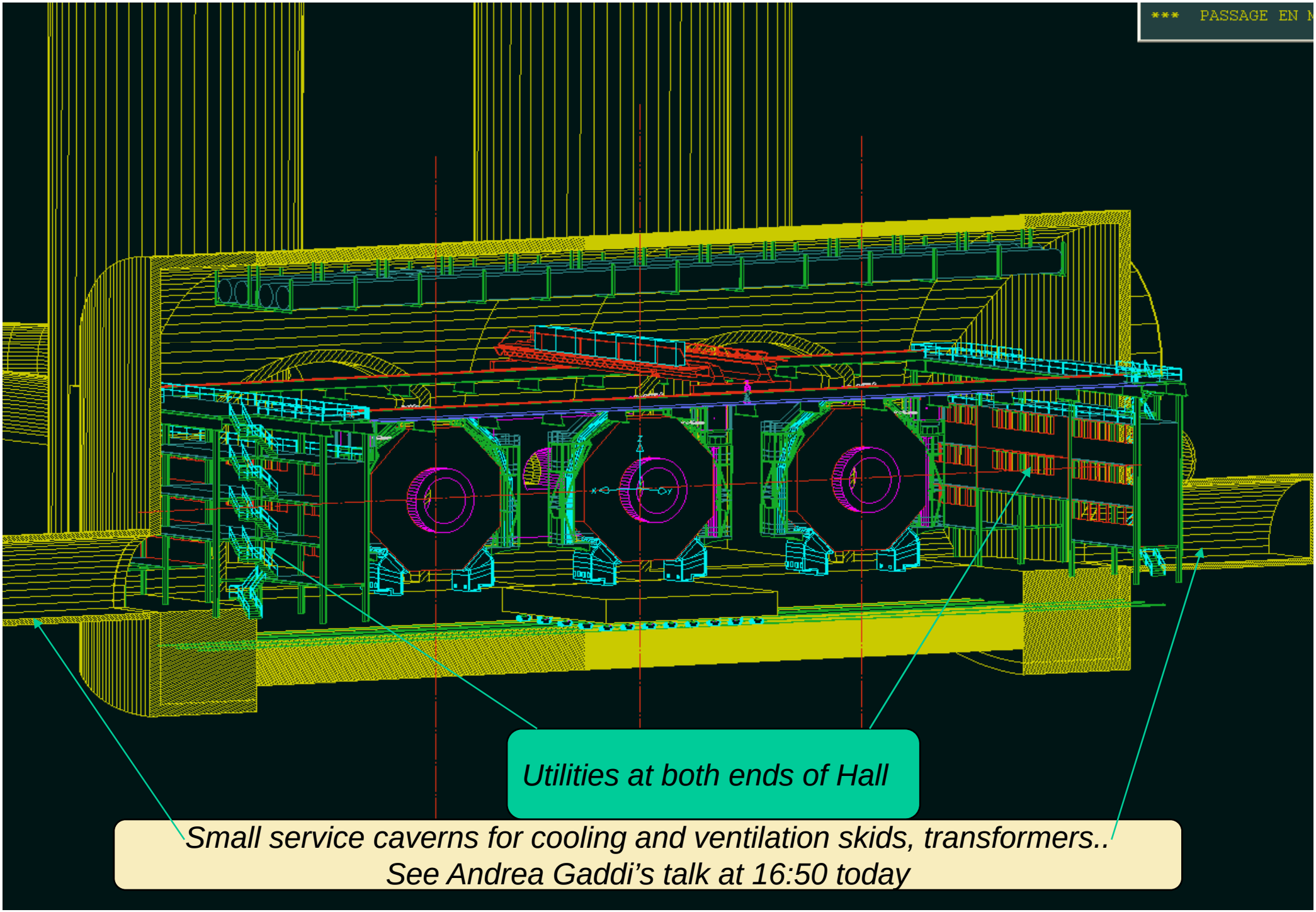
Two Large Shafts - With experiments

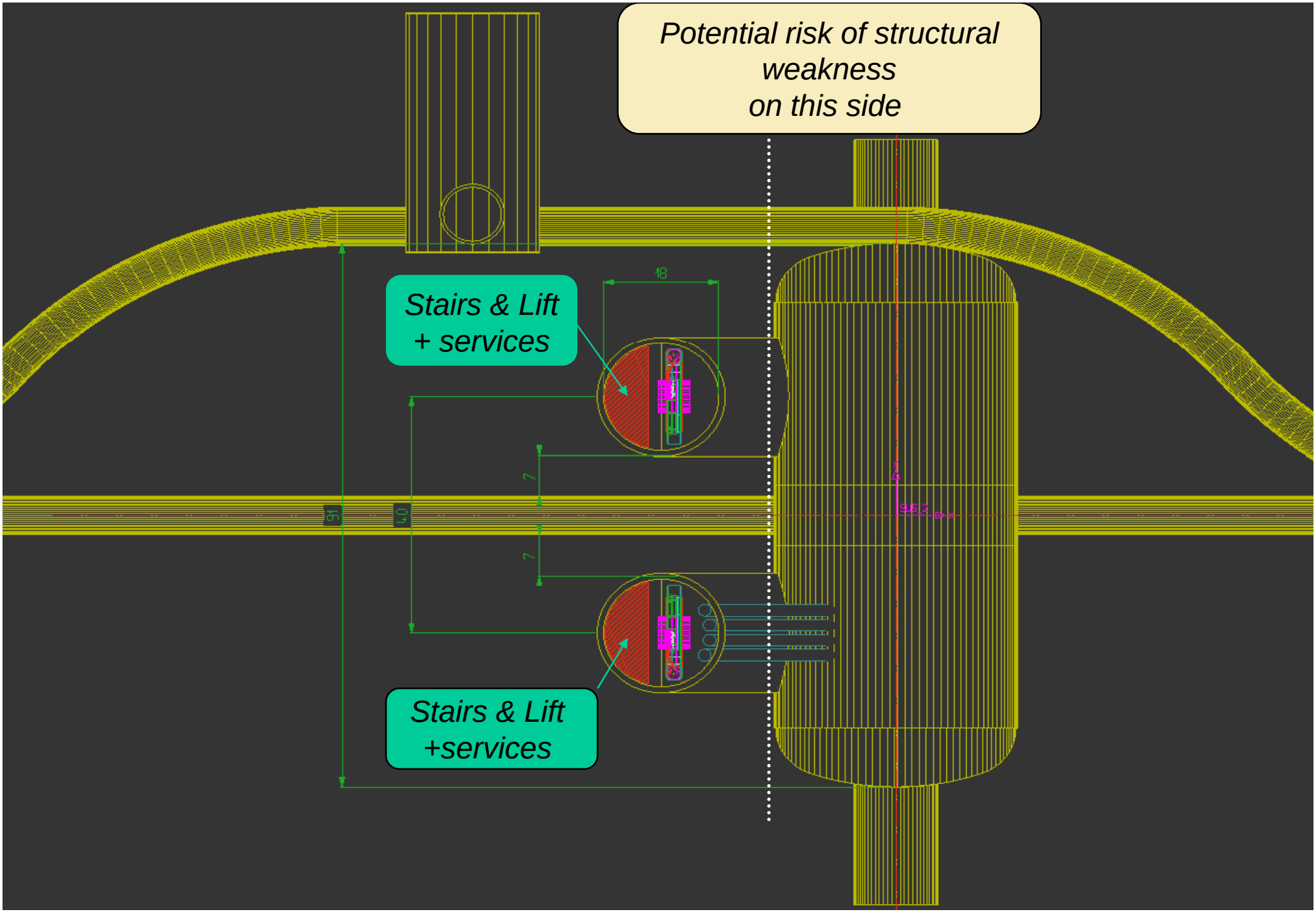
Two asymmetric 40-ton cranes can be ganged to move around 80-ton pieces

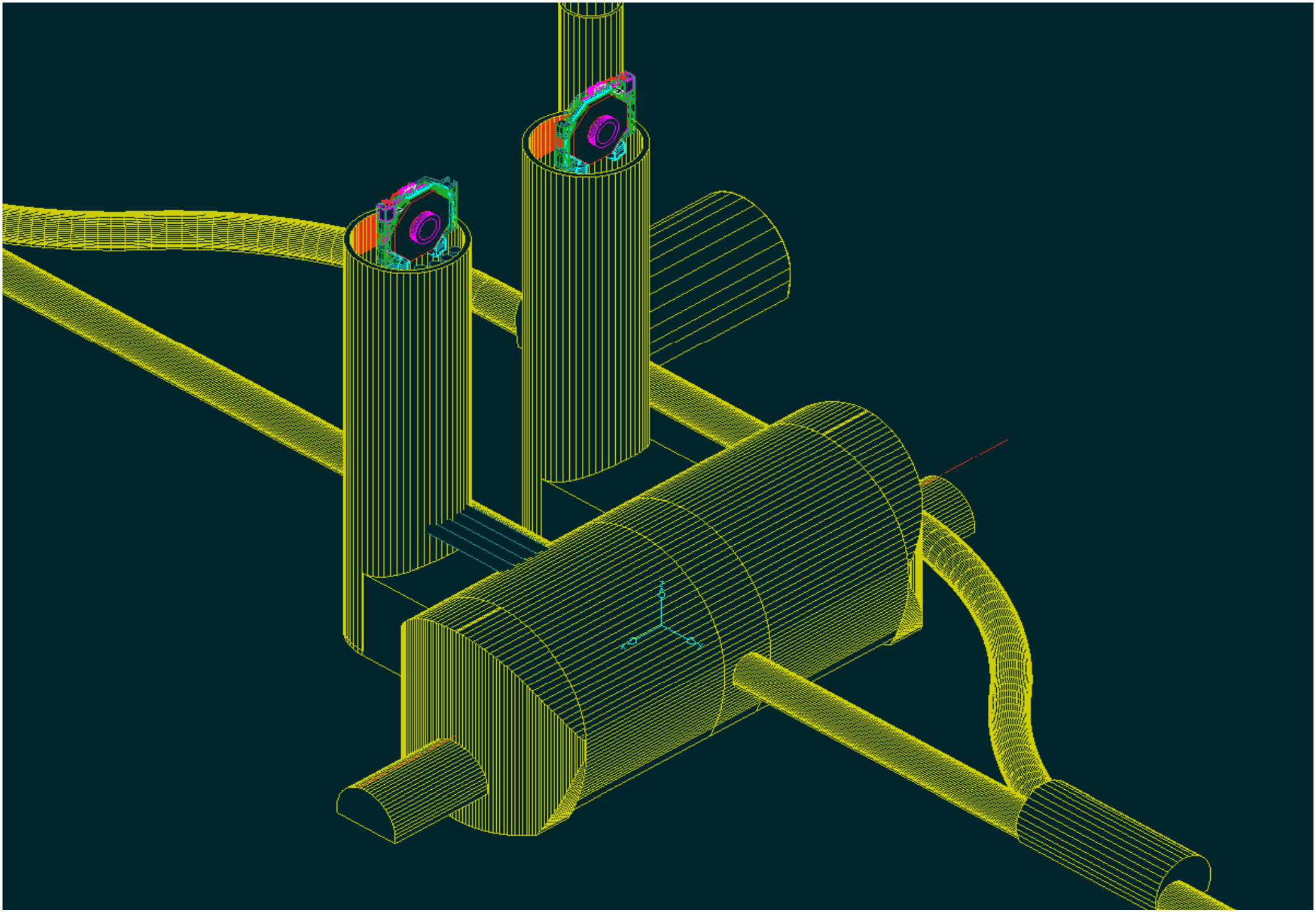


Two Large Shafts with possible dimensions

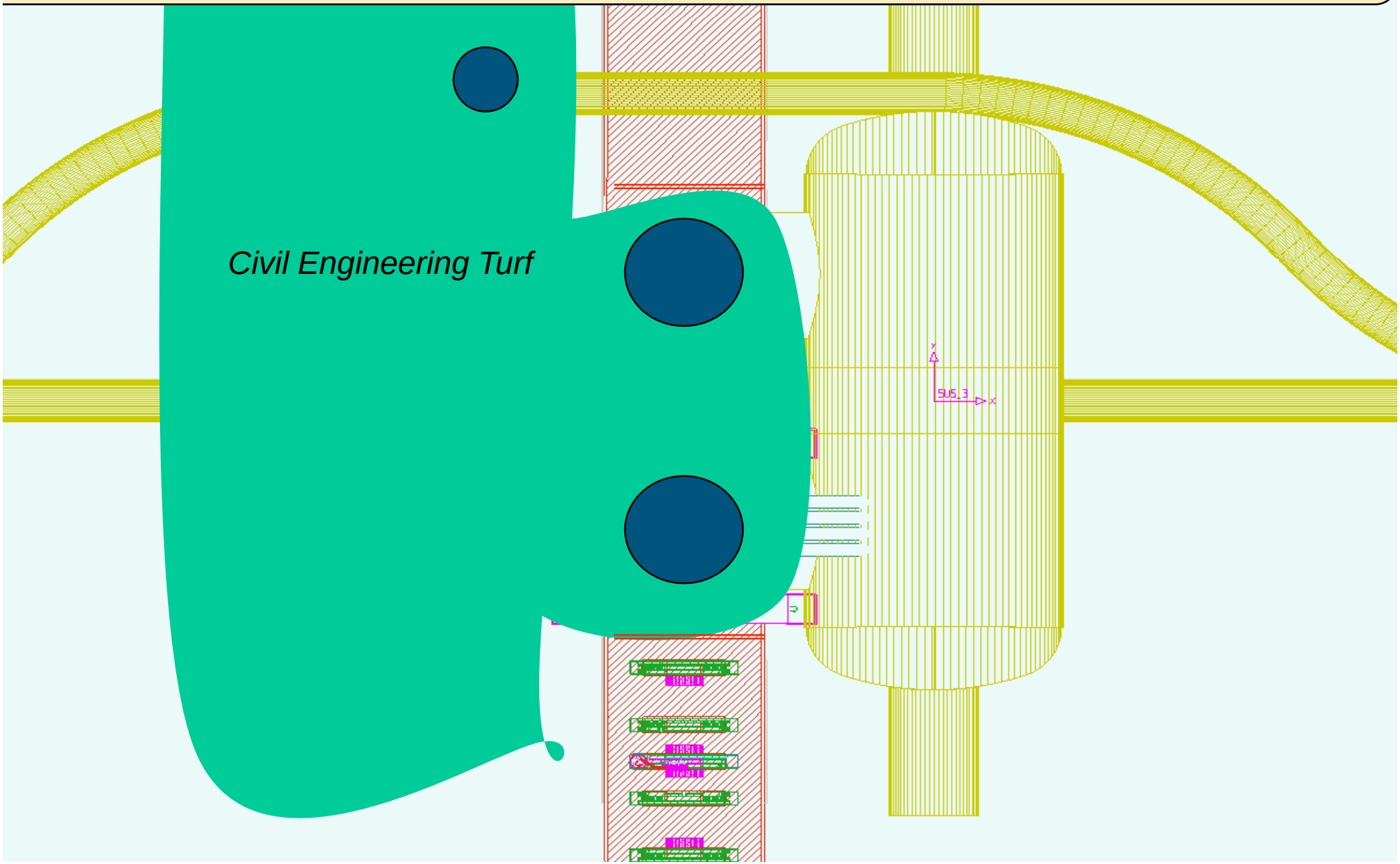



*** PASSAGE EN
Utilities at both ends of Hall
Small service caverns for cooling and ventilation skids, transformers..
See Andrea Gaddi's talk at 16:50 today

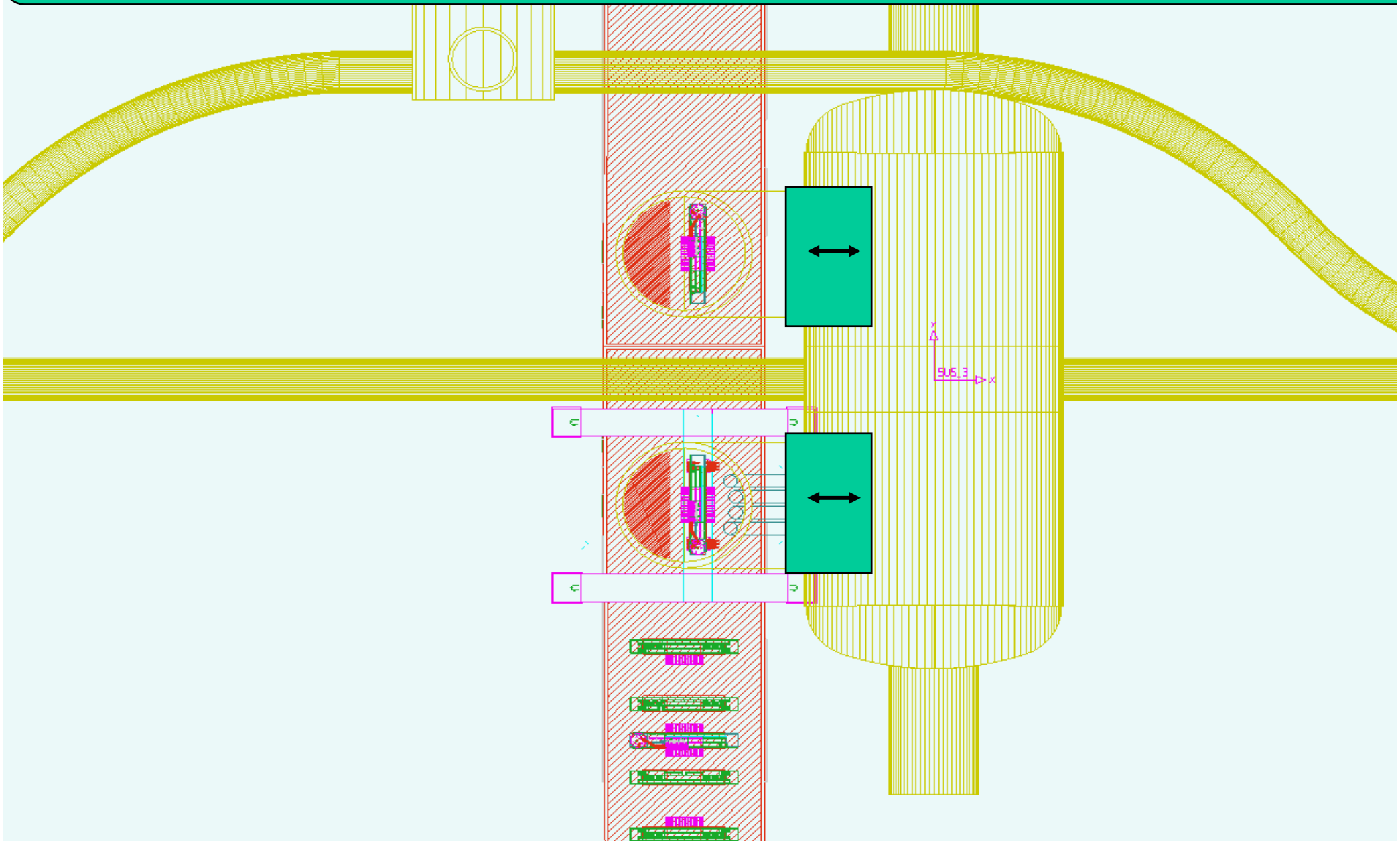

Potential risk of structural weakness on this side
Stairs & Lift + services
Stairs & Lift +services
18
7
7



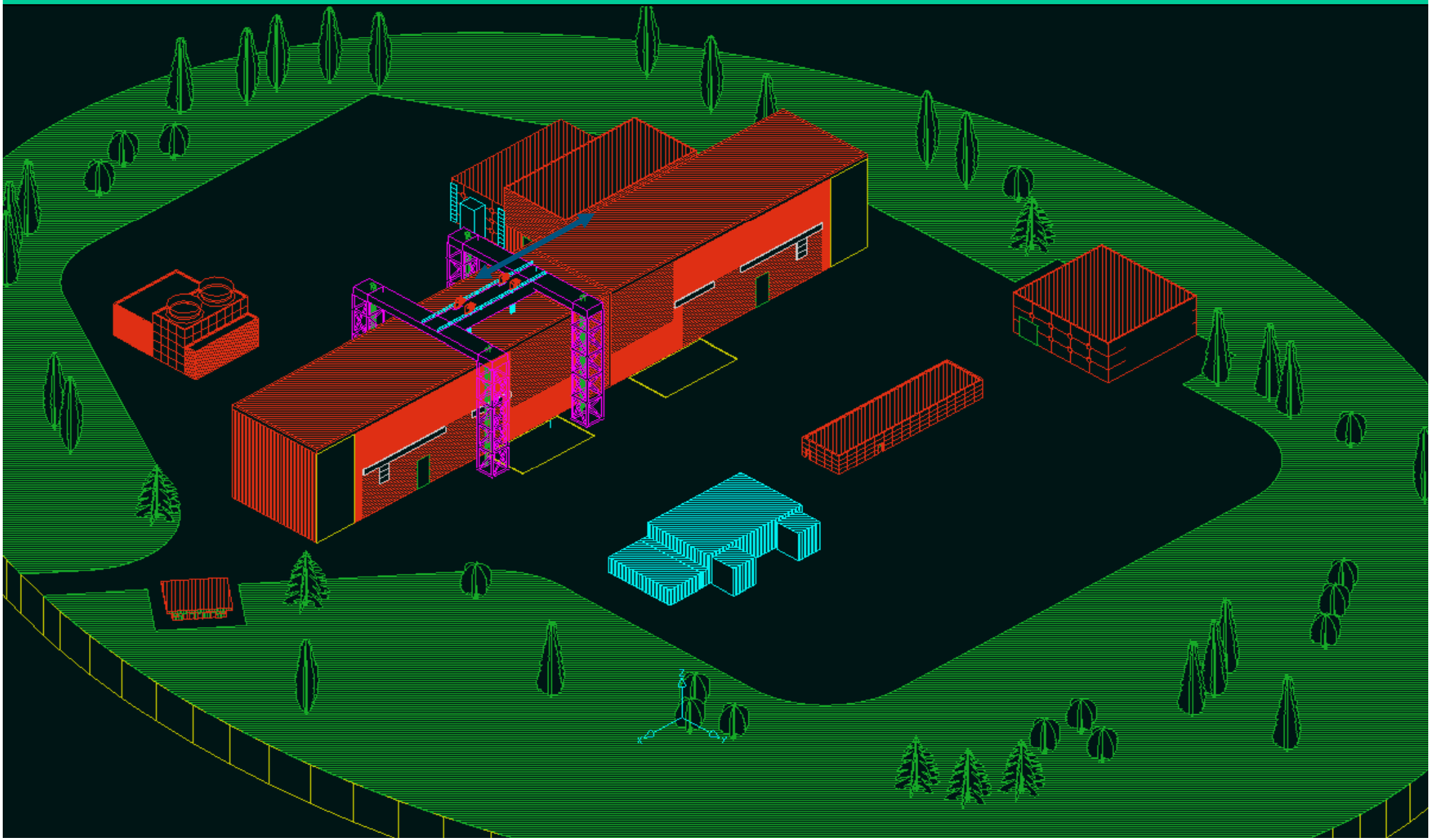
Two Large Shafts - Phase I

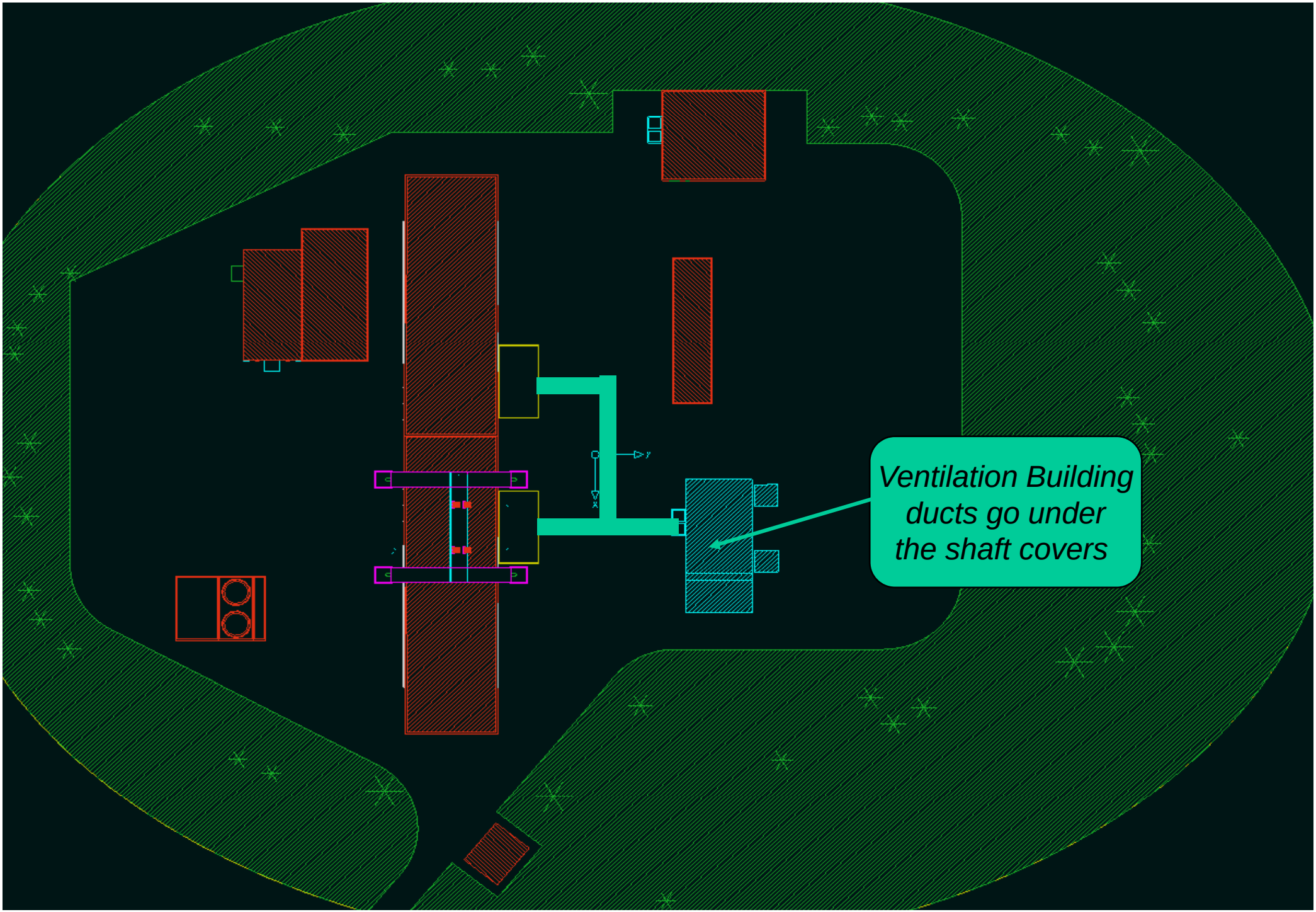


Two Large Shafts - Phase II



Gantry can be shifted (without load) from one shaft to the other one




Ventilation Building
ducts go under
the shaft covers

Experimental Area

Two Large Shafts

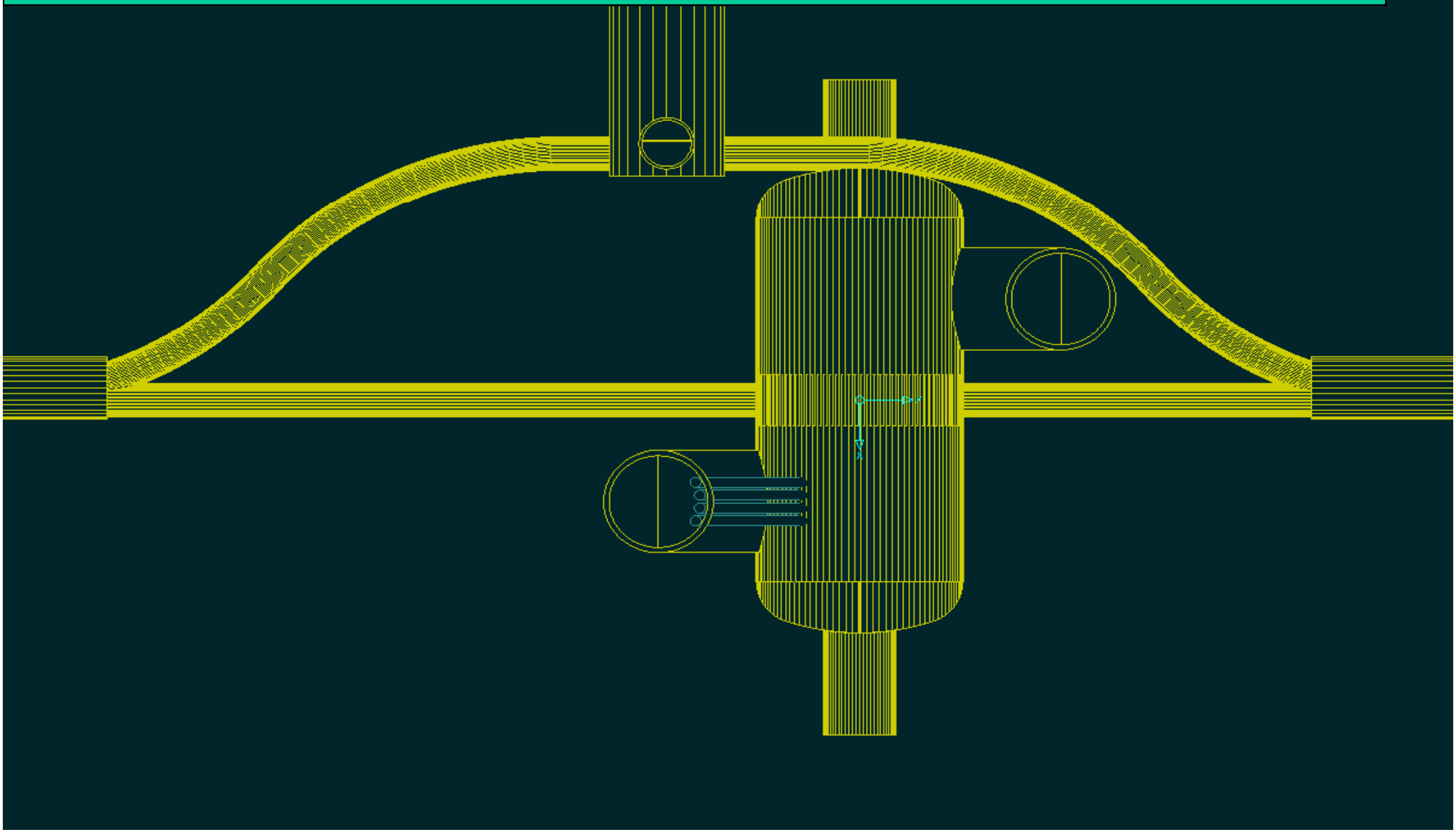
Offset Diagonally wrt IP

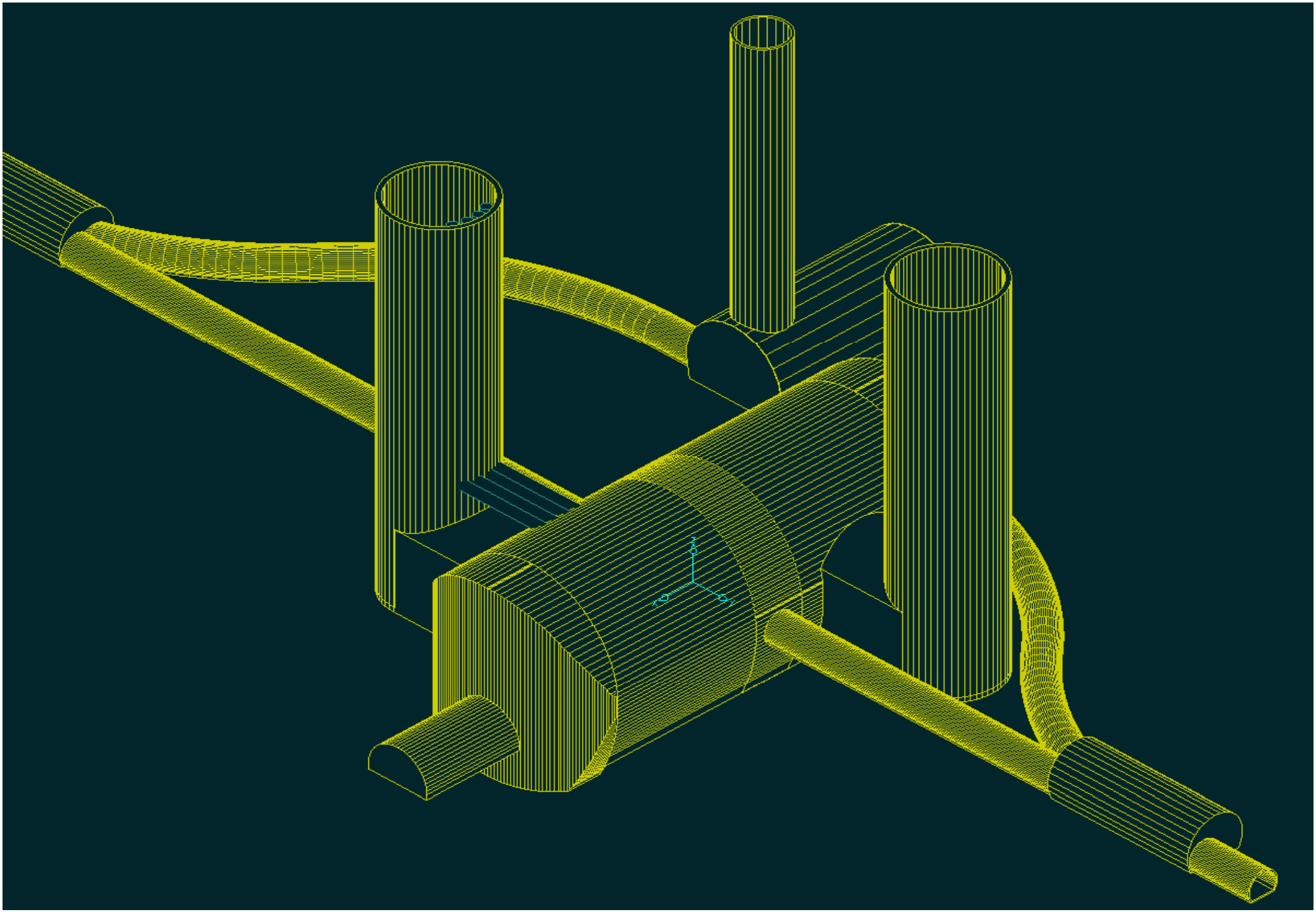
The two large shafts are moved outside the main cavern diagonally

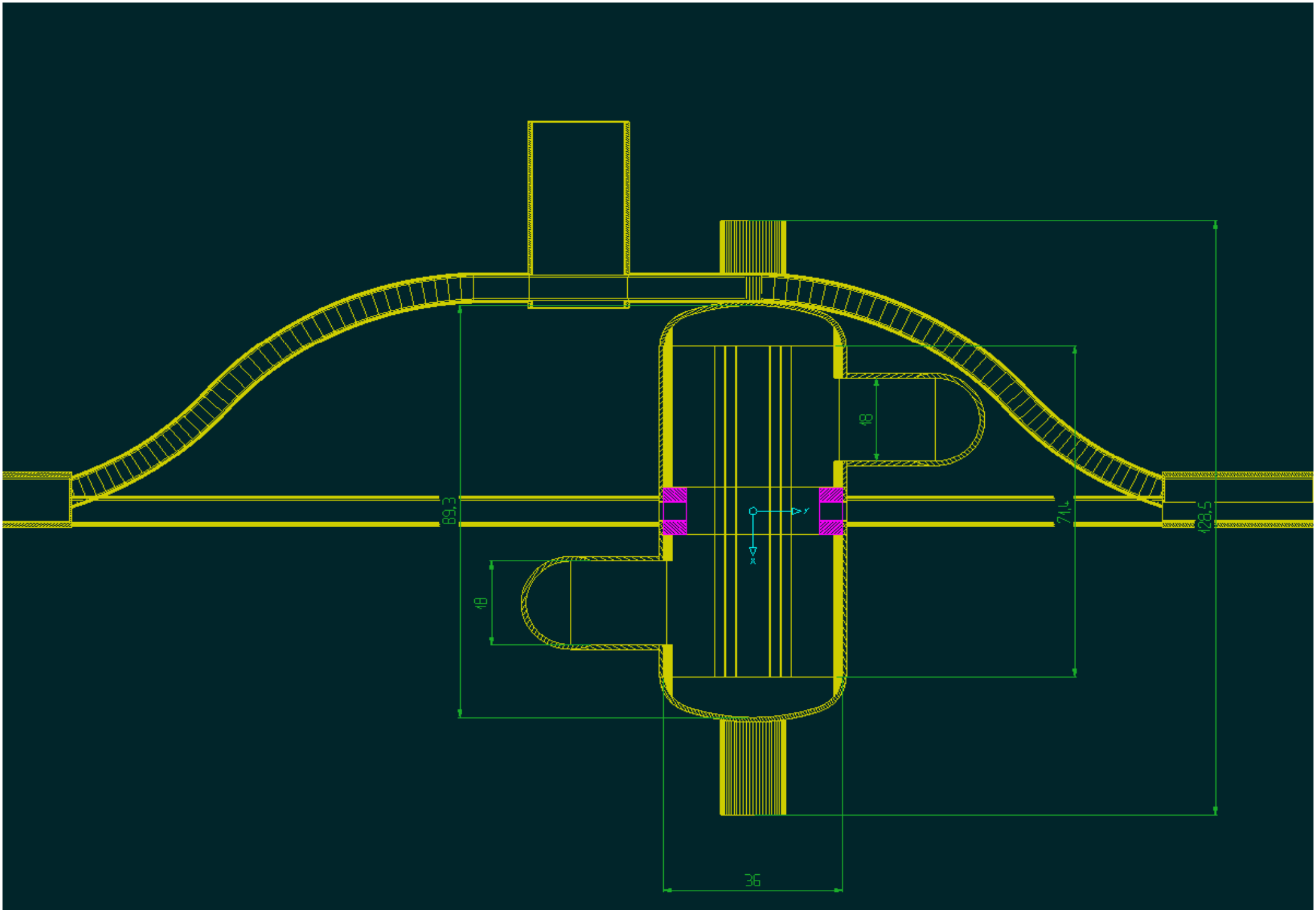
- To have a more symmetric design for the cavern, and have all shafts well separated, we can move them diagonally wrt. IP

- This scheme seems better than the previous one, very similar in logistics apart for the surface hall

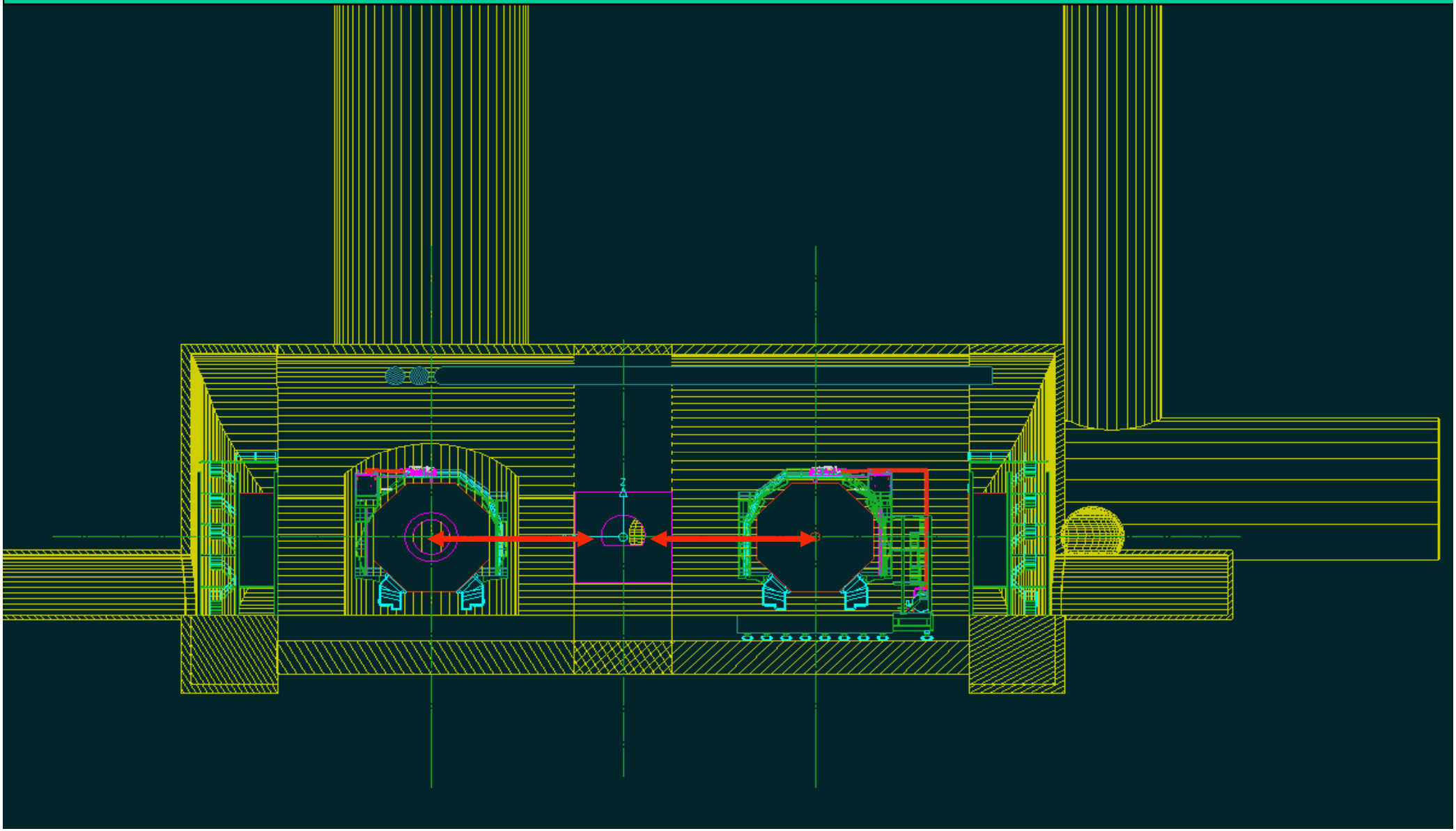
Two Large Shafts in Diagonal
to reduce structural weakness on the side of the two shafts

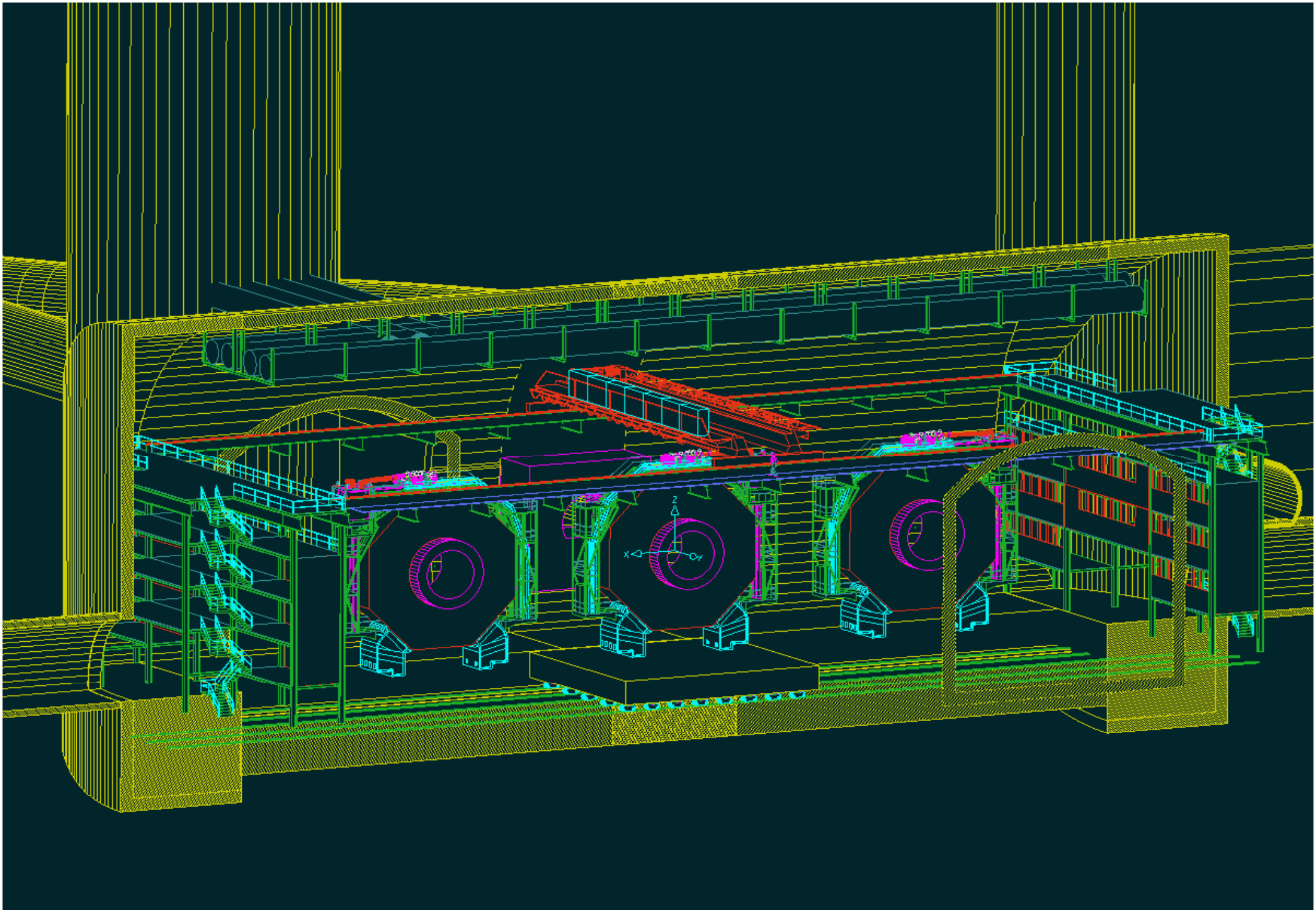




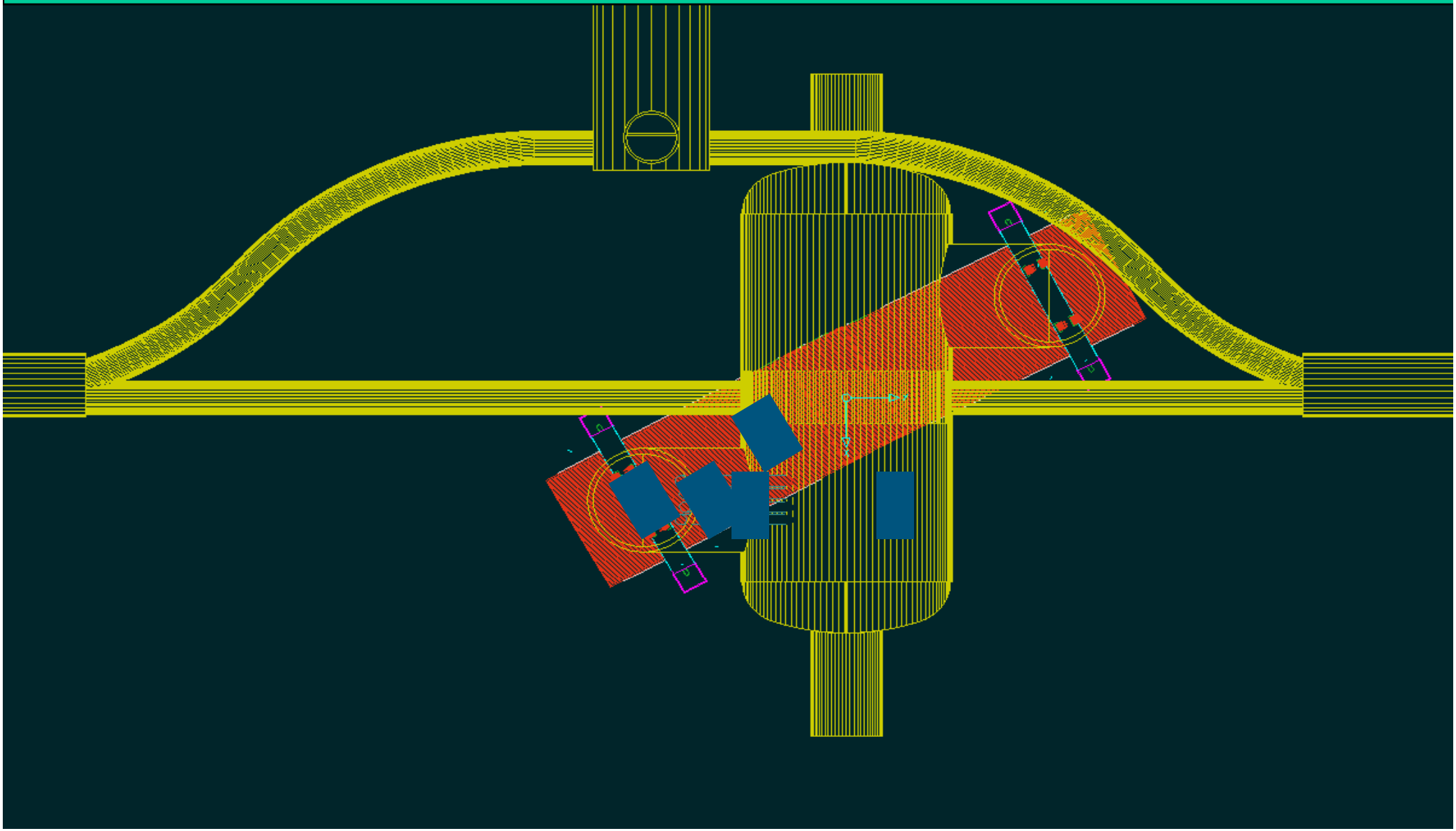

89,3
48
48
71,4
128,5
36
y
x

For the Experiments in the Underground Hall
there is no difference

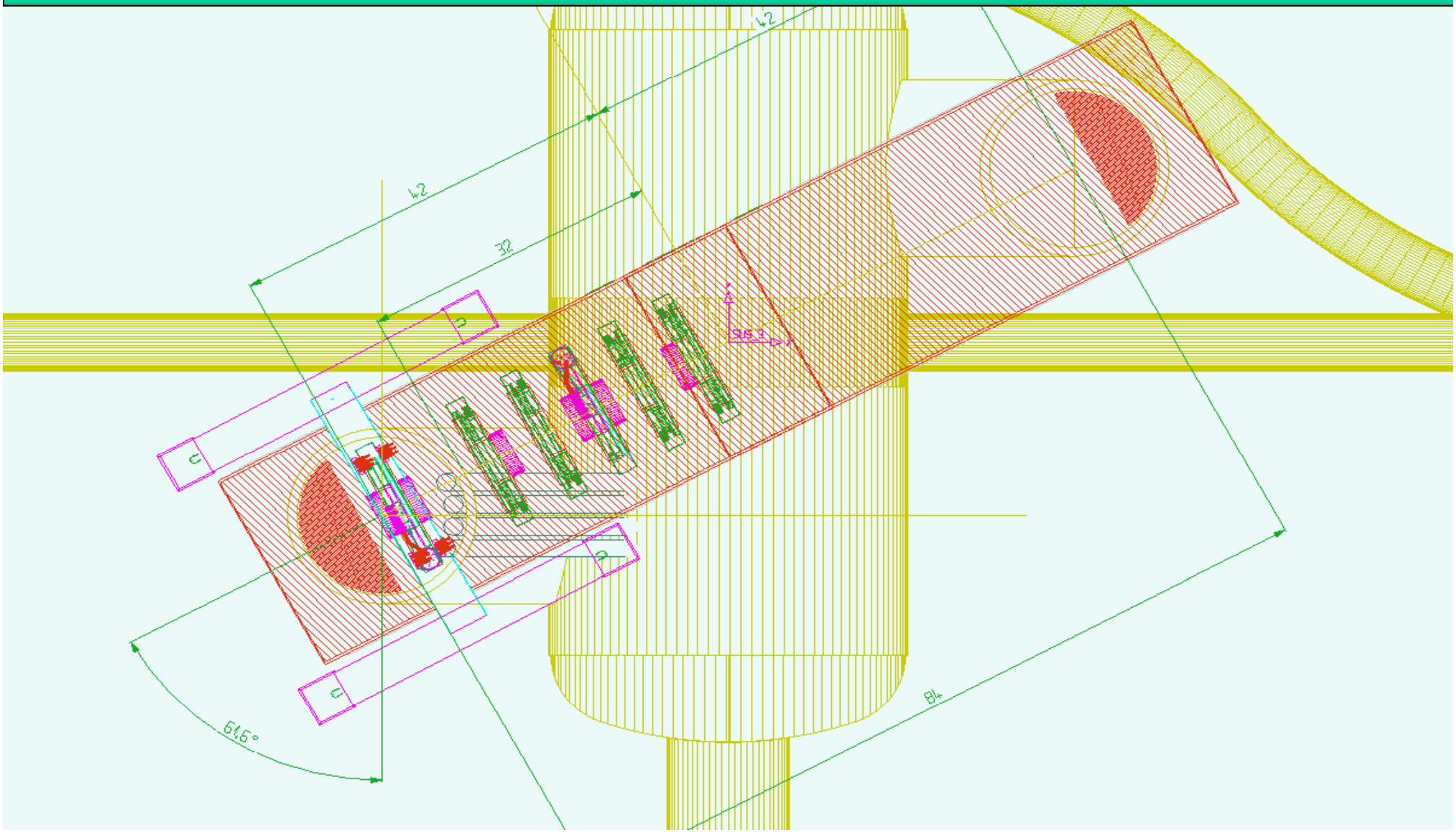




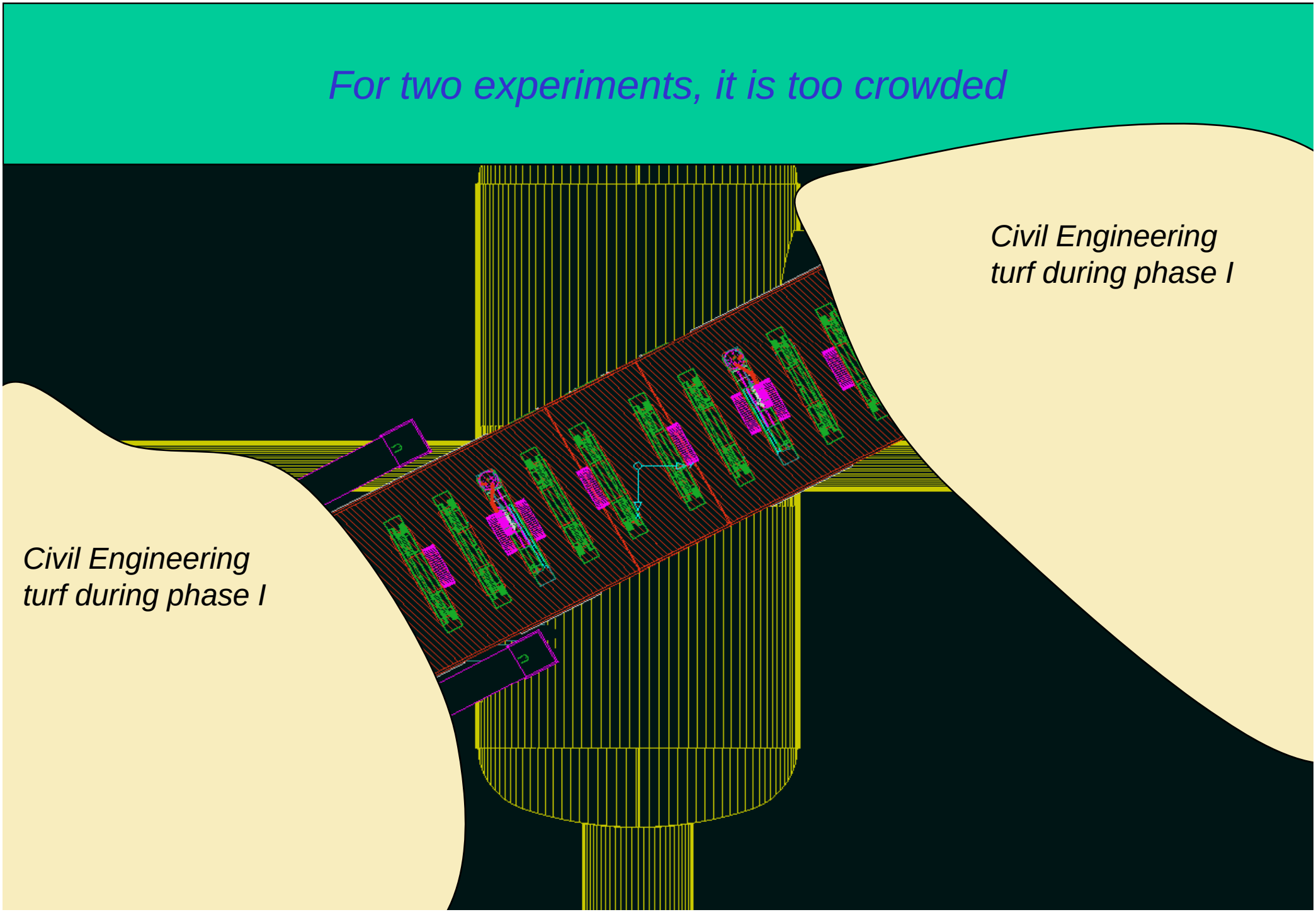
Elements could be lowered at an angle and rotated in the Transfer Tunnel



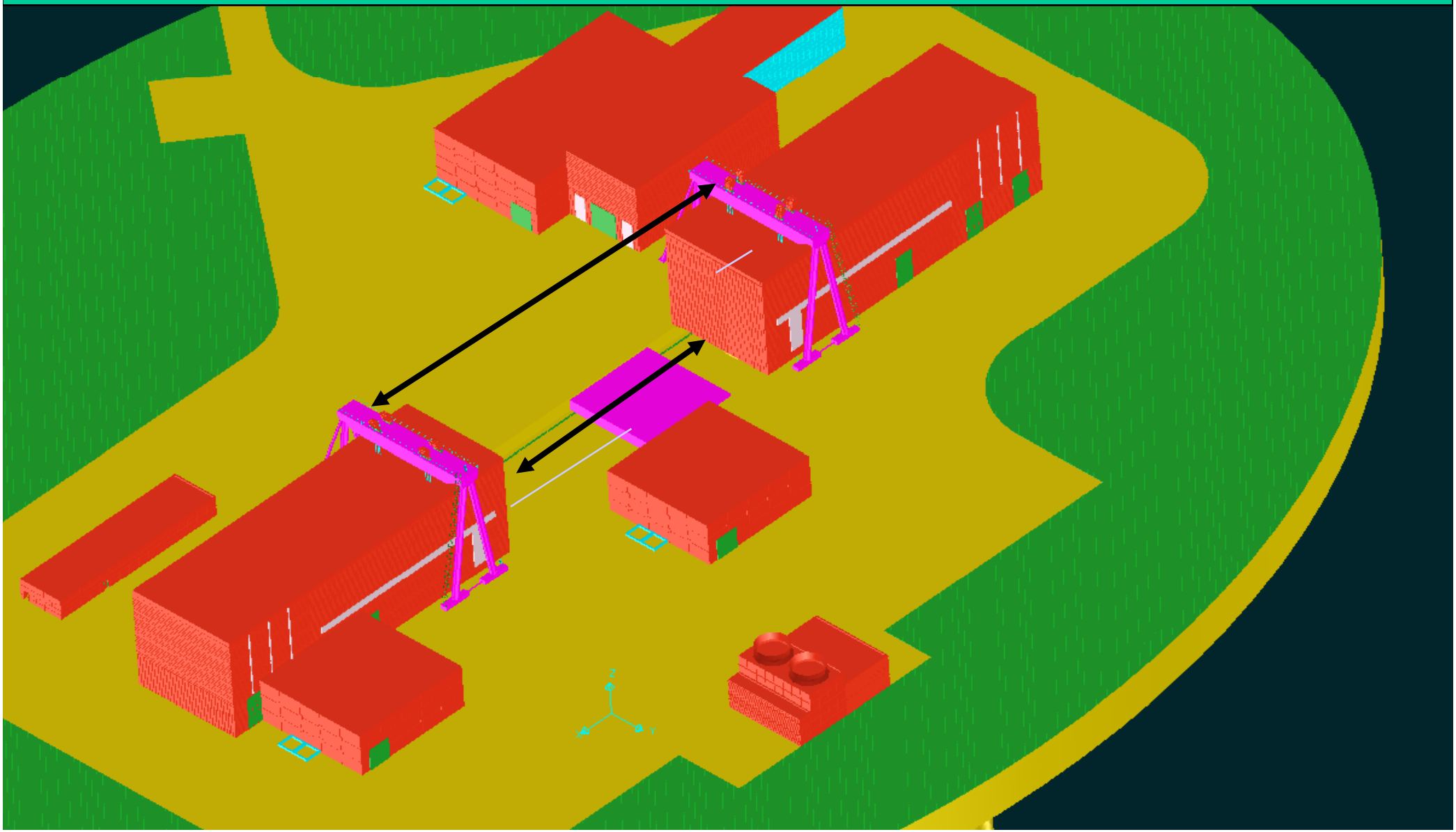
For one Large experiment space
in between the two shafts looks OK



For two experiments, it is too crowded



Two Halls can be separated, and still
Gantry (possibly cover) could be shared

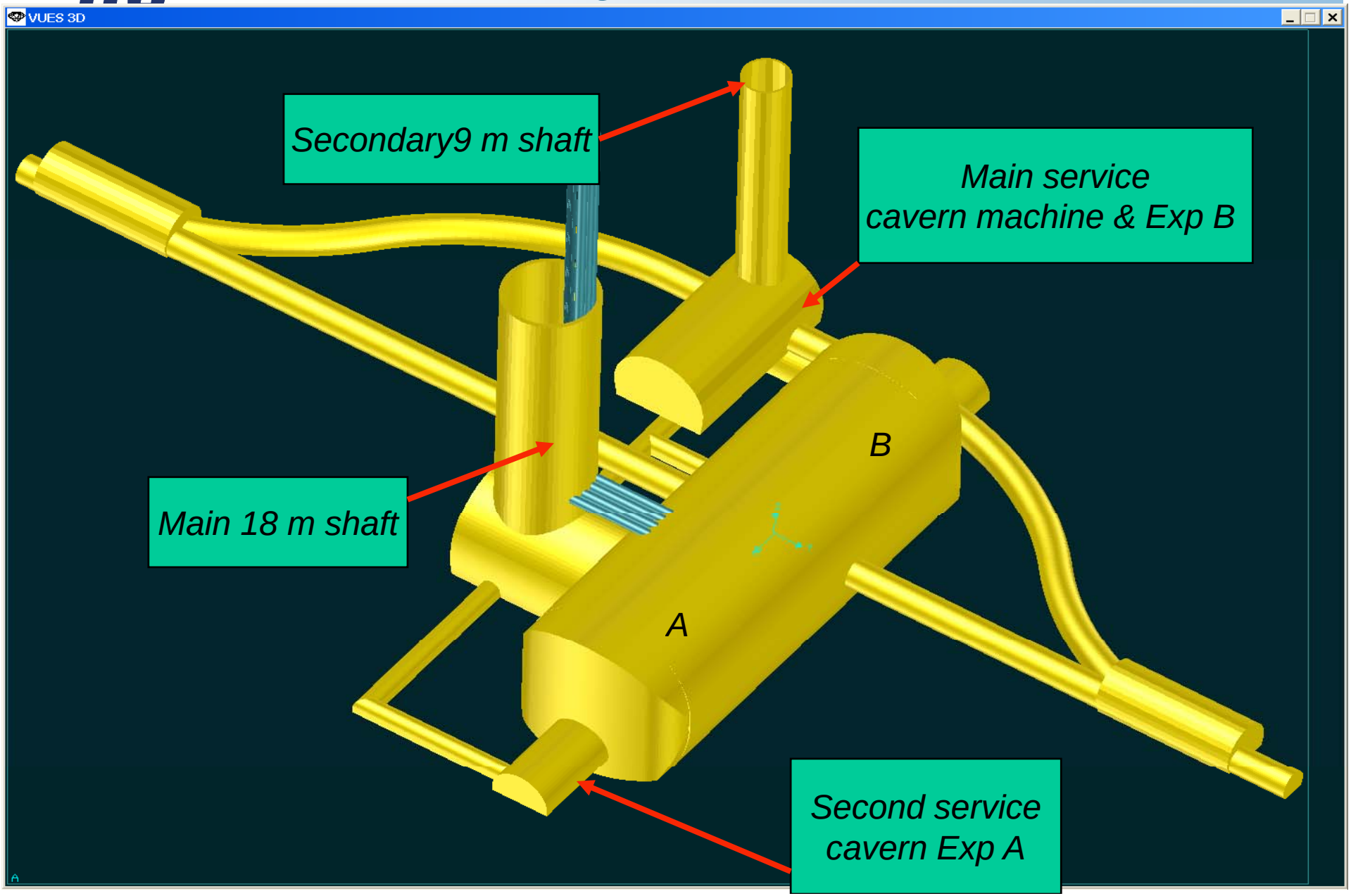


Experimental Area
Only One Large Shaft

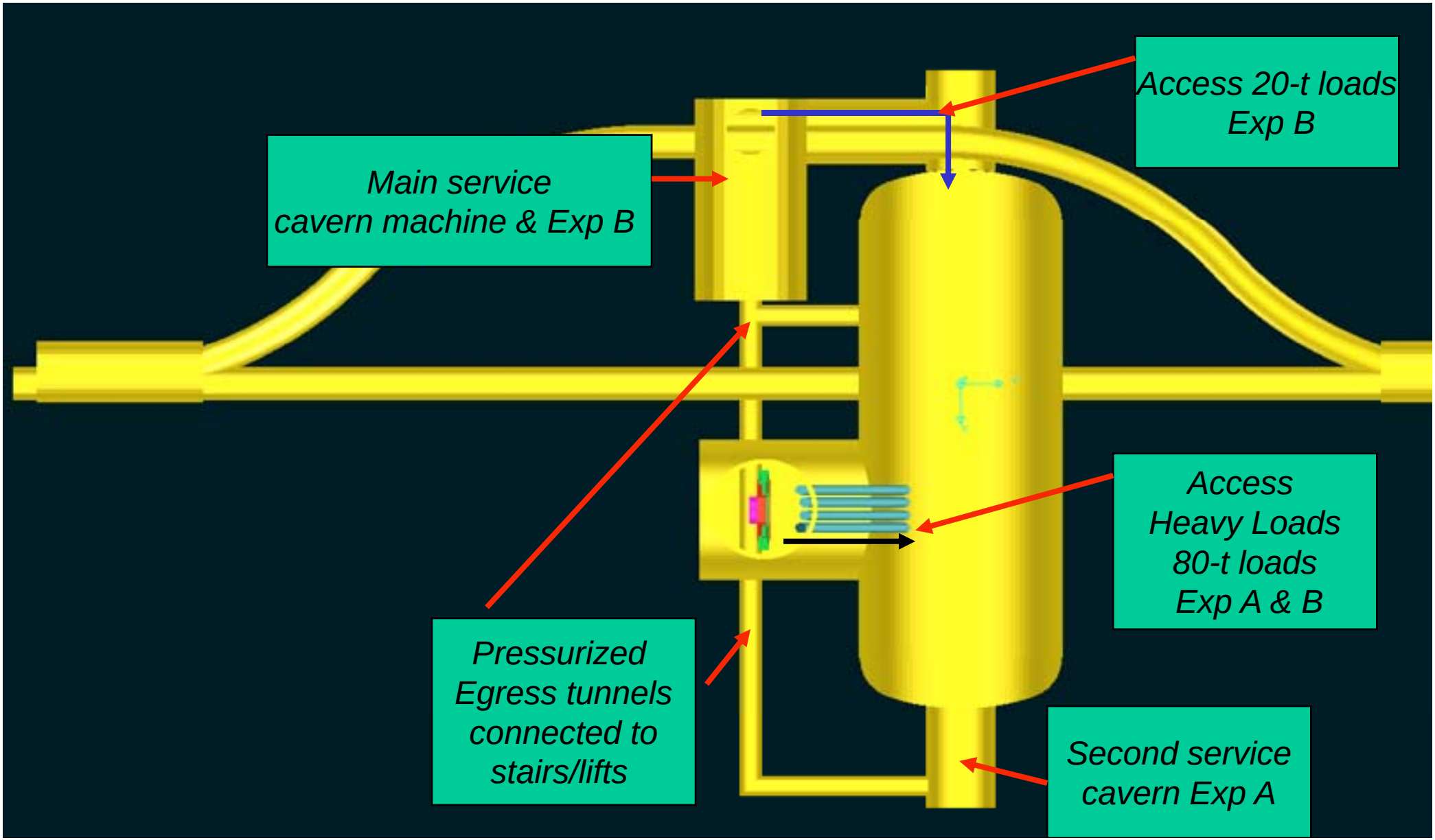
One Large Shaft only

- This solution has been looked at at the suggestion of Andrei. There is a *potential* saving
- However, the symmetry between the two experiment is broken, and one is *necessarily* better served than the other

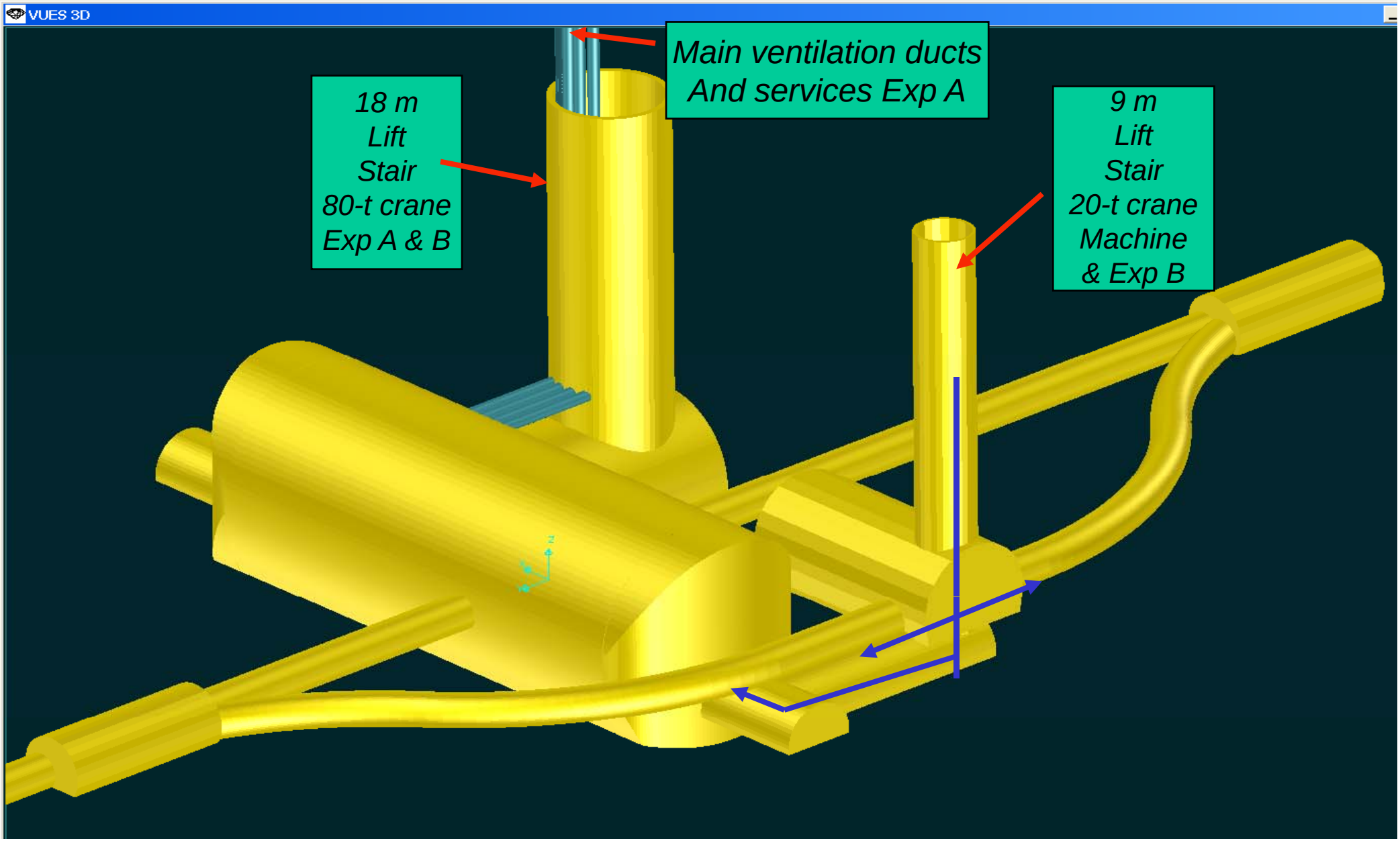
One Large Shaft - General view



Top view

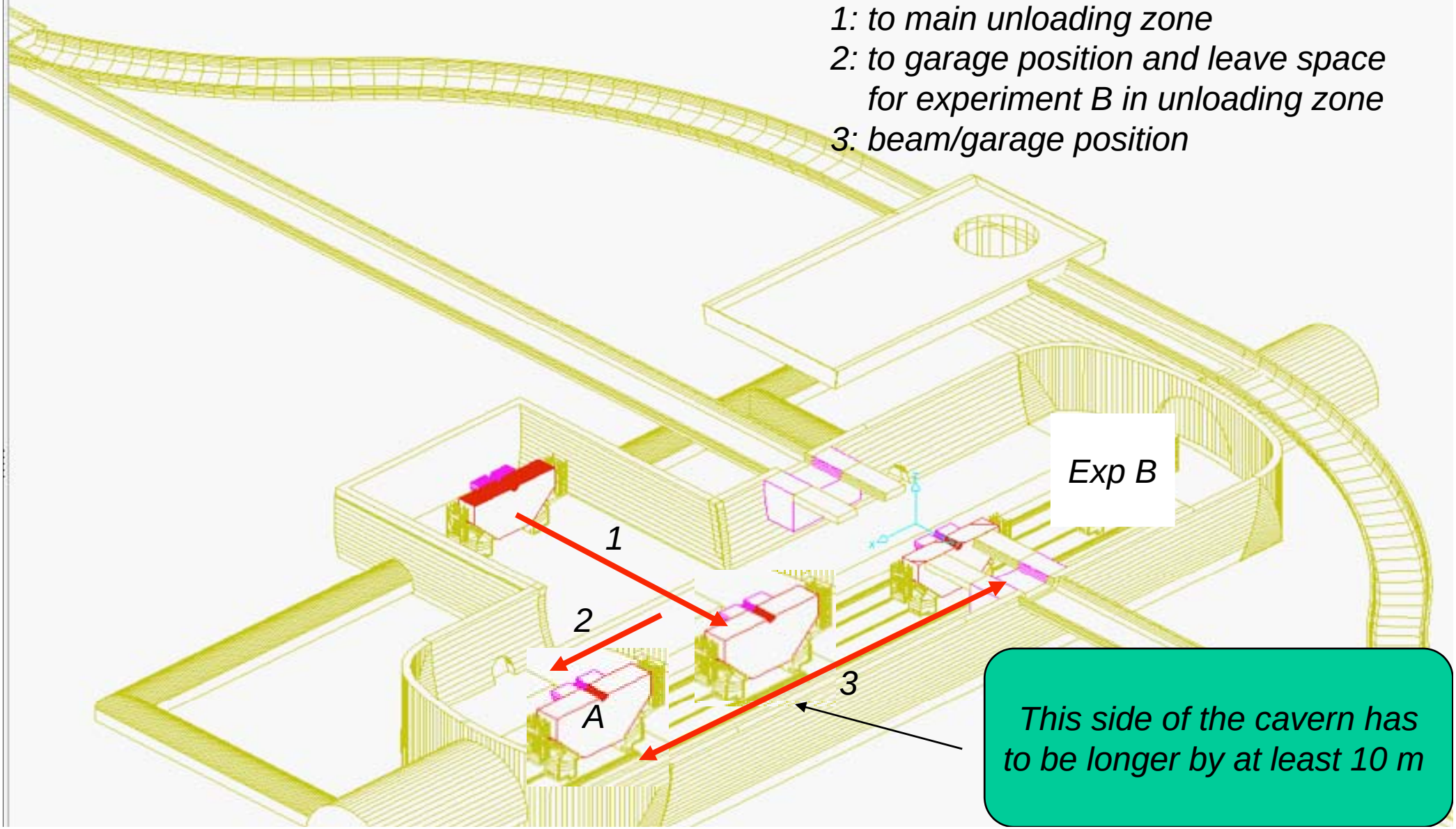

Access 20-t loads
Exp B
Main service
cavern machine & Exp B
Access
Heavy Loads
80-t loads
Exp A & B
Pressurized
Egress tunnels
connected to
stairs/lifts
Second service
cavern Exp A

Side view


VUES 3D
Main ventilation ducts
And services Exp A
18 m
Lift
Stair
80-t crane
Exp A & B
9 m
Lift
Stair
20-t crane
Machine
& Exp B

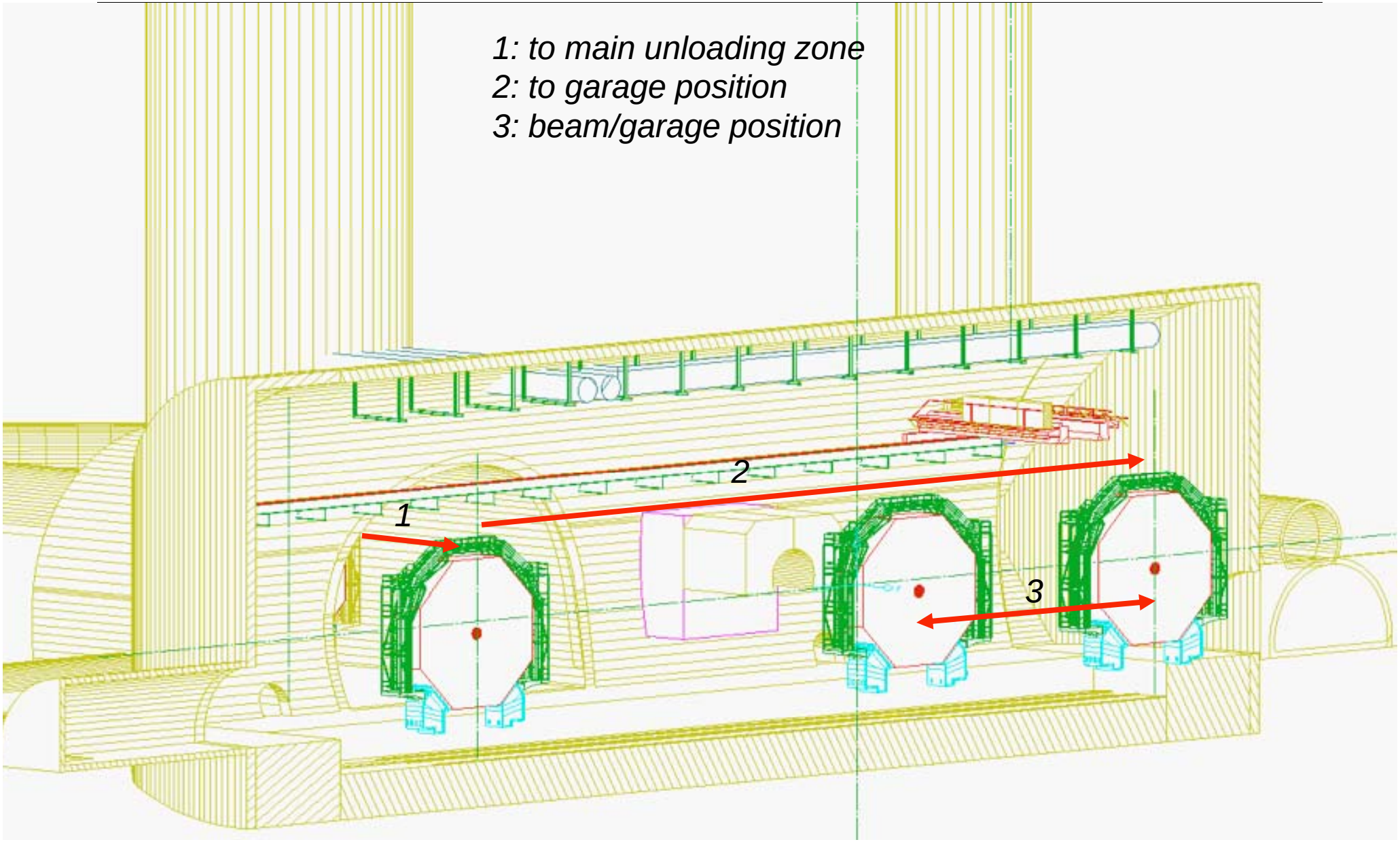
Movements of Experiment A

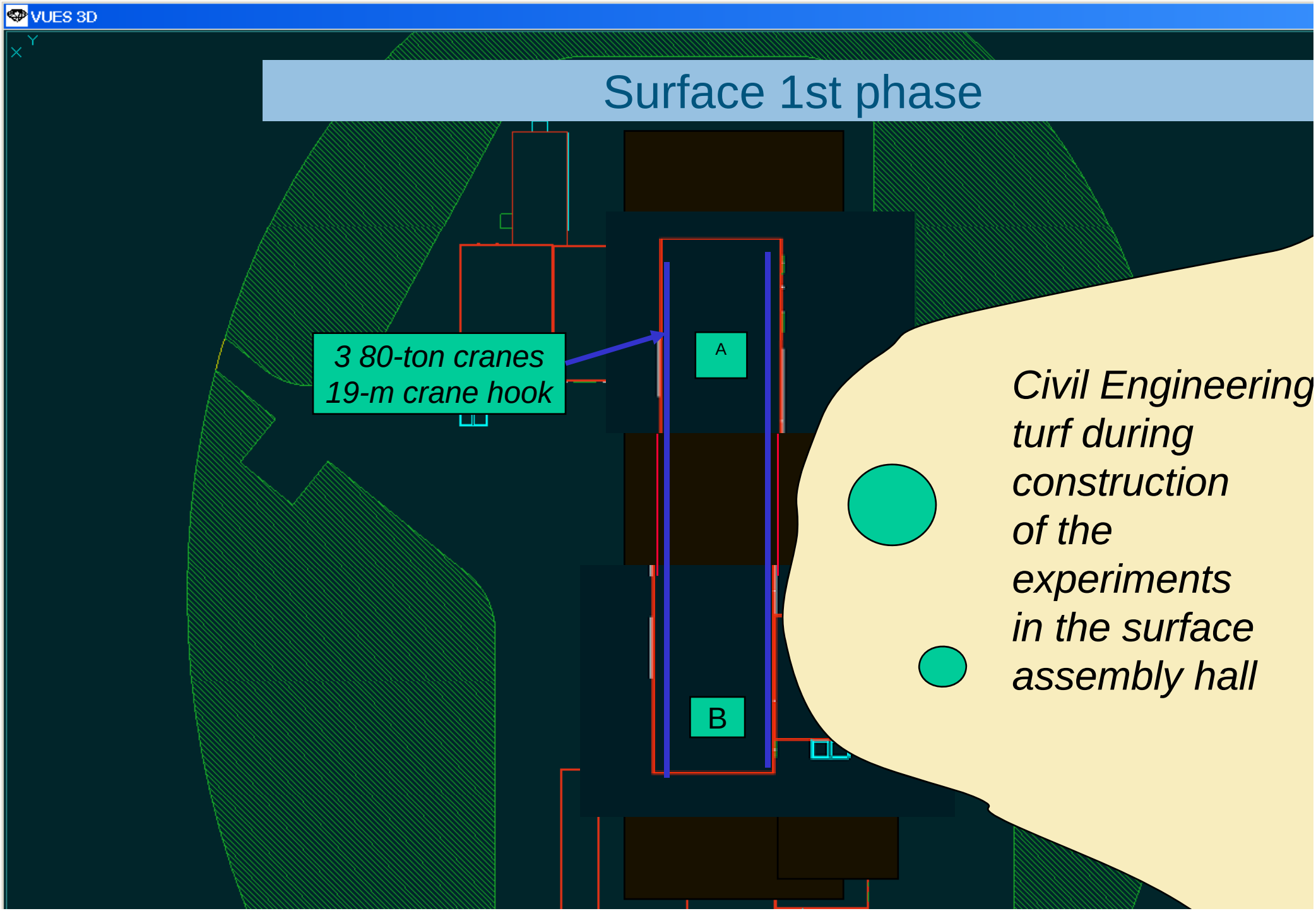
1: to main unloading zone
2: to garage position and leave space for experiment B in unloading zone
3: beam/garage position



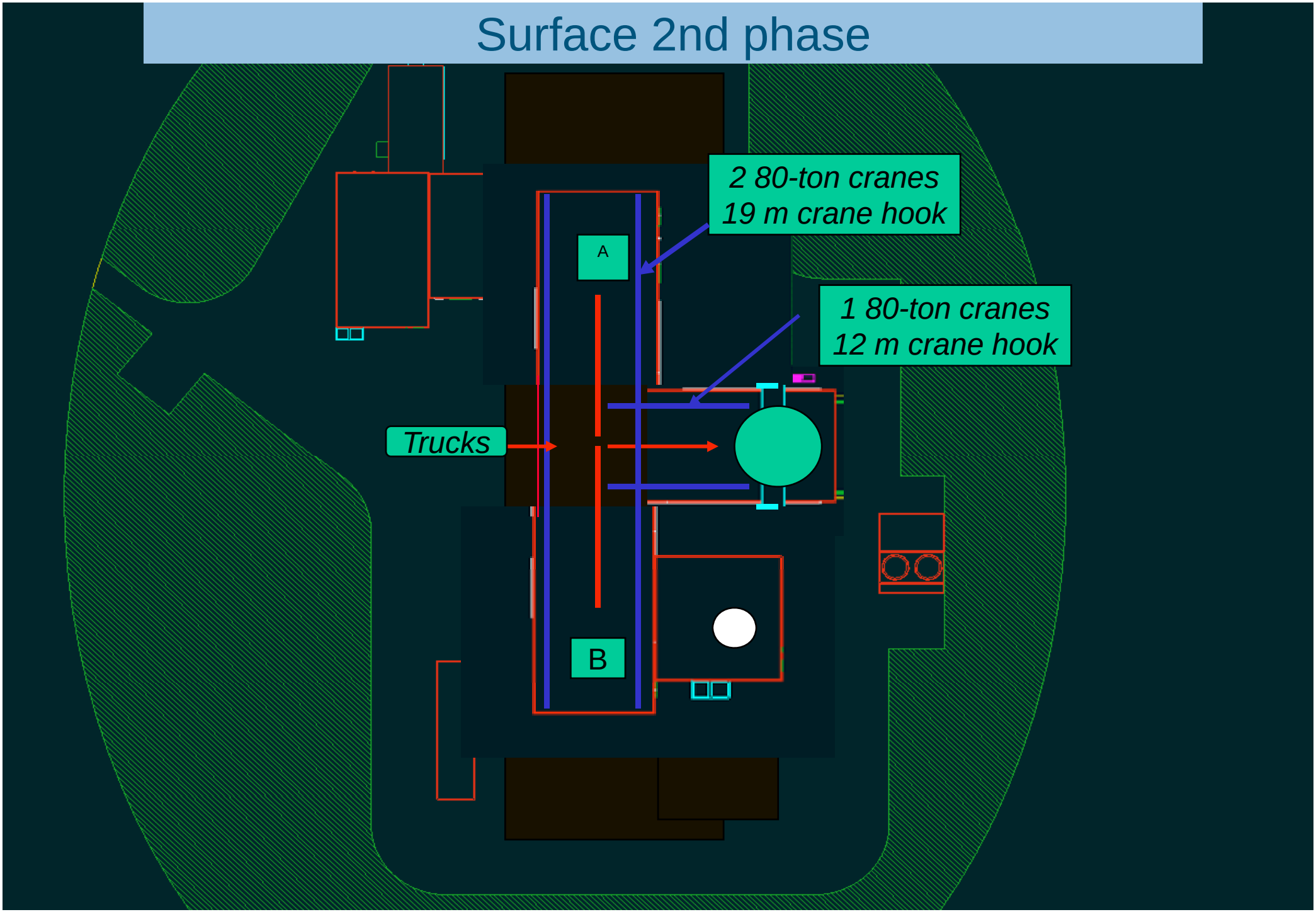
Movements of Experiment B

1: to main unloading zone
2: to garage position
3: beam/garage position

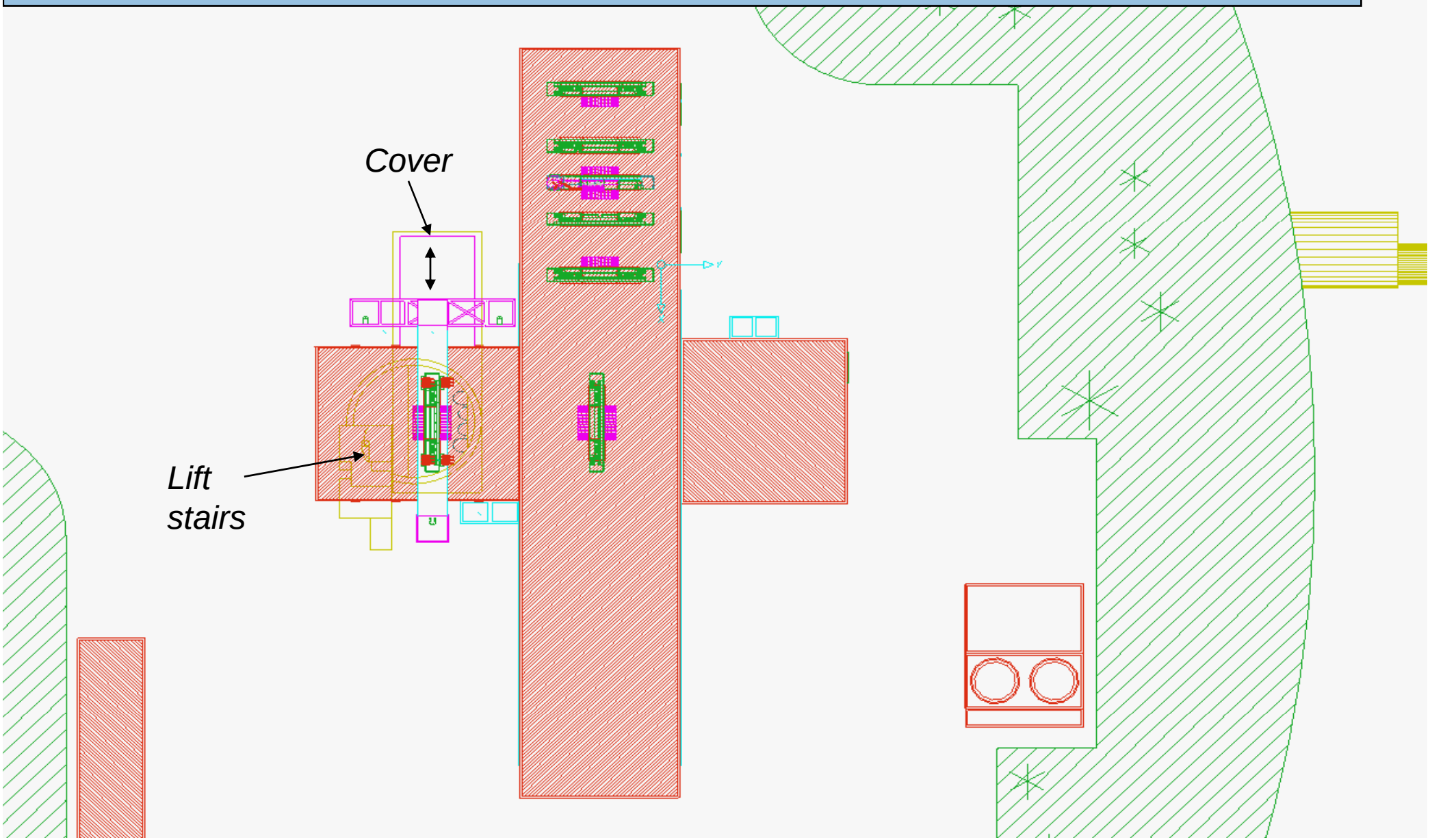



VUES 3D
Surface 1st phase
3 80-ton cranes
19-m crane hook
A
B
Civil Engineering
turf during
construction
of the
experiments
in the surface
assembly hall

Surface 2nd phase



Solving interference Cover/Lift in Large shaft
One solution with rectangular cover

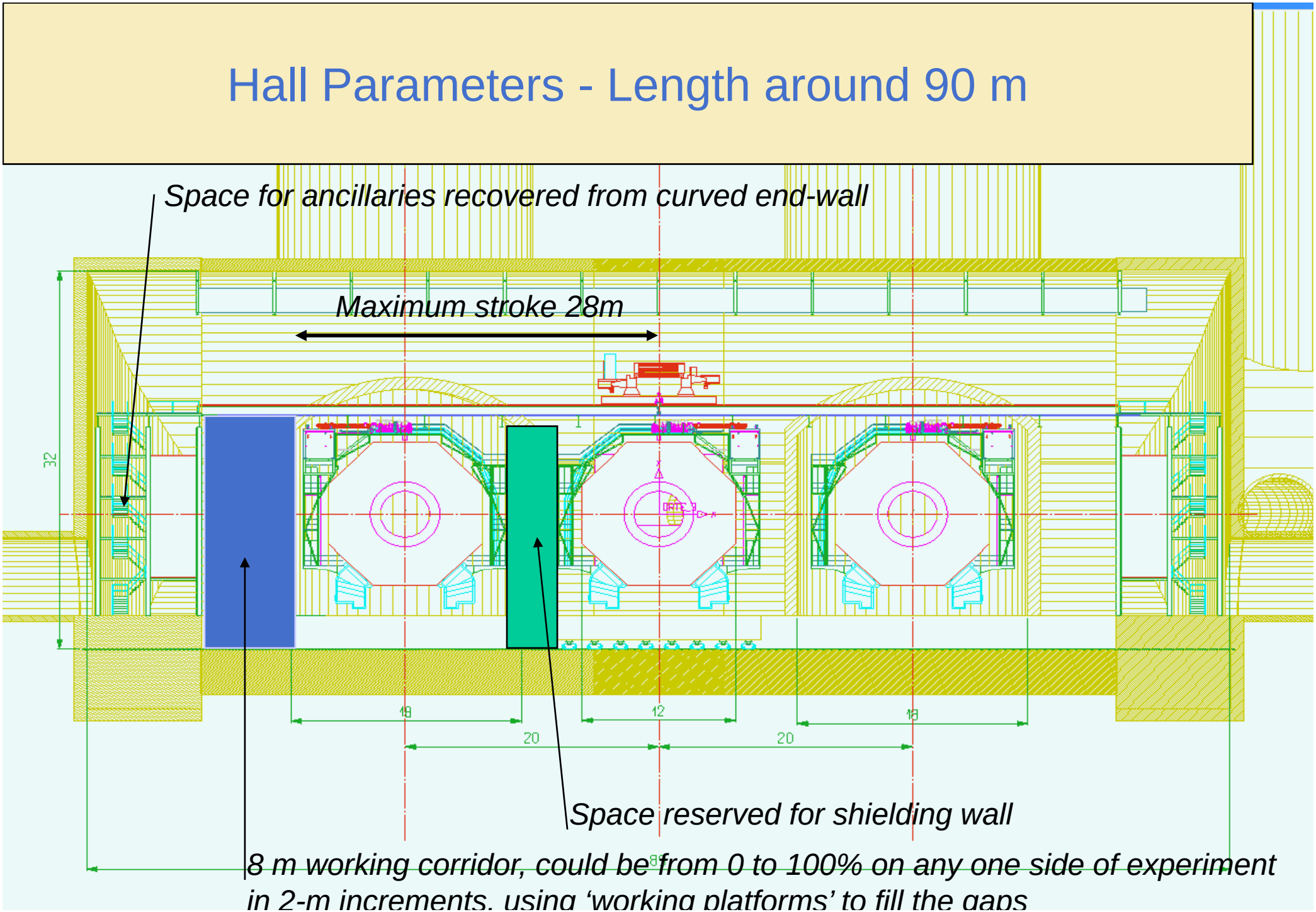



VUES 3D

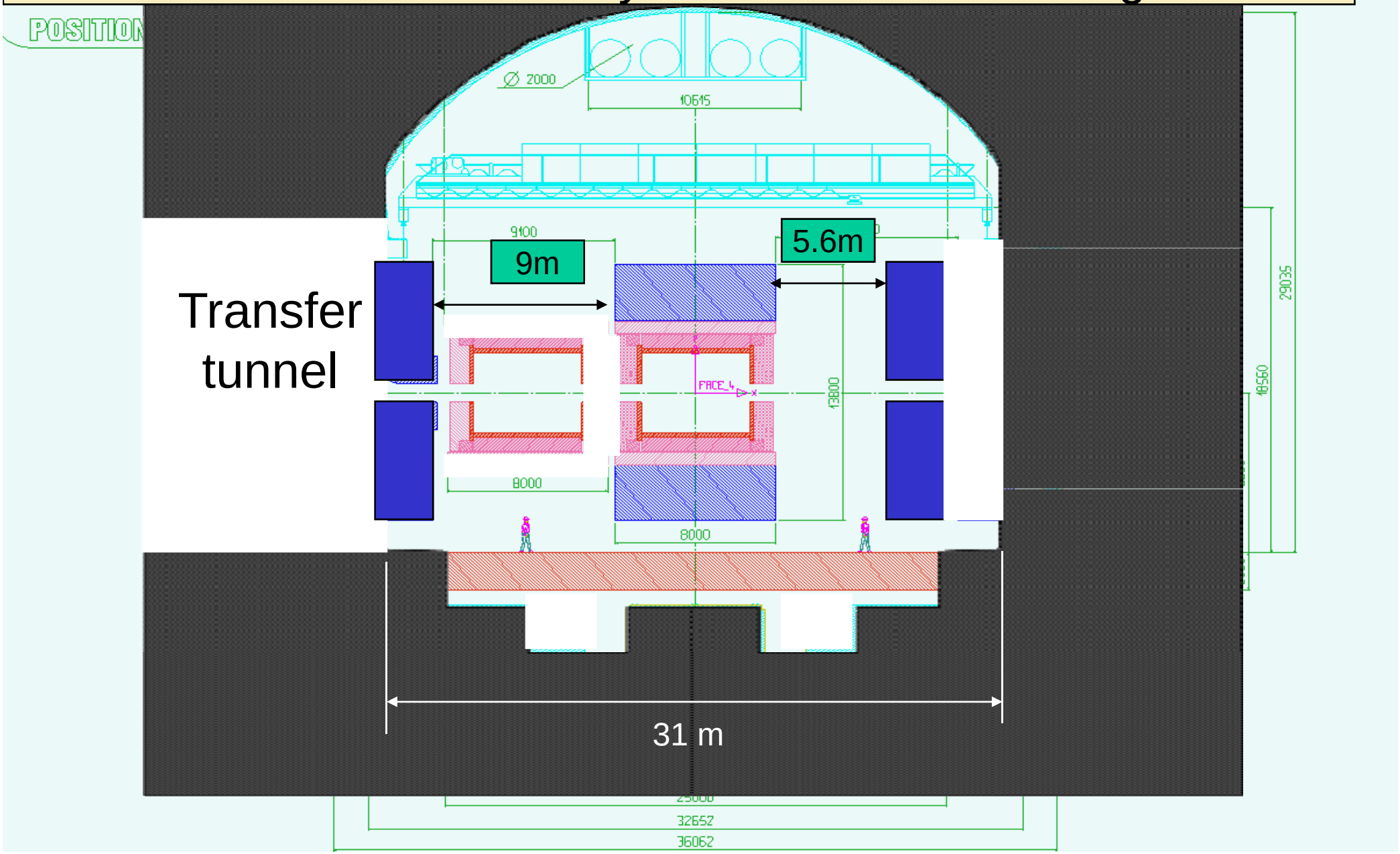
Experimental Area

Underground Hall Parameters for Two Large Shaft Solution

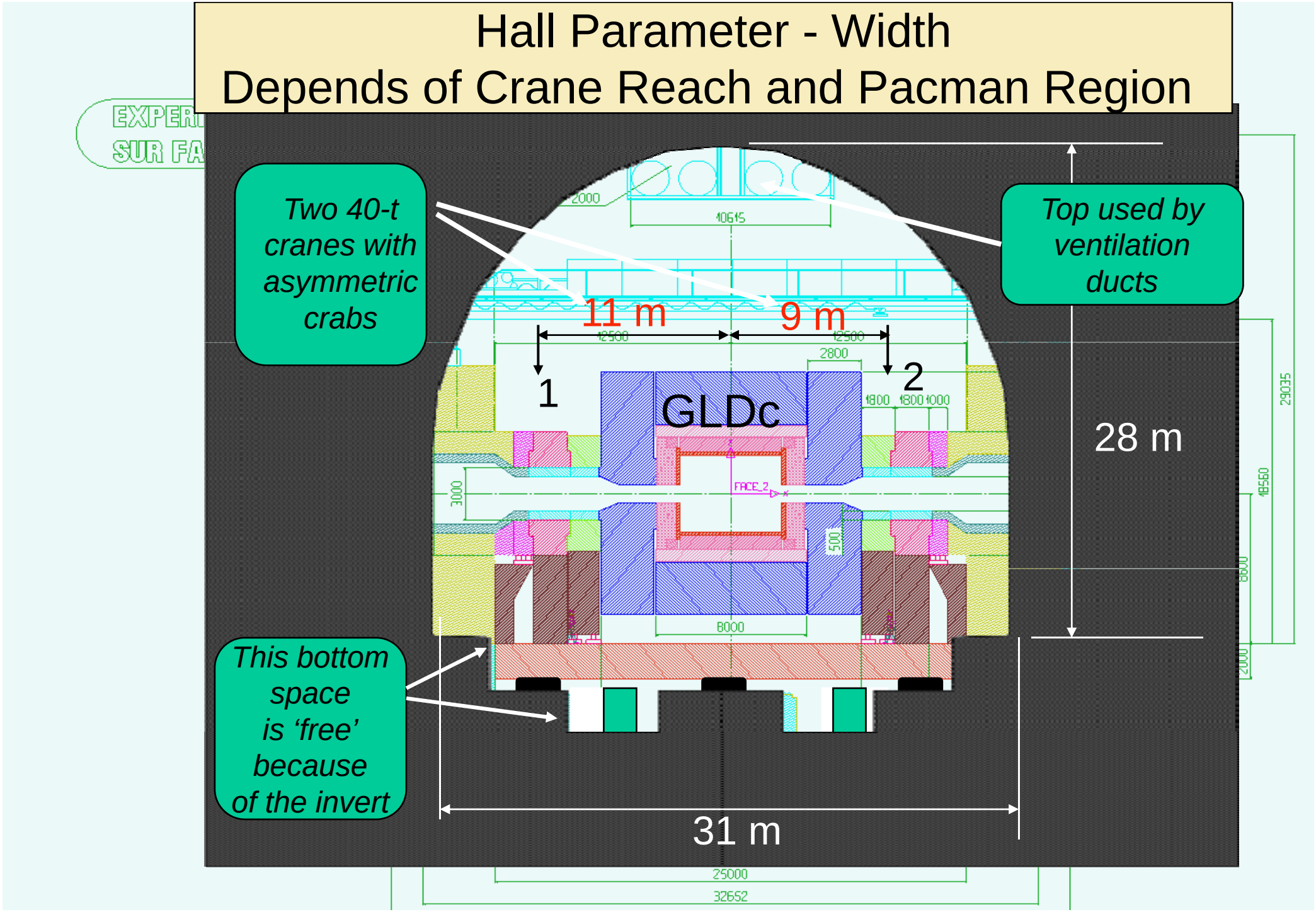
Hall Parameters - Length around 90 m



Hall Parameter - Width
Transfer Tunnel allows easy extraction of ‘Tracking Device’



Hall Parameter - Width
Depends of Crane Reach and Pacman Region



Conclusions

Conclusions-I

I have examined various experimental area dispositions assuming that:

- A deep site is used
- Assembly on the surface and heavy lifting are used
- At least one large detector is installed on a platform and push-pull scheme is used

Conclusions-II

- Two large shafts positioned directly above the underground hall (RDR) are not the preferred solution
- If two large shafts are used it seems better to position them diagonally wrt IP, outside the footprint of the underground hall
- Stairs, lift and services can be installed in these large offset shafts
- To have one large shaft only is possible, but it is a disadvantage for the ‘smaller’ experiment

Conclusions-III

- The length of the underground hall could be around 90 m for the two-large-offset-shaft solution
- The width depends of the way the pacman region is designed and which crane coverage is acceptable
- These parameters, like the best disposition of the experimental area, are ‘detector dependent’.

Conclusions-IV

- In all cases, a pressurized tunnel can connect airlocks at bottom of stairs/lifts and go around the underground hall, providing as many safety egresses from the hall as required by codes
- The platform can move on rollers as it has to go in one direction only (see John Amman's talk)
- The preferred solution for moving the detector elements is the use of air-pads as complex paths are likely to be required
- These air pads can be used in the 'sublifting' mode for maintenance operations (see Hubert Gerwig's talk)