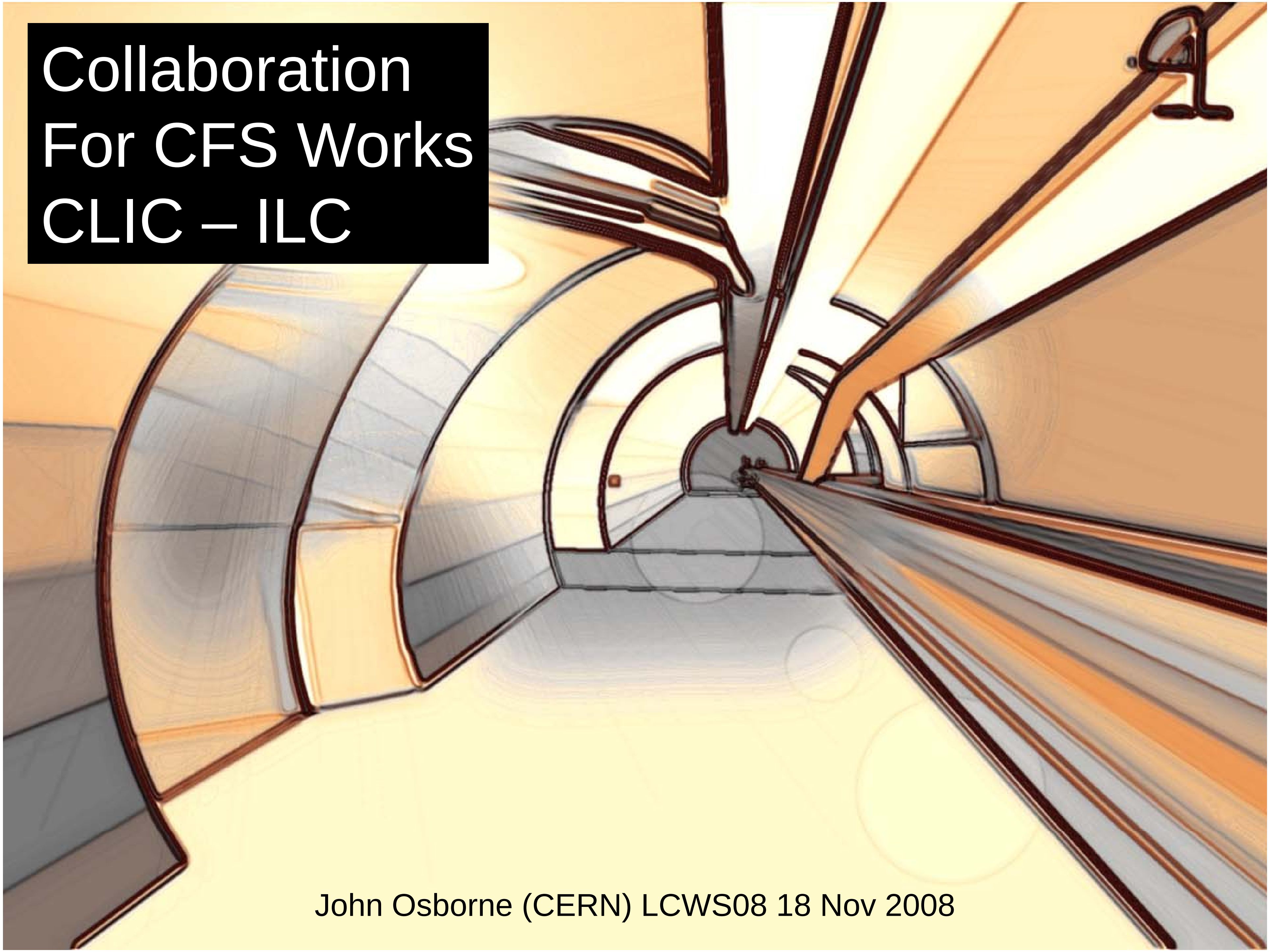
Collaboration For CFS Works CLIC – ILC



John Osborne (CERN) LCWS08 18 Nov 2008

CLIC Civil Engineering & Services (CES) Working Group

Members: H. Braun, A. Enomoto (KEK), J. Inigo-Golfin, K. Kahle, K. Kershaw, A. Kosmicki, V. Kuchler (FNAL), H. Mainaud Durand, Ch. Martel, J.A. Osborne (Chairman), D. Parchet, Th. Pettersson, I. Ruehl, R. Trant

Mandate (Link)

Meetings in 2008

Indico's agendas are available under: http://indico.cern.ch/categoryDisplay.py?categId=1882

last updated on 16.06.2008

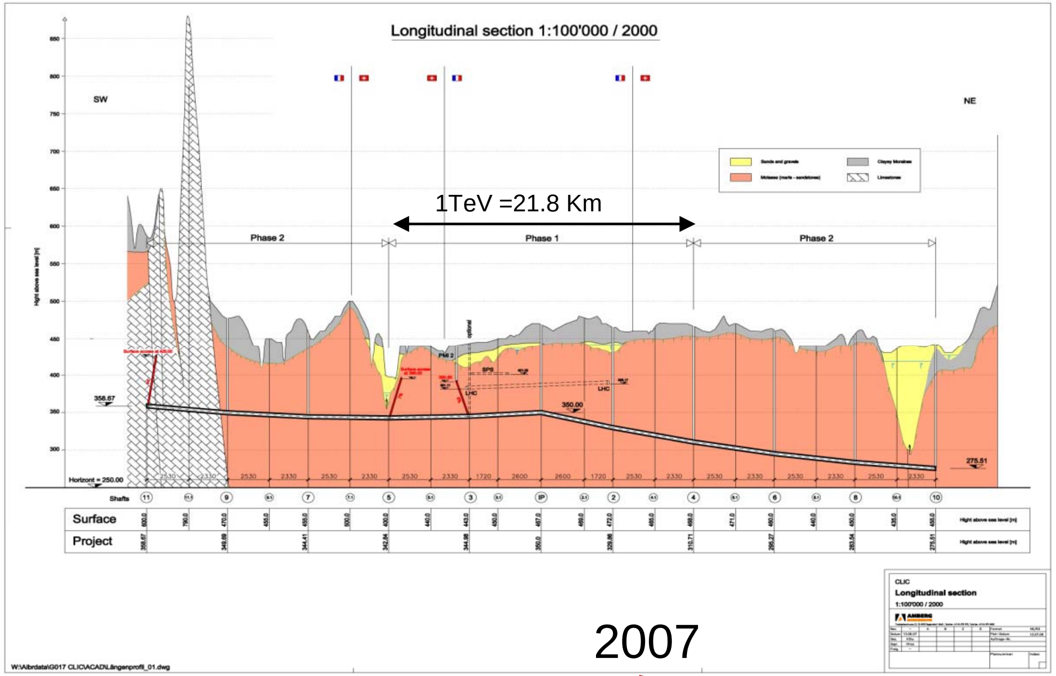
Back to CLIC main page

Studies 2008/2009 in CLIC CES and ILC CFS, include :

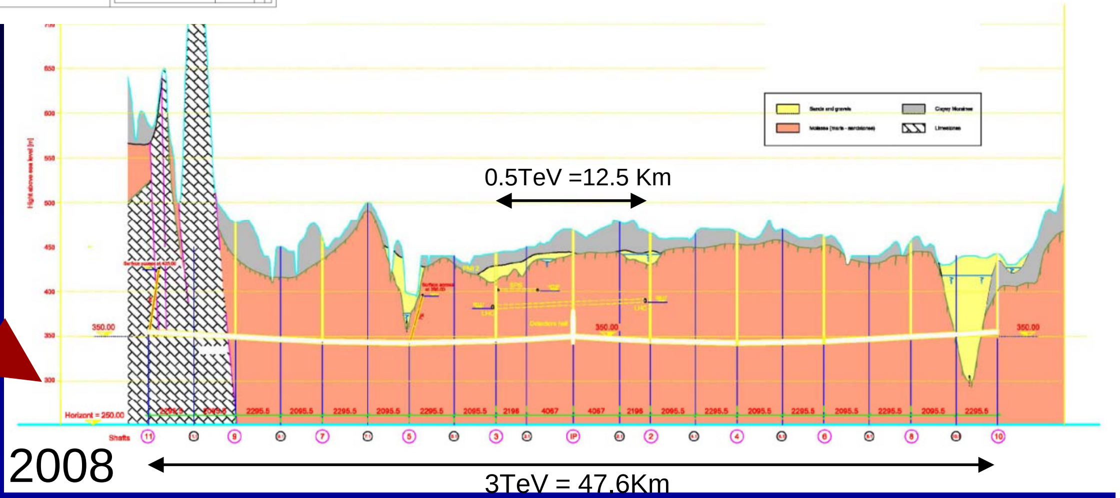
- Civil Engineering layouts : eg 3d Modelling using CATIA software
- Transport
- Cooling and Ventilation
- Joint Safety document for ILC & CLIC
- Costing (can also benefit from latest CERN experience eg LINAC 4)

CLIC Civil Engineering Layouts :

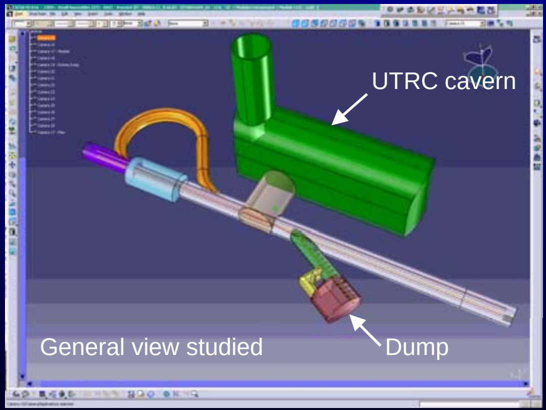
New Long Profile with 0.5TeV phase and reduced tunnel depth

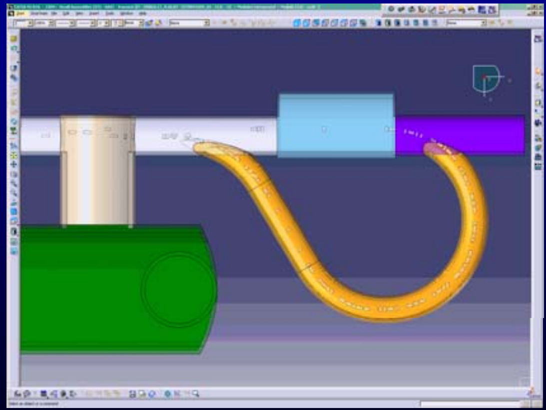


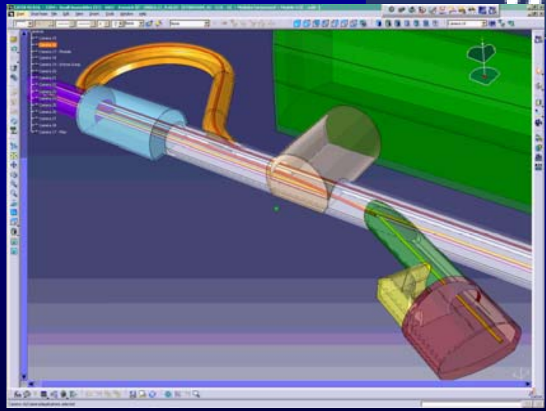
2007

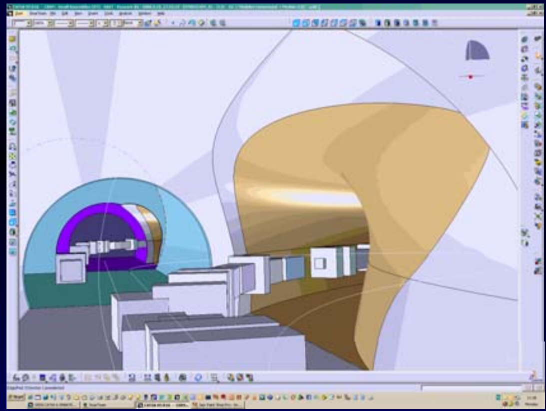


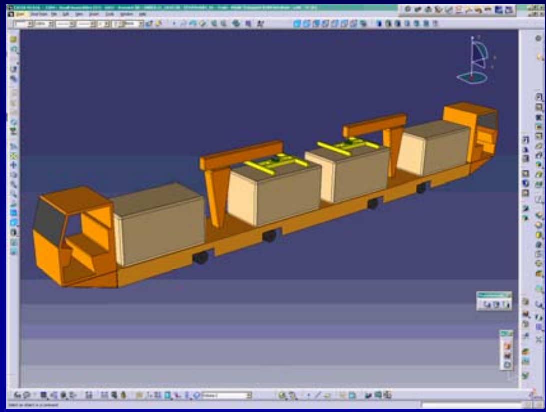
2008





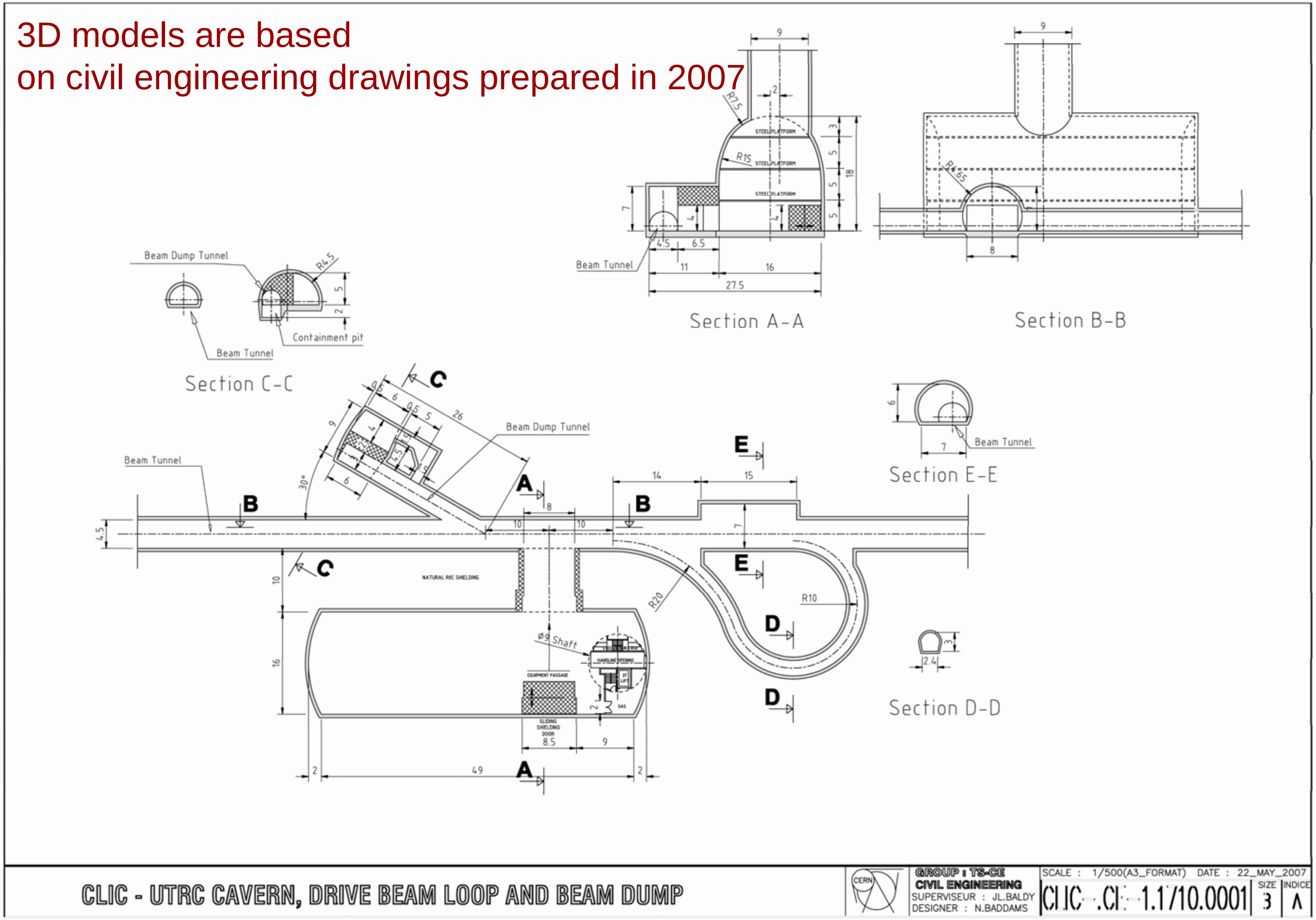


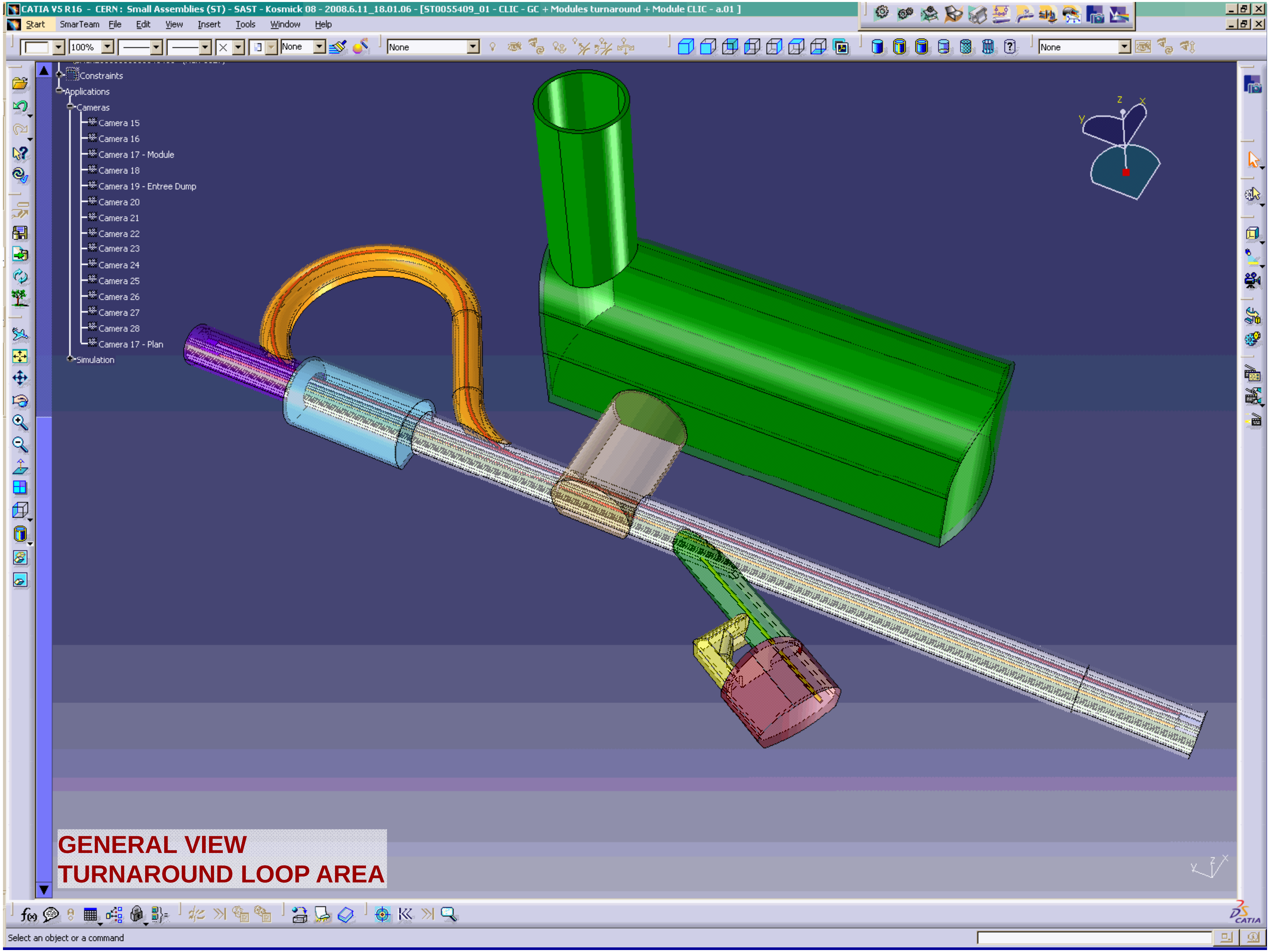




CLIC 3d studies using CATIA Software

3D models are based
on civil engineering drawings prepared in 2007

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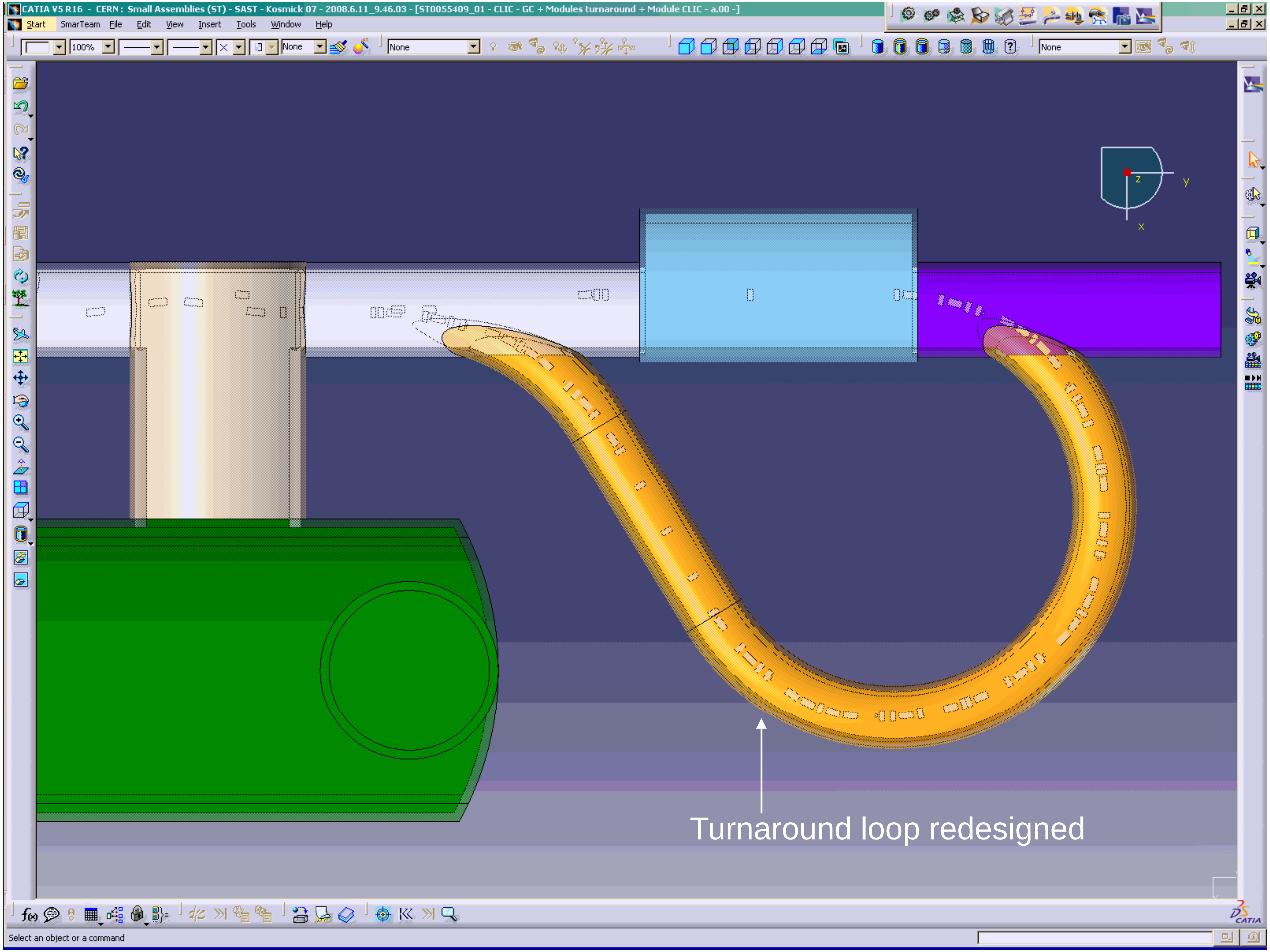
Start SmarTeam File Edit View Insert Tools Window Help
Constraints
Applications
Cameras
Camera 15
Camera 16
Camera 17 - Module
Camera 18
Camera 19 - Entree Dump
Camera 20
Camera 21
Camera 22
Camera 23
Camera 24
Camera 25
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
Simulation
GENERAL VIEW
TURNAROUND LOOP AREA
Select an object or a command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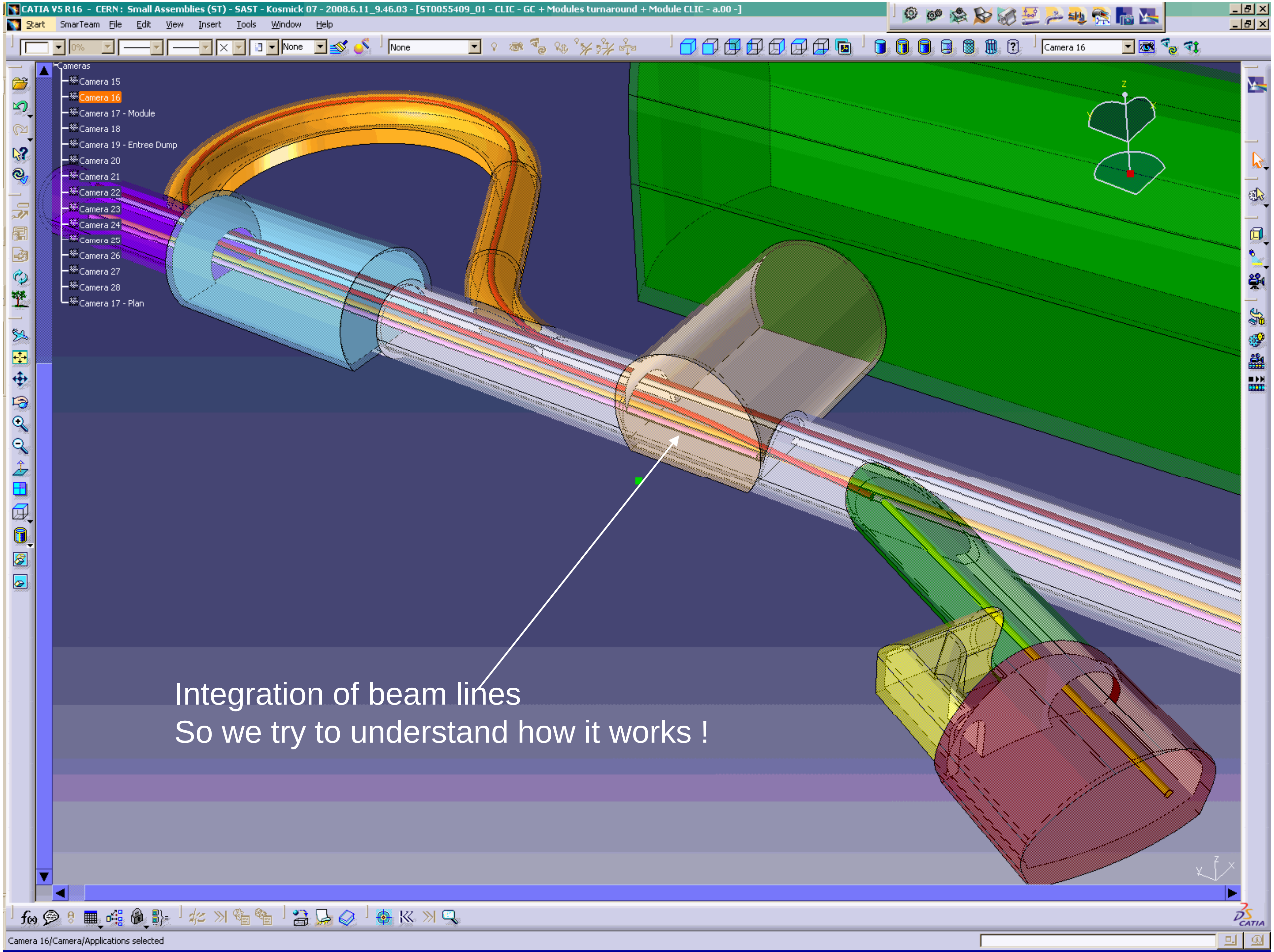
Start SmarTeam File Edit View Insert Tools Window Help
Turnaround loop redesigned
Select an object or a command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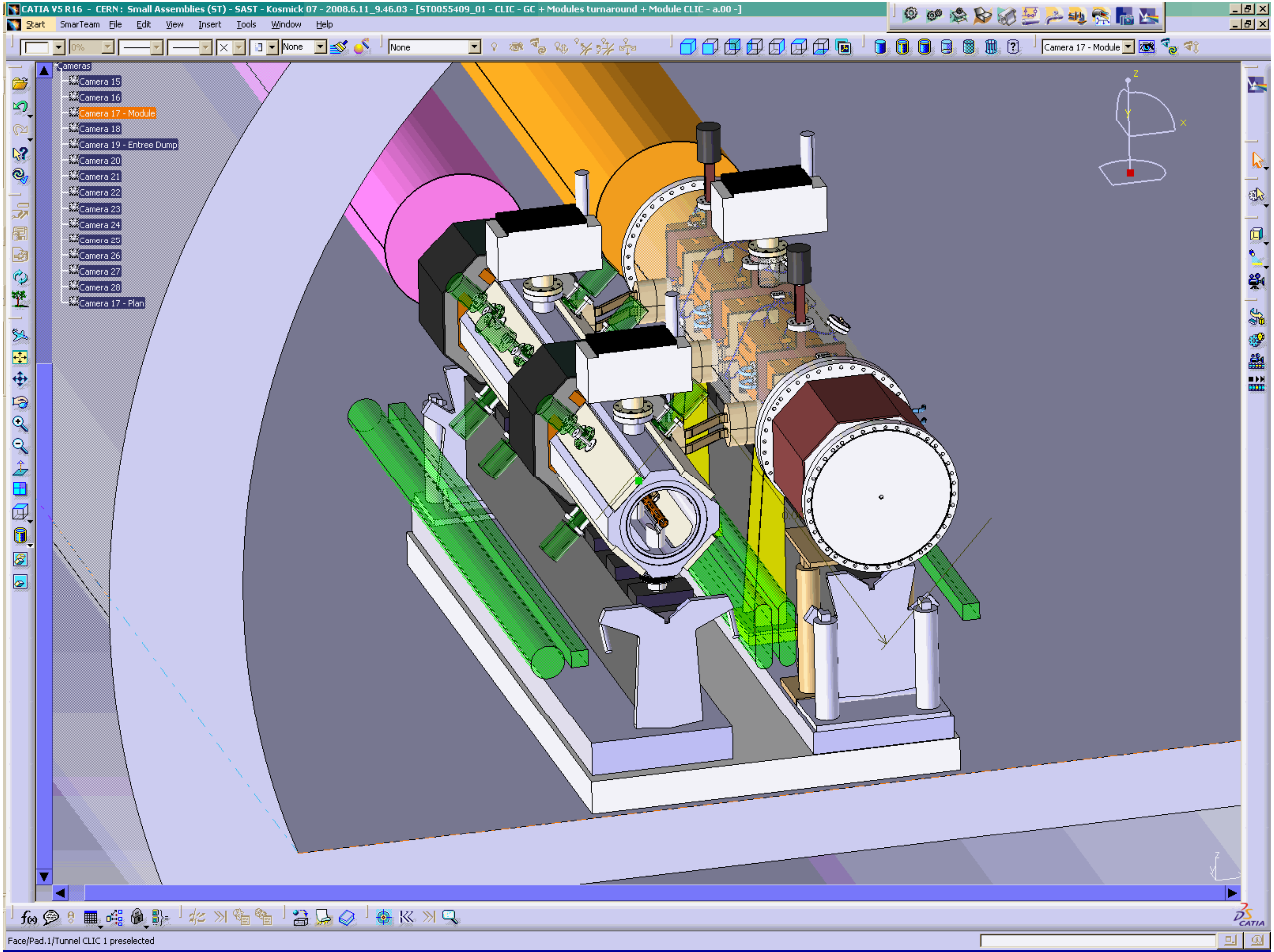
Camera 28
Camera 17 - Plan
Integration of beam lines
So we try to understand how it works !
Camera 16/Camera/Applications selected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Camera 19 - Entree Dump
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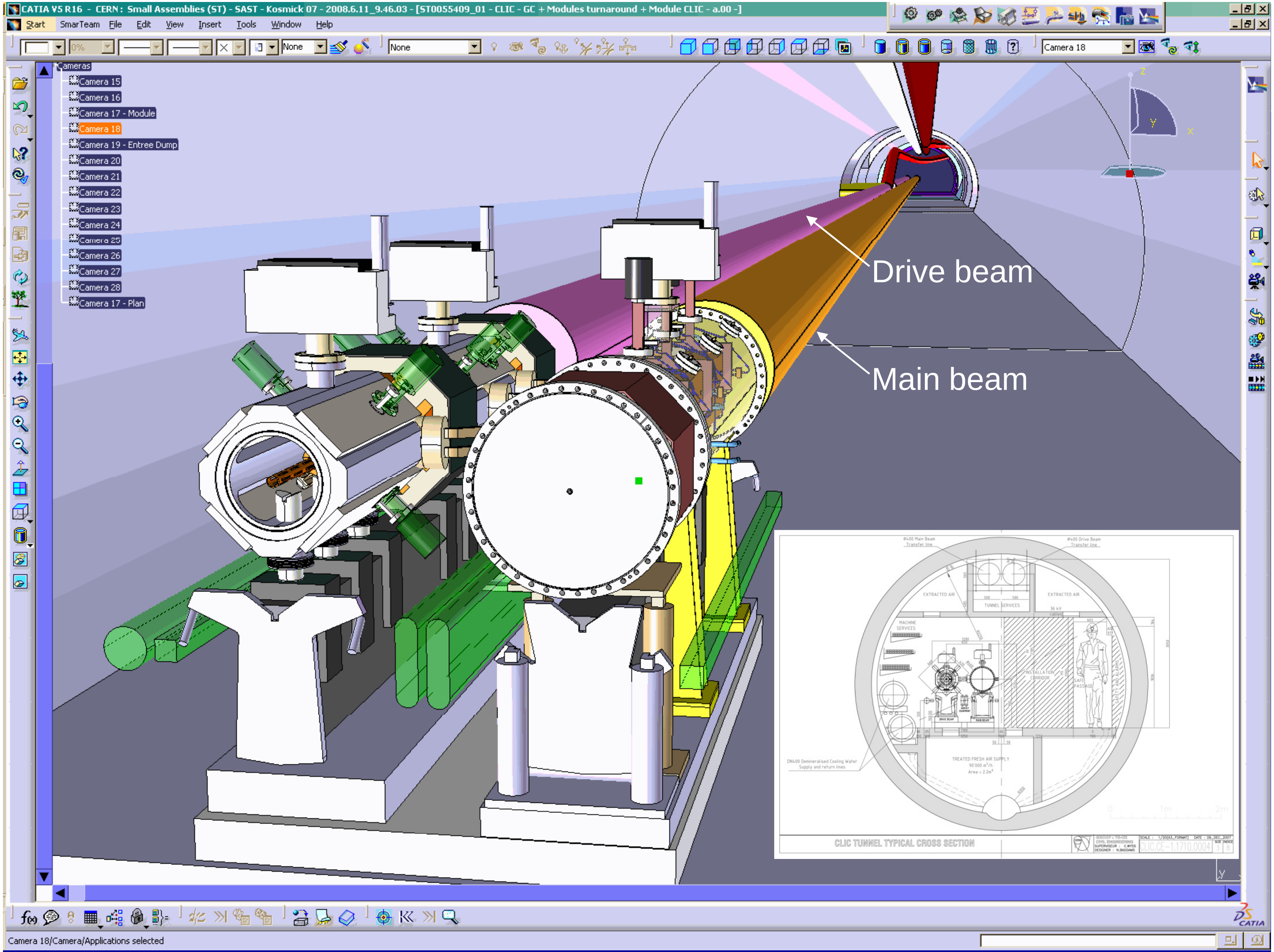
Camera 28
Camera 17 - Plan
Face/Pad.1/Tunnel CLIC 1 preselected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Camera 17 - Module
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Camera 19 - Entree Dump
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Camera 22
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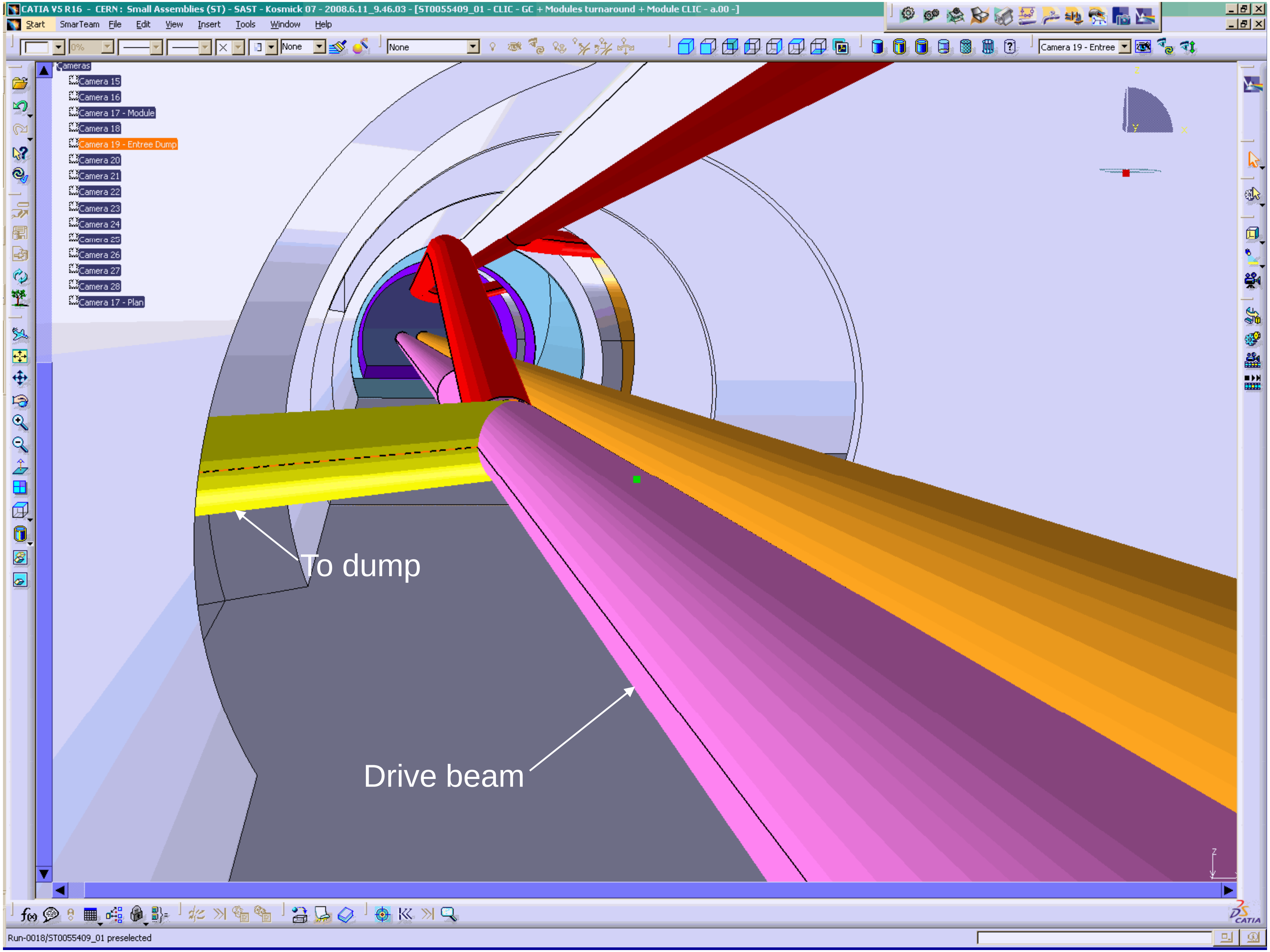
Camera 24
Camera 25
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
Drive beam
Main beam
CLIC TUNNEL TYPICAL CROSS SECTION
Camera 18/Camera/Applications selected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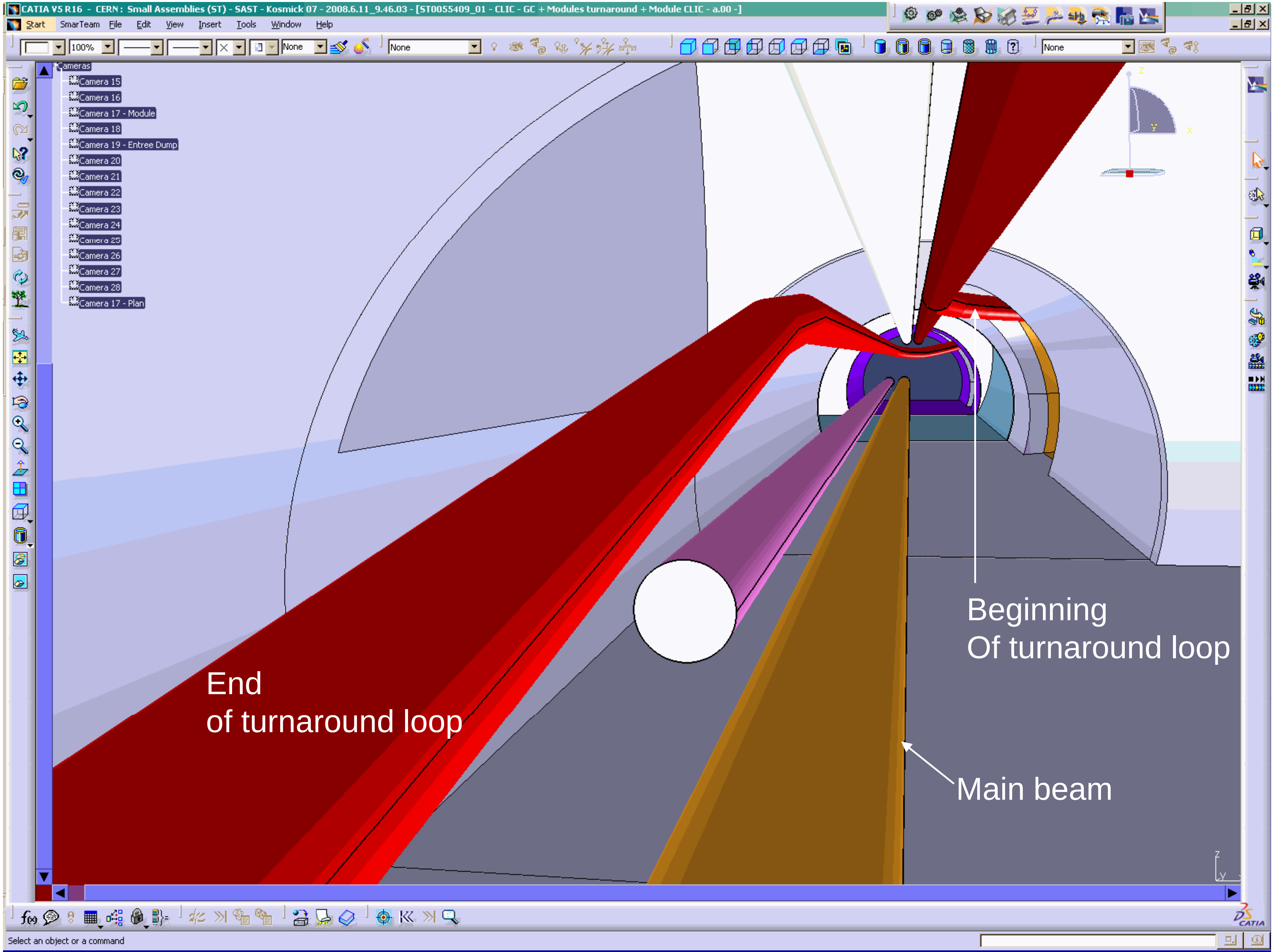
Camera 17 - Plan
Camera 19 - Entree
To dump
Drive beam
Run-0018/ST0055409_01 preselected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Start SmarTeam File Edit View Insert Tools Window Help
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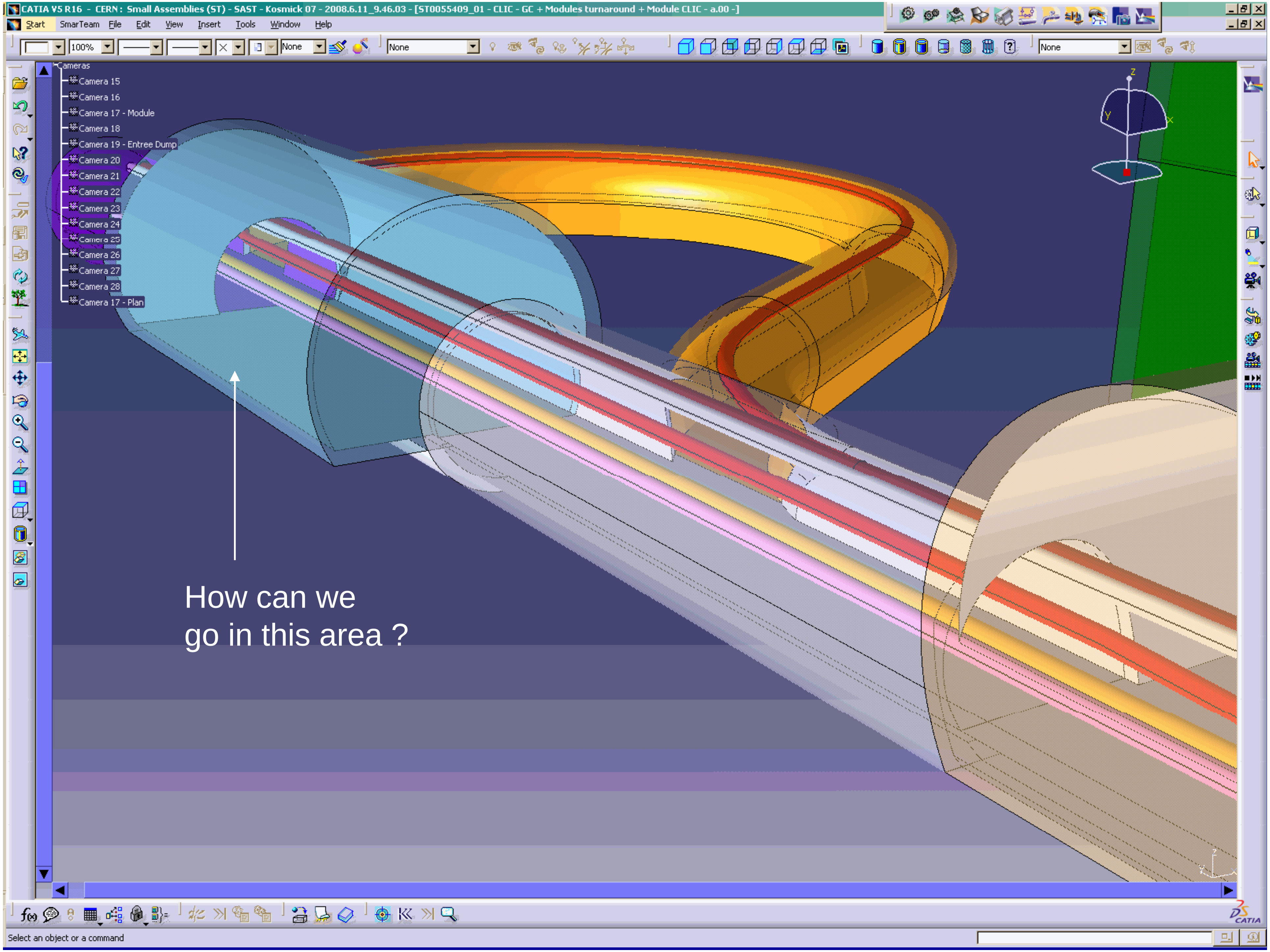
Camera 16
Camera 17 - Module
Camera 18
Camera 19 - Entree Dump
Camera 20
Camera 21
Camera 22
Camera 23
Camera 24
Camera 25
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
Beginning
Of turnaround loop
End
of turnaround loop
Main beam
Select an object or a command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Start SmarTeam File Edit View Insert Tools Window Help
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Camera 17 - Module
Camera 18
Camera 19 - Entree Dump
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Camera 21
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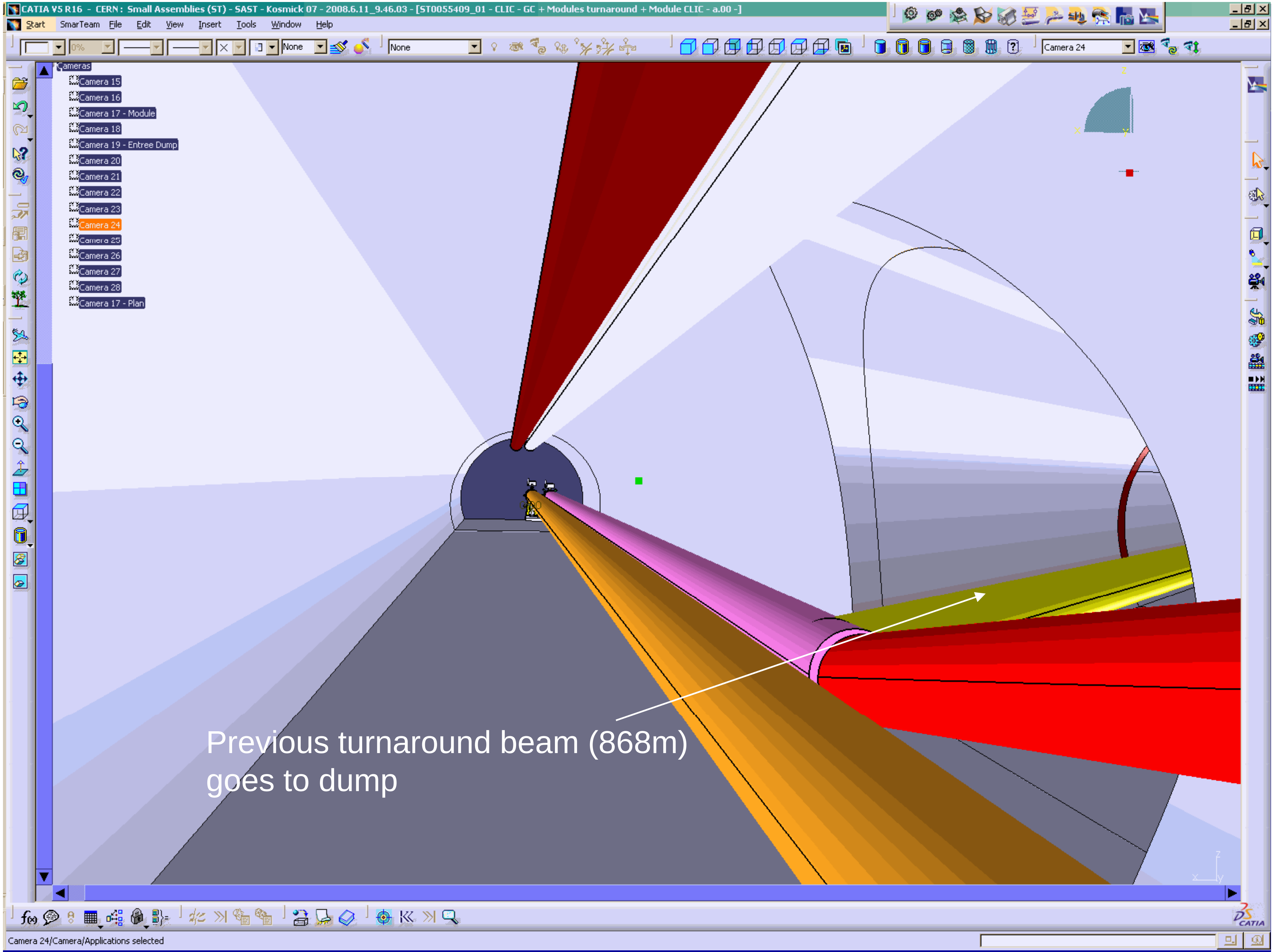
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
How can we
go in this area ?
Select an object or a command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Camera 18
Camera 19 - Entree Dump
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Camera 21
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Camera 24
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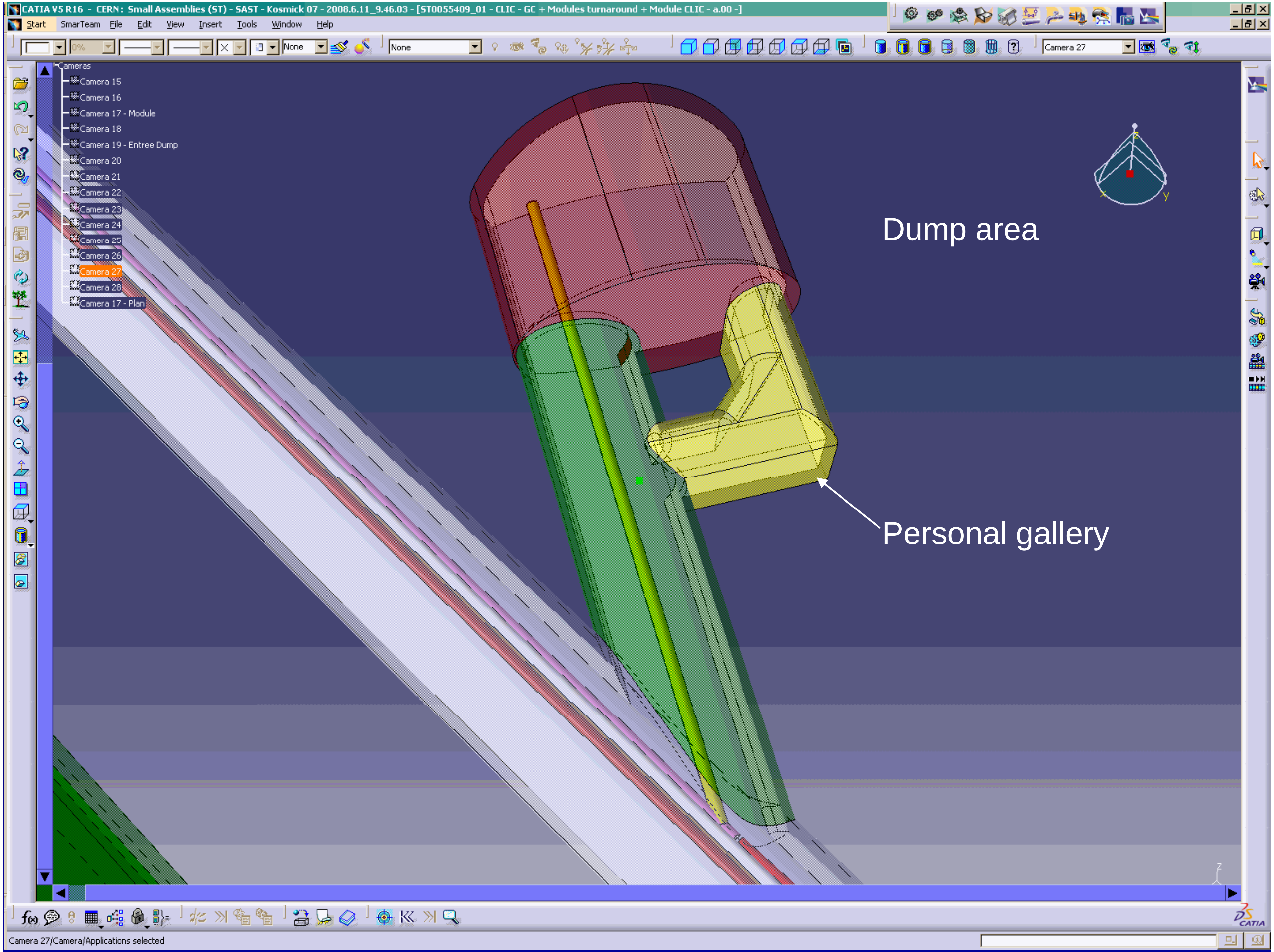
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
Camera 24
Camera 24/Camera/Applications selected
Previous turnaround beam (868m)
goes to dump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Start SmarTeam File Edit View Insert Tools Window Help
Cameras
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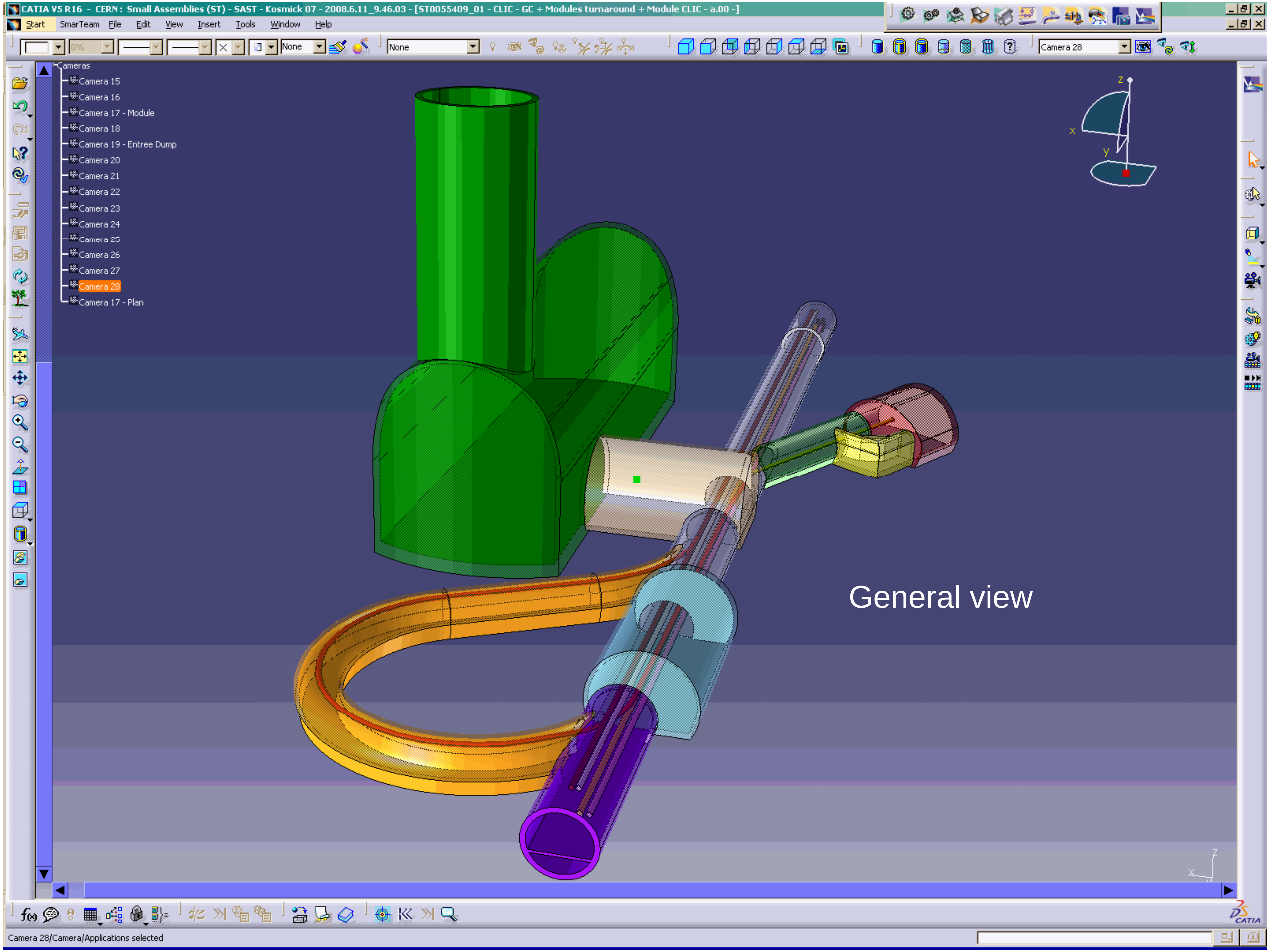
Camera 16
Camera 17 - Module
Camera 18
Camera 19 - Entree Dump
Camera 20
Camera 21
Camera 22
Camera 23
Camera 24
Camera 25
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
Dump area
Personal gallery
Camera 27
Camera 27/Camera/Applications selected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View
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Tools
Window
Help
Cameras
Camera 15
Camera 16
Camera 17 - Module
Camera 18
Camera 19 - Entree Dump
Camera 20
Camera 21
Camera 22
Camera 23
Camera 24
Camera 25
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
Camera 28
General view
Camera 28/Camera/Applications selected

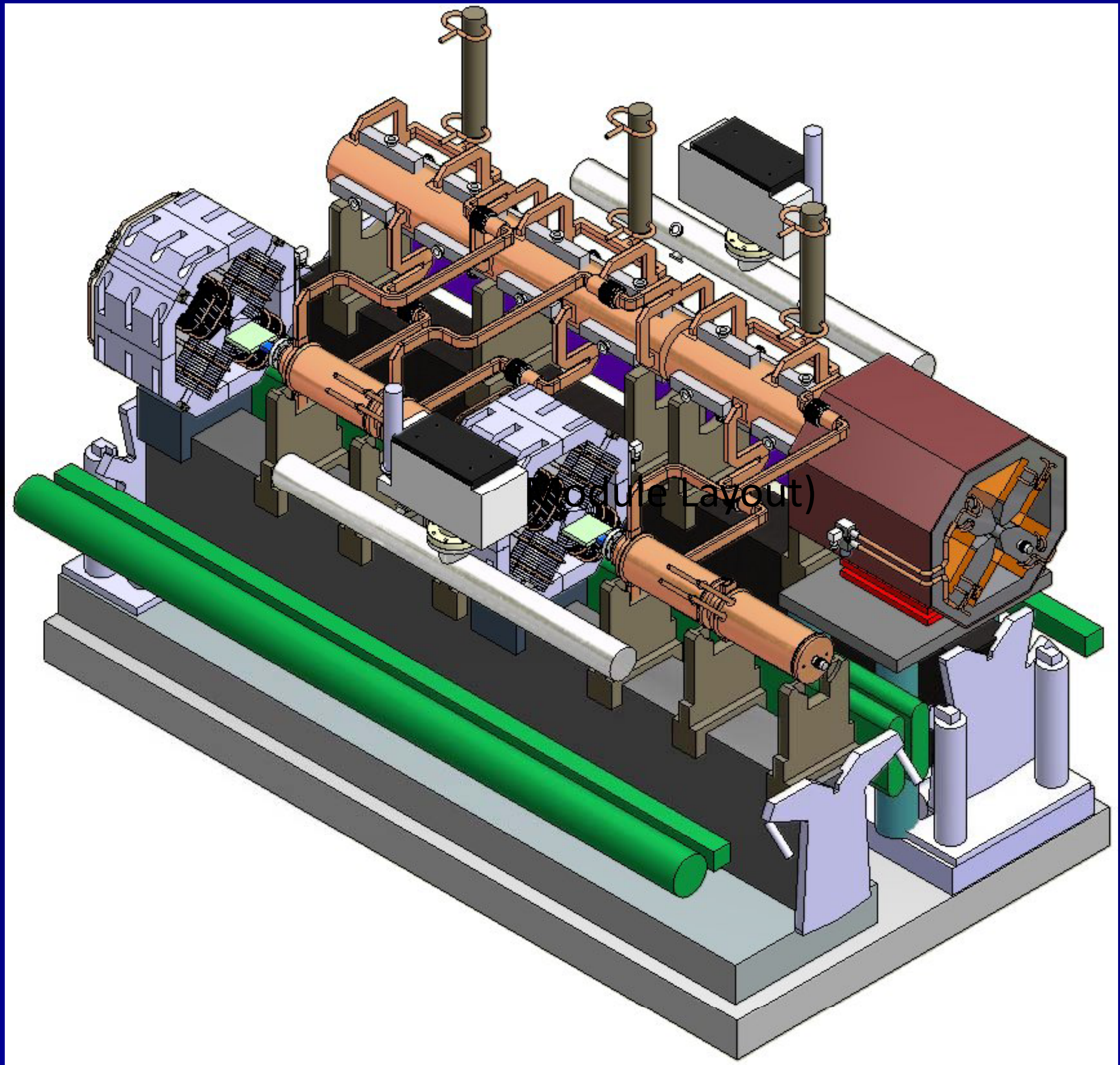
TRANSPORT OF THE CLIC MODULES AND ELEMENTS

Keith Kershaw, TS Dept, CERN

AIMS

- Review requirements and propose conceptual solution for lowering, underground transport and installation of CLIC modules.
- This conceptual design will be an input into the tunnel integration studies
- Bear in mind transport of other elements

CLIC Module Layout



Module Layout №2,
status (June 2008)

NEED TO CONSIDER

- Lowering from surface and entry into tunnel
- Transport along tunnel
- Transfer and installation on supports
- Over 20,000 modules so need to be fast
- Allow individual module exchange (between two installed modules)

TRANSPORT AND TRANSFER

CERN LEP Monorail Train

CERN LEP Installation “Lobster”

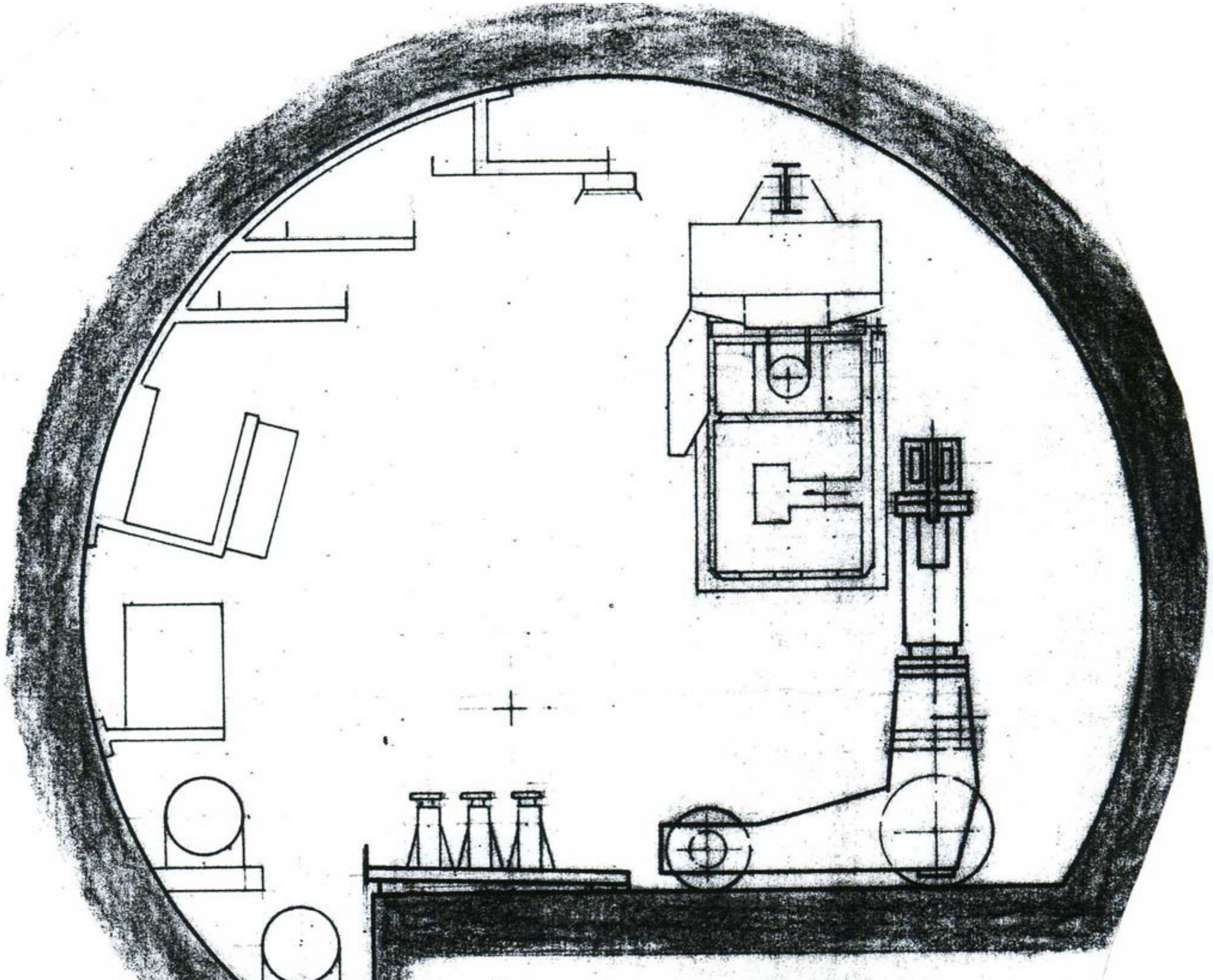


fig.1. arrivage dipoles.
ARRIVAL OF THE DIPOLES.

CERN LEP installation “Lobster” 2

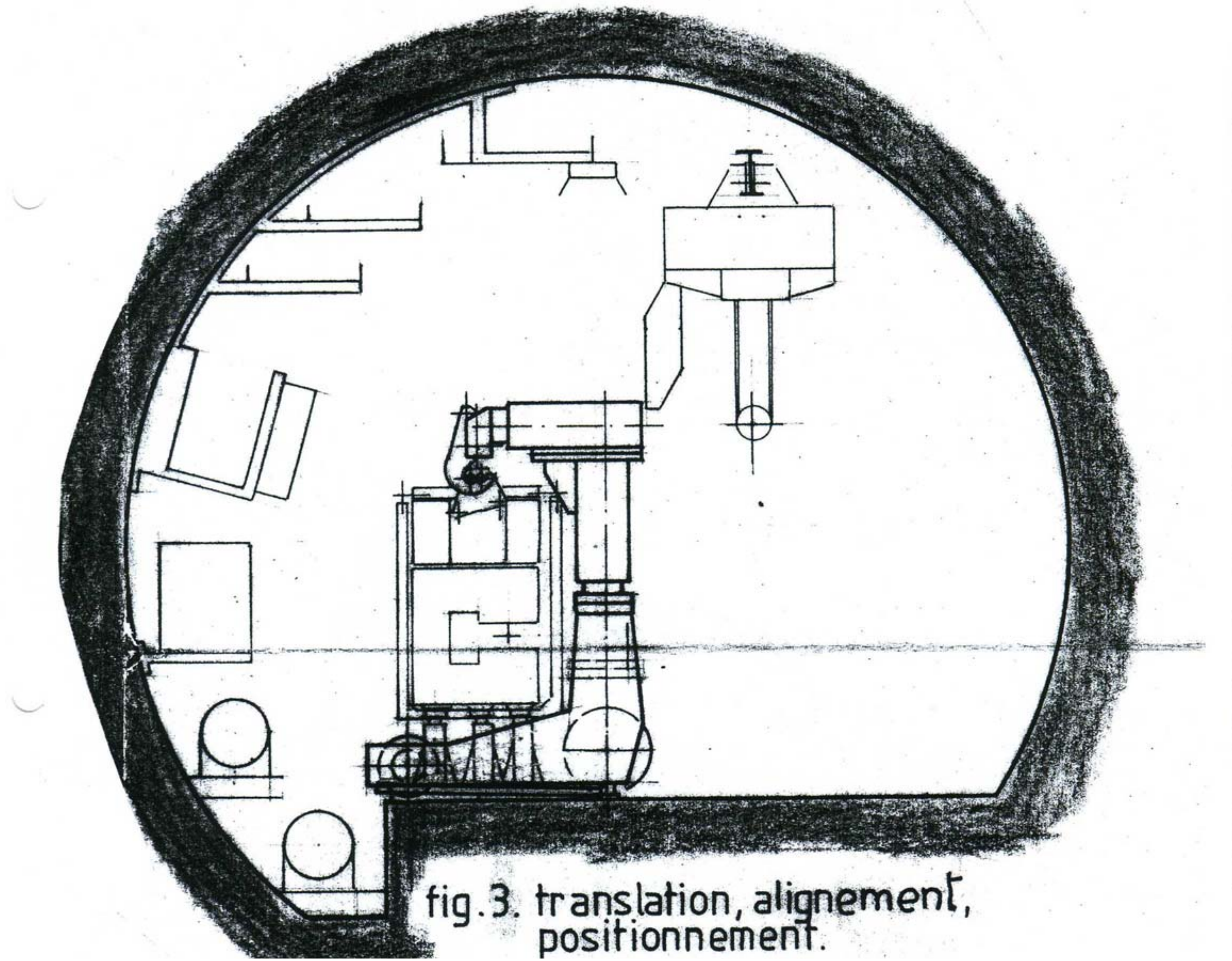
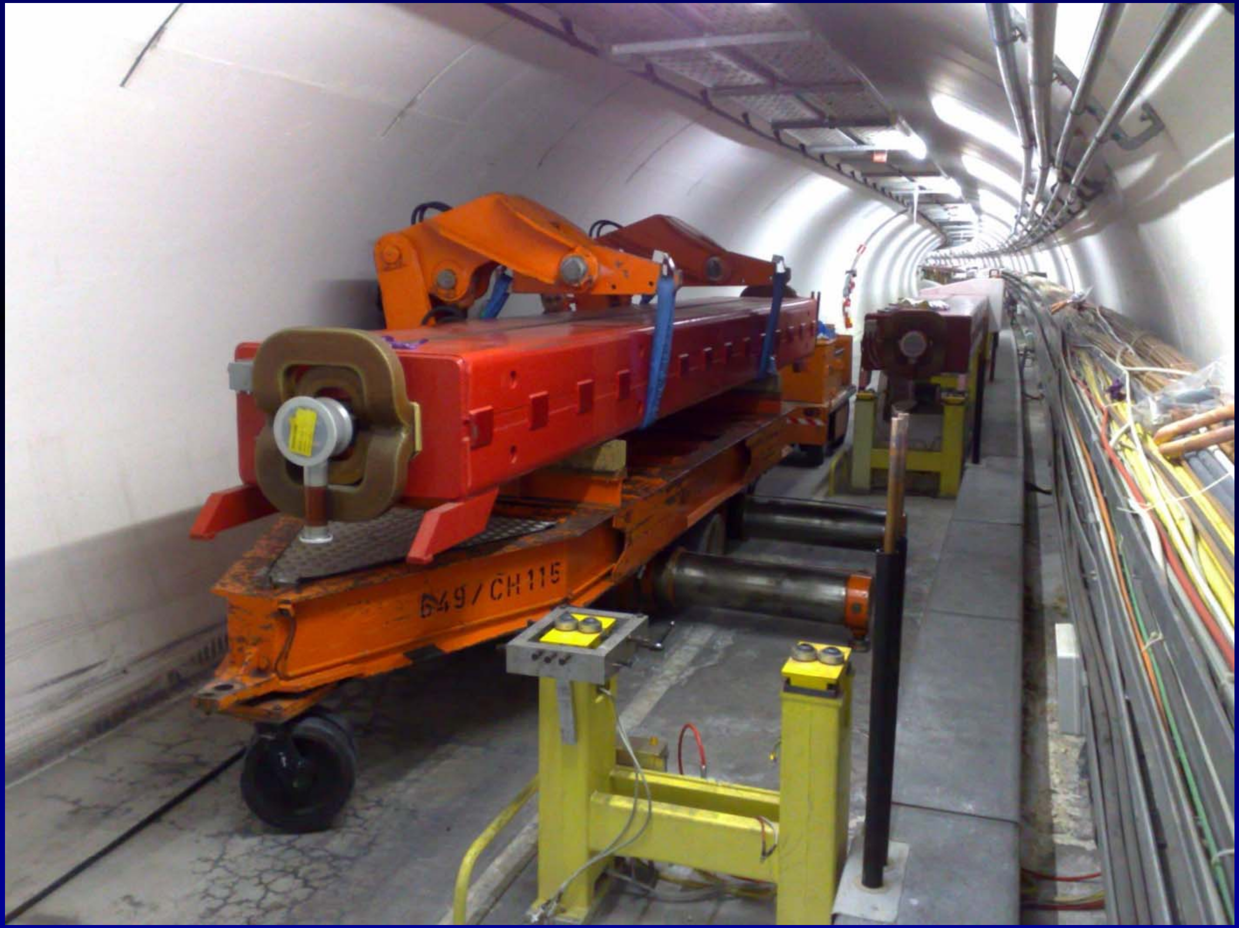


fig. 3. translation, alignement, positionnement.

CERN SPS magnet installation



CERN SPS magnet installation (2)

CLIC

ilc

CLIC 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

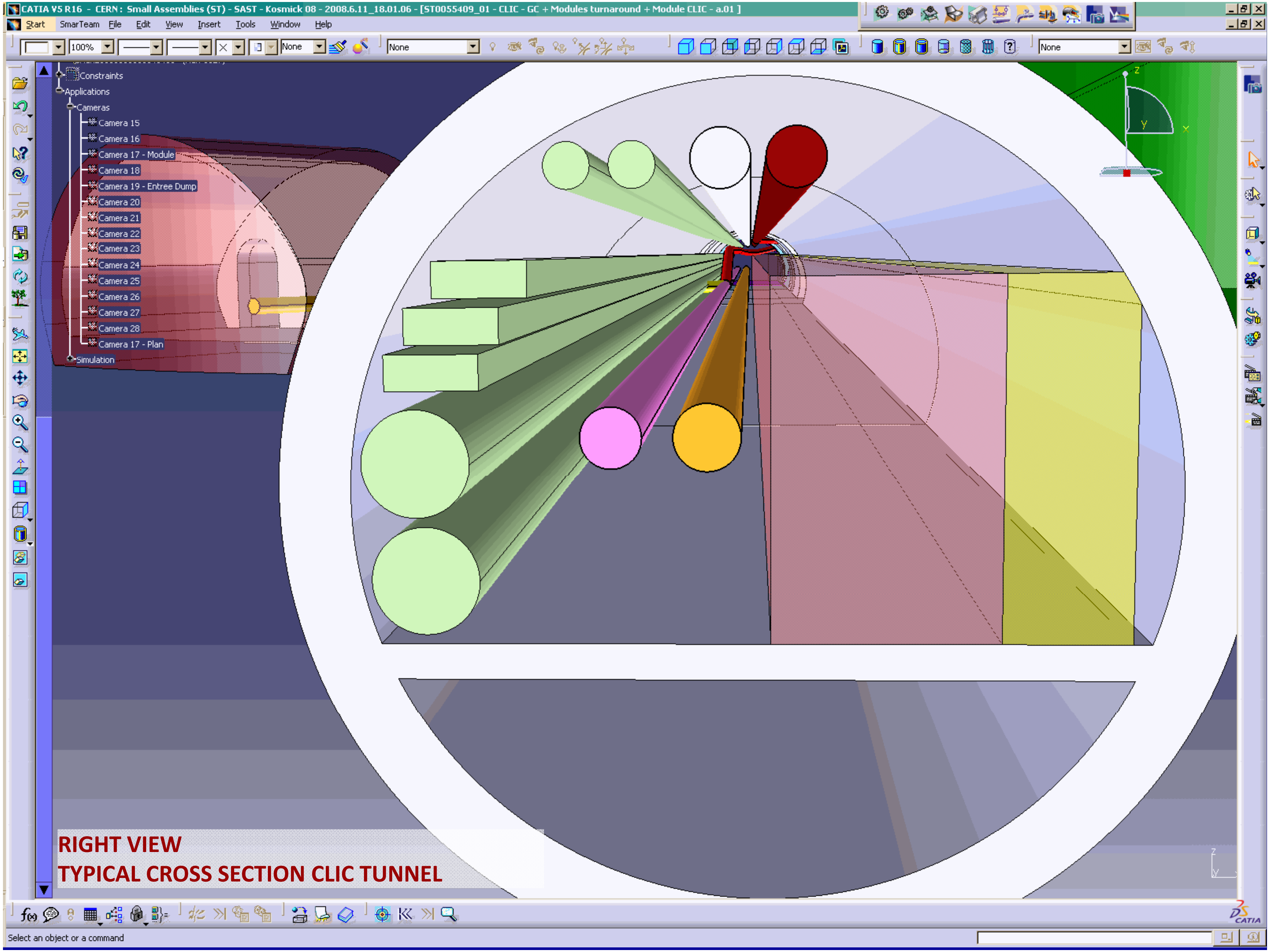
POSSIBLE SIMULTANEOUS TRANSPORT/INSTALLATION OF SEVERAL INTERCONNECTED MODULES

- What 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 / ACCELERATIONS

- Indicative values for permissible accelerations during transport and handling - 1*g* acceleration used as basis (i.e. normal handling techniques) note: need to avoid overloading supports during installation.

3-D Integration of Module Transport and Installation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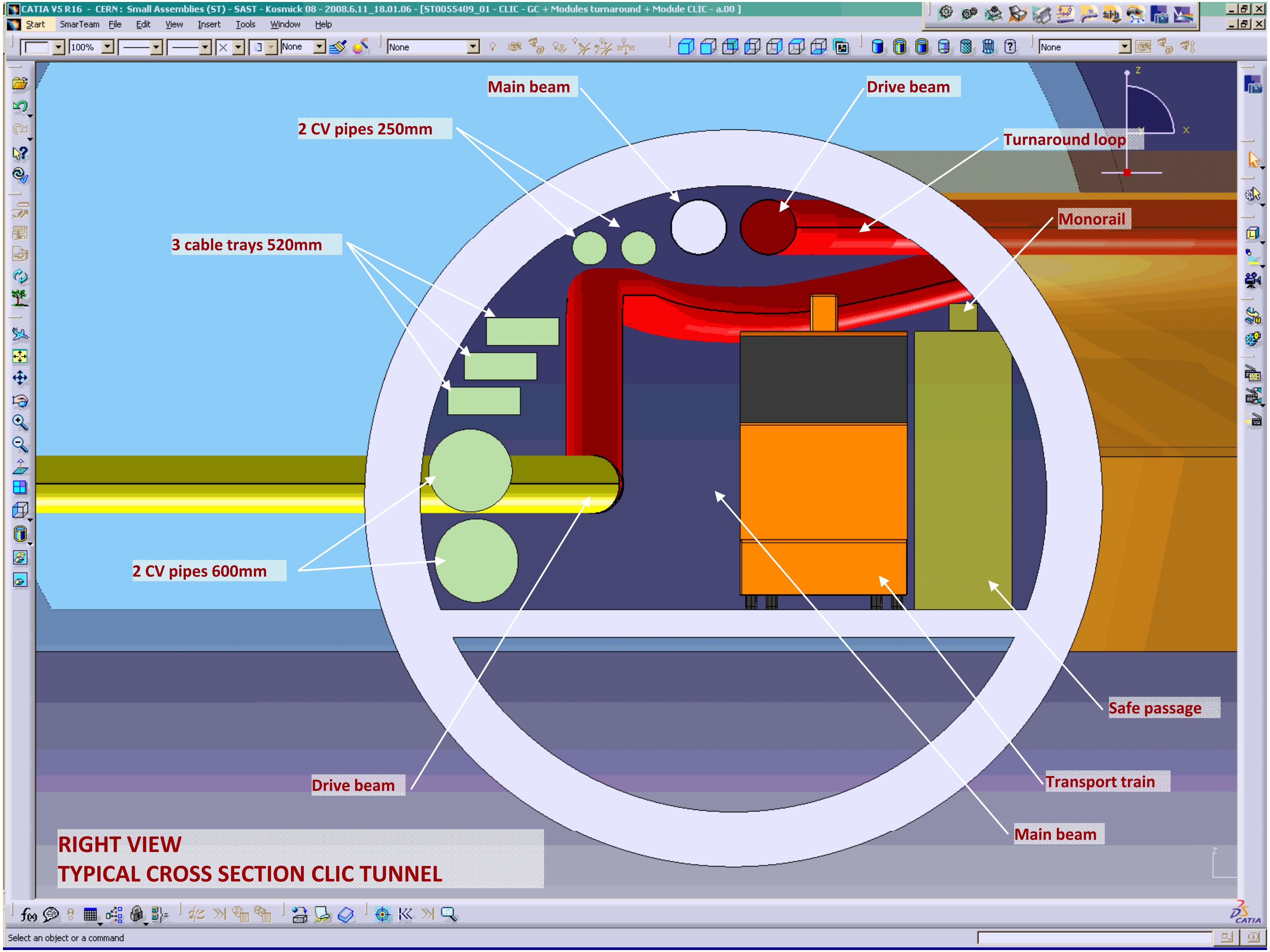
Camera 24
Camera 25
Camera 26
Camera 27
Camera 28
Camera 17 - Plan
Simulation
RIGHT VIEW
TYPICAL CROSS SECTION CLIC TUNNEL
Select an object or a command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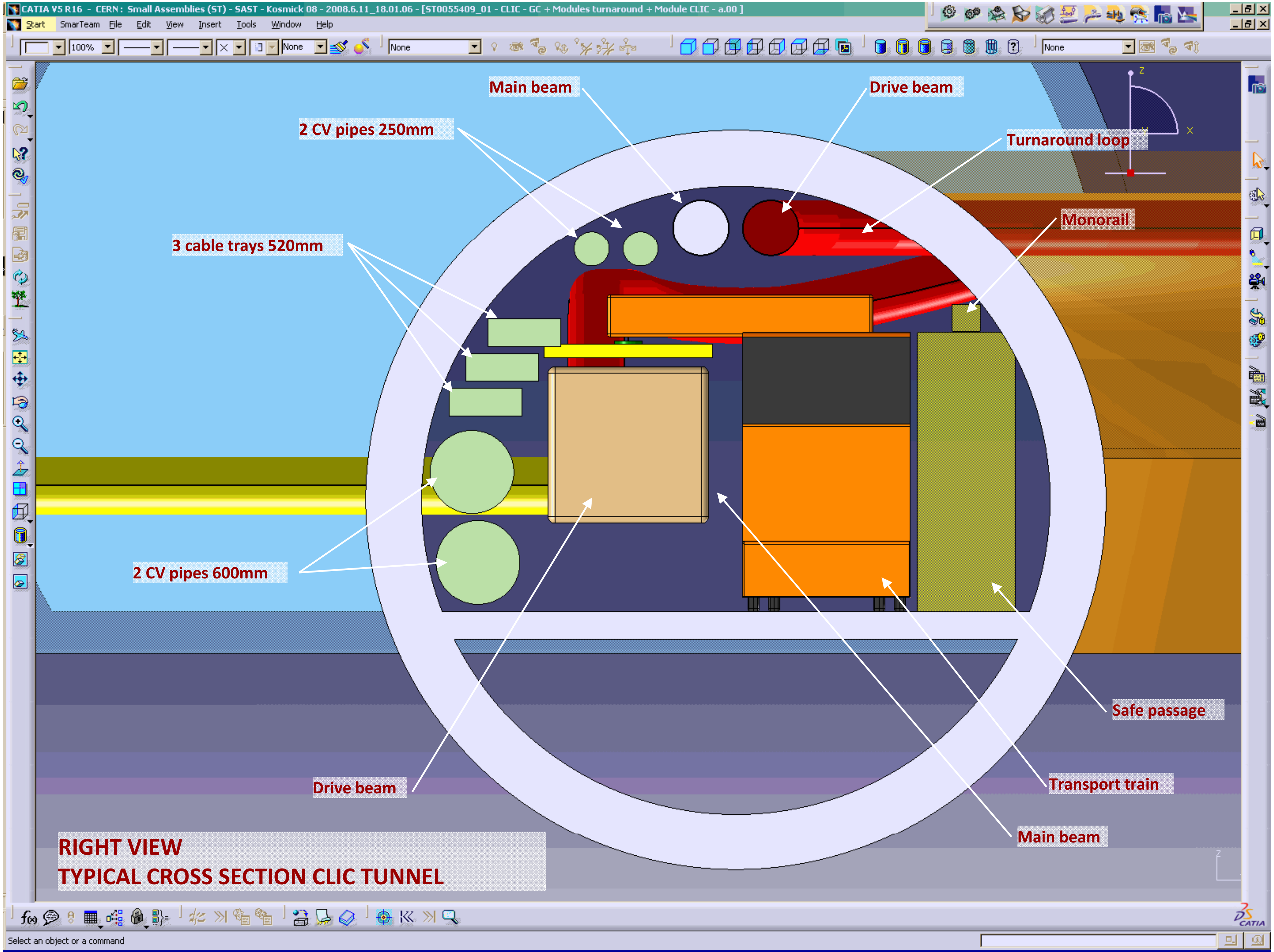
Main beam
Drive beam
2 CV pipes 250mm
Turnaround loop
Monorail
3 cable trays 520mm
2 CV pipes 600mm
Safe passage
Drive beam
Transport train
Main beam
RIGHT VIEW
TYPICAL CROSS SECTION CLIC TUNNEL
Select an object or a command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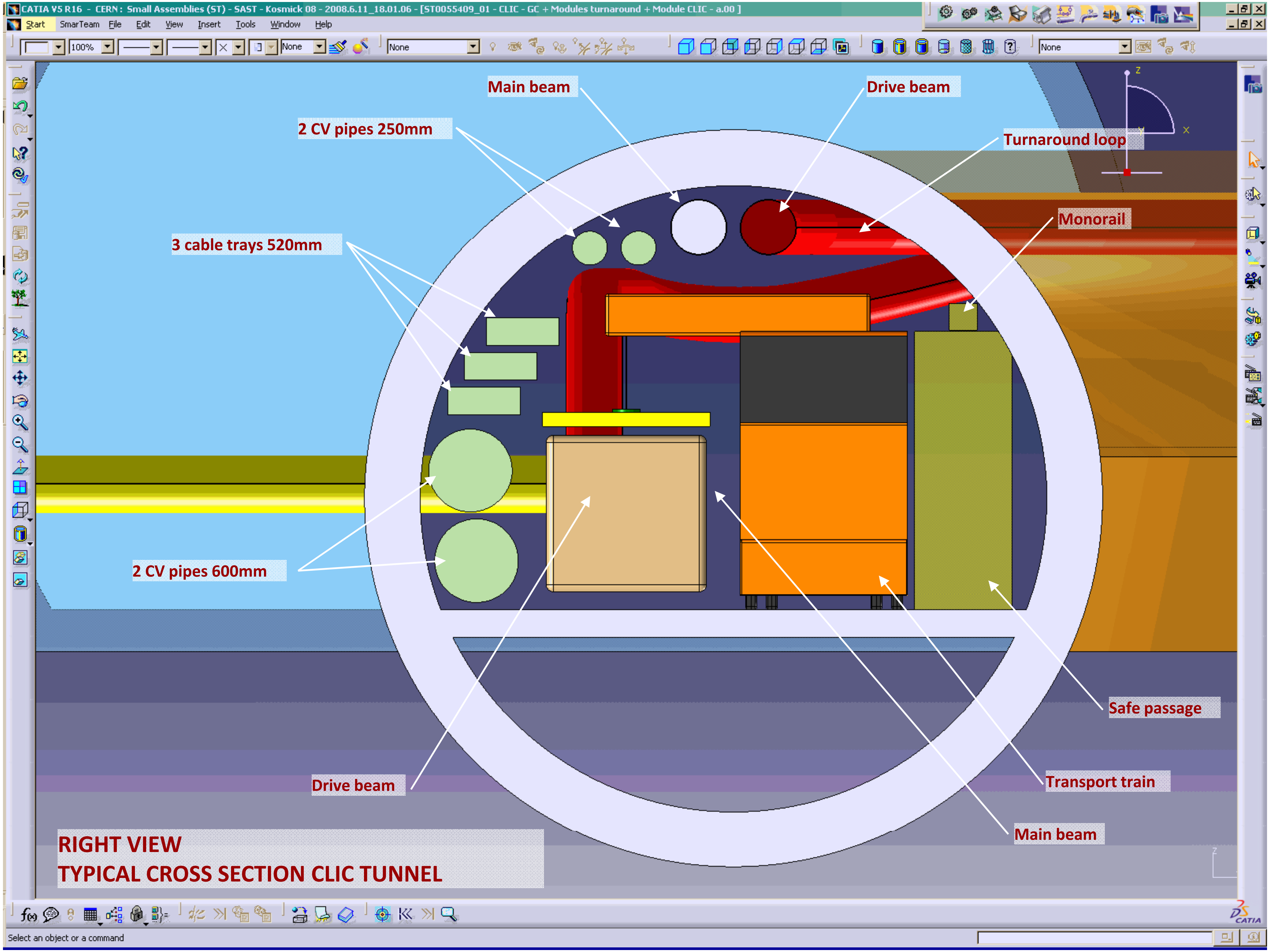
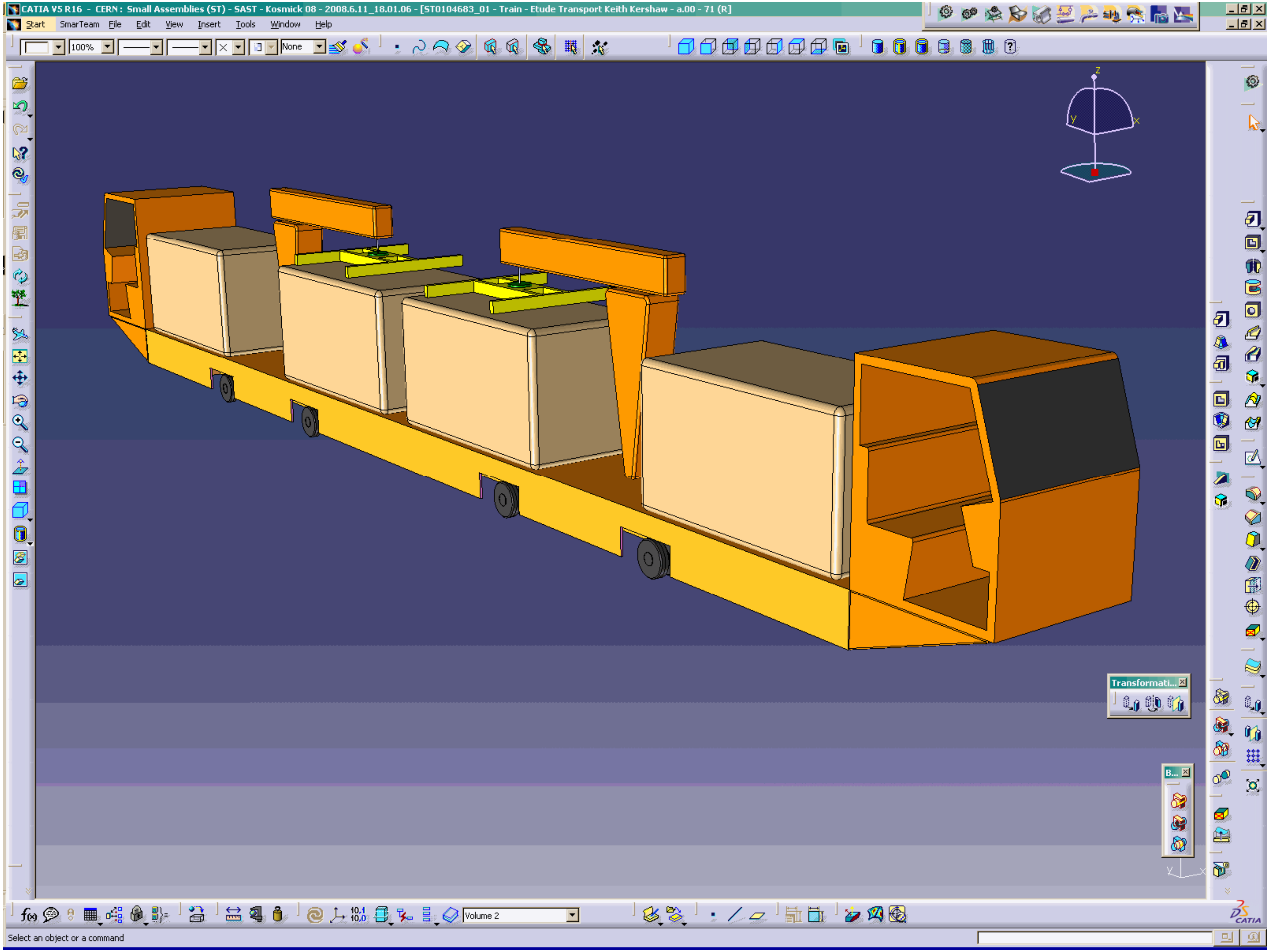
Select an object or a command


CATIA V5 R16 - CERN : Small Assemblies (ST) - SAST - Kosmick 08 - 2008.6.11_18.01.06 - [ST0055409_01 - CLIC - GC + Modules turnaround + Module CLIC - a.00]
Start SmarTeam File Edit View Insert Tools Window Help
Main beam
Drive beam
2 CV pipes 250mm
Turnaround loop
Monorail
3 cable trays 520mm
2 CV pipes 600mm
Safe passage
Transport train
Drive beam
Main beam
RIGHT VIEW
TYPICAL CROSS SECTION CLIC TUNNEL
Select an object or a command

- 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)
- Automatic guidance
- Allows reservation of space in tunnel for transport and transfer of modules (however module beam offset issues may change transfer height)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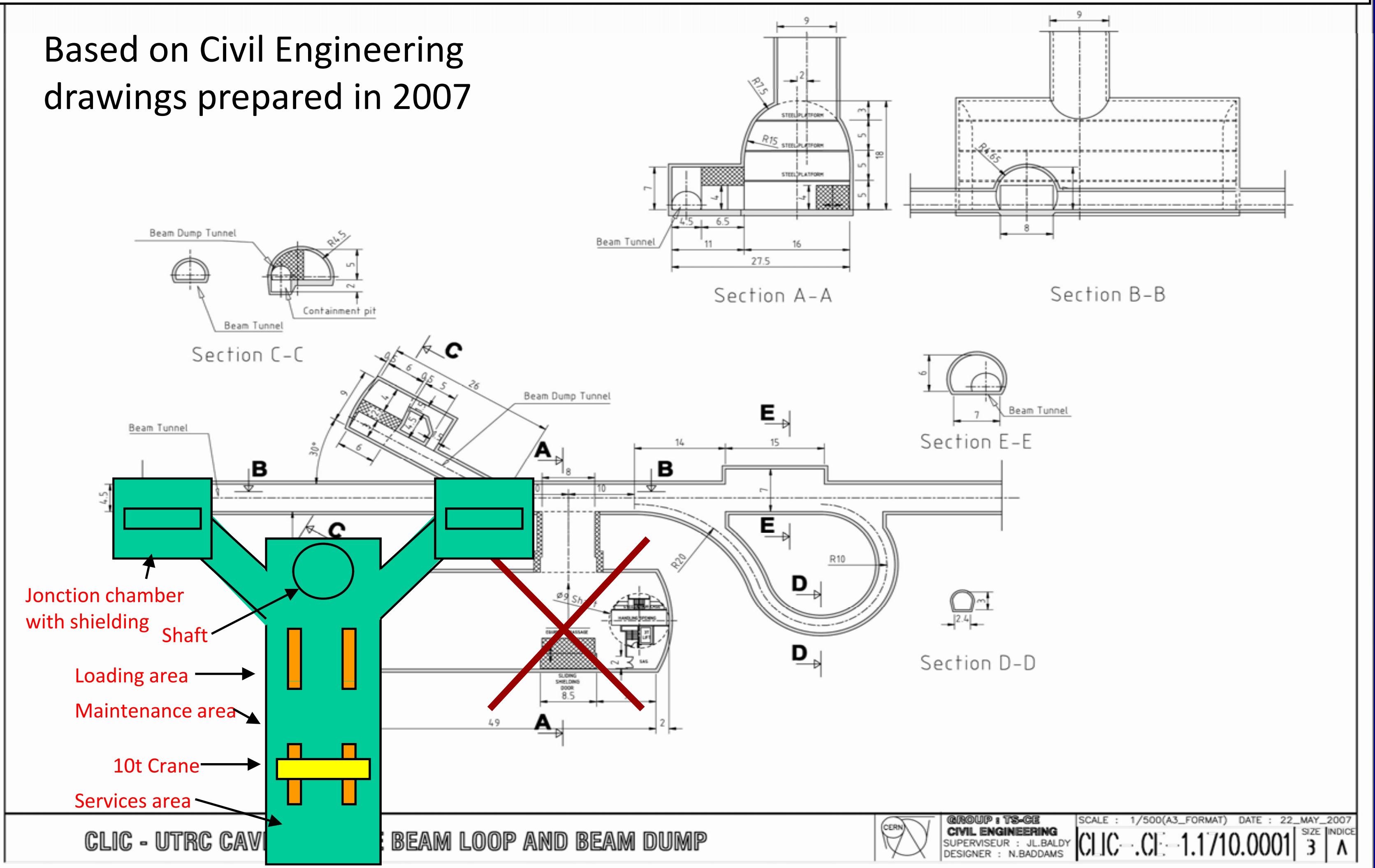
Start SmarTeam File Edit View Insert Tools Window Help
100%
None
Transformati...
Volume 2
Select an object or a command

- Use lifts (elevators) for fast lowering of modules
- Need method of fast loading of modules onto vehicles
- Provide passing places to allow queuing and sorting of vehicles for logistics flexibility
- Provide space for maintenance / repair

Proposal for module lowering and tunnel access

Based on Civil Engineering drawings prepared in 2007



CLIC Logistics – indicative figures

ILC Integration issues

ILC Contacts for transport study ?

- Name of contact person to provide information, drawings and answer questions.

Joint ILC/CLIC Safety document
S.Weisz & F.Corsanego (CERN)

- Incentive for this document:
  - Share effort to define a coherent safety protocol for future linear colliders.
  - Insure that both projects use a common set of safety assumptions for their cost study.
- Scope of this document:
  - General safety of the site and its installation (not only tunnel safety compliance ?).
  - Go beyond national regulations but still identify them whenever relevant.

Sites and installations

- Safety and access to the sites:
  - Access for staff (inc. associate institute), for suppliers, for visitors;
  - Site protection : fencing, access control and supervision;
  - Access conditions to special buildings: workshops, storage of dangerous material (chemical, radioactive, flammable gas, …);
  - Access conditions to installations (surface and underground): during installation, during commissioning and check-out, during operation and during maintenance;
  - Prevention and safety training;
- Safety intervention on sites:
  - Fire brigade & rescue team;
  - First aid workers: presence, identification and training;
  - On-site physician and nurses;

Hazards identification and Safety regulations

- **Electrical**: qualification required, standards and electrical safety code, emergency stops, secured powering systems.
- **Fire**: standards and safety codes, detection and alarms, fire resistant material, smoke extraction, safe pressurized areas, emergency exits, fire fighting systems.
- **Chemical**: classification, labeling and medical examinations of personnel handling chemical material - rules concerning purchase, storage, transport, use and disposal.
- **Flammable gas**: classification, recommended practices, design and operation of systems.
- **Cryogenic fluids**: safety instructions for storage and set to work, leak detection and oxygen deficiency alarms.
- **Ionization and radioactive materials**: classification of radiation areas and dose limits, guidelines, monitoring (individual, material, areas and sites), radiation alarms, handling of material, traceability, disposal …
- **Non ionizing radiation** (laser, magnetic fields, X-ray …): classification, precautions for use, mark out and interlock.

Hazards identification and Safety regulations

- **Pressure vessels**: design codes, test, installation, regular inspections.
- **Heavy handling**: regulation, certificates, reception and control procedures, maintenance, regular tests, qualifications of drivers.
- **Flood**: surface (thunderstorm, heavy rain or snow) early warning, prevention, shaft protection – underground geological leaks or rupture of a cooling system, detection, alarm and pumps.
- **Earthquake**: risk quantification and consequences, practice and safety margin applied on structures, anchoring.
- **Noise**: levels, prevention (sound-insulating casing, dampers, …), environmental issue – over half the cases of occupational illness recognized at CERN correspond to hearing impairments.
- **Pollution and protection of the environment**: waste collection and treatment, practice, retention basins, admissible levels for rejection in air and/or water.

Safety systems

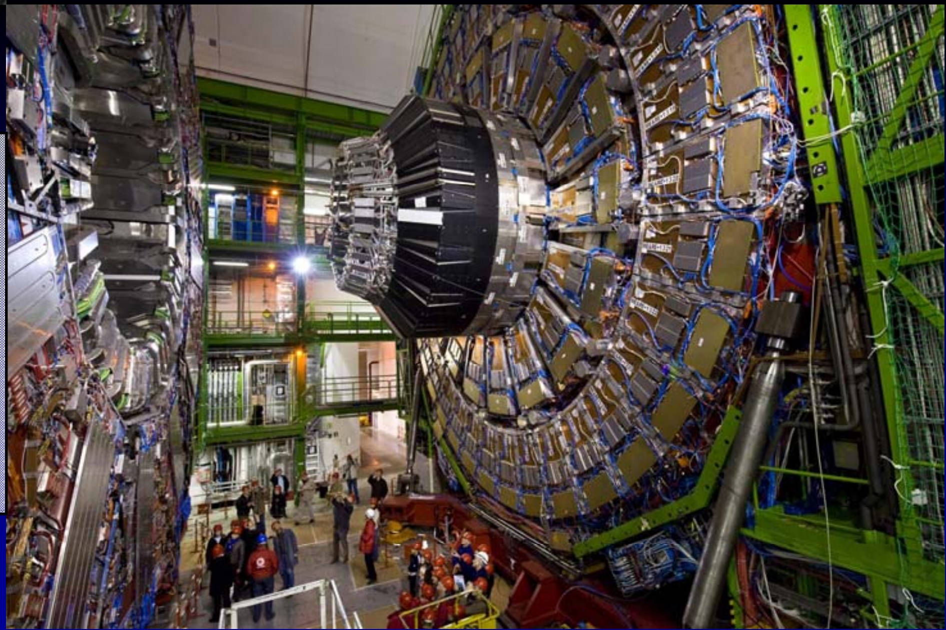
- Detection: locations & requirements of detectors for smoke, ventilation failure, flammable gas leaks, ODH, radiation, emergency power stops and power failure, emergency call system ("red telephone"), flood, etc…
- Alarms: triggering of evacuation sirens and flashing lights, alarm communication and management, actions resulting of abnormal situations which places or is likely to place lives in danger ("Level 3" alarms);
- Secured systems: requirements for uninterruptible power system, diesel, anti-panic lightning, hard-wire & fail-safe communication, emergency exits;
- First-aid equipment: locations & requirements for medicine chests, fire extinguishers and fire hose stations, electrical safety kits;
- Individual safety equipment and training: oxygen mask, dosimeter, GSM (?), helmet, light, etc… ; General and specific safety training.

Structure of the safety report

Basic Assumptions

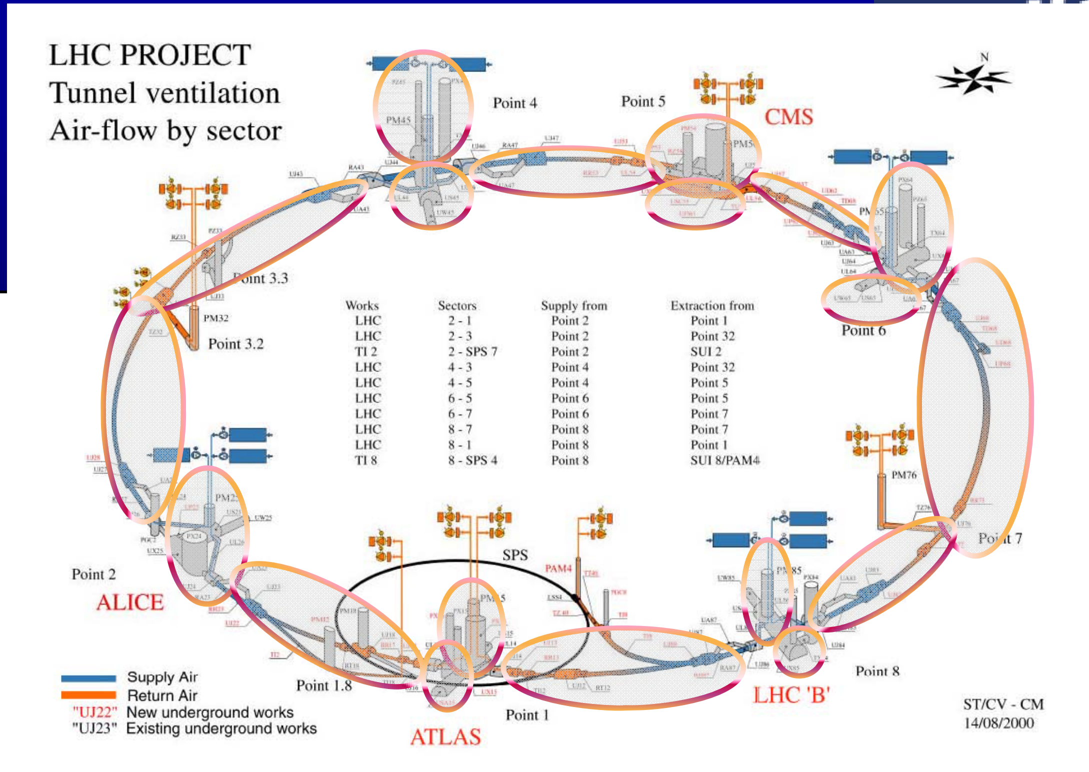
"Low fire load" in the tunnels

Fire radiologic risk localized in few specific points (collimators, experiments)

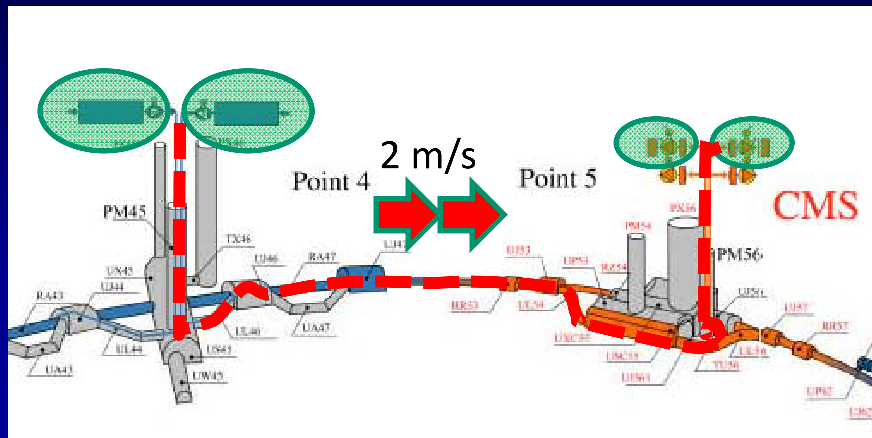


A) Prevention-design (1)

- Subdivision into ventilation sectors



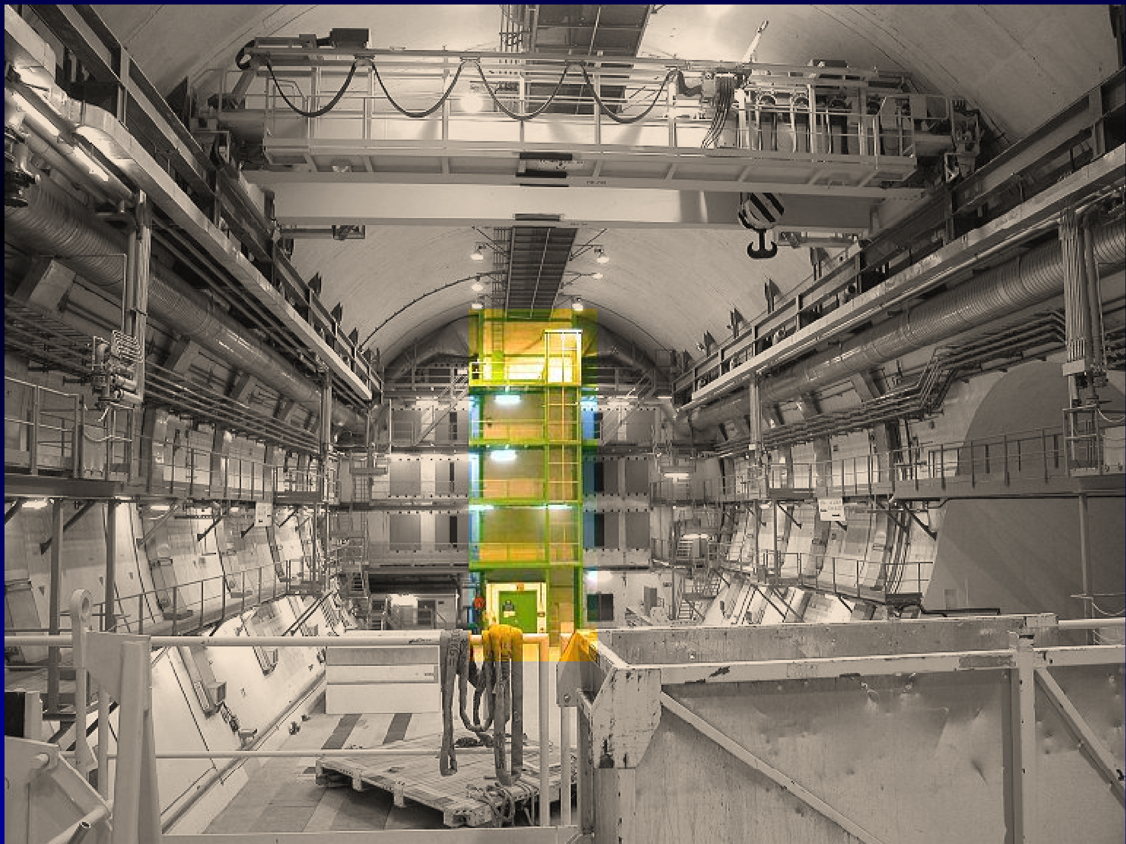
- Possibility to increase ventilation flow in the tunnel (to 2 m/s)

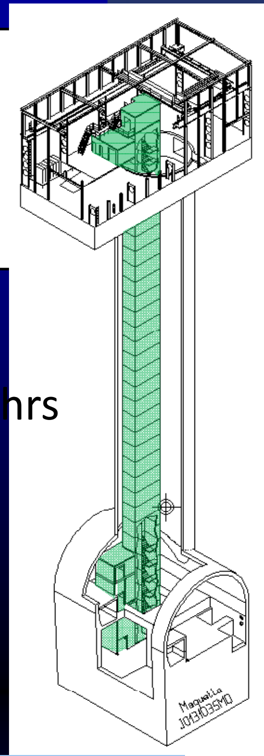


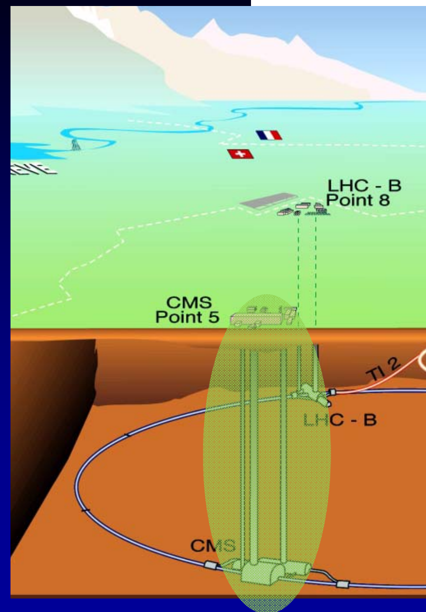
A) Prevention –Design (2)

- Pressurized access shafts

P>0
Fire Rated 2 hrs

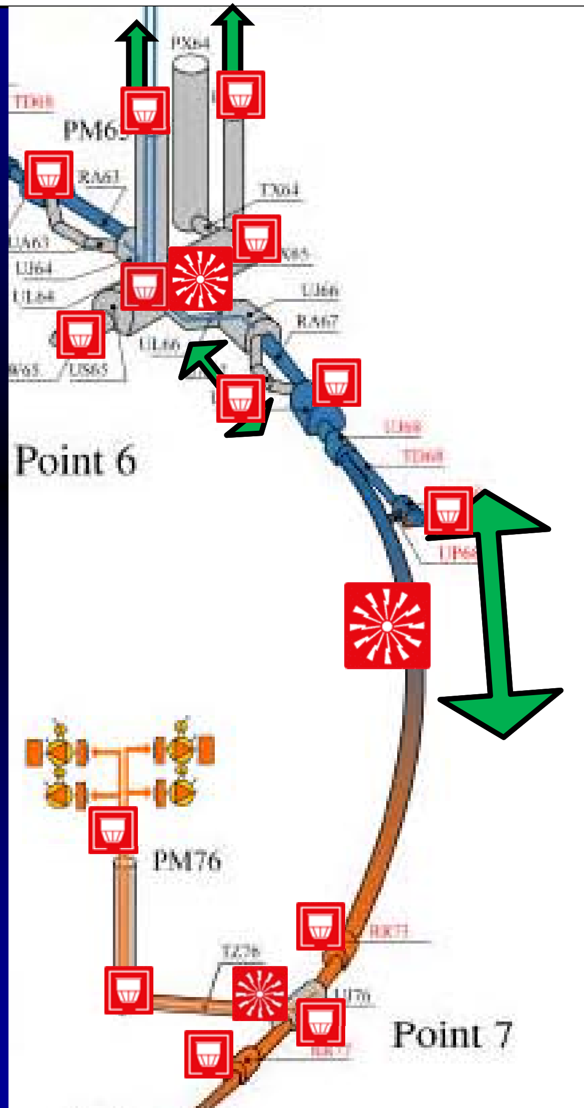






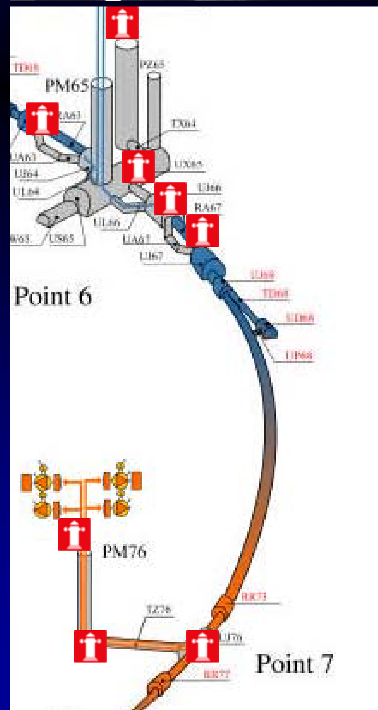
A) Prevention-design (3)

- All zones with "periodic access" have multiple way out
- Evacuation system
- Automatic Fire detection in areas with relevant fire load



A) Prevention-design (4)

- Electric Vehicles for Fire Brigade
- Areas with large fire loads have internal hydrants
- Warm magnets are interlocked with thermal detection

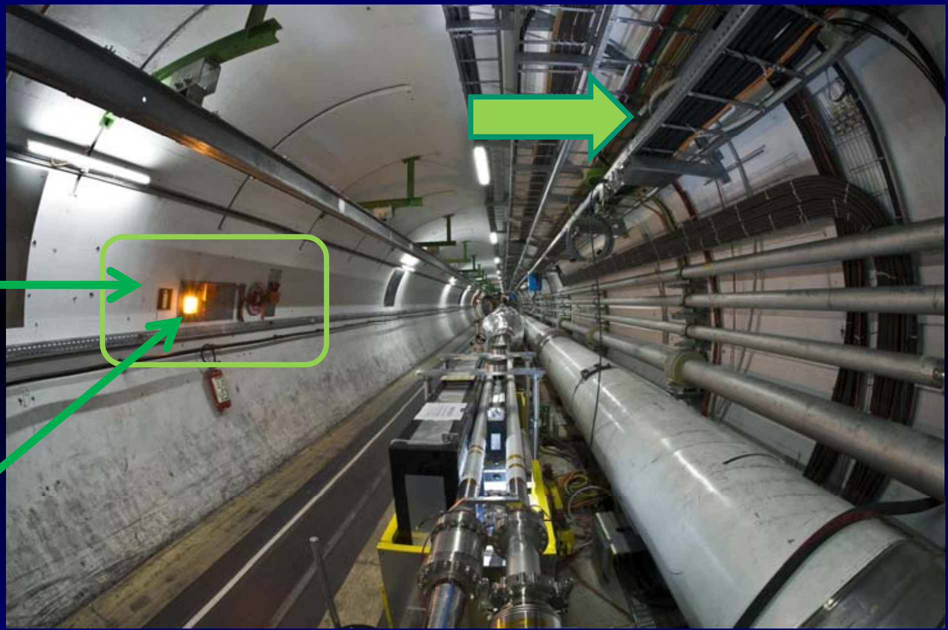


B) Prevention-organization (1)

- Temporary storage of combustibles forbidden
- Regular maintenance of the automatic detection system
- Fire Brigade has materials and resources adapted to the hazards..
- Hot work permits
- No smoking facility

C) Protection -design

- Fire retardant no halogen cables and plastics
- Emergency call points every 60m with evacuation buttons and phones
- Emergency light and signs
- Foam system in the cavern



D) Protection - Organization

- Fire brigade has intervention procedures including smoke extraction
- Manual fire fight means

(extinguishers, hydrants, are localized where there is large fire load)

- Training for workers
- Self rescue breathing devices

- SPS~=1200m
- LEP-LHC~=3000m
- ILC-CLIC~=5000m

Cost reduction requires to reduce number of access pits…law of the double every 20 years?

Need to assure quick and easy evacuation of personnel in case of accident


Cable
Trays
Monorail
Fire
Door
FIREWALL

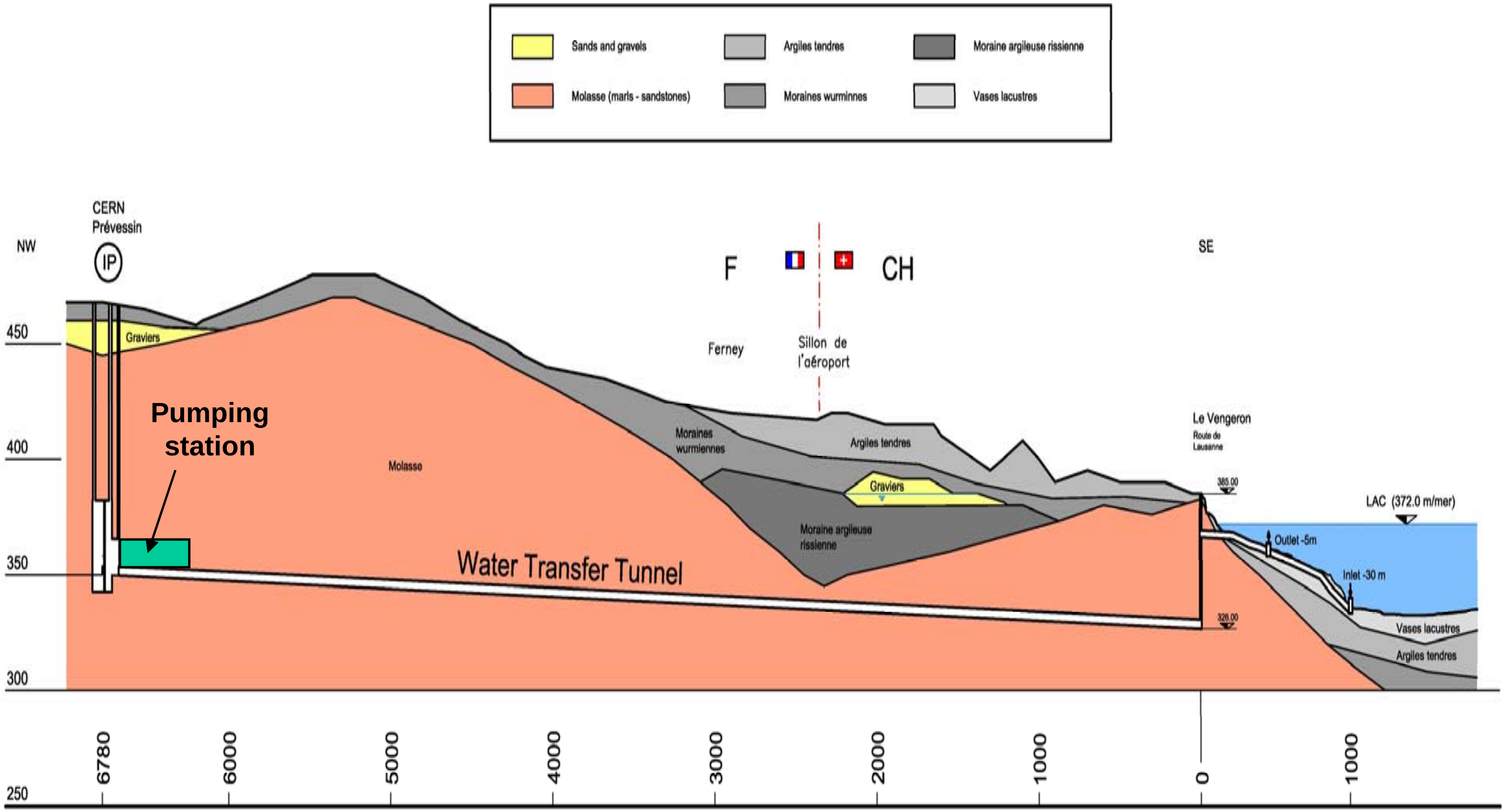
COOLING AND VENTILATION IN THE TUNNEL

J. Inigo-Golfin - C. Martel
CERN TS/CV
Presented 17 November 08

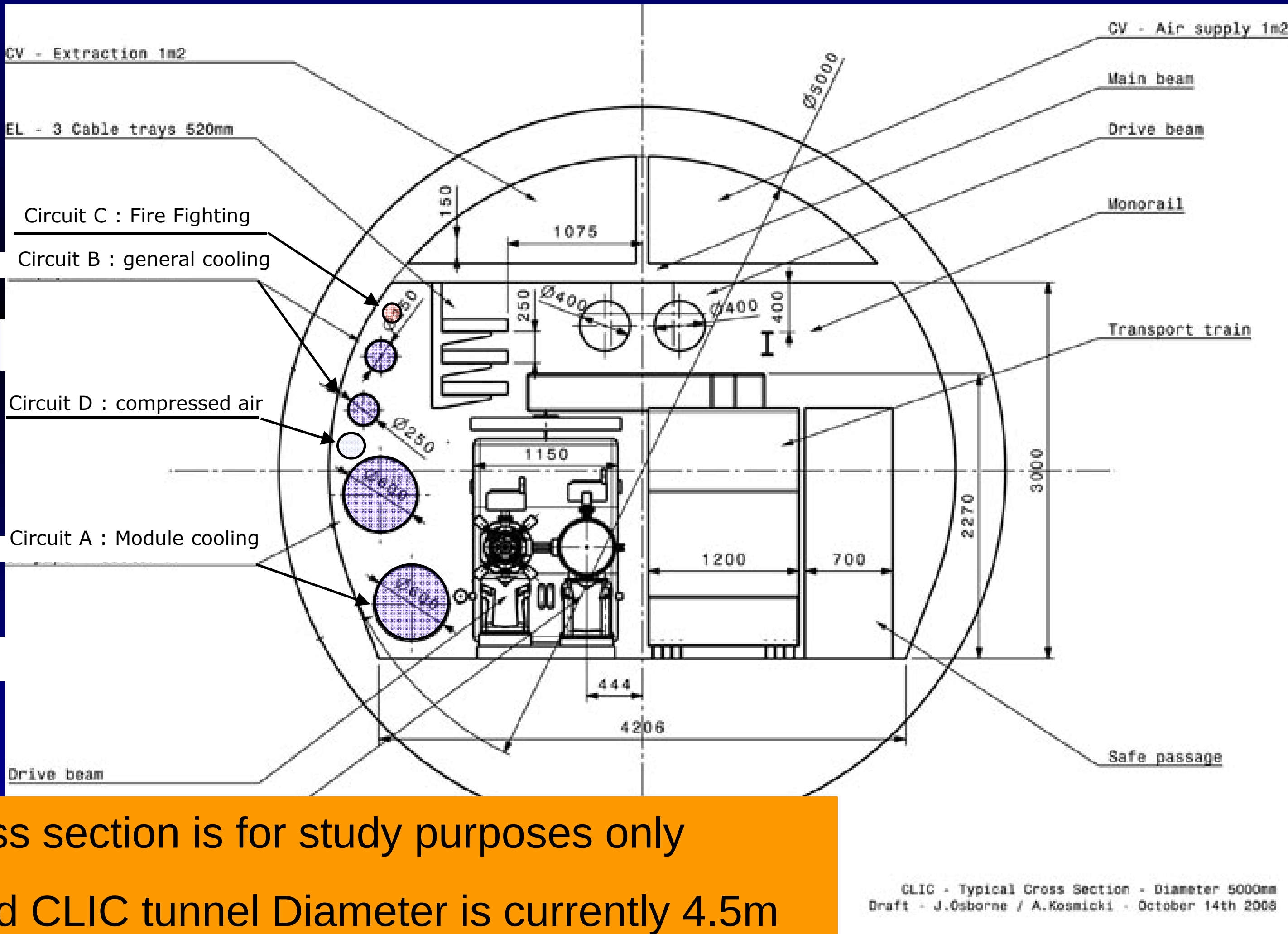
Cooling Production

Longitudinal section 1:25'000 / 2'500

Water Transfer Tunnel



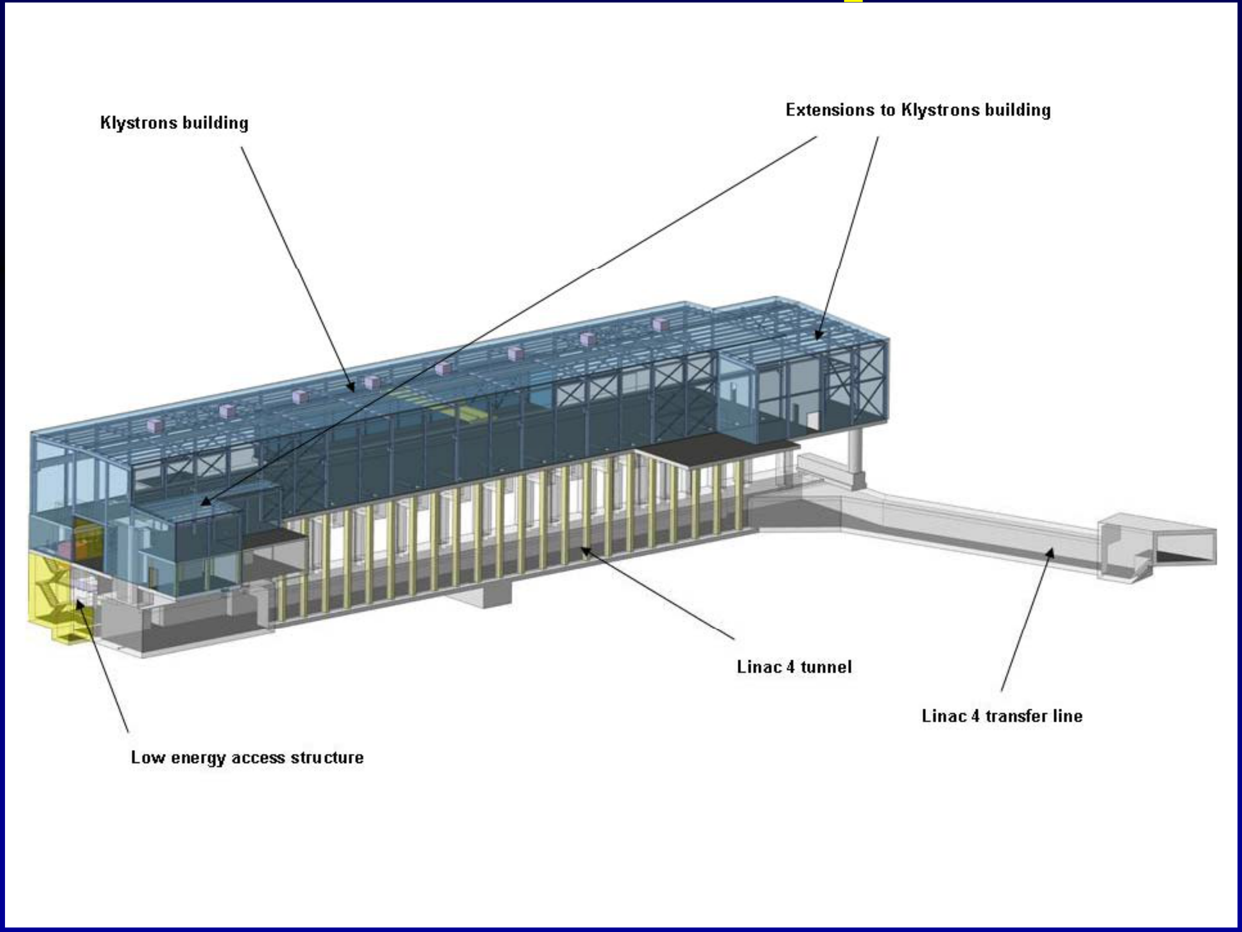
Tunnel section. Piping



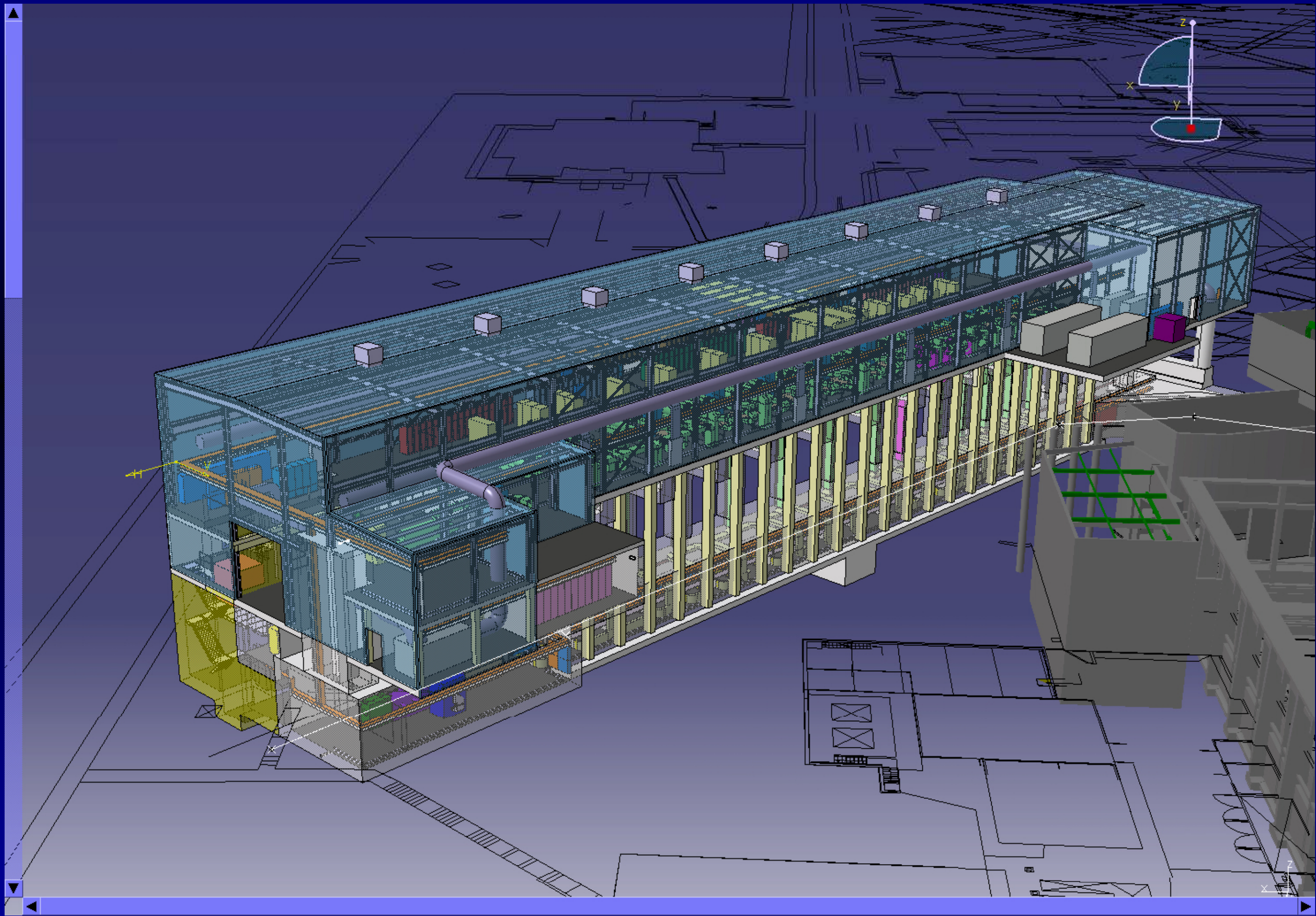
This cross section is for study purposes only

Approved CLIC tunnel Diameter is currently 4.5m

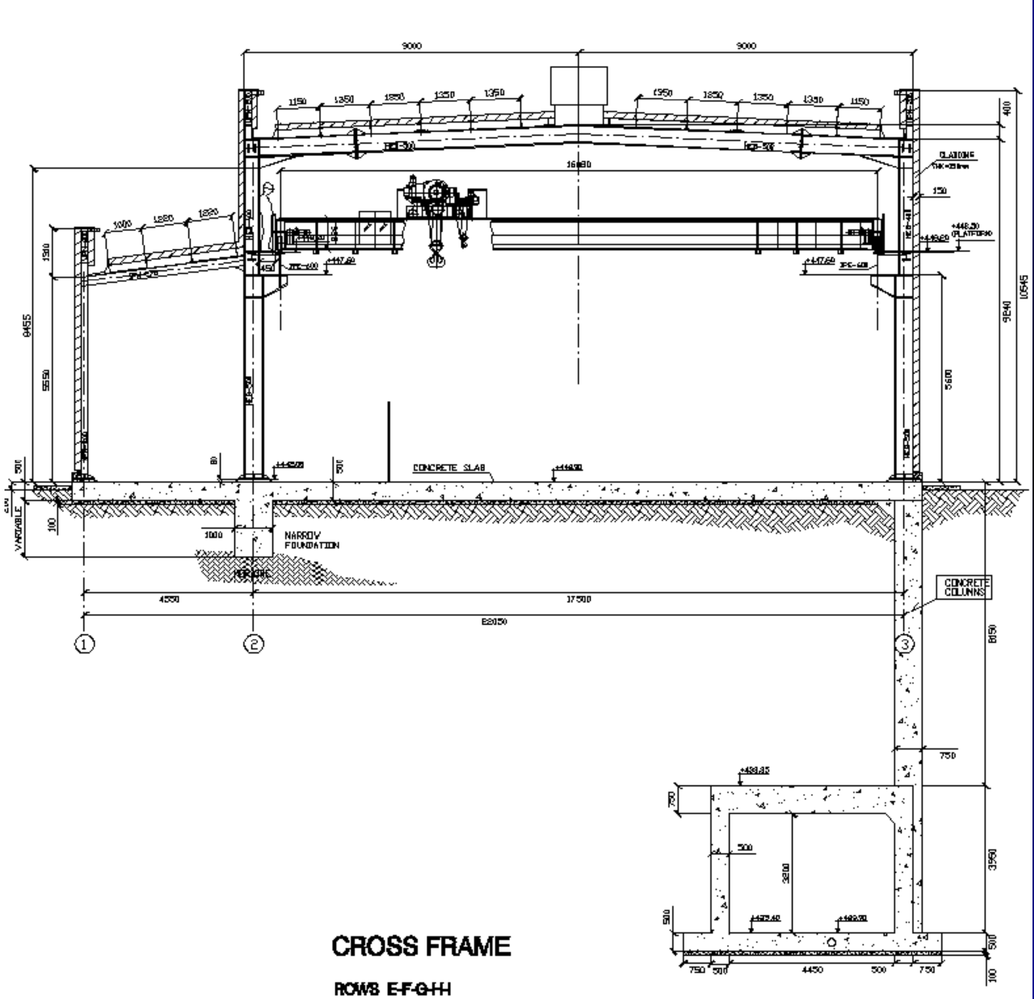
New CERN experience on LINAC 4 : can be utilised for next costing exercises for cut & cover options

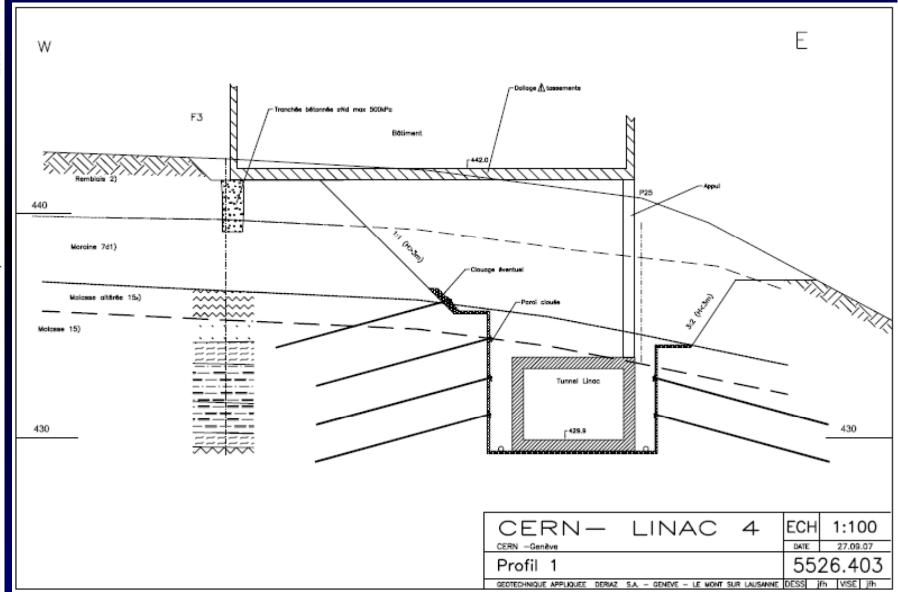


CERN LINAC 4



CERN LINAC 4


CROSS FRAME
ROWS E-F-G-I-H
CONCRETE SLAB
NARROW FOUNDATION
CONCRETE COLUMNS


W
E
Tunnel Linac
CERN— LINAC 4
ECH 1:100
Profil 1
5526.403

CERN LINAC 4

Some CFS/CES Objectives for 2009 for discussion :

- **Civil engineering :**
  - 3d modelling for ILC using CATIA Software (by Spring 09)
  - Assist in studies for possible new ILC sites (Dubna,Desy)
  - Draw up plans for new ILC RF cluster design
  - Assist in shallow site studies v RDR deep tunnel
- **Transport** – to study ILC installation methods (by summer 09)
- **HVAC** – CLIC & ILC teams to work together to develop cooling and ventilation design
- **Safety** – to draw up a common document for underground safety rules that should be applied to CLIC & ILC (by summer 09)