

CLIC MODULE TRANSPORT AND INSTALLATION

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CES, 8 October 2008

AIMS

- REVIEW REQUIREMENTS AND PROPOSE CONCEPTUAL SOLUTION FOR LOWERING AND UNDERGROUND TRANSPORT / INSTALLATION OF CLIC MODULES.
- THIS CONCEPTUAL DESIGN WILL BE AN INPUT INTO THE TUNNEL INTEGRATION STUDIES

APPROACH

NEED TO CONSIDER :

- TRANSPORT ALONG TUNNEL
- TRANSFER AND INSTALLATION ON SUPPORTS
- LOWERING FROM SURFACE AND ENTRY INTO TUNNEL
- 20,000 MODULES SO NEED TO BE FAST.
- ALLOW INDIVIDUAL MODULE EXCHANGE

Previous presentations reviewed transport and installation solutions used elsewhere

Transport questions + answers

MODULE CONDITIONING FOR TRANSPORT

- What is the unit of transport? -one module –see later slides
- Dimensions in transport configuration - see later slide
- Weights in transport configurations -1500kg
- Potential lifting points (e.g. for transfer) –consider lifting points above module – allow space for spreader beam
- Potential support points – support under girders during transport

TRANSFER TRAJECTORY RESTRICTIONS

- What supports etc will already be installed on the floor? – see later slides
- How much clearance space between adjacent modules during transfer/installation- 30mm allowed for interconnections – space available during installation to be defined

POSSIBLE SIMULTANEOUS TRANSPORT/INSTALLATION OF SEVERAL INTERCONNECTED MODULES

- What are the possibilities/implications if several modules are interconnected on the surface and transported/ installed at same time? –support and survey concepts based on module installation one at a time

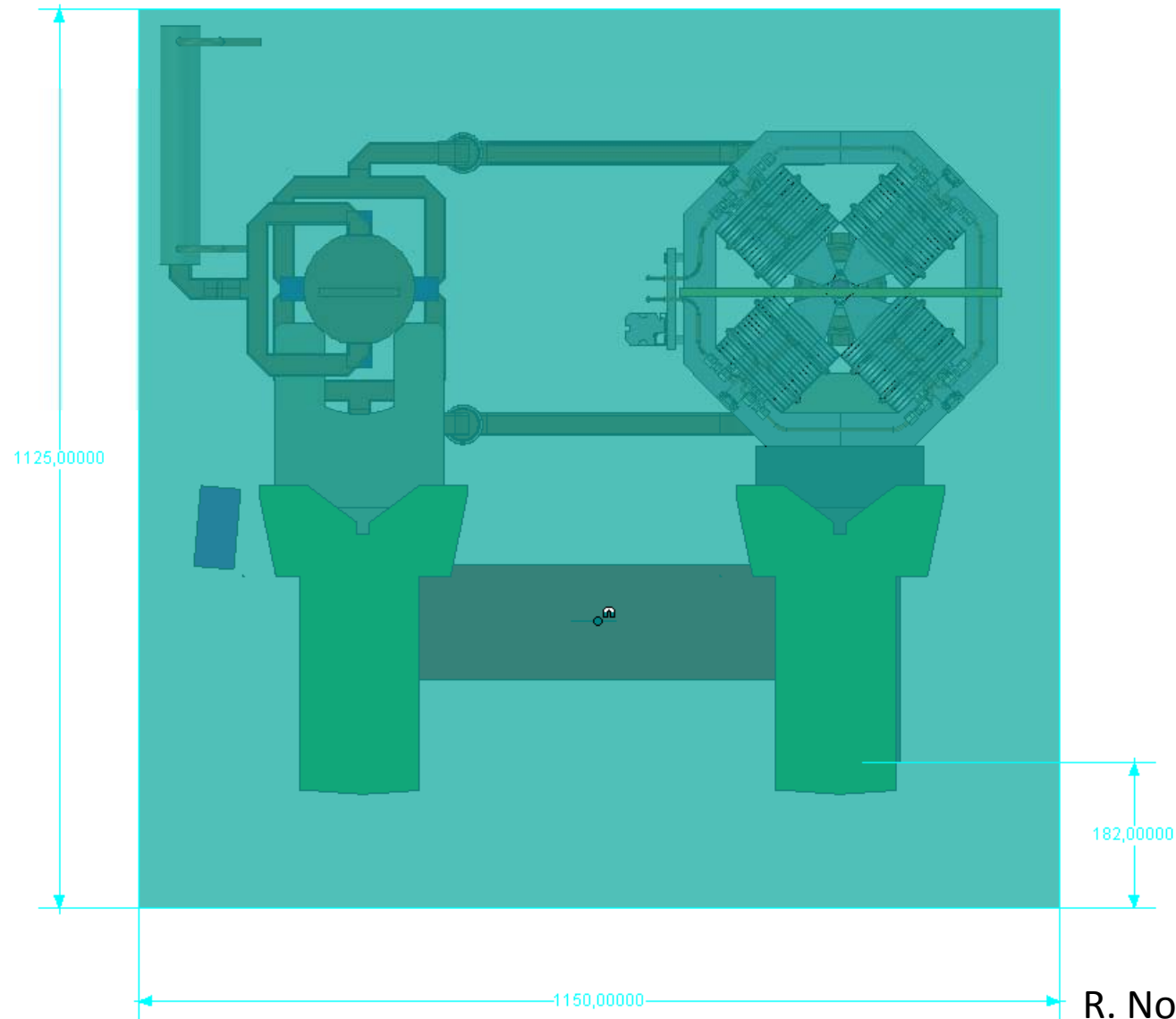
VIBRATIONS

- Is it reasonable at this stage to assume that the levels of precaution taken for cryodipole tunnel transport will be sufficient? - 1g used as basis (i.e. normal handling techniques) note: need to avoid overloading supports during installation.

Transport envelope in cyan – 1125 x 1150 x 2100

Lifting points according to the worst case, i.e. on top of the transport envelope.

Intergirder support acceptable assumption for the moment.



R. Nousiainen 04092008

Assembly, Transport and Installation

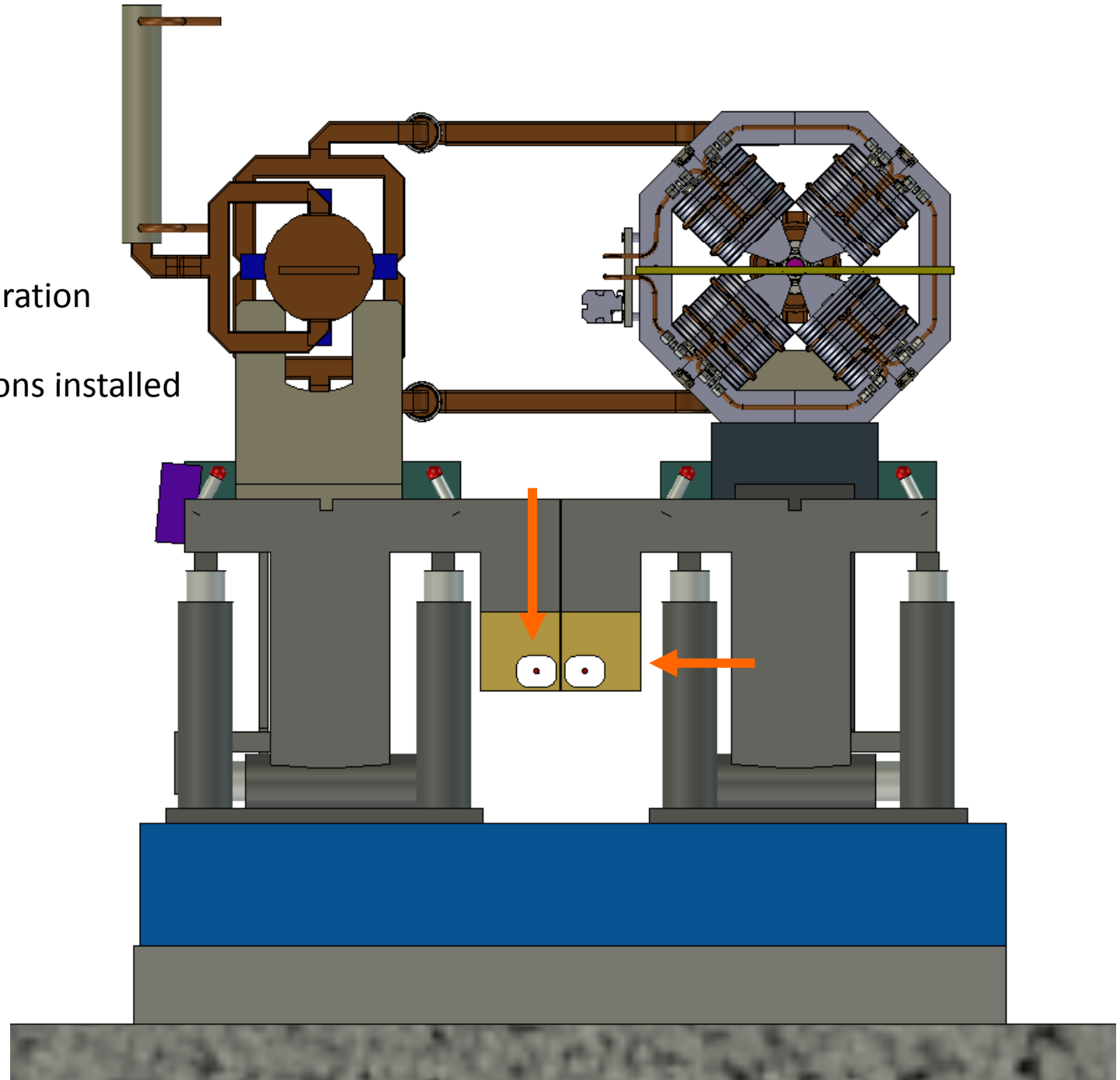
Continuation of the meeting held on
28th of August 2008

K. Kershaw, H. Mainaud Durand, R. Nousiainen,
G. Riddone, T. Touze
(R. Nousiainen slides)

STEP 1

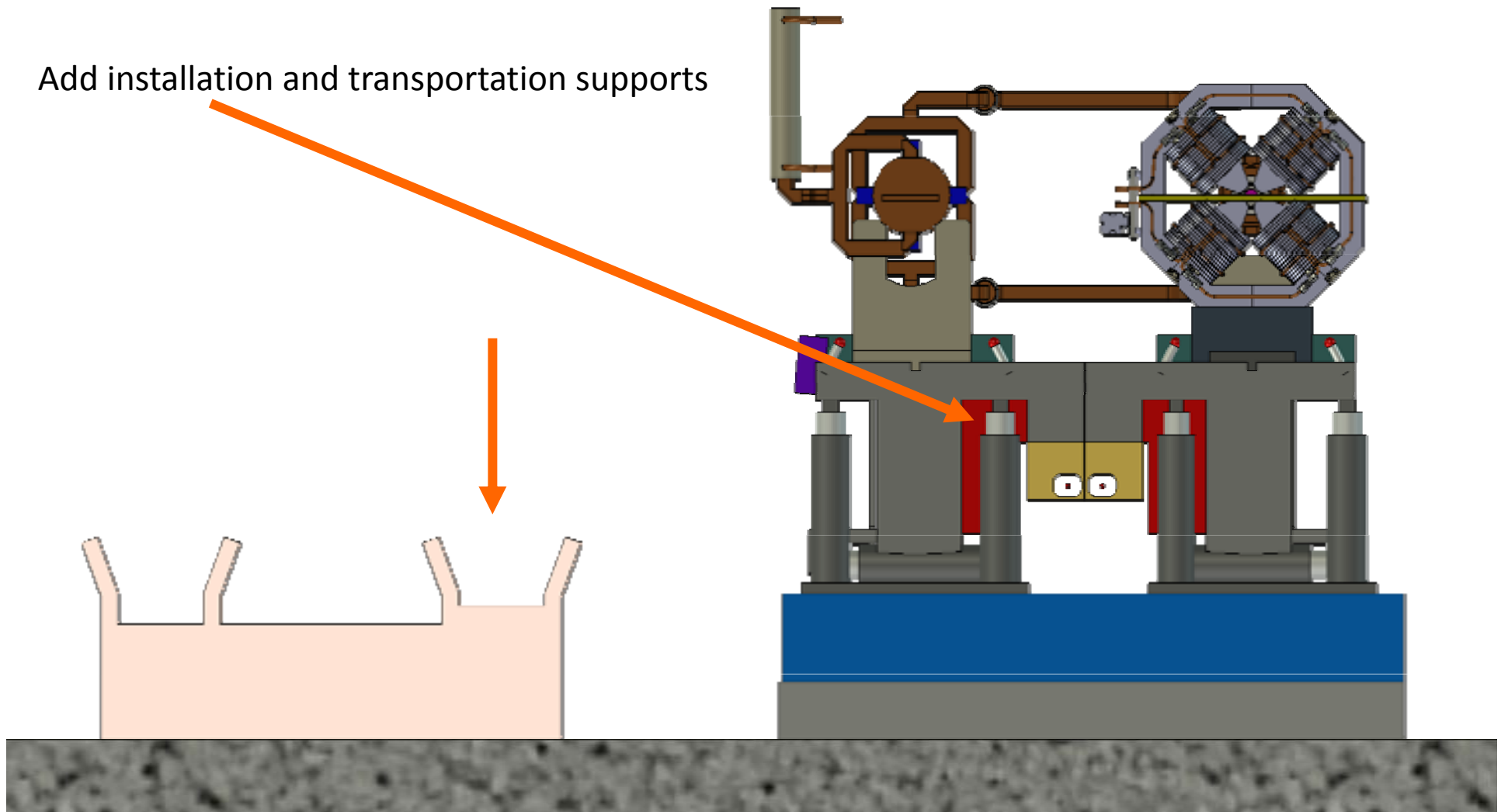
Assembly at surface

- Use the same configuration as in the tunnel
- MB-DB interconnections installed
- Fiducialisation done



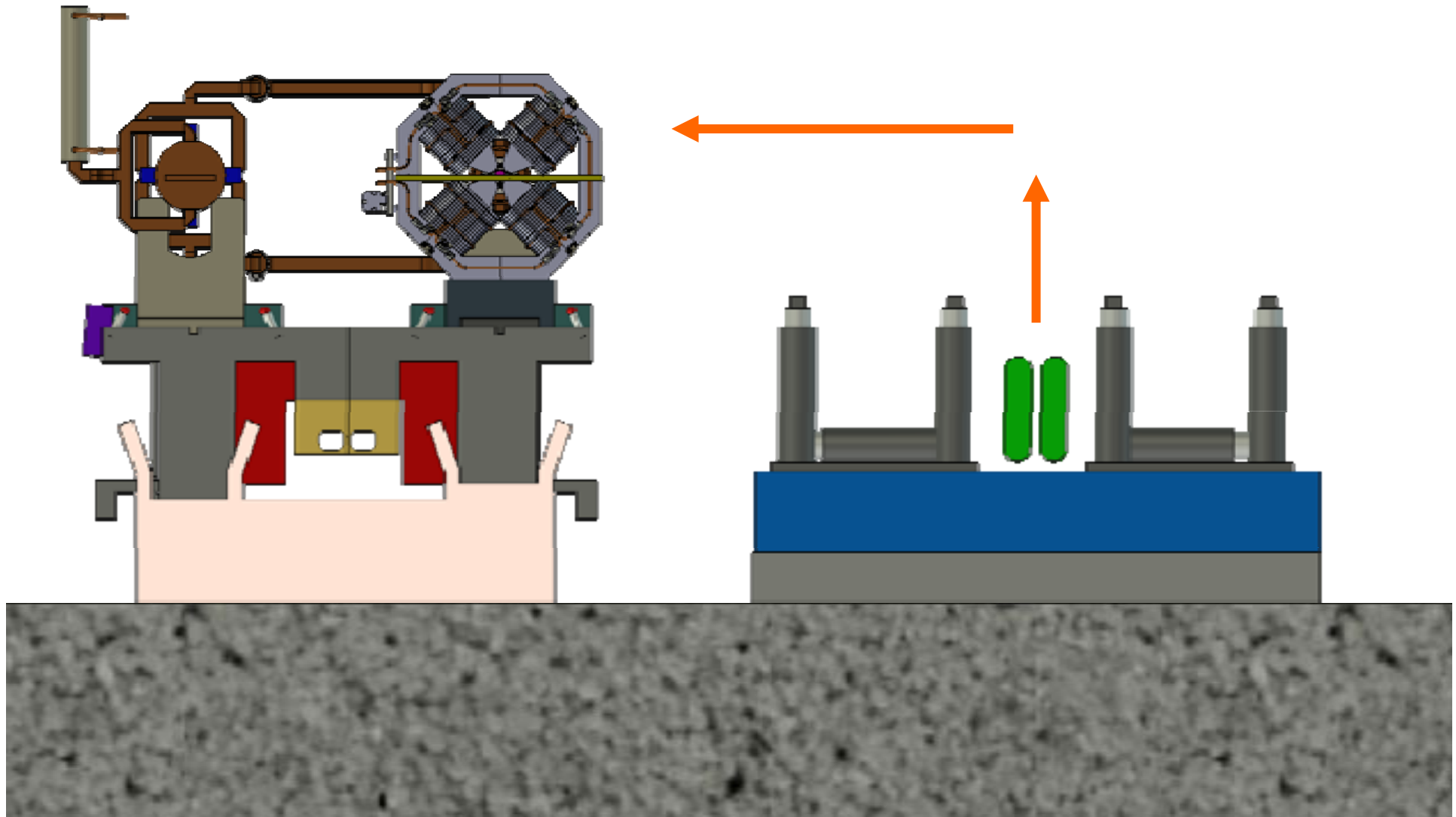
STEP 2

Add installation and transportation supports



STEP 3

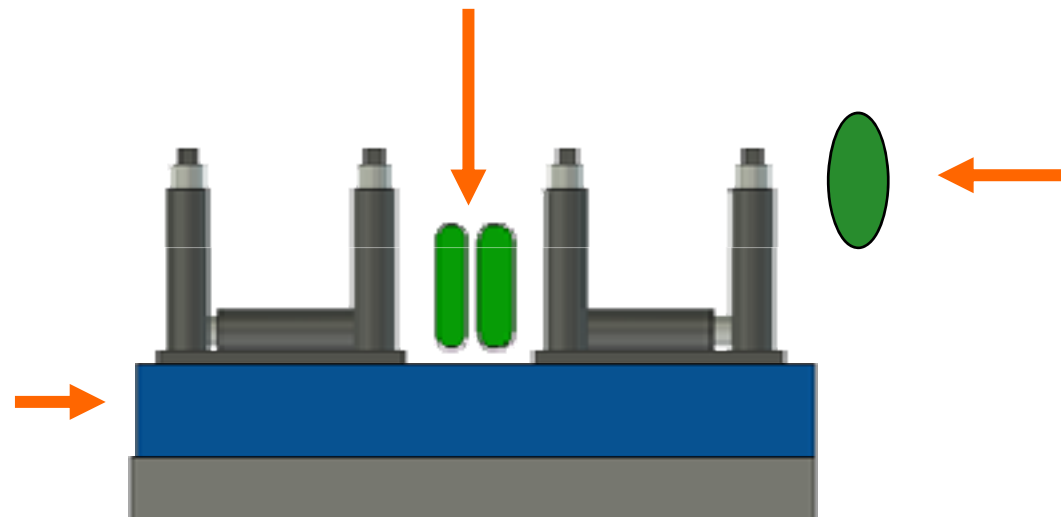
Move module to a transportation support



STEP 4

Tunnel before module installation

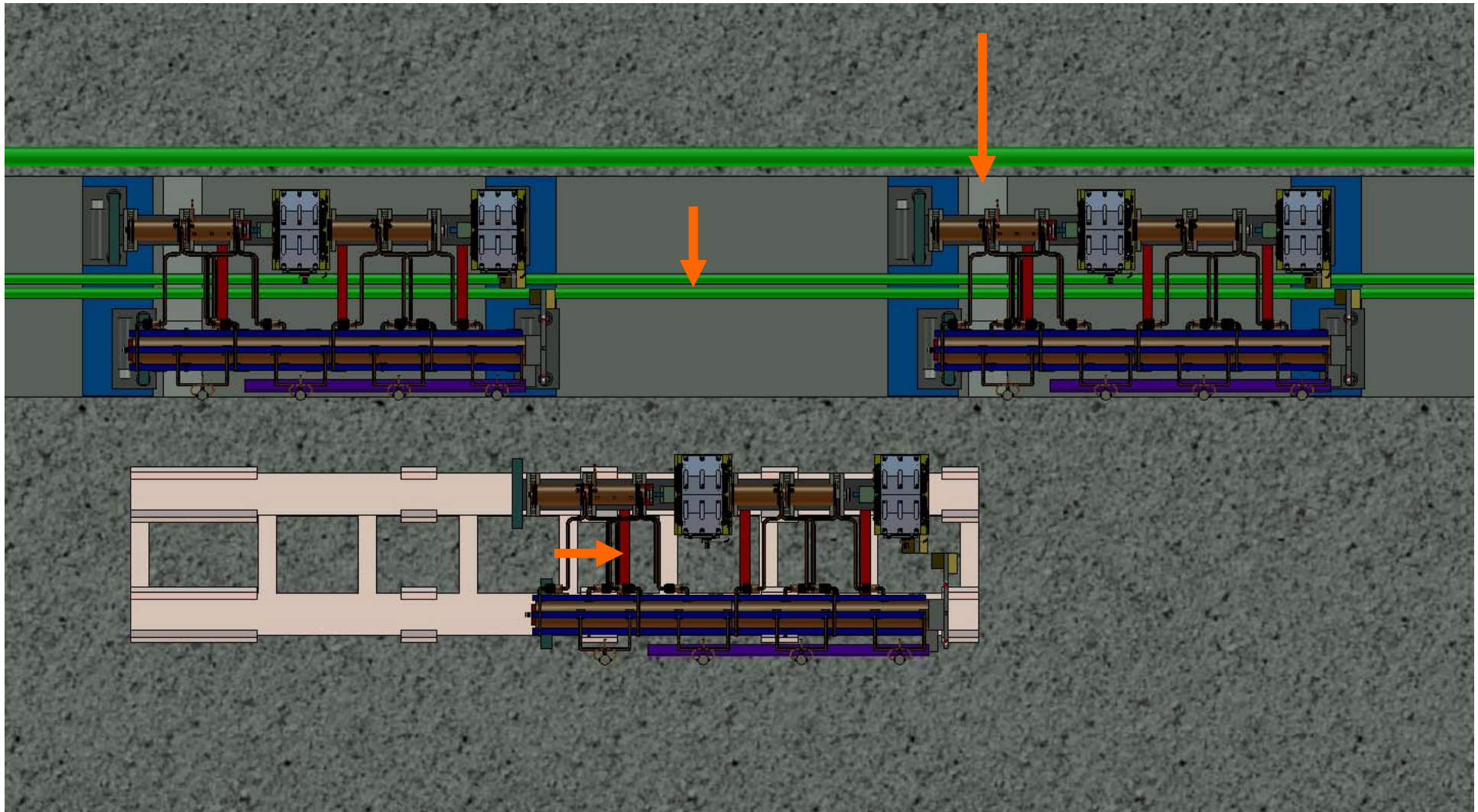
- Prepare propagation network reference and pre-align supports



STEP 5

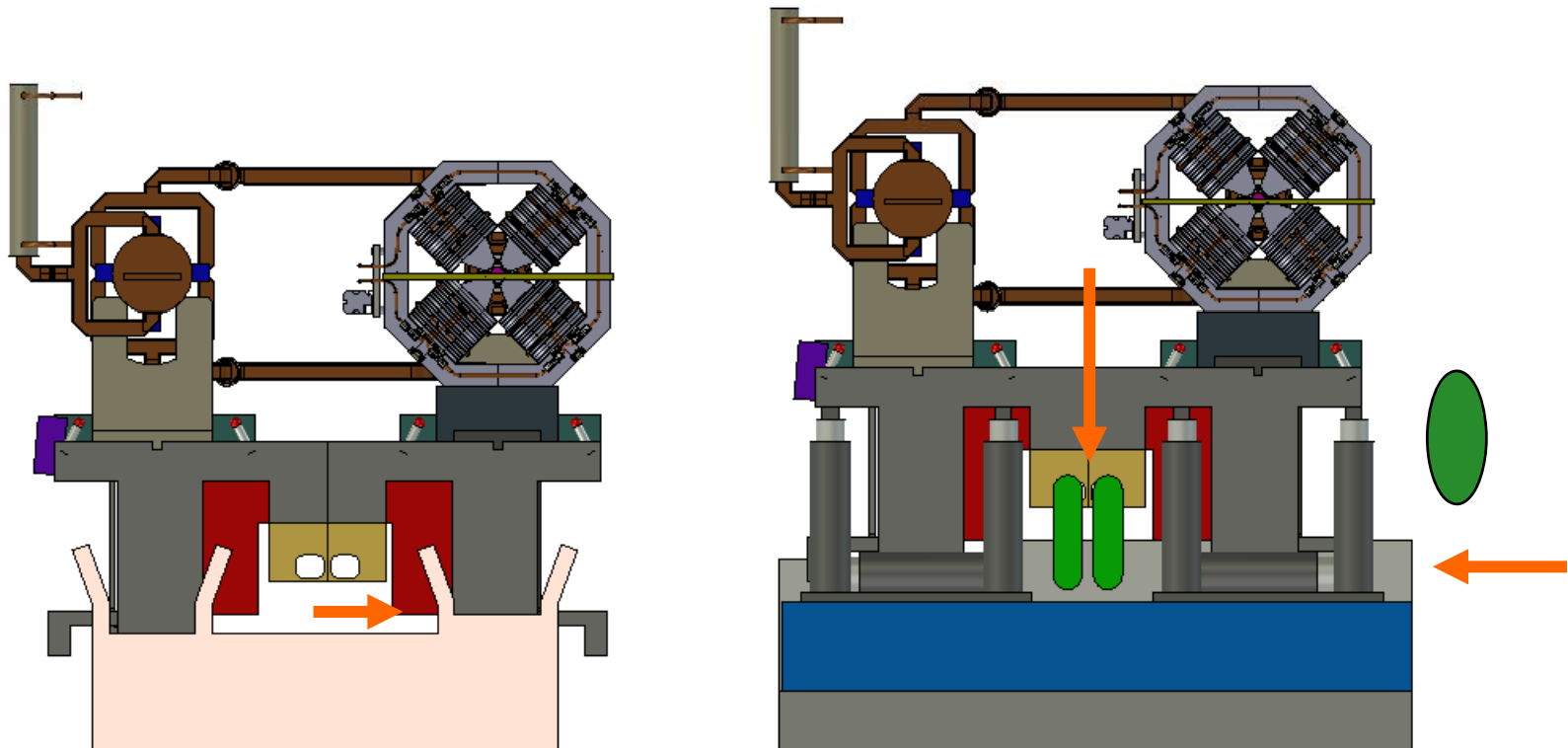
Module at the installation point.

- Use temporary supports for installation.



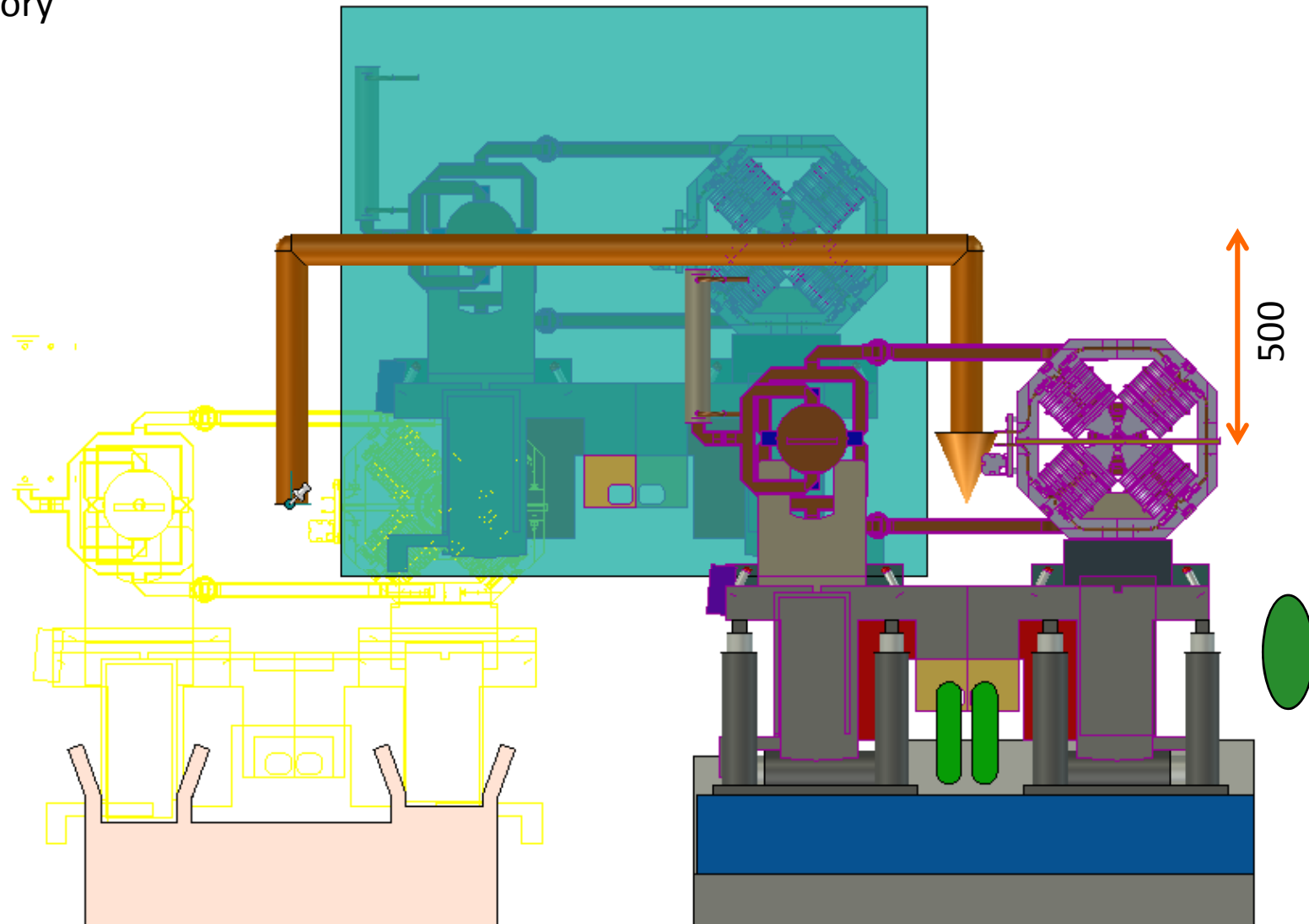
STEP 5B

- Module at the installation point.
- Use temporary supports for installation.



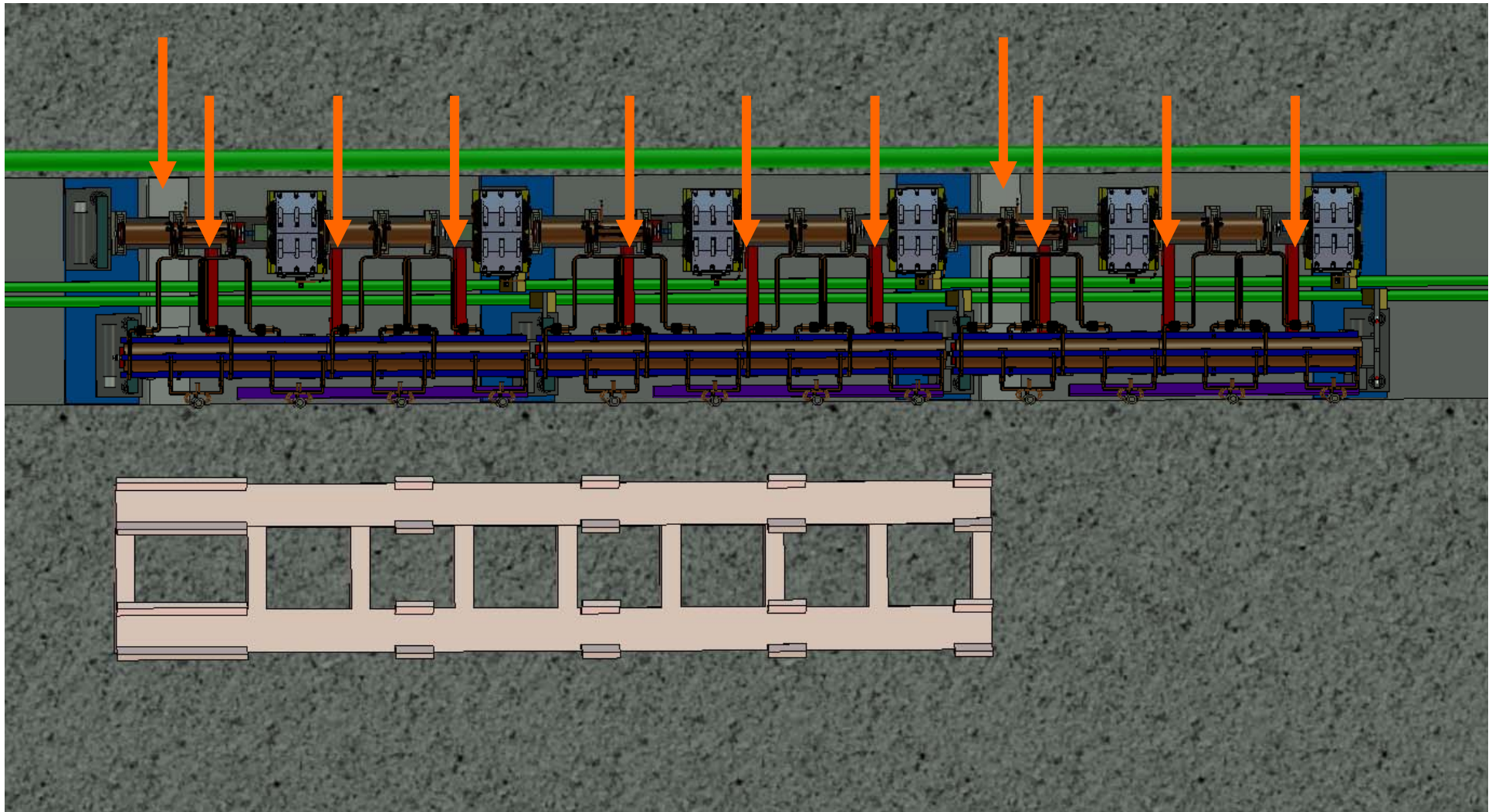
STEP 6

Module installation trajectory



STEP 7

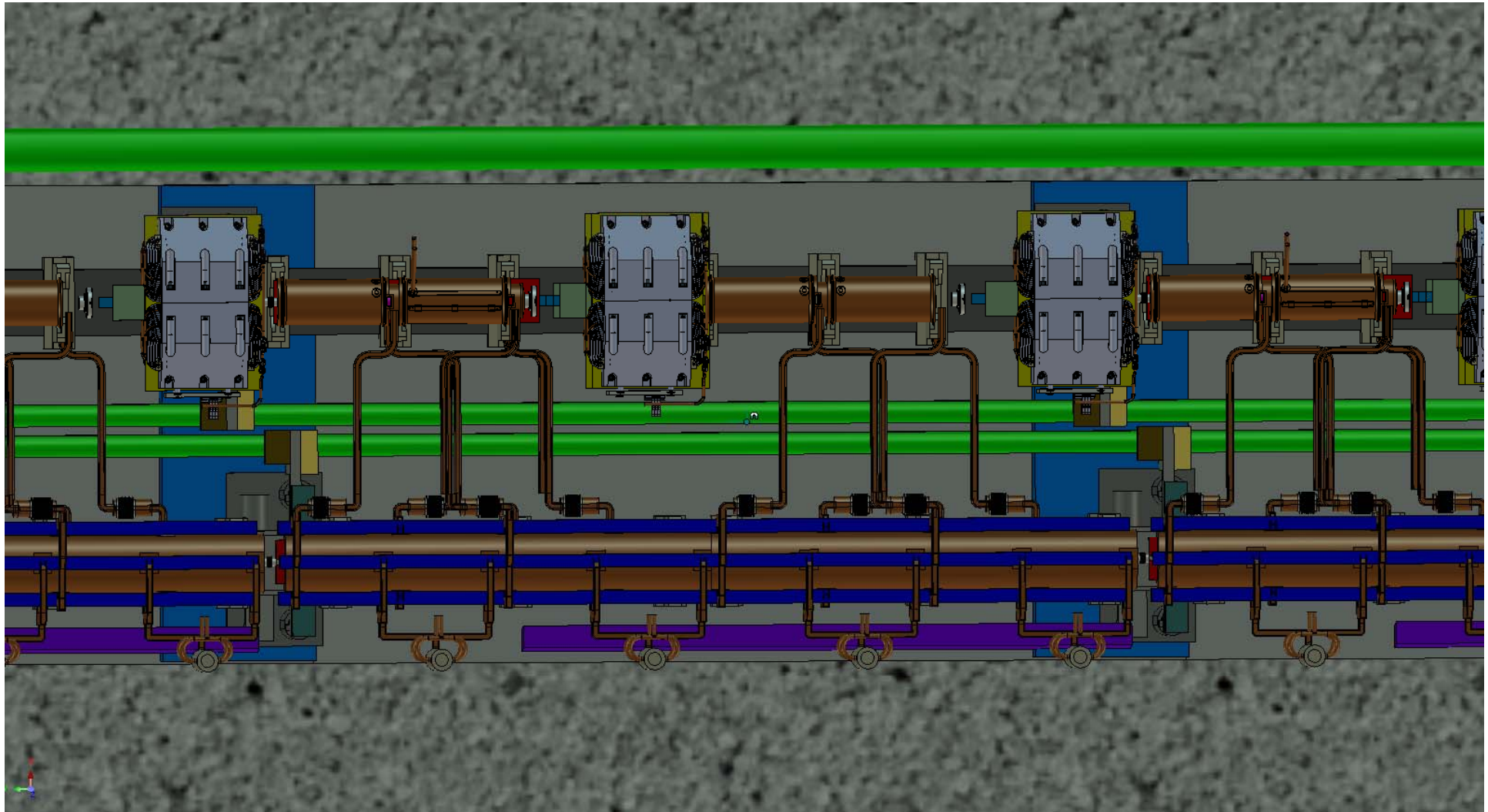
Installed module with temporary supports



STEP 7B

Installed module

- Temporary supports removed

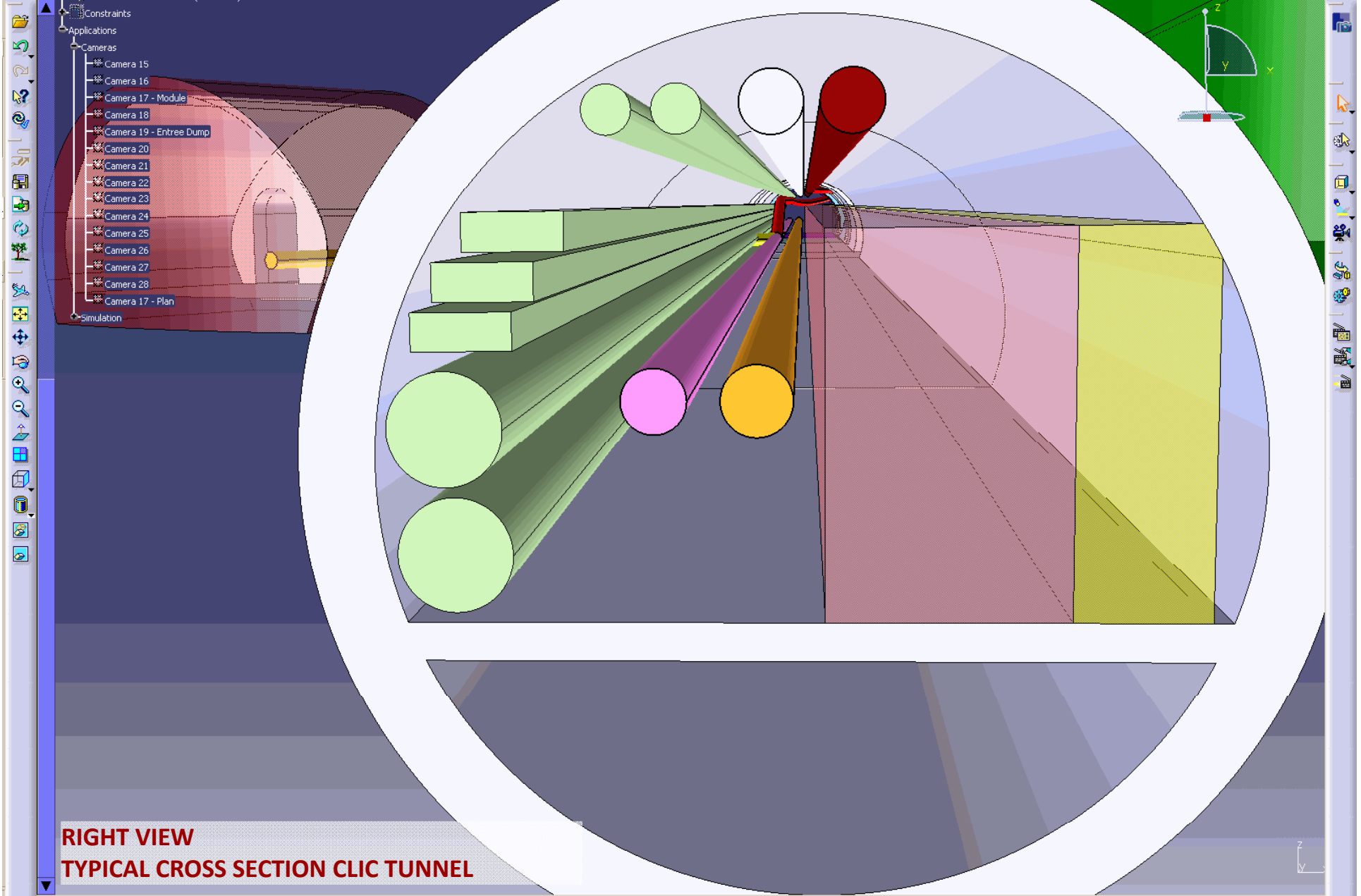


CLIC

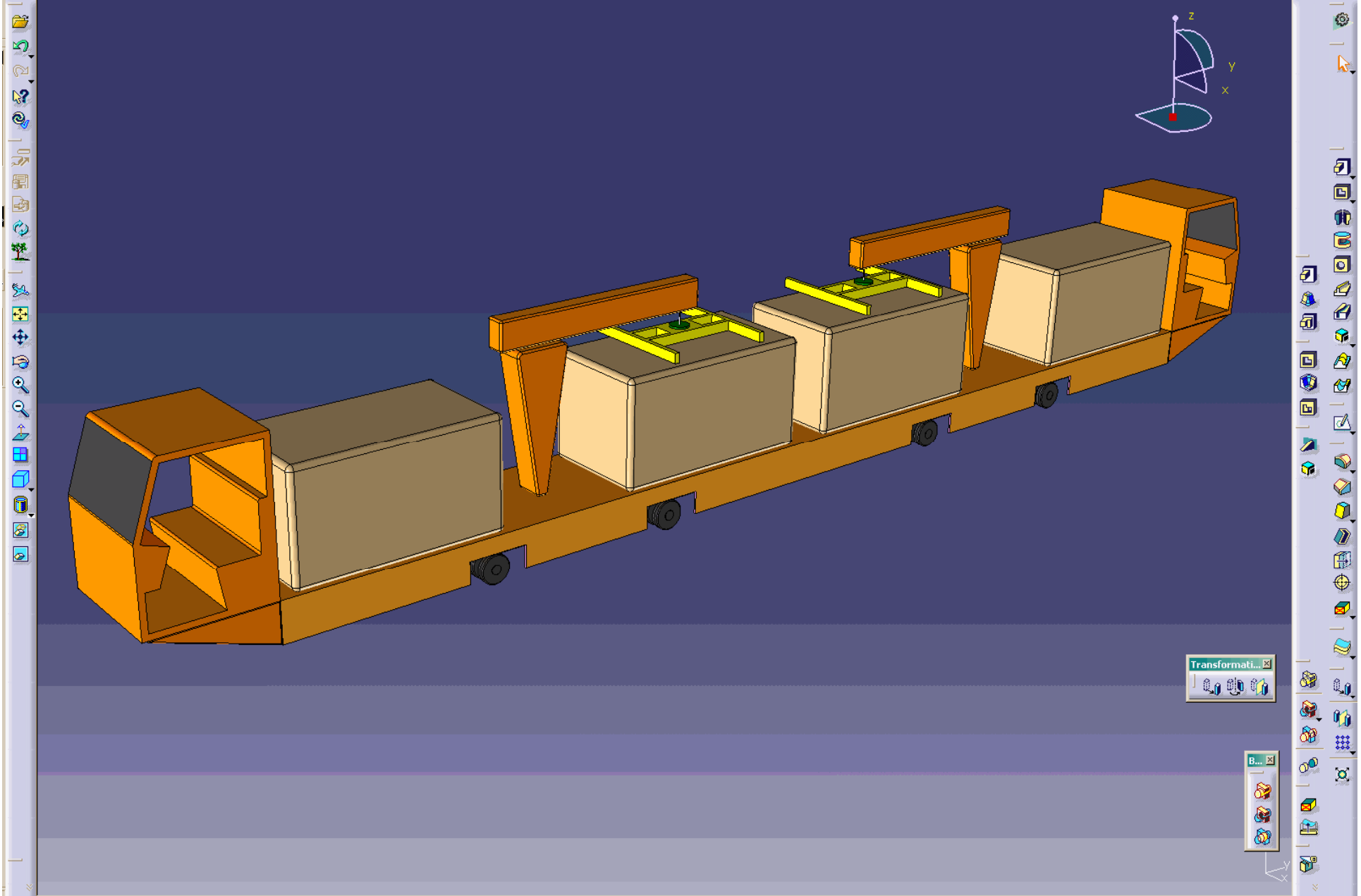
3-D Studies for module Transport and Installation

Keith Kershaw / John Osborne / A.Kosmicki

2008 Sept. 25th

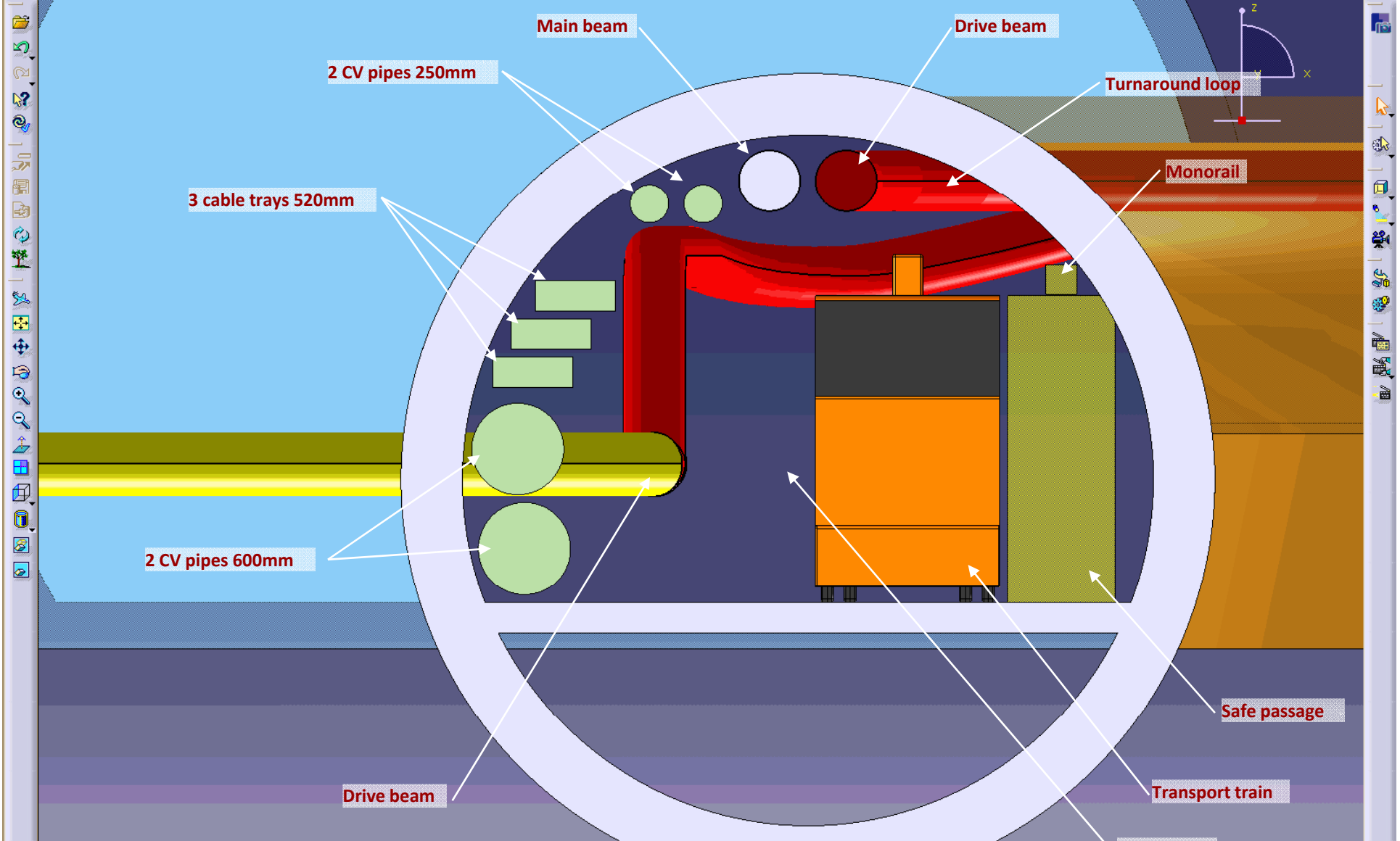


RIGHT VIEW
TYPICAL CROSS SECTION CLIC TUNNEL

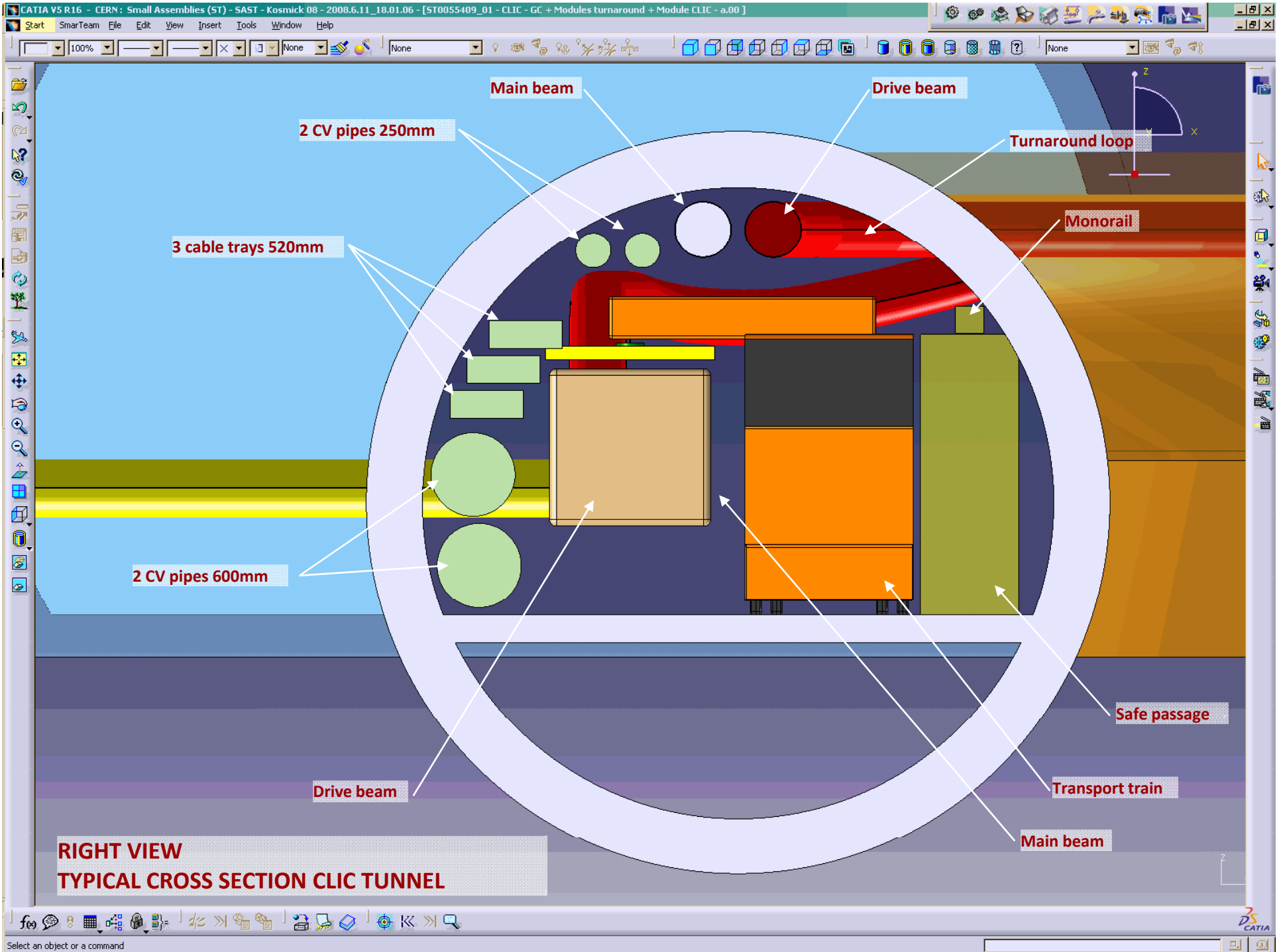


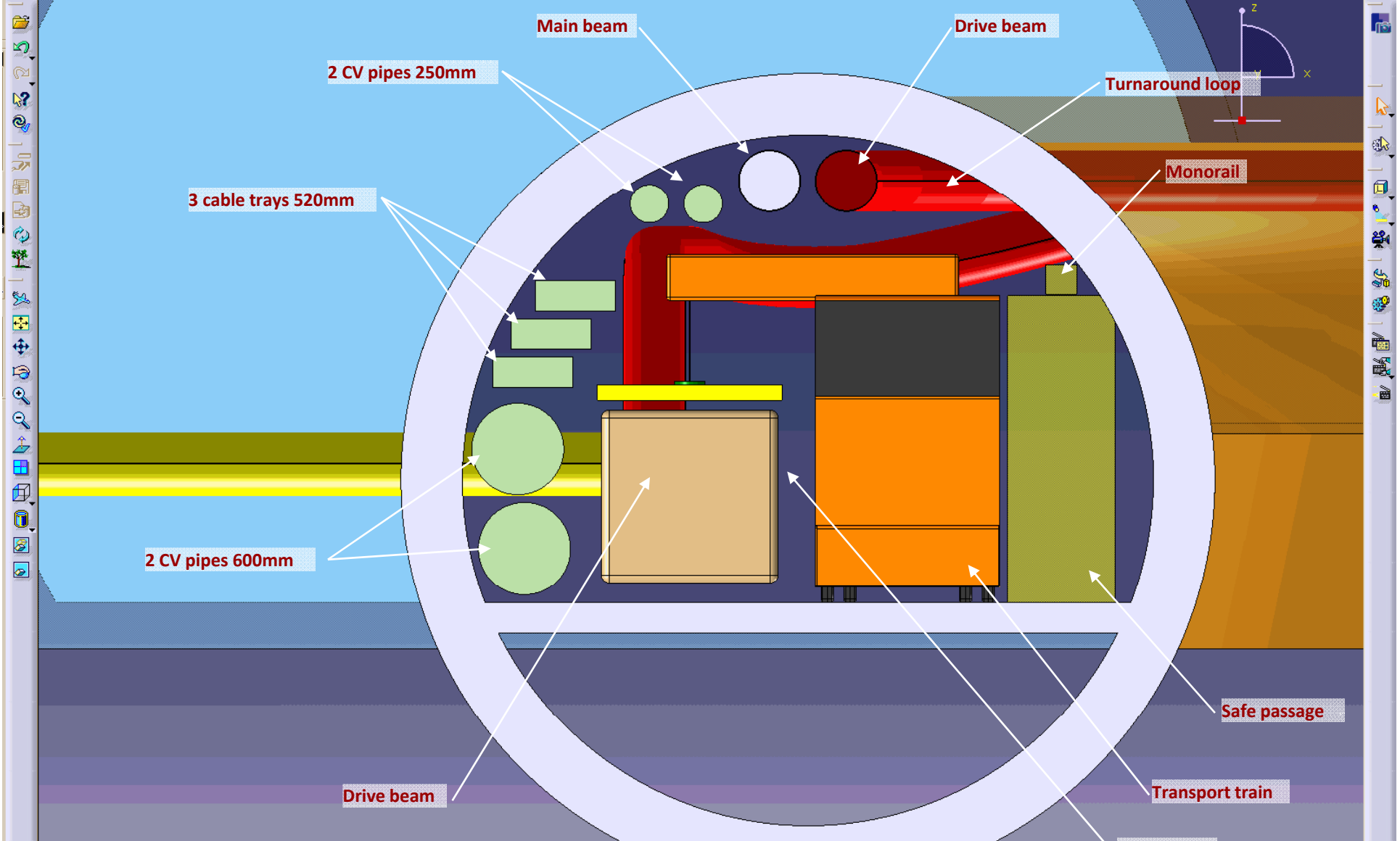
Vehicle conceptual design

- Floor – running vehicles with on-board (un)loading cranes.
- Transport several modules at a time
- Avoid requirement for reserved space below beams / girders
- Modular: vehicle base with separate operator cabins and interchangeable lifting equipment modules
- Monorail for power (+ buffer batteries)
- 1200 wide x 2270 high x 12m long (+ 2.5m for cabs)
- Allows reservation of space in tunnel for transport and transfer of modules (however module beam offset issues may change transfer height)

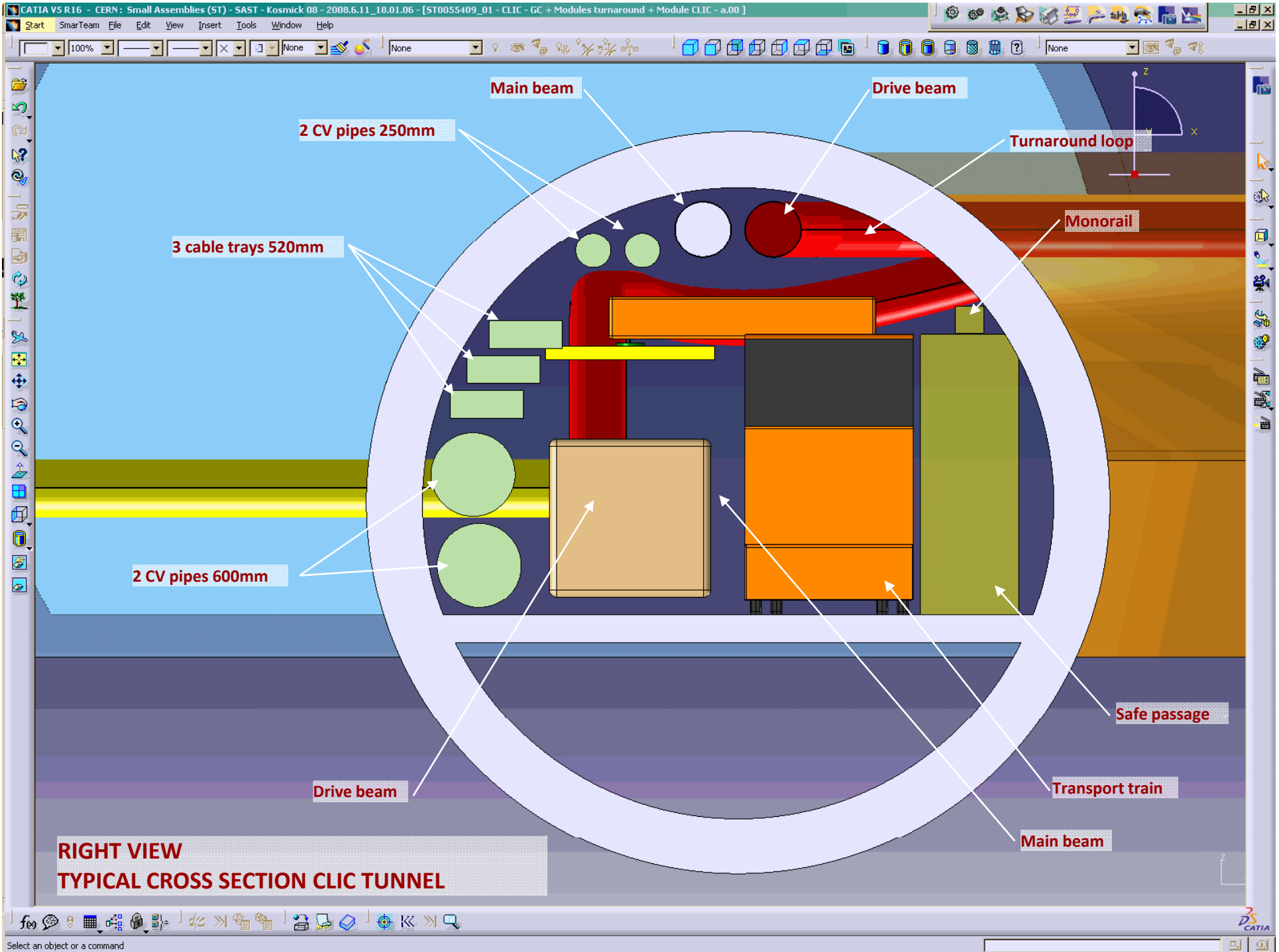


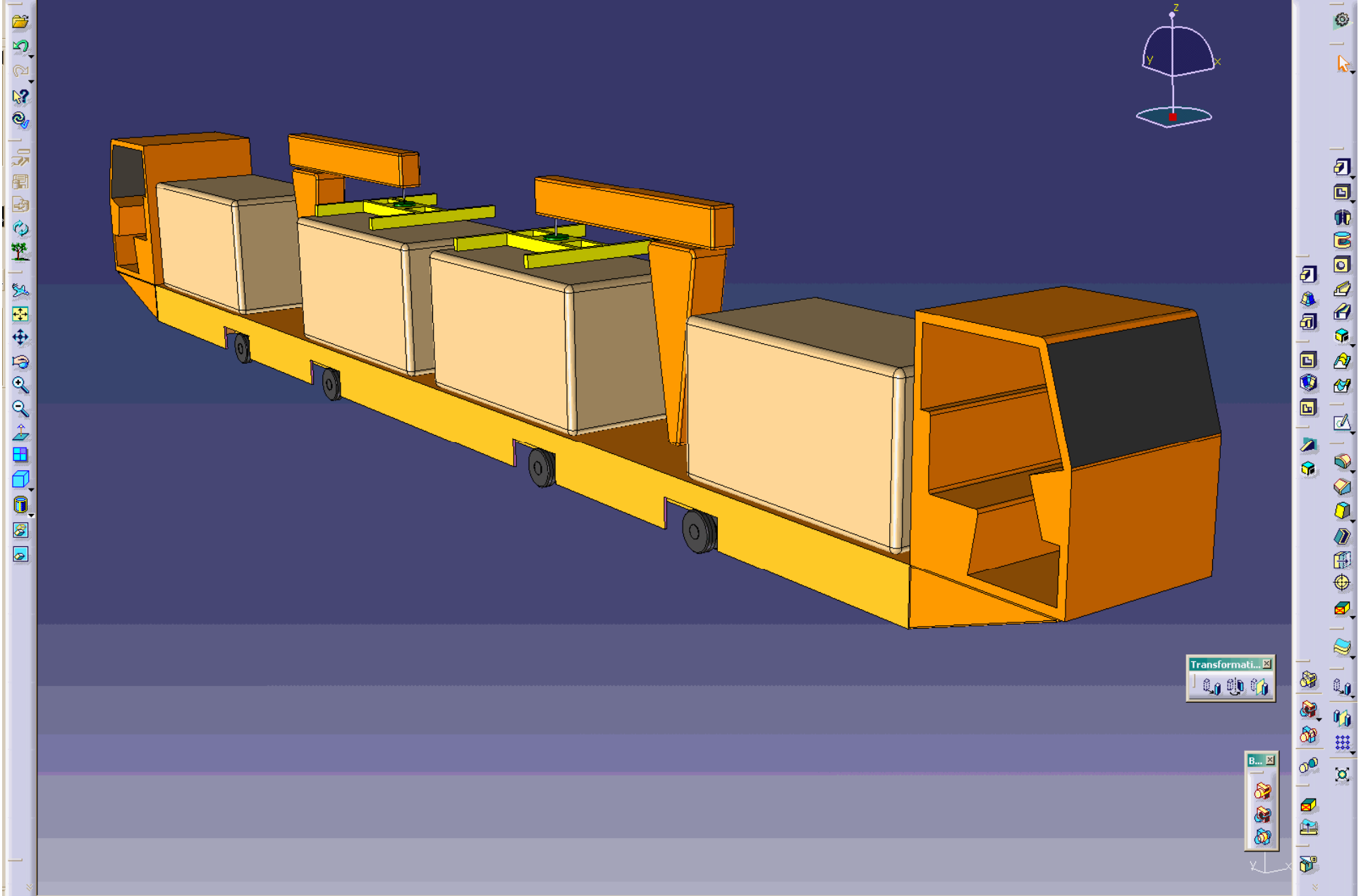
RIGHT VIEW
TYPICAL CROSS SECTION CLIC TUNNEL





RIGHT VIEW
TYPICAL CROSS SECTION CLIC TUNNEL





Transformati...

B...



Lowering of modules etc

- Use lifts for fast lowering of modules
- Method of fast loading of modules onto vehicles
- Space to allow loaded vehicles to queue before driving along tunnel (-e.g. grouped passage through interconnection work sites)
- Space for maintenance /repair
- Passing places to allow sorting of vehicles/modules

Logistics – indicative figures

- 20,549 modules to install (assume supports already in place)
- Access shafts 5km apart
- Consider 1 vehicle with 4 modules
- Driving speed 4km/h
- Consider mid-sector (2.5km driving each way)
- Ignore loading time (queuing)
- Driving time = $2 \times 2.5/4 = 1.25$ hrs
- Unloading / installation time = say $\frac{1}{2}$ hr $\times 4 = 2$ hrs
- 1 shift \rightarrow 8 modules with one vehicle
- 20549 modules in 2 years (single shift, weekdays) \rightarrow
 ~ 41 /day \rightarrow need min 6 operational vehicles for modules

Next steps

- 1) Agree concept as basis for further work – feedback from other groups
- 2) Continuous review and refinement as more details of modules and supports and other items and services become available
- 3) Consider transport and installation of:
 - Overhead magnets
 - Turnarounds
 - Beam dumps
 - Services