Interaction Region Engineering at ILC Push-Pull Option

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  - Deep site, push-pull, surface assembly…
- Various dispositions of Experimental Area
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Hypotheses for ILC workshop in September

- Difficult to equip ILC with two independent IRs, but need two indpendent experiments
- Choice of Push-Pull scheme to exchange experiments frequently, say every month or so
- Exchange must be done quickly, say in small week.

Hypotheses for ILC workshop in September

- These goals are ambitious. It was 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 ILC workshop in September

- 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 (GLDc is used as example here).
- If the other one is a 'Smaller Detector', it will benefit from improved facilitities.

Moving platform is a 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.
- It provides 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 protruding inside the detector would need to be re-connected (and re-aligned), in a common effort.

A concrete platform will be stiff enough….

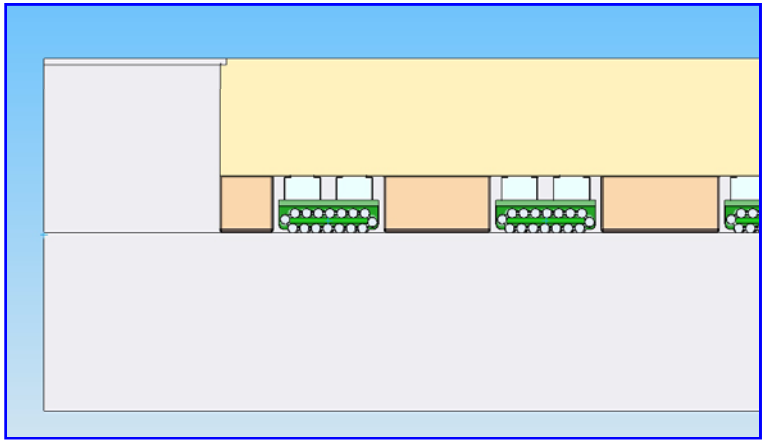
Example:
A 2’500-ton load on the CMS cover : 20 m between supports and only 3 mm sag…

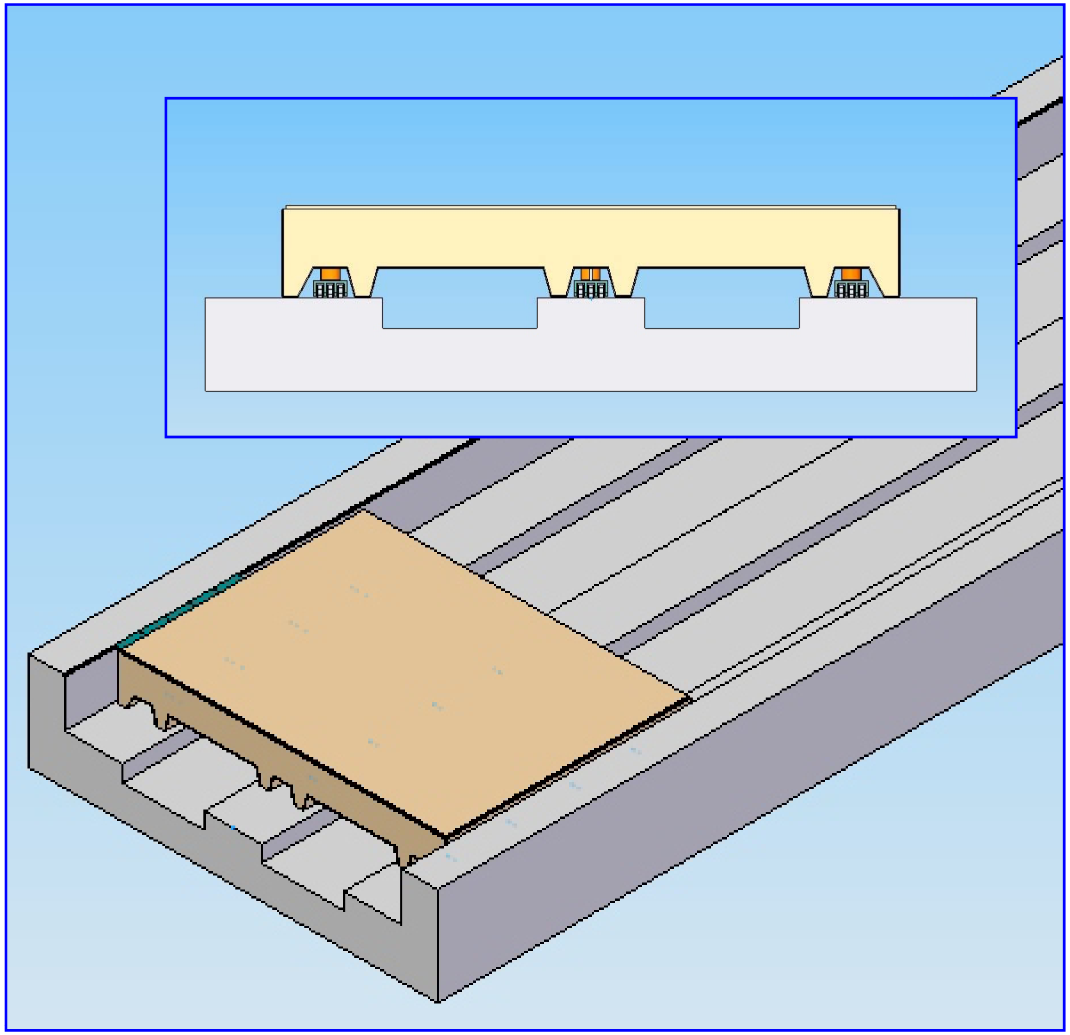
ILC Sliding Platform Design Concept

Concept developed by J. Amann, A. Hervé and H. Gerwig

Platform details:

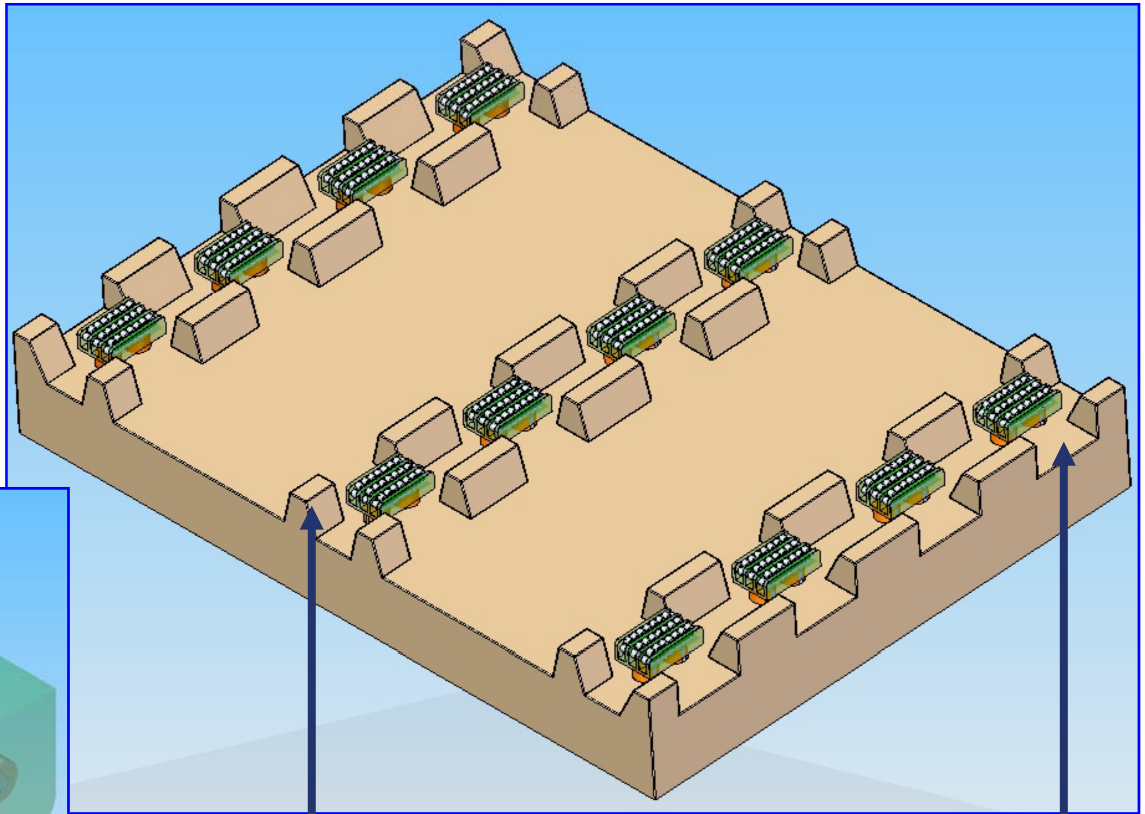
- 20x15x2m
- 5m wide trenches for cable chain and roller access.
- Steel reinforced concrete

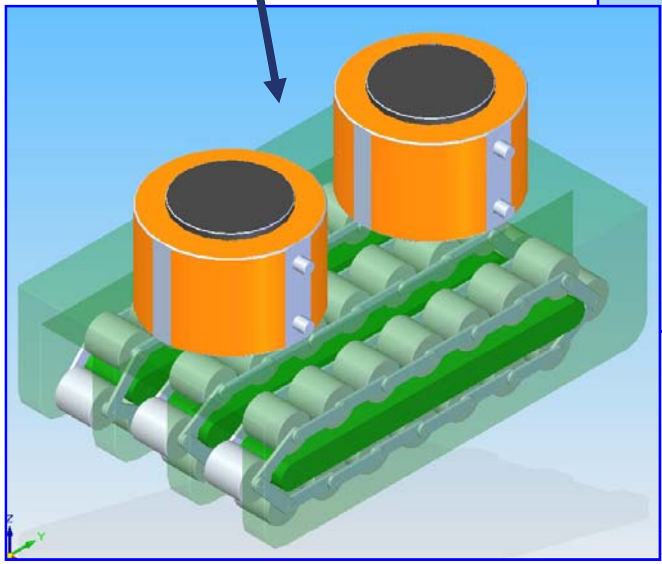




ILC Sliding Platform Design Concept

Uses 1.5kT roller module with 1kT hydraulic jacks. Design must be optimized to distribute load evenly over roller module.



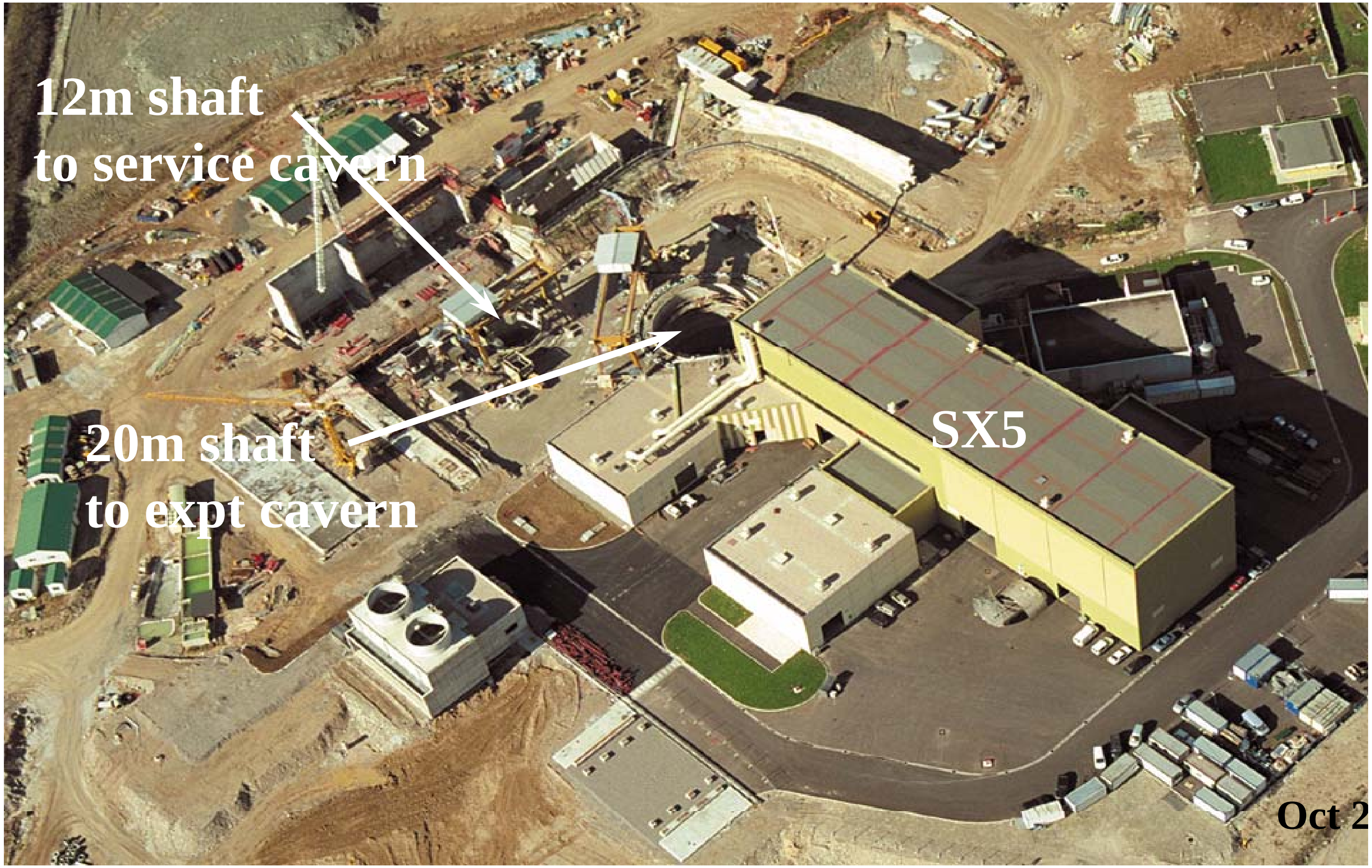


Feet support platform when stationary. Could provide isolation from vibration

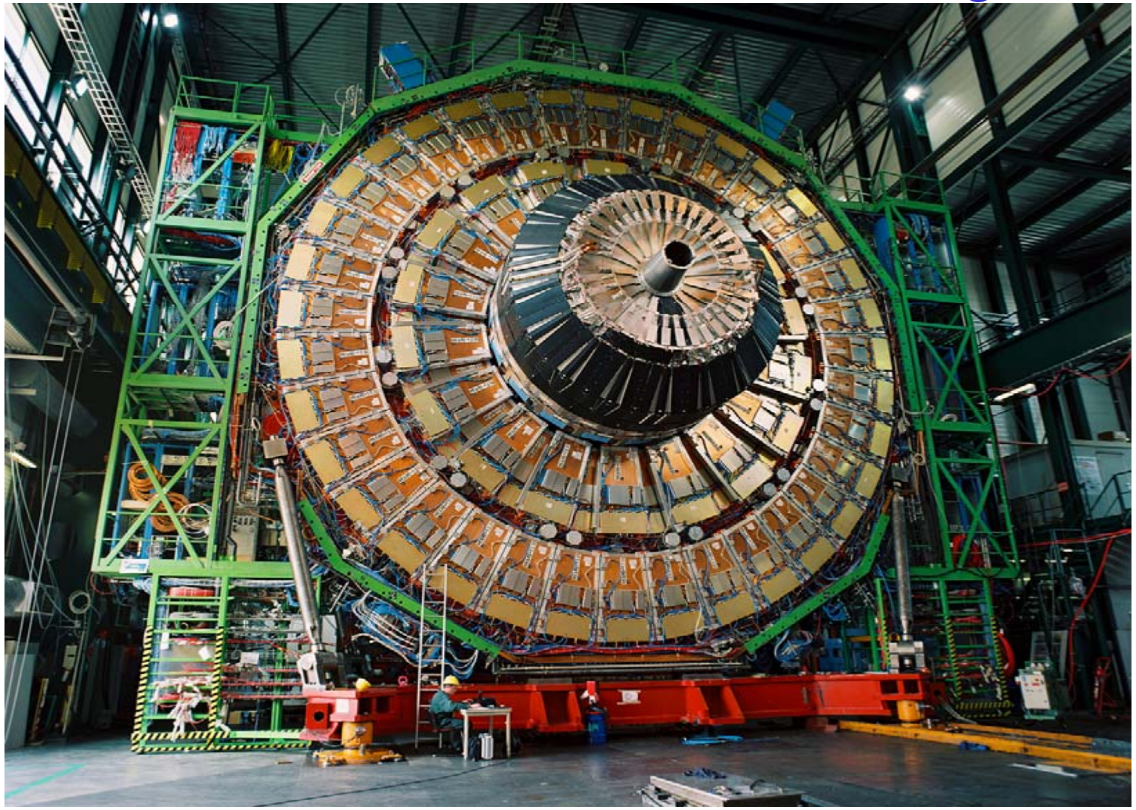
Space for access to rollers/jacks.

Choice of Full Surface Assembly for schedule reasons

Pressure from Civil Engineering Schedule will be as important for ILC than for CMS, (maybe also for CLIC…)



Another advantage of Surface Assembly ‘à la CMS’ is that Elements fully are fully commissioned before being lowered



Elements are fully cabled to local racks.

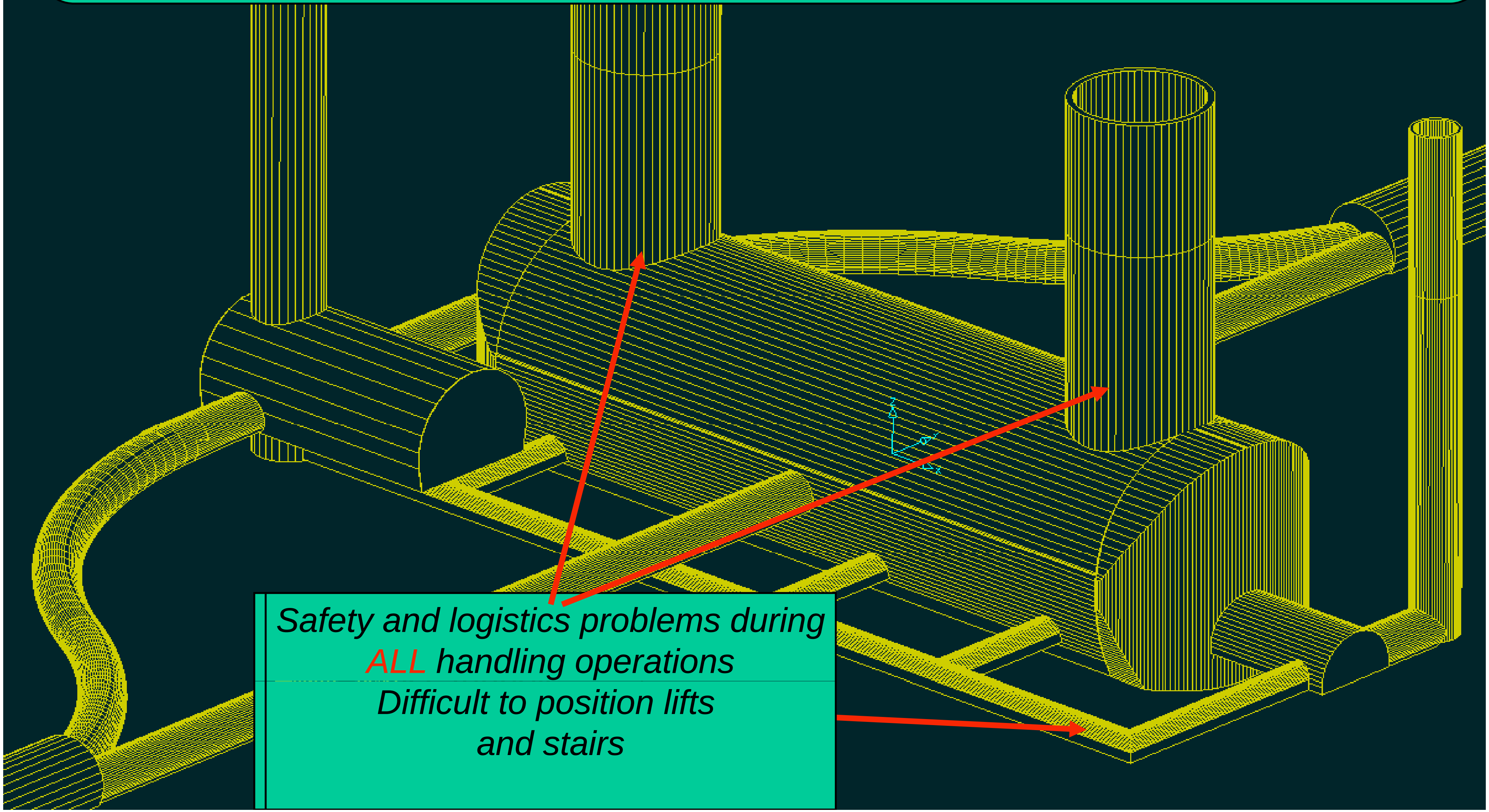
All services, gas and water cooling pipes are there.

Subdetectors are fully commissioned.

Once below they can be connected to the umbilical cables going to the counting rooms through the cable chains.

Experimental Area
Two Large Shafts
RDR Design

This design has been put aside looking for better solutions

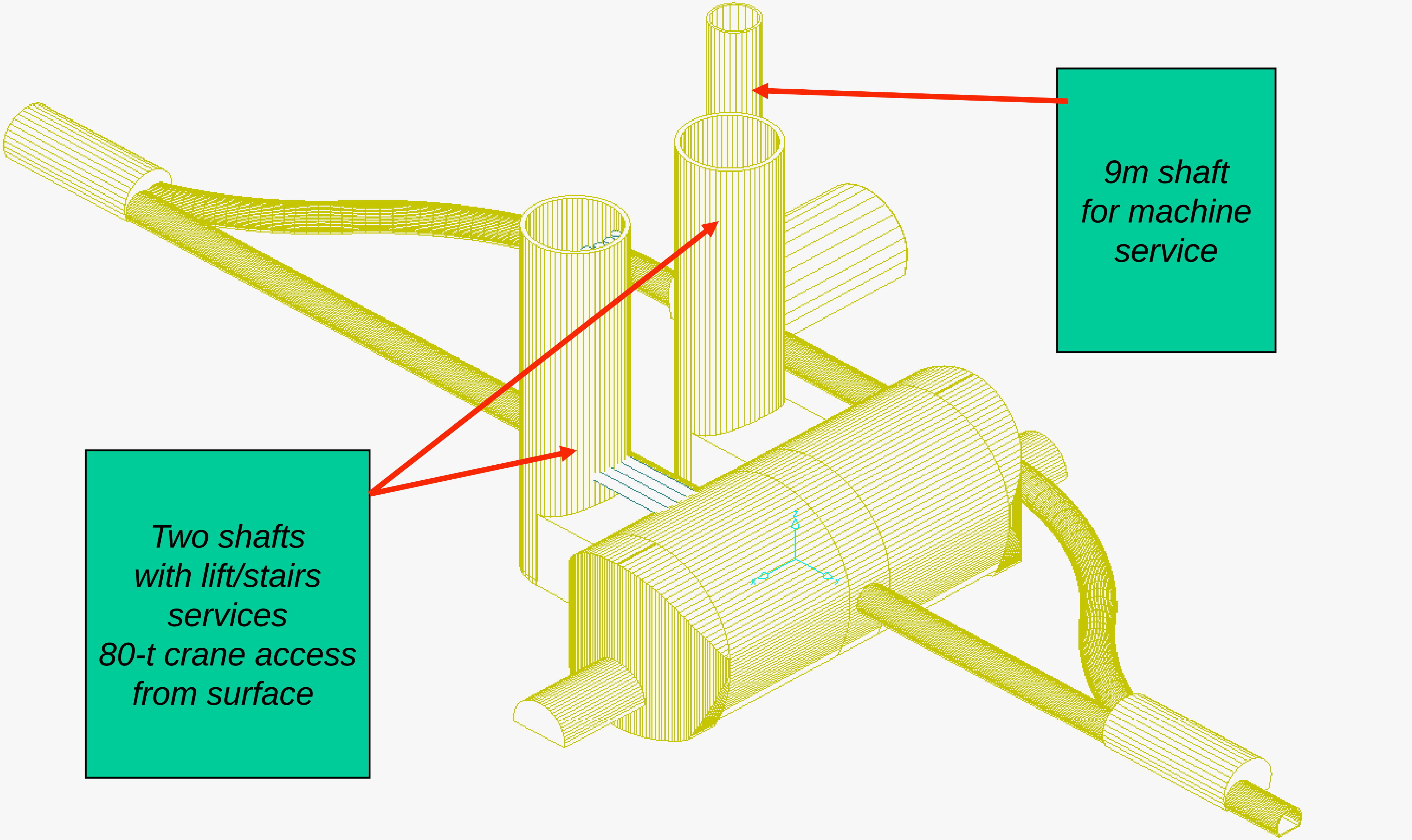


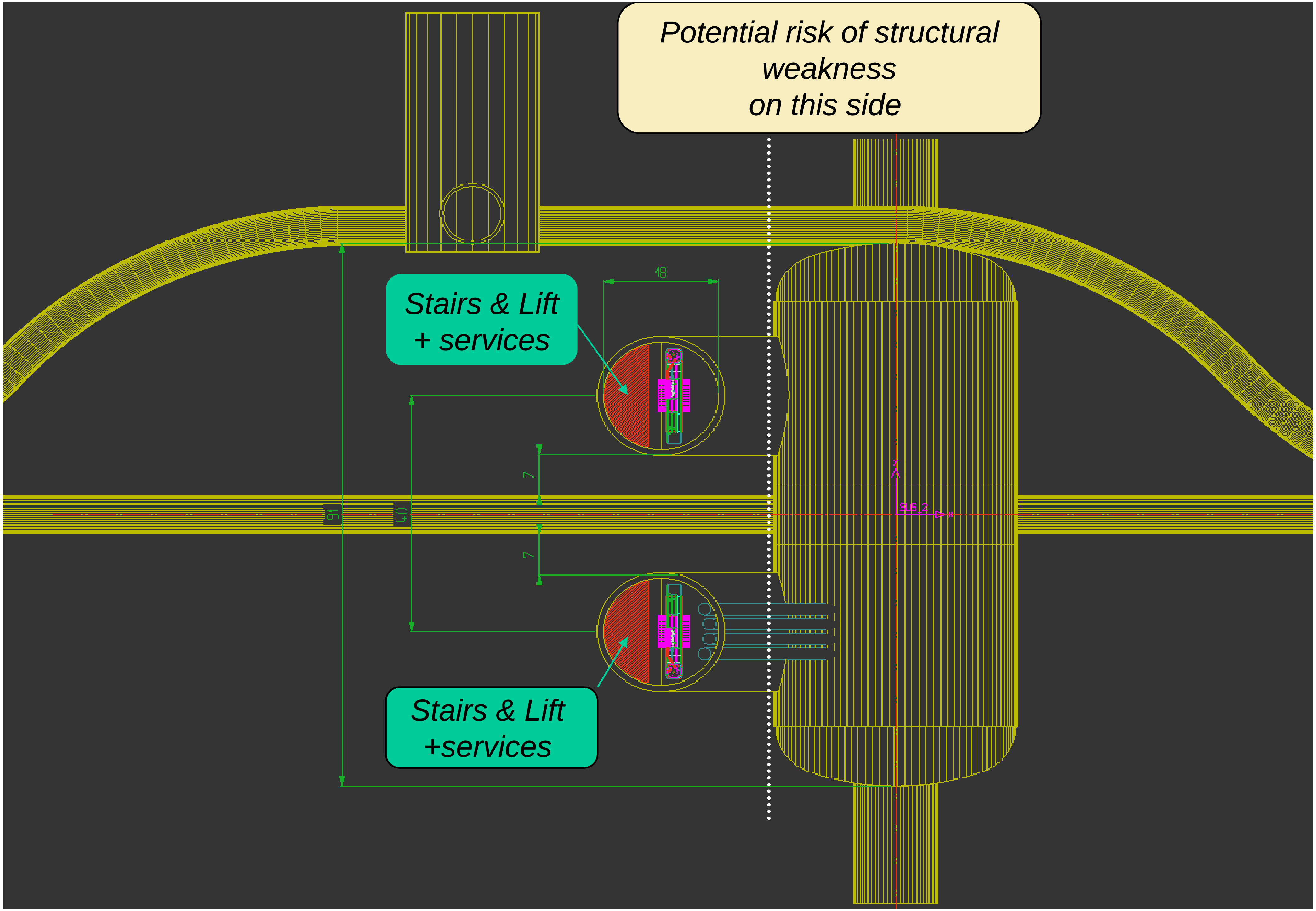
Experimental Area
Two Large Offset Shafts

Shafts are moved outside the main cavern

- The two shafts are positioned outside the footprint of the main underground hall to do away with interferences (in safety logistic 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 when the number and weight of elements to transfer in UX is limited.

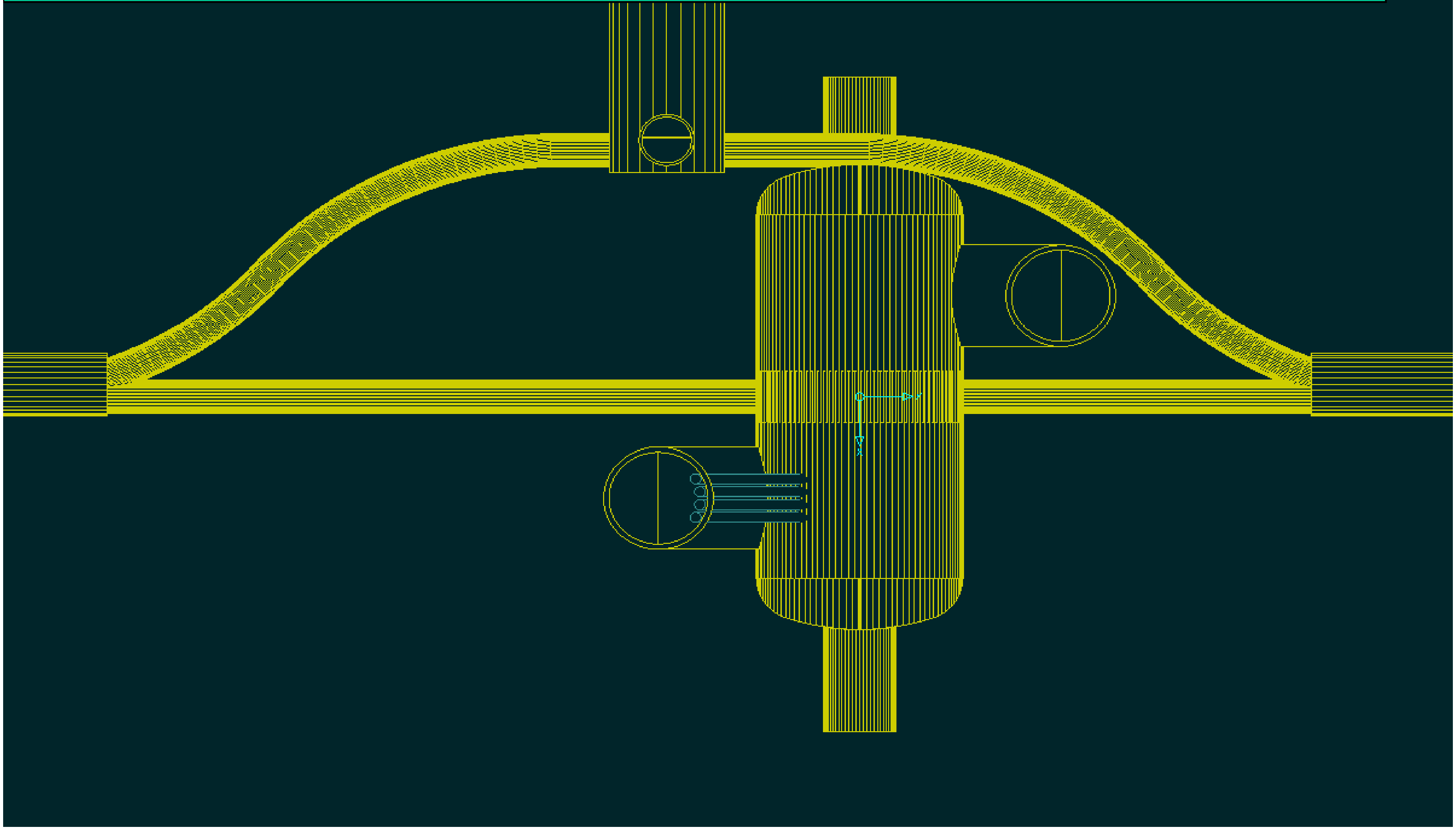
Two Large Shafts outside the Footprint

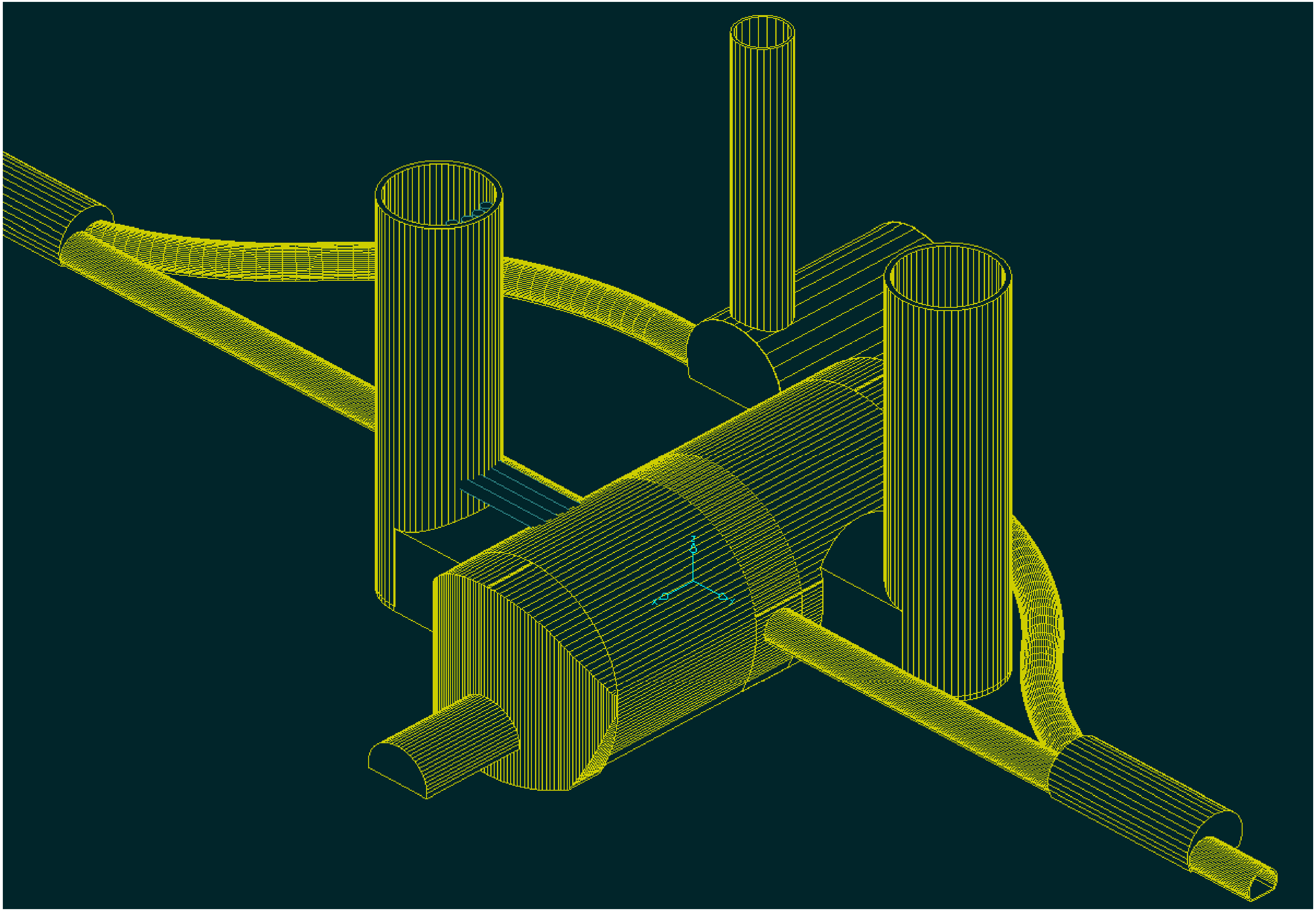



Potential risk of structural weakness on this side
Stairs & Lift + services
Stairs & Lift +services
48
7
7

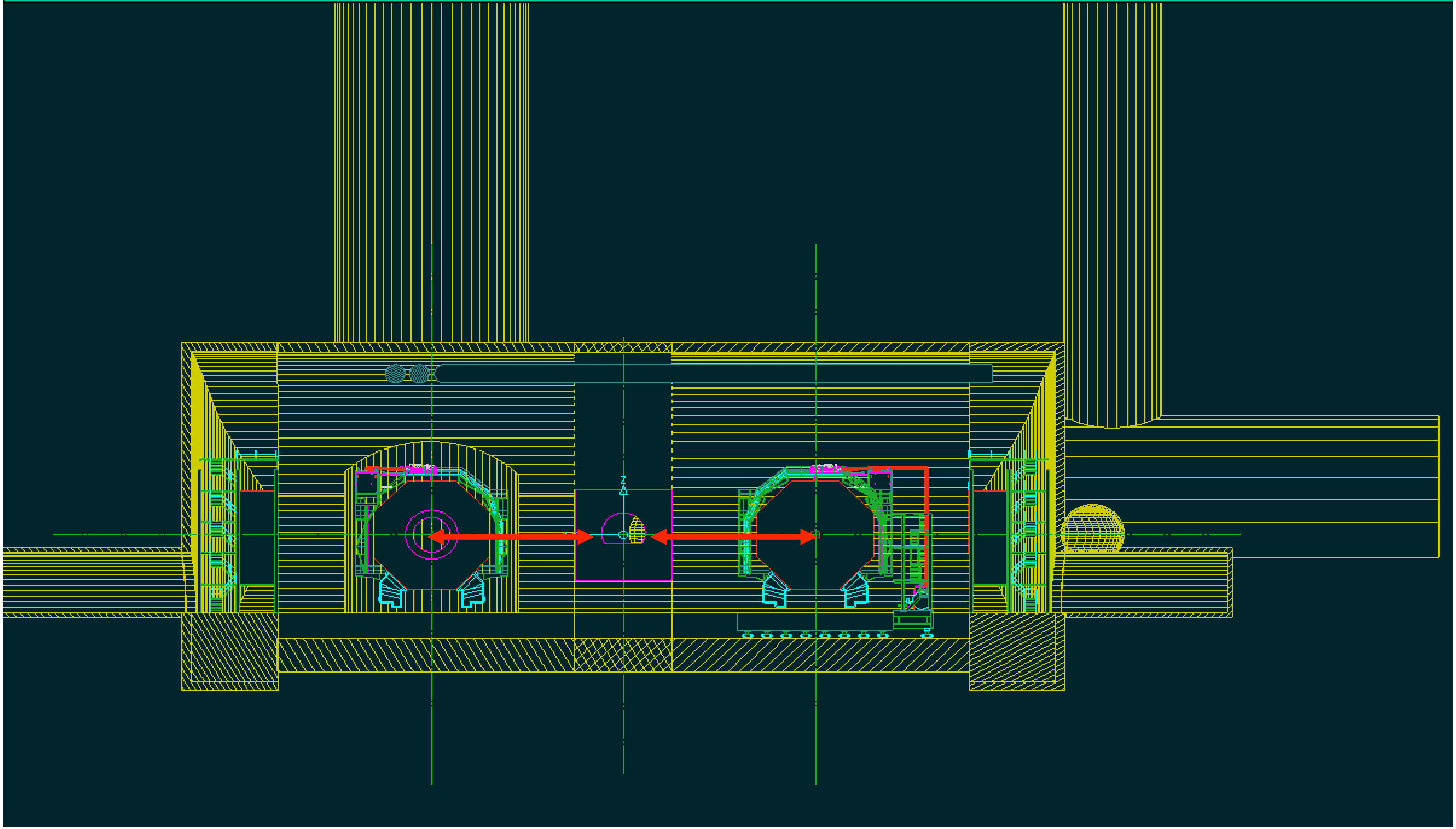
Experimental Area
Two Large Shafts
Offset Diagonally wrt IP

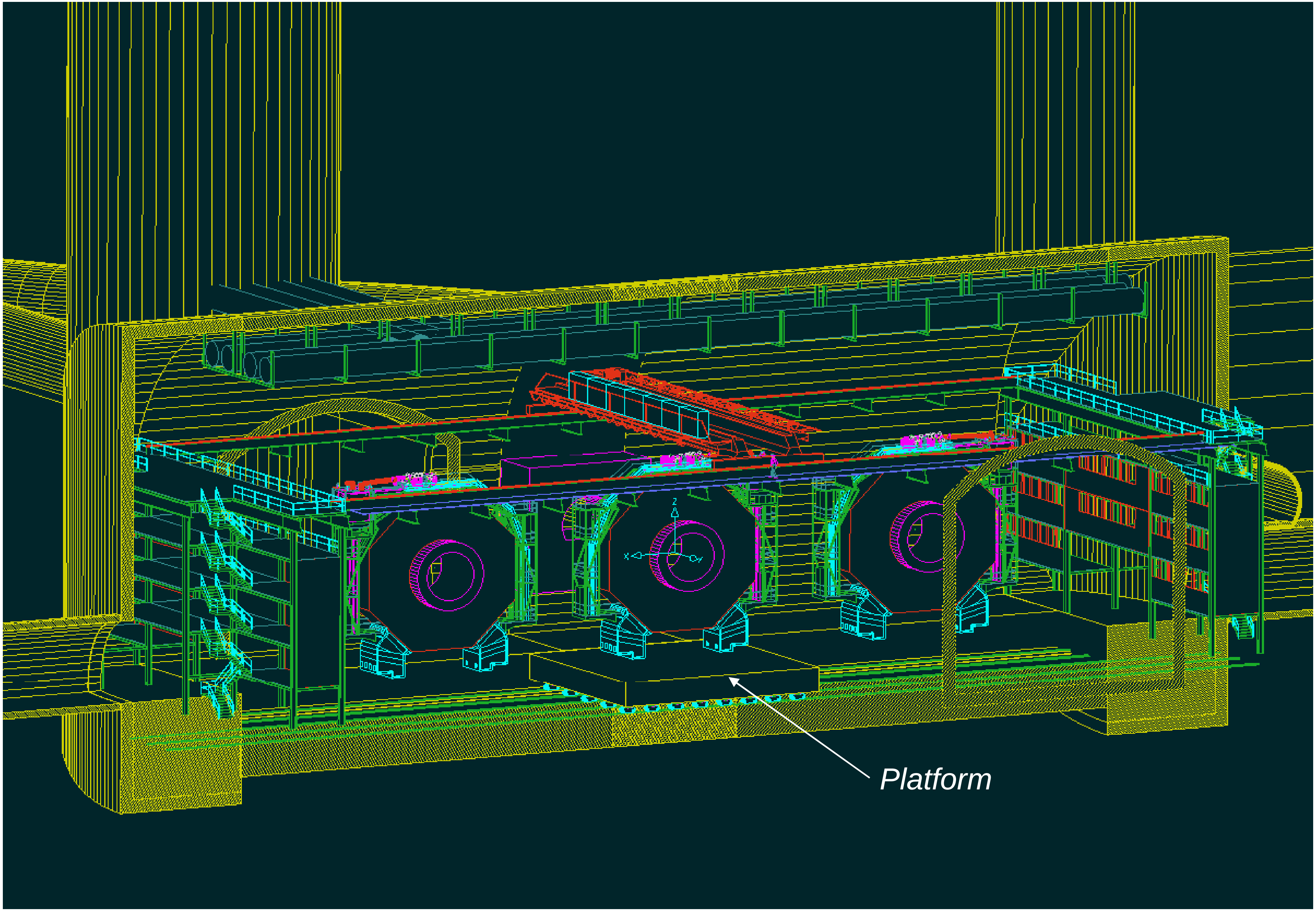
Two Large Shafts in Diagonal
to reduce structural weakness on the side of the two shafts





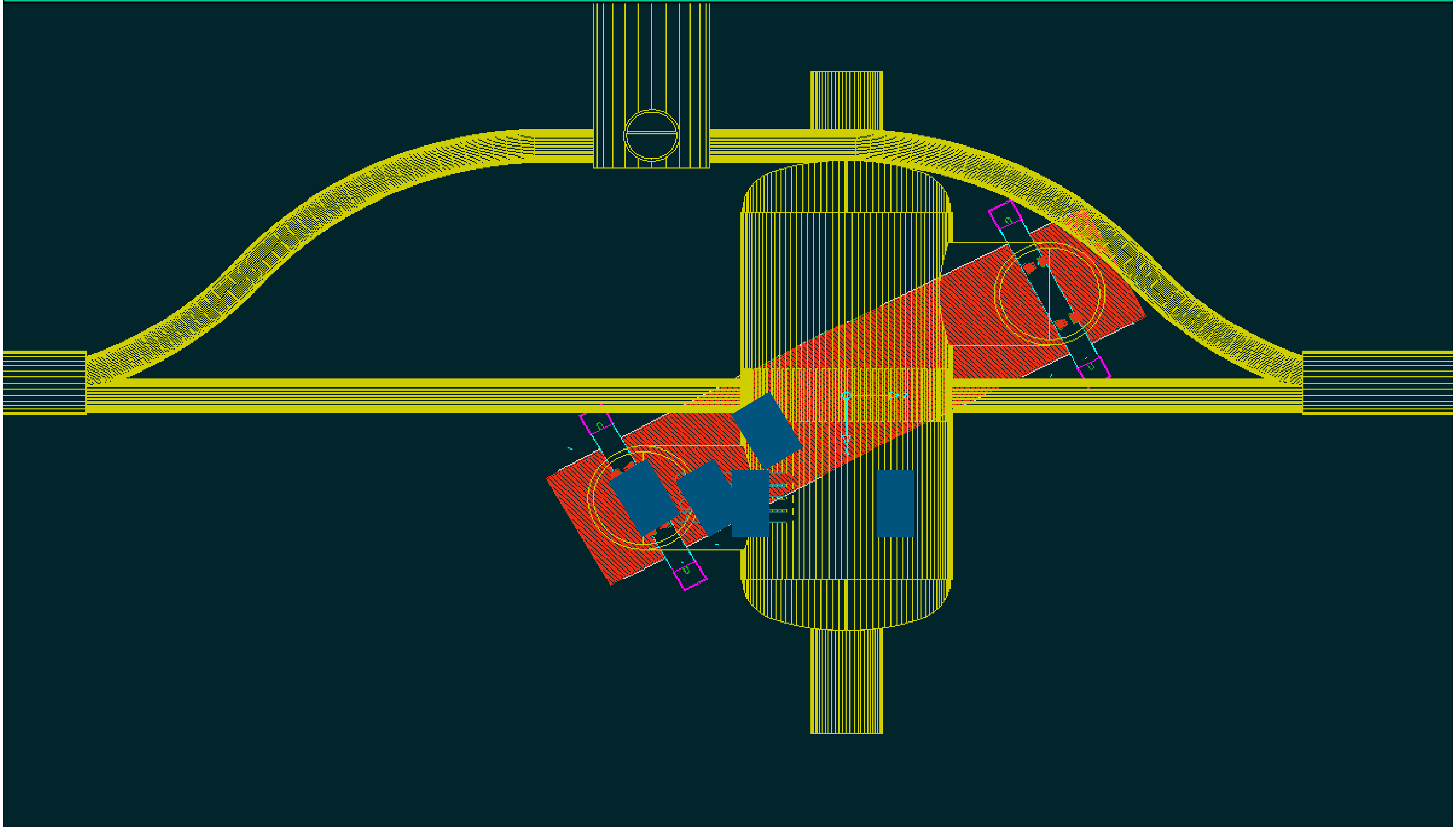
For the Experiments in the Underground Hall there is no difference



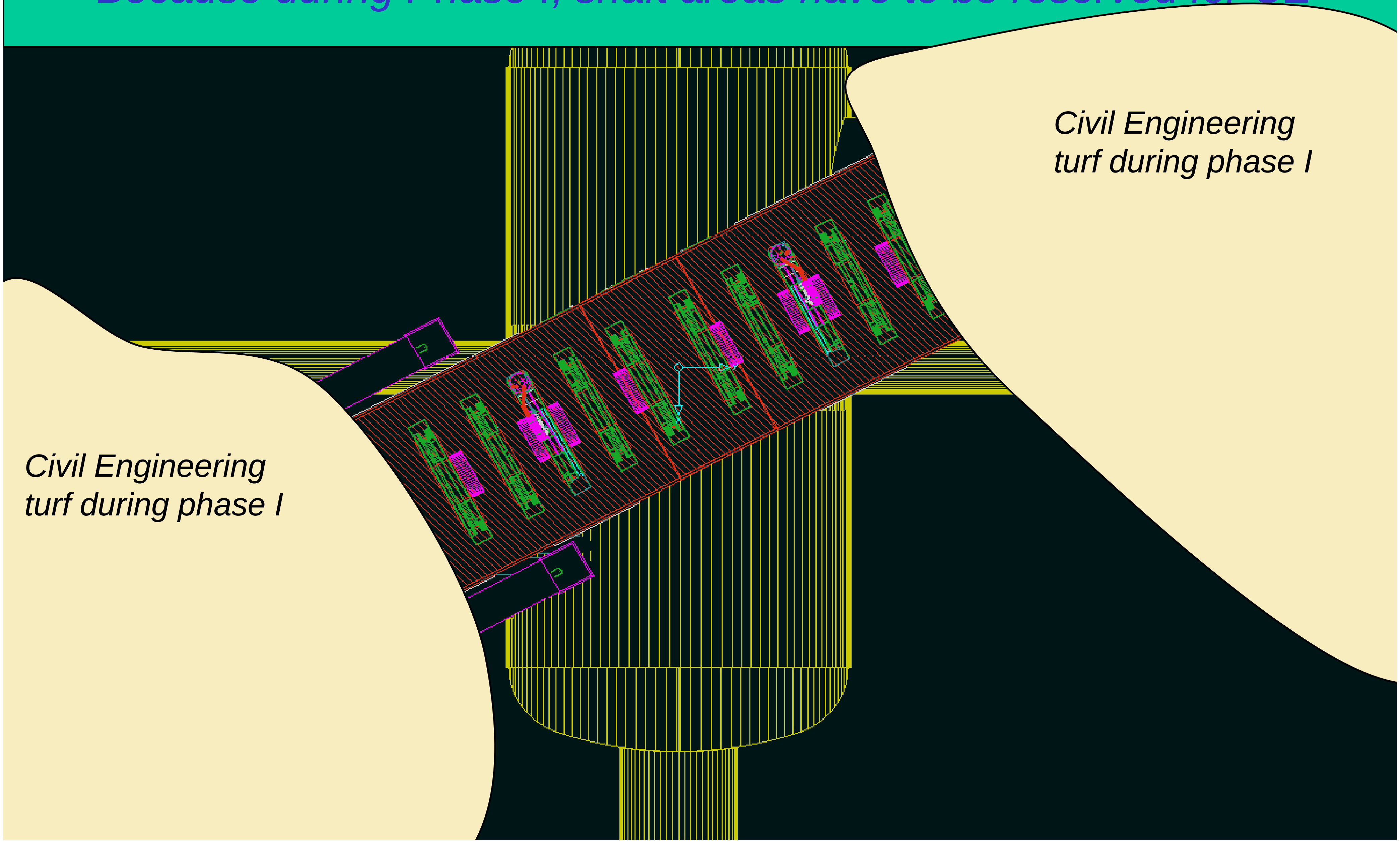


Platform

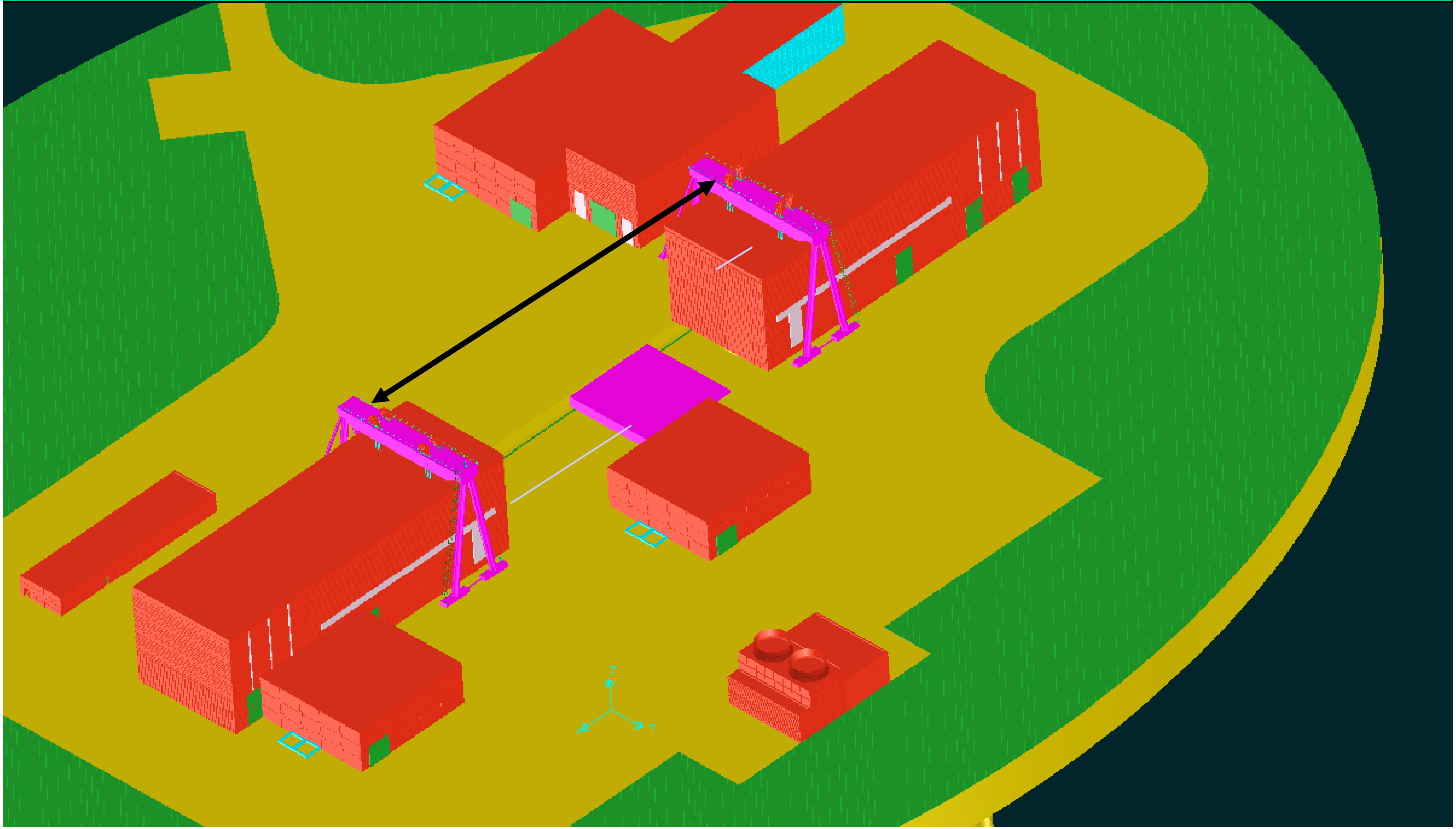
Elements could be lowered at an angle and rotated in the Transfer Tunnel



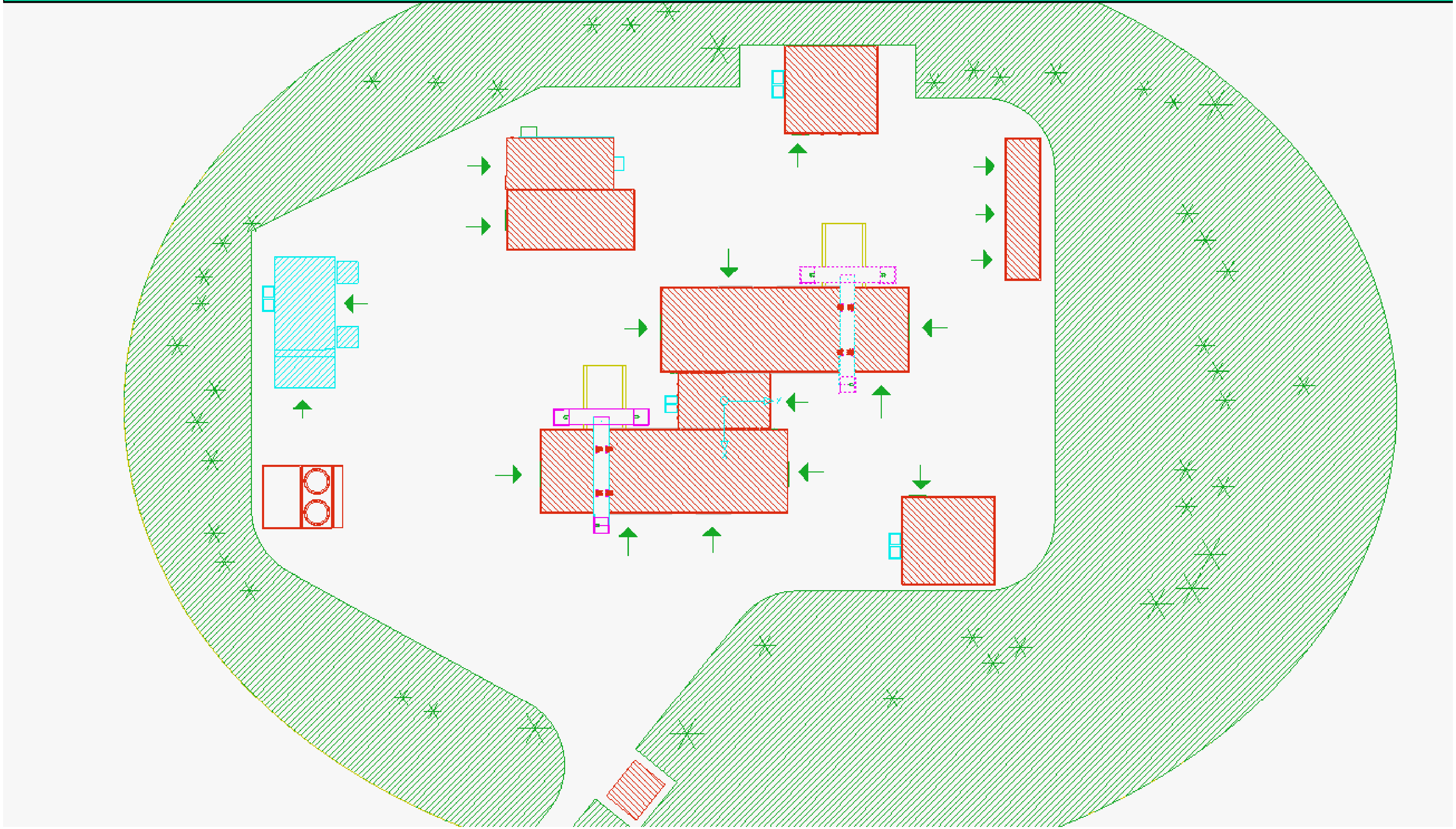
For two experiments, it is too crowded with only one SX hall
Because during Phase I, shaft areas have to be reserved for CE



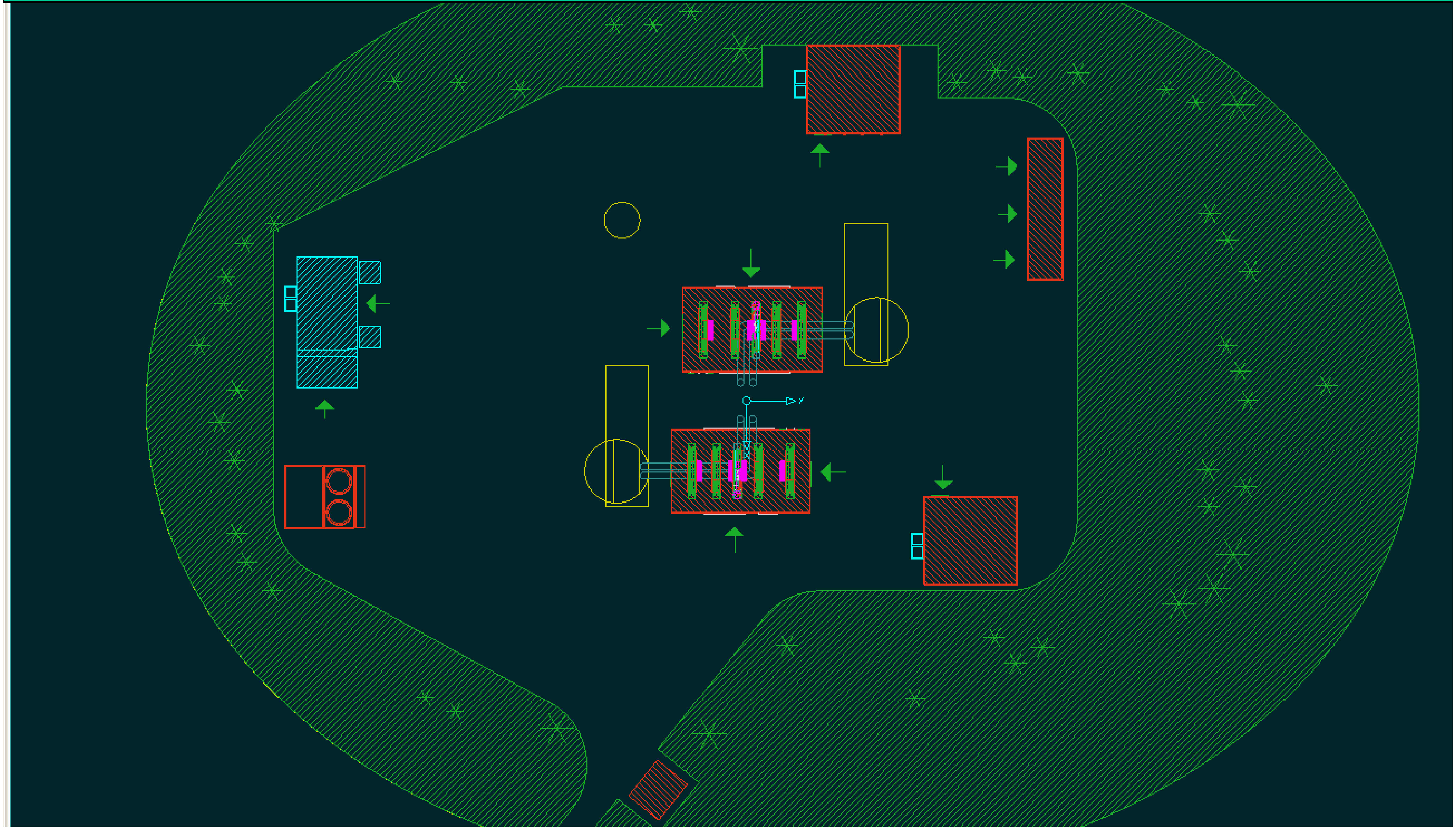
One solution is to separate the two Surface Halls
If needed gantry can be shared



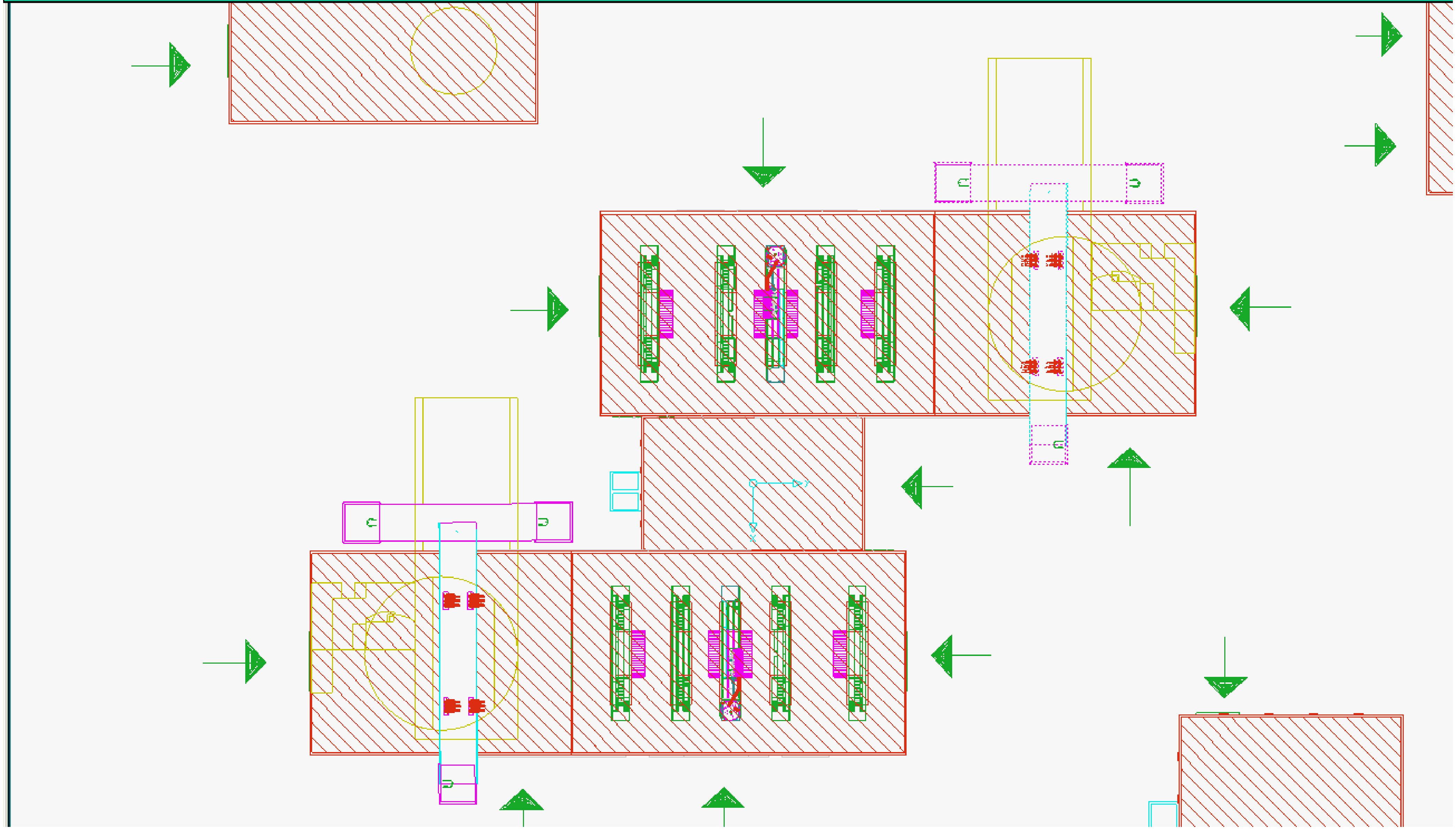
However, the simplest solution for logistics is to have two parallel halls
The gantry can still be shared if needed



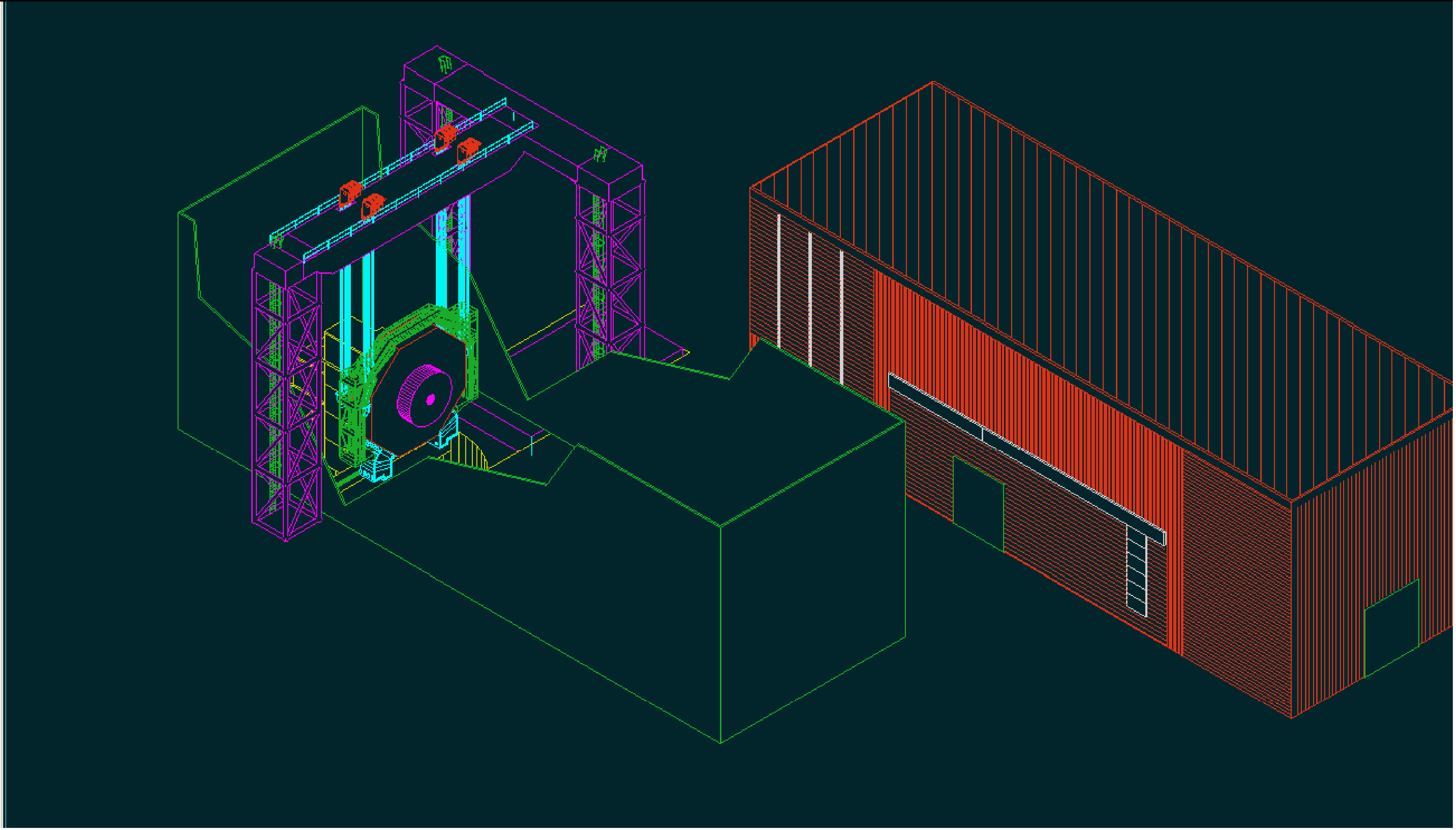
This is a view of phase I, when civil engineering uses the shafts



And a view of phase II



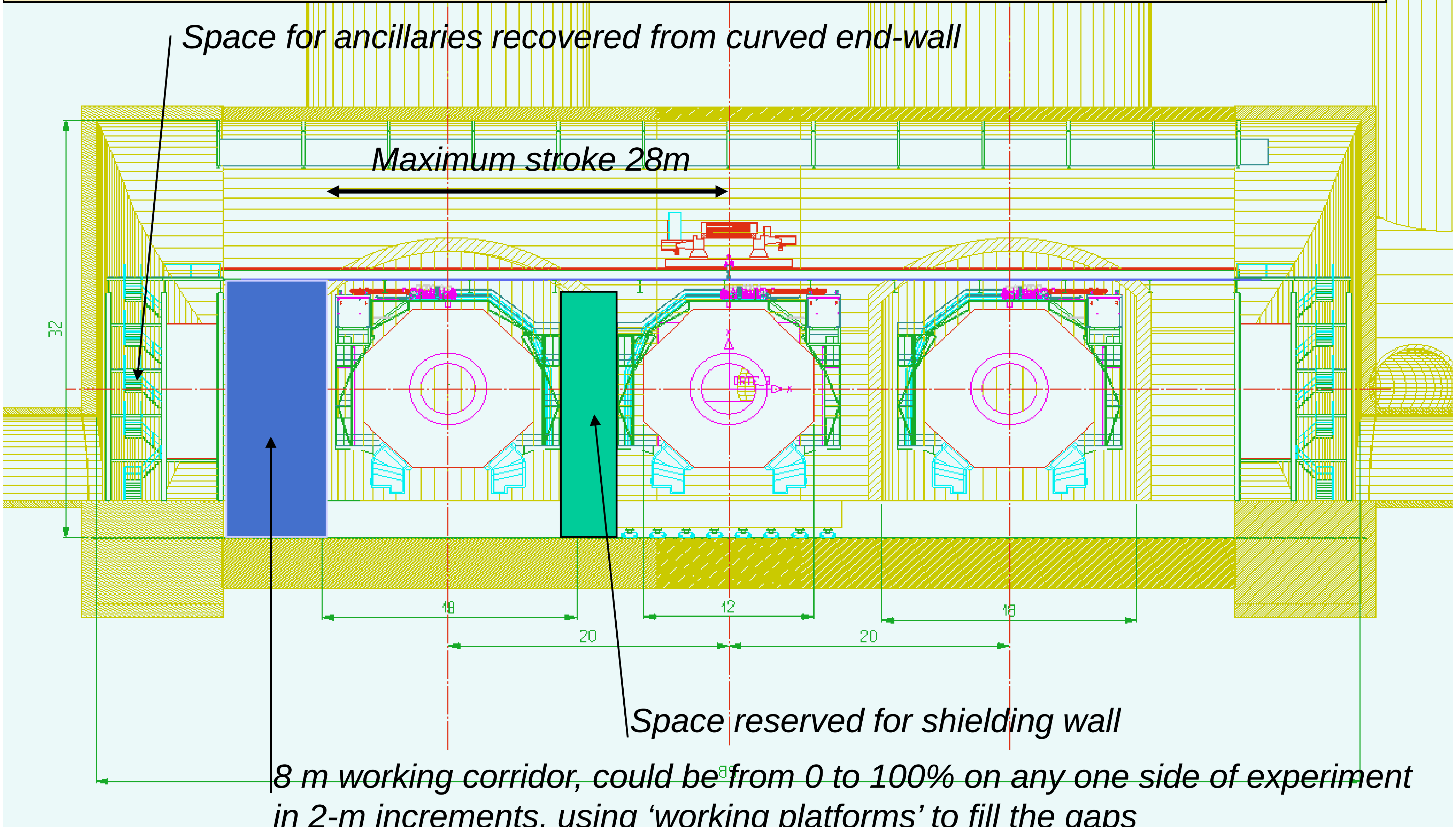
And a view of phase II during Heavy Lifting operations



Experimental Area

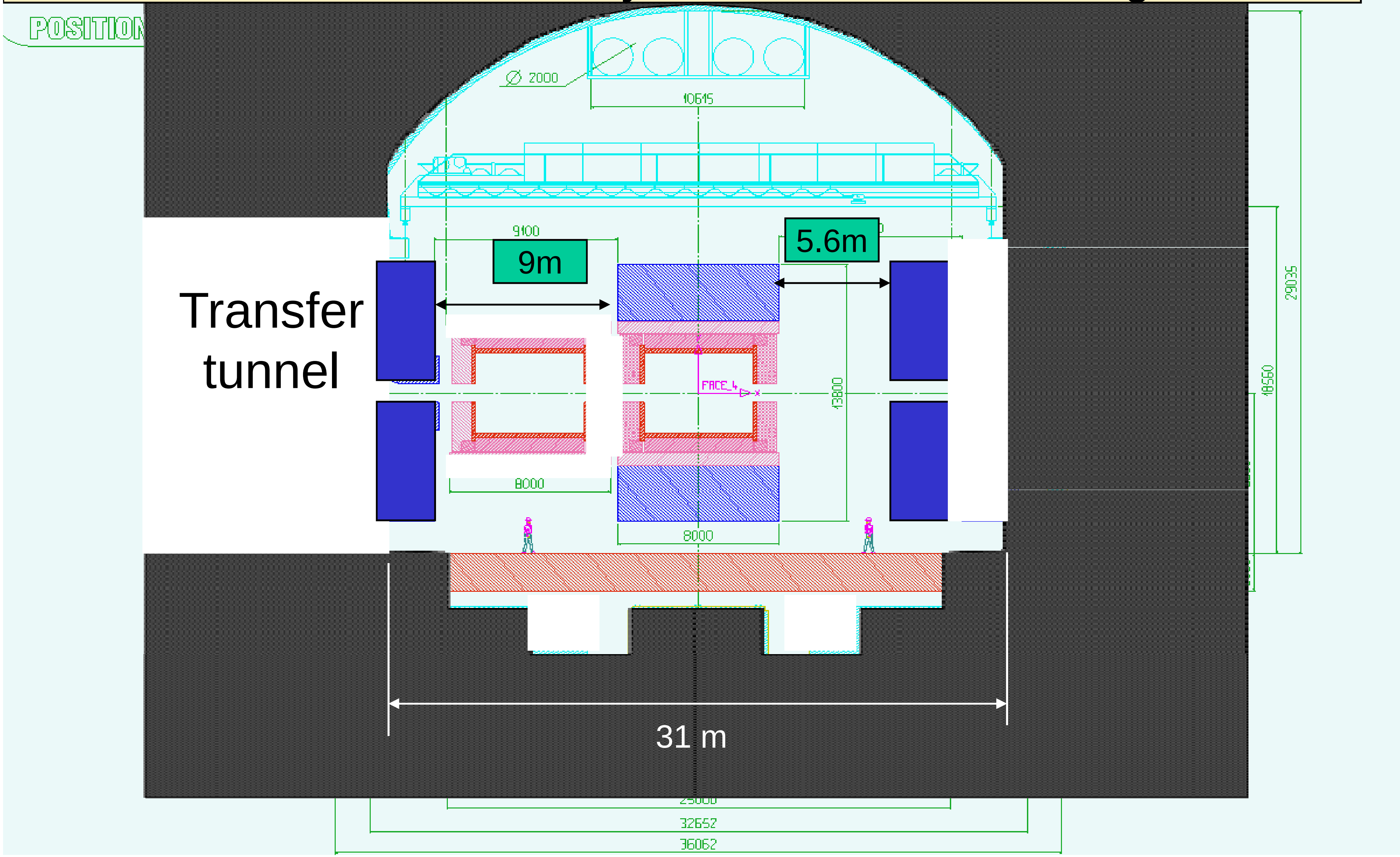
Underground Hall Parameters for Two Large Shaft Solution

Possible Hall Parameters - Length around 90 m

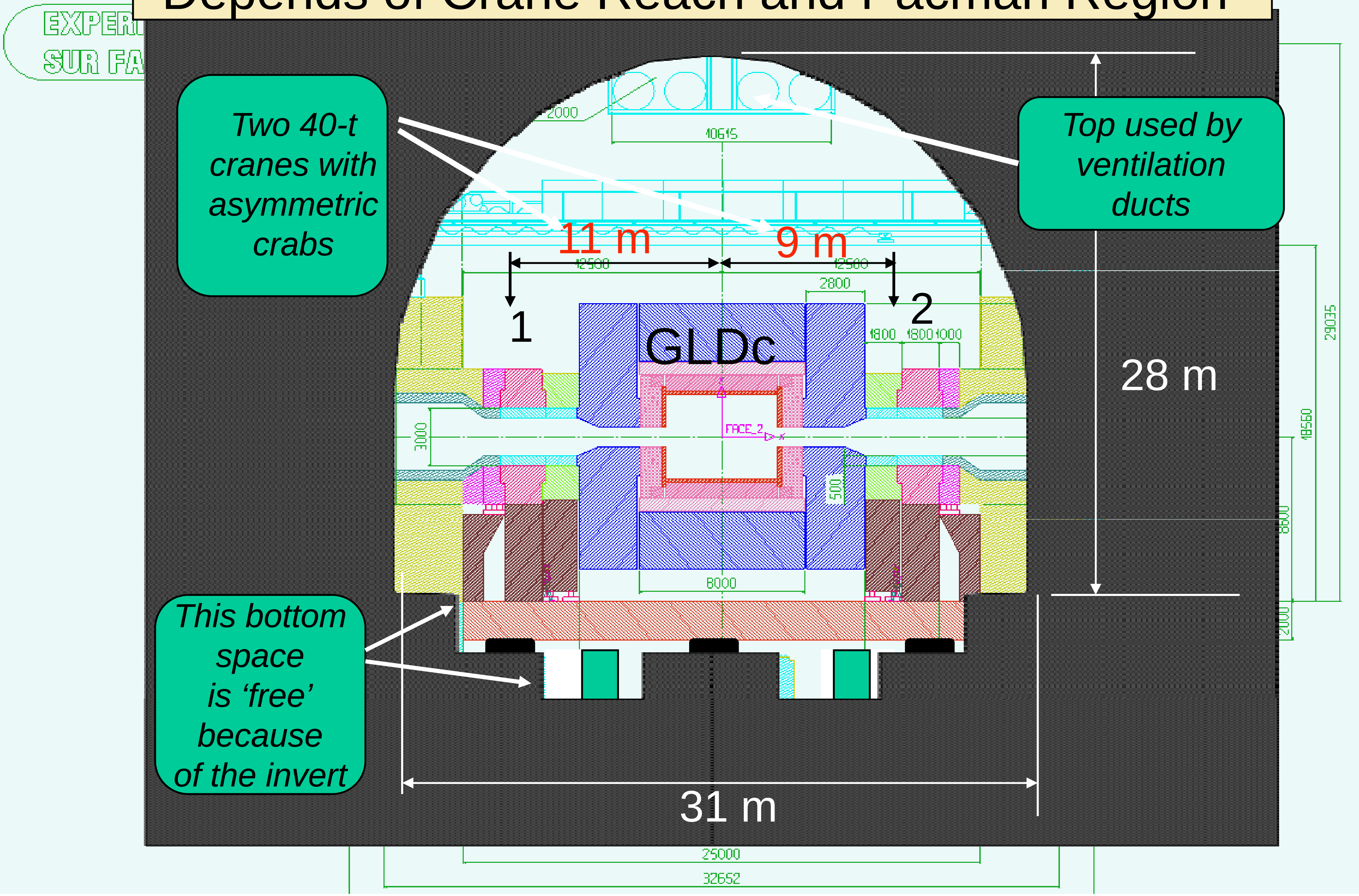


Possible Hall Parameter - Width

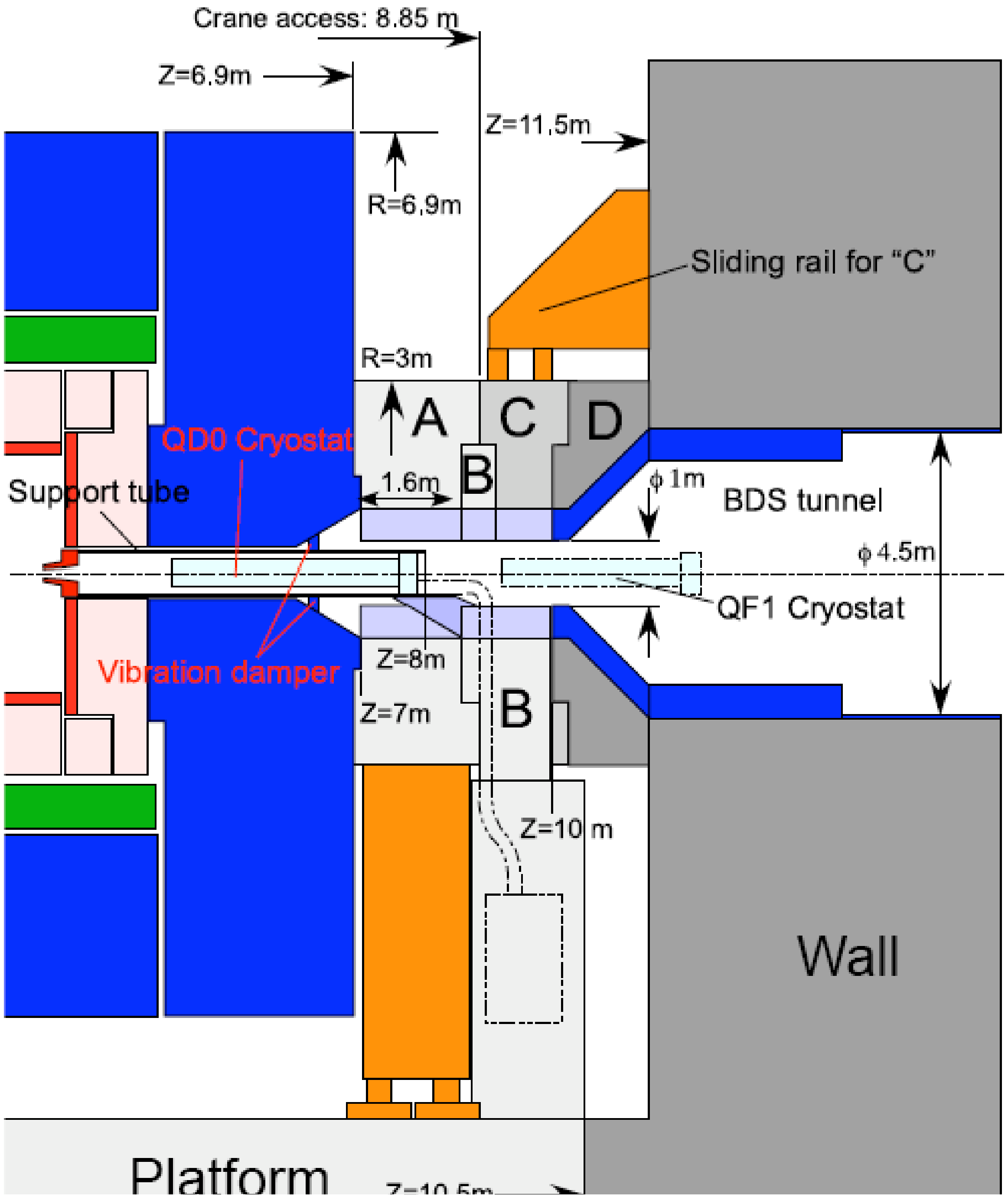
Transfer Tunnel allows easy extraction of ‘Tracking Device’



Possible Hall Parameter - Width
Depends of Crane Reach and Pacman Region

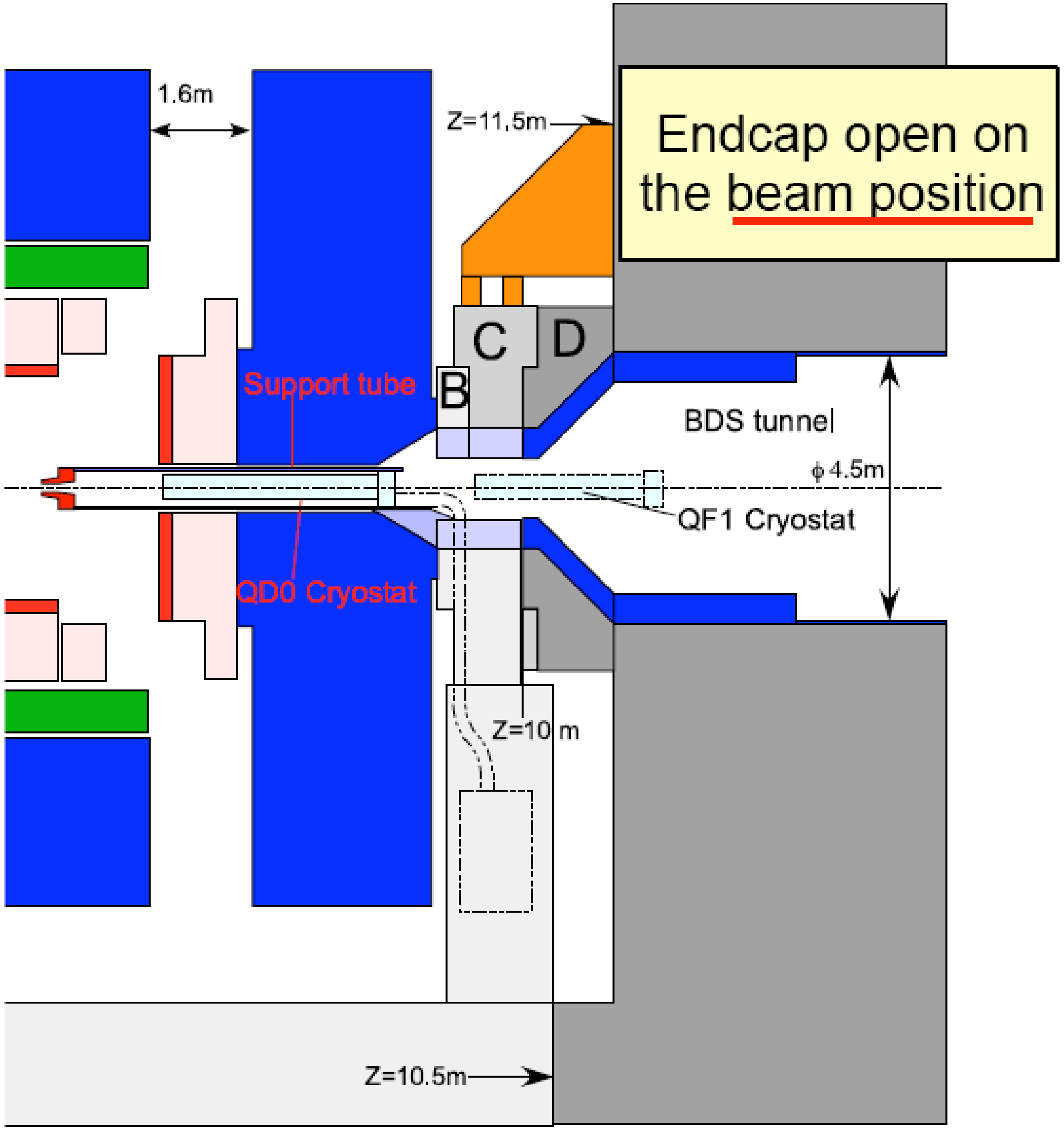


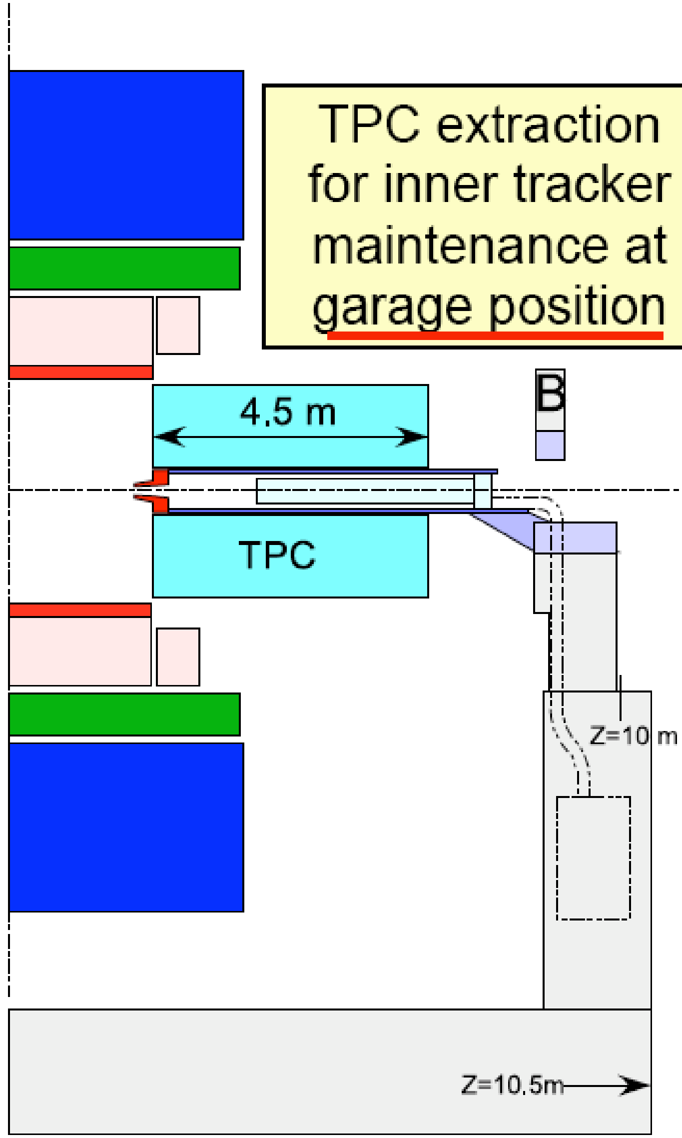
Example of GLDc at ILC



The interface between the experiment, the last part of the machine and the movable shielding (pacman) is a complex region that needs an integrated effort

Example of GLDc at ILC, Opening Scenarios govern the choice of hall parameters





Conclusions

Conclusions-I

Various experimental area dispositions have been looked at for ILC, assuming that:

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

Conclusions-II

- The platform can move on heavy-duty rollers as it has to go in one direction only
- The preferred solution for moving the detector elements is to use air-pads as complex paths are likely to be required
- These air pads can be used in the ‘sublifting’ mode for maintenance operations guaranteeing no relative vertical movements (H. Gerwig)

Conclusions-III

- If surfaced assembly is used, two large shafts positioned directly above the underground hall 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

Conclusions-IV

- 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-V

- Most of this reasoning is certainly applicable to CLIC IR, however there will be differences, for example the amount of services and the radiation environment outside the detectors.
- It would be useful to form early enough a study group, working closely with a proto-collaboration and a typical CLIC detector, to orient correctly the civil engineering studies for the CLIC IR and experimental hall(s), (and also other studies for CLIC detectors…)