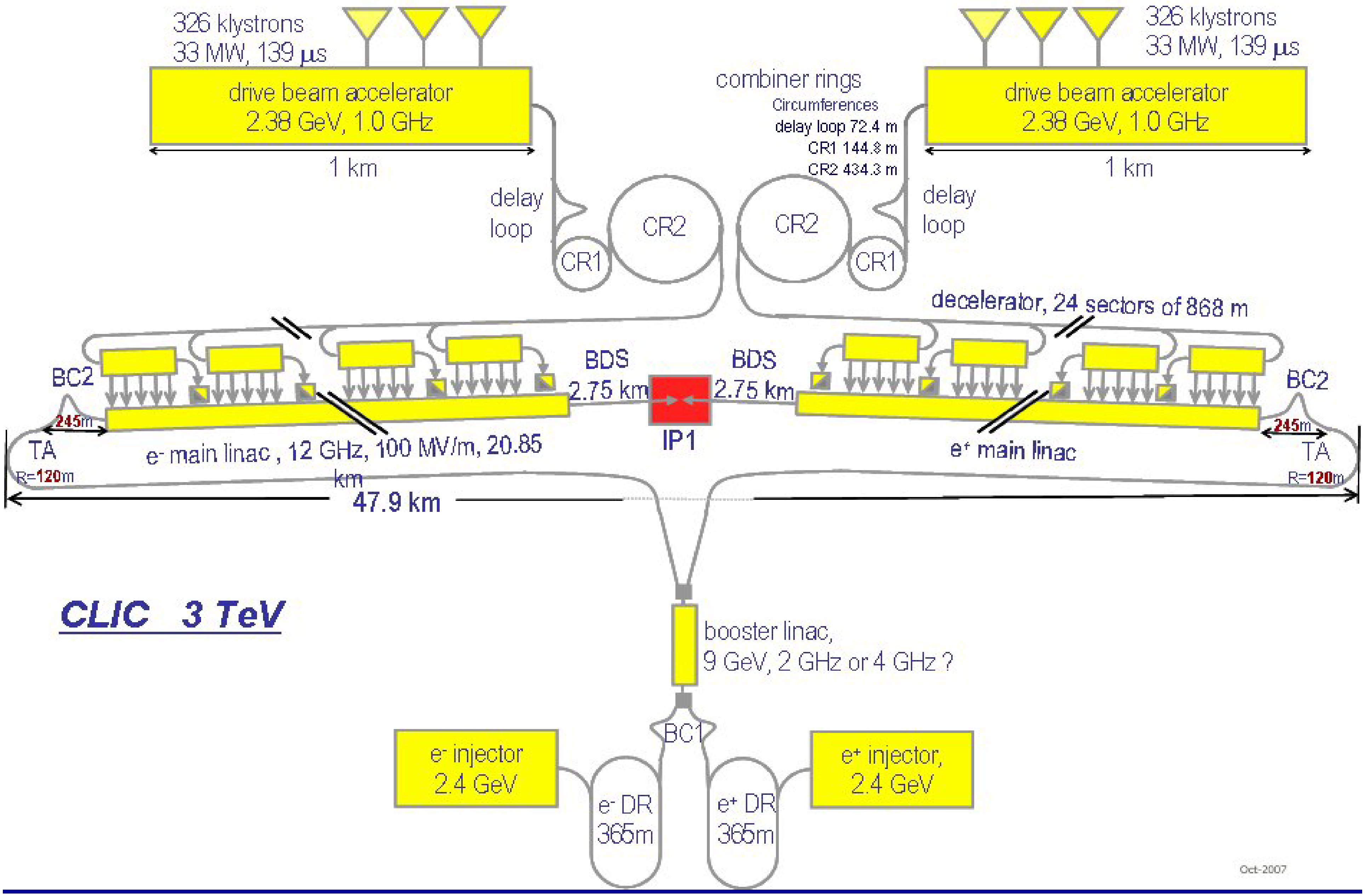
CLIC v ILC

1. CLIC from CFS point of view

2. Possible Layout for a Shallow Site Interaction Region

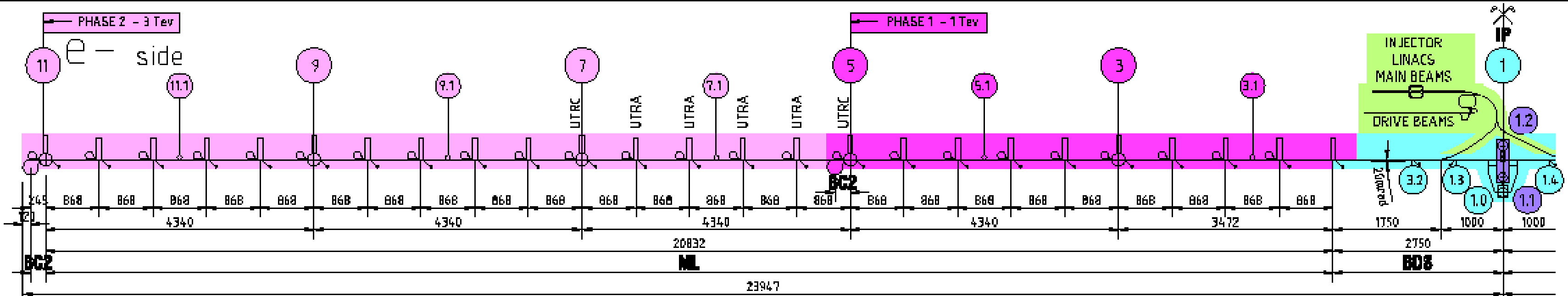
J.P. Delahaye & J.Osborne
CERN



CLIC 3 TeV

Oct-2007

CLIC – General Layout



TUNNEL LENGTHS (m)

	main beam turn-around	BC2	e– side ML	BDS	e+ side ML	drive beam accelerator +DL+CR1+CR2+ links	e– e+ injectors + DR +link +booster linac	main + drive beam transfer tunnels	TOTAL
Phase 1	1508	490	7 812	5 500	7 812	2 216 (to be revised)	1 430 (to be revised)	2 516	29 284
Phase 2	1508	490	12 775	-	12 775	-	-	-	27 548
Total	3016	980	20 587	5 500	20 587	2 216	1 430	2 516	56 832

SITE LENGTHS (m)

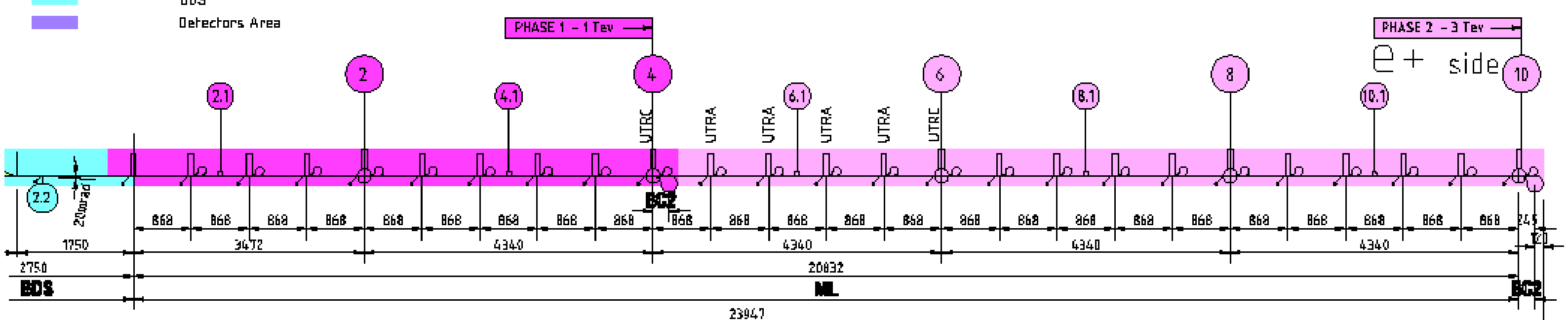
	main beam turn-around	BC2	e– side ML	BDS	e+ side ML	TOTAL
Phase 1	240	490	7 812	5 500	7 812	21 854
Phase 2	240	490	12 655	-	12 655	26 040
Total	480	980	20 467	5 500	20 467	47 894

Legend : Phase 1 Phase 2

- ML
- Main/Drive beam Injectors
- BDS
- Detectors Area

TUNNELS SECTIONS

Area	beam turn-around	e– e+ sides ML	BDS	main/drive beam transfer tunnels	main/drive beam common transfer tunnel
section dims.	ø3 m	ø4.5 m	ø4.5 m	ø3.8 m	ø4.5m



SHAFTS

Point	1.0	1.1	1.2	2	3	4	5	6	7	8	9	10	11
øm	9	16	16	9	9	9	9	9	9	9	9	9	9

SURVEY BORINGS

Point	2.1, 3.1, 4.1, 5.1	6.1, 7.1, 8.1, 9.1, 10.1, 11.1
øm	1.50	

SHAFT BASE CAVERNS (10 UTRC)

Point	2, 3, 4, 5	6, 7, 8, 9, 10, 11
(LxWxH) m	49 x 16 x 18 3 storeys	

UTRA CAVERNS

Nombre	20 x	30 x
(LxWxH) m	26 x 9 x 7.2	

DETECTORS HALL + SERVICE HALL

Point	1.1, 1.2	1.0
(LxWxH) m	120 x 25 x 39	40 x 16 x 15

MAIN BEAM DUMP CAVERNS & SERVICE HALLS (↙)

Point	BDS CAVERNS 1.3, 1.4, 2.2, 3.2	BDS SERVICE HALLS 1.3, 1.4, 2.2, 3.2
(LxWxH) m	20 x 8 x 14 + 1 storey	38 x 16 x 10

MUON WALL WIDENINGS

Point	1.3, 1.4
(LxWxH) m	25 x9x7.2 +15x9x7.2

CONNECTION CAVERNS

Point	1.3, 1.4
(LxWxH) m	18 x 9 x 7.2

DRIVE BEAM DUMP CAVERNS (↘)

Nombre	At each UTRAs and UTRCs 20 x	30 x
(LxWxH) m	6 x 9 x 5	

DRIVE BEAM RETURN LOOP

Nombre	18 x	30 x
(LxWxH) m	63 x 2.4 x 3	

INDICE A: 24 DB sectors, 868 m each and 5 DB sectors between 2 shafts

UTR = Underground Technical Room

CLIC - UNDERGROUND STRUCTURES SCHEMATIC LAYOUT(COLOURED BY ZONES)

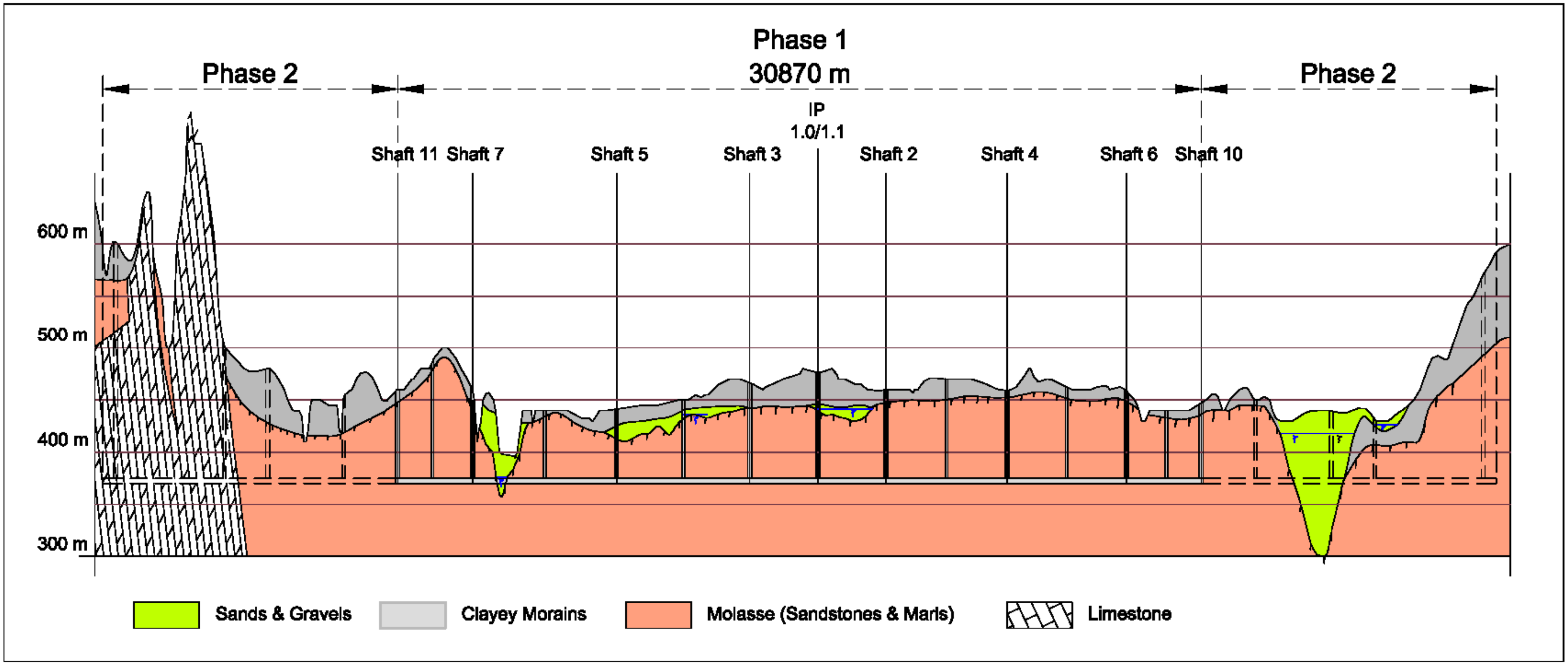
CERN

GROUP : TS-CE
CIVIL ENGINEERING
SUPERVISOR : J.OSBORNE
DESIGNER : A.KOSMICKI

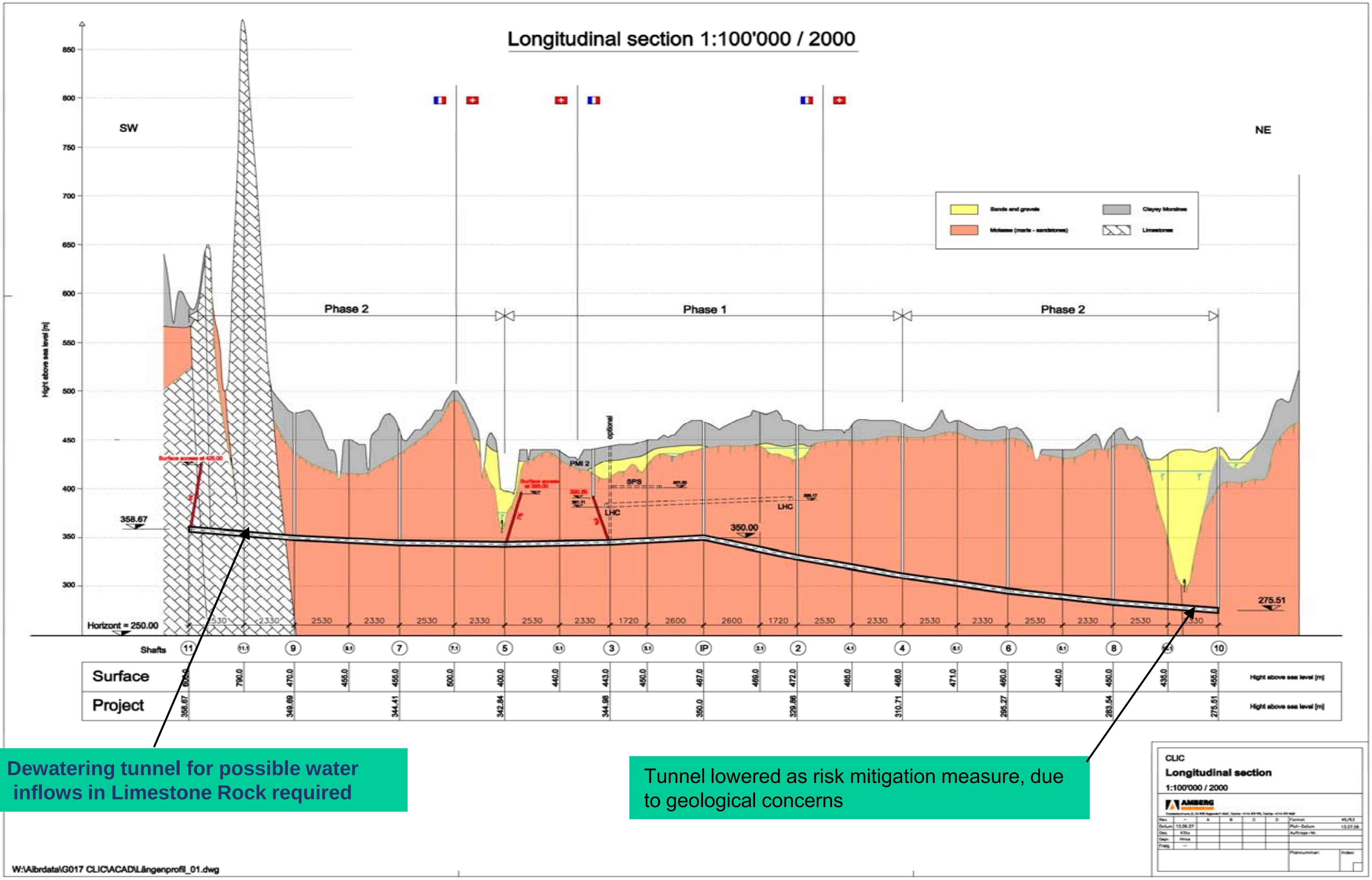
SCALE : 1/62500(A3_FORMAT) DATE : 15_JAN_2008

CLIC.CE–1.1749.0003 SIZE 3 INDICE A

ILC – Long Profile for CERN sample site



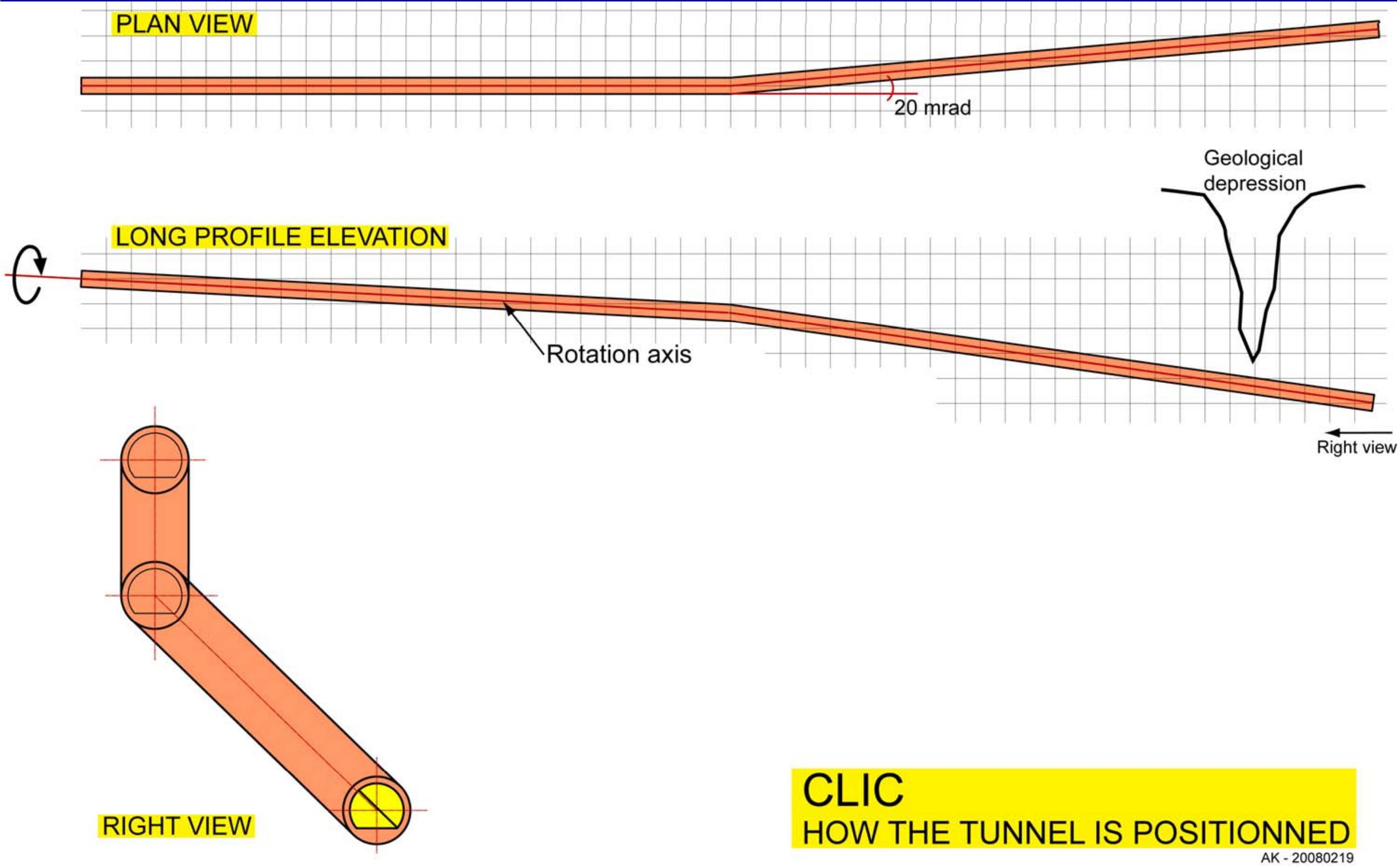
CLIC – Long Profile (laser straight)



Dewatering tunnel for possible water inflows in Limestone Rock required

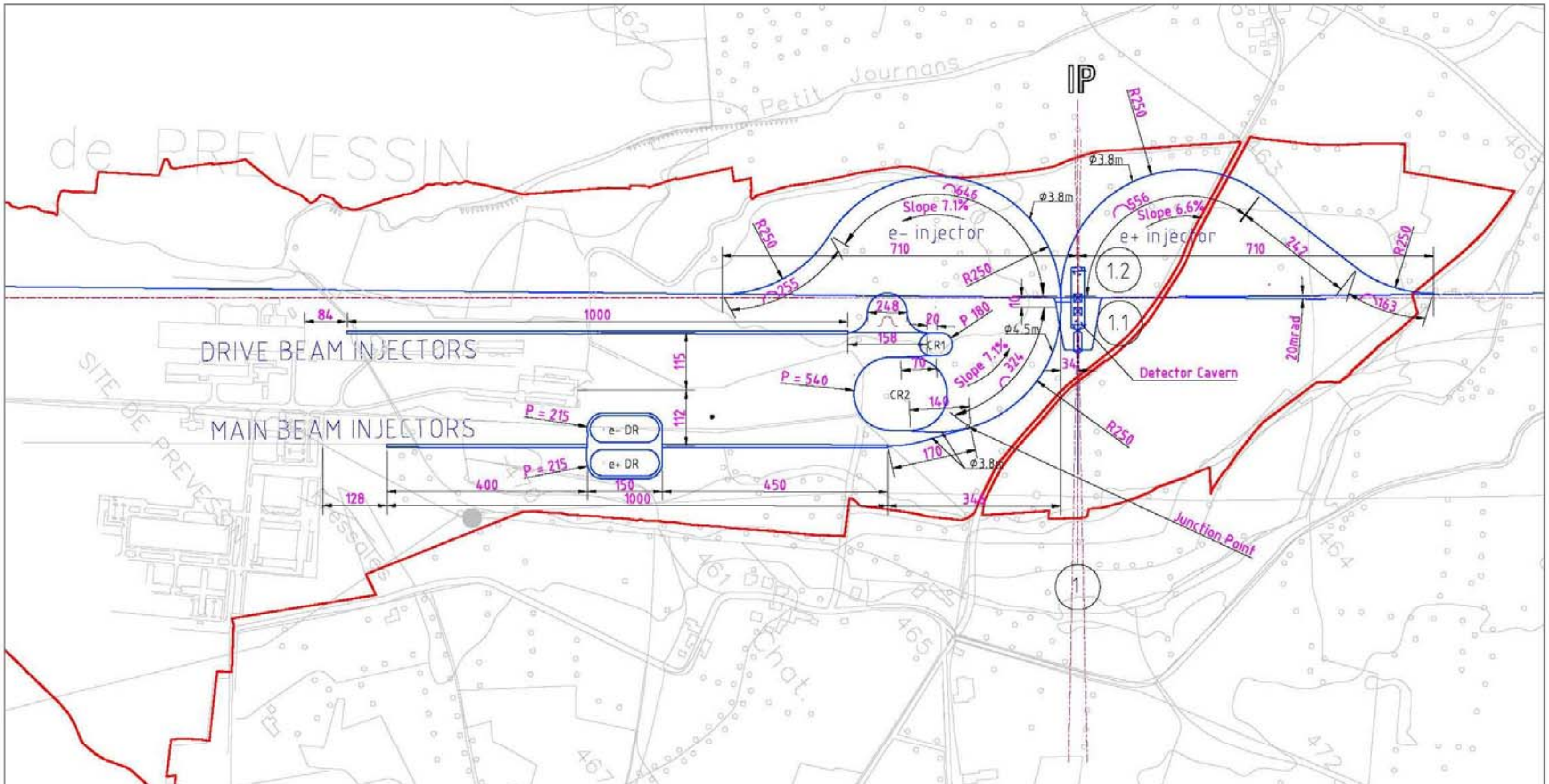
Tunnel lowered as risk mitigation measure, due to geological concerns

CLIC – Laser straight



G:\Departments\TS\Groups\CE\Activities and Services\DO\Kosmicki\etudes\20071109-CLIC\20080218-schema positionnement tunnel

CLIC – Injectors



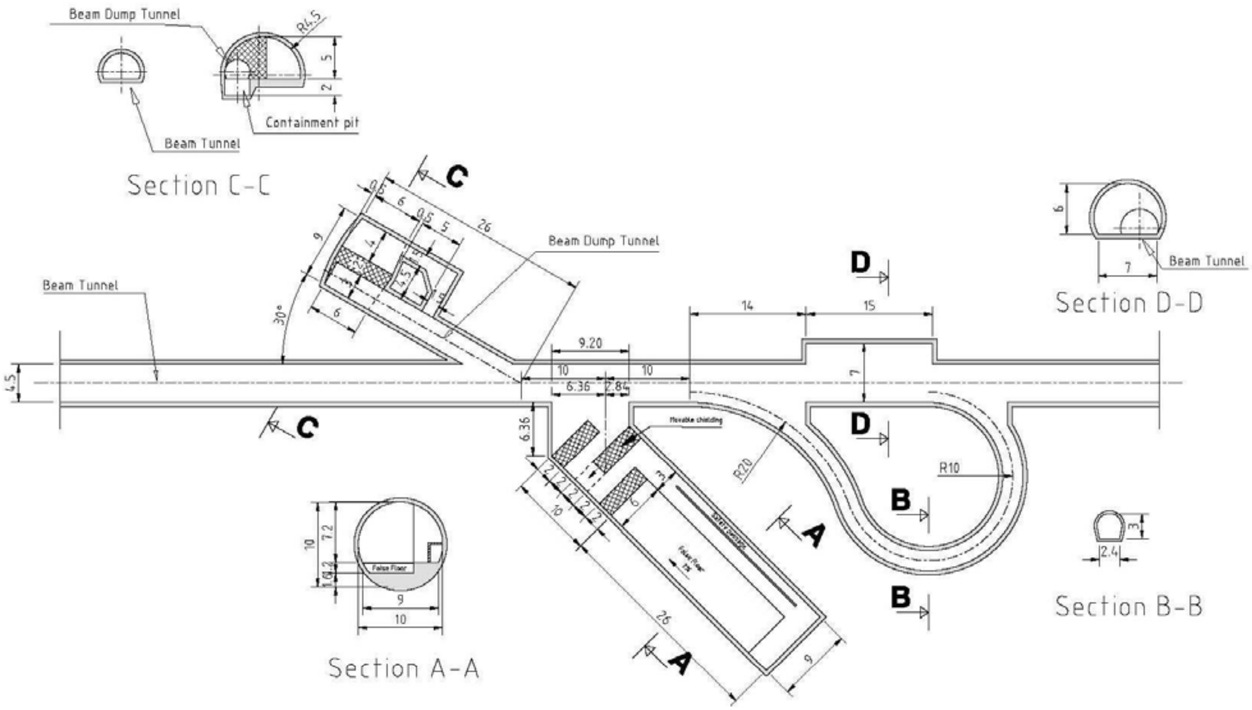
INJECTORS TUNNELS	DRIVE BEAM INJECTORS COMPLEX					MAIN BEAM INJECTORS COMPLEX						COMMON & FINAL TRANSFER TUNNELS (after Junction Point)		
	LINAC	DELAY LOOP	CR 1	CR 2	TT to Junction Point	LINAC 1	e- DR	e+ DR	DR Link	LINAC 2 + BC 1	TT to Junction Point	COMMON	e- TT	e+ TT
Length (l) m	1000	406	180	540	140	400	215	215	150	450	170	334	901	971
Section (l x h) m	6 x 3	4 x 3	4 x3	4 x 3	ϕ 3.8	3 x 3	6 x 3	6 x 3	14 x 3	3 x 3	ϕ 3.8	ϕ 4.5	ϕ 3.8	ϕ 3.8

CLIC- MAIN / DRIVE BEAM INJECTORS AND EXPERIMENTAL AREA LAYOUT

CERN — GROUP : TS-CE — CIVIL ENGINEERING — SUPERVISOR : JL.BALDY — DESIGNER : N.BADDAMS

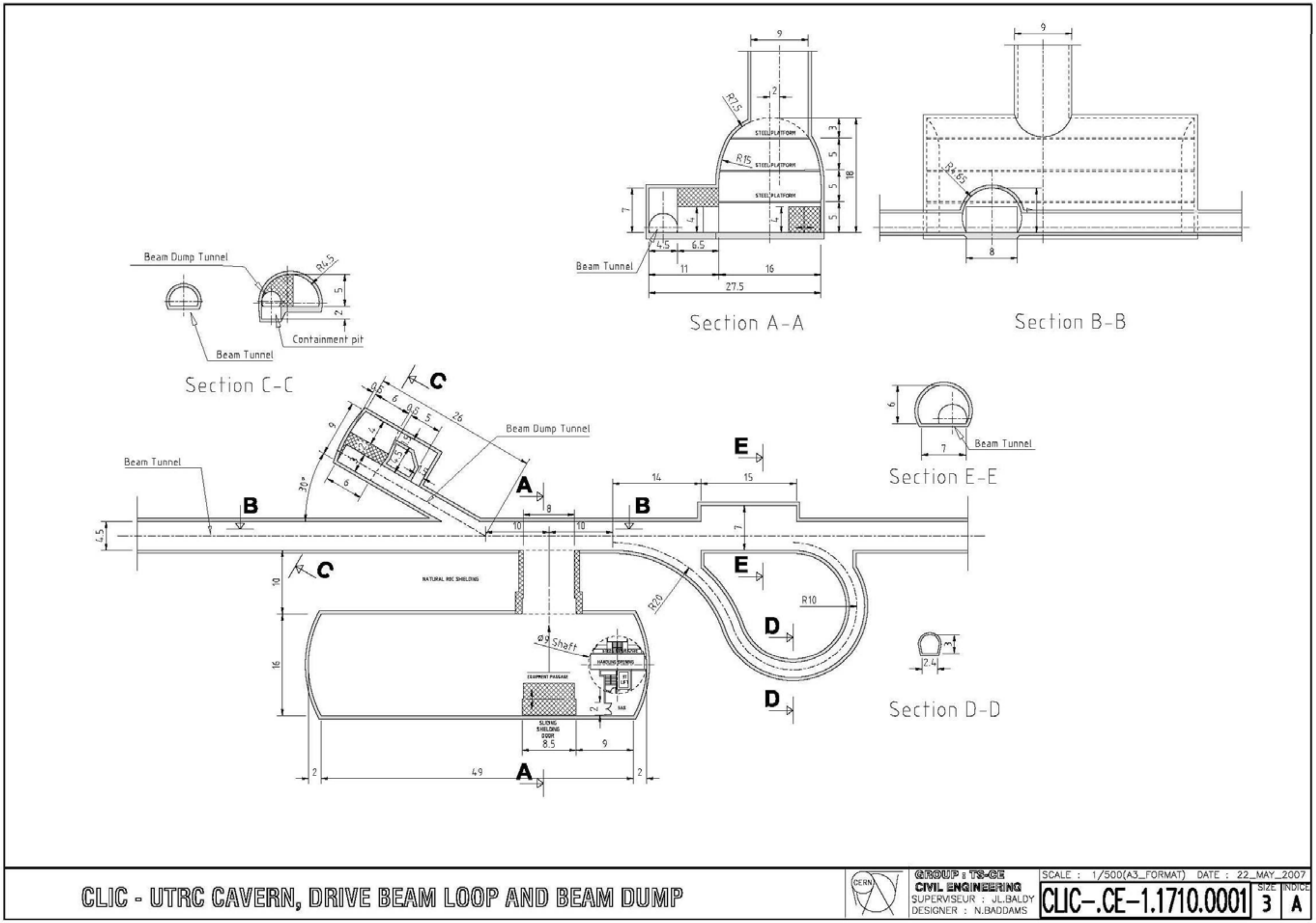
SCALE : 1:5500(A3_FORMAT) DATE : 12_JUNE_2007

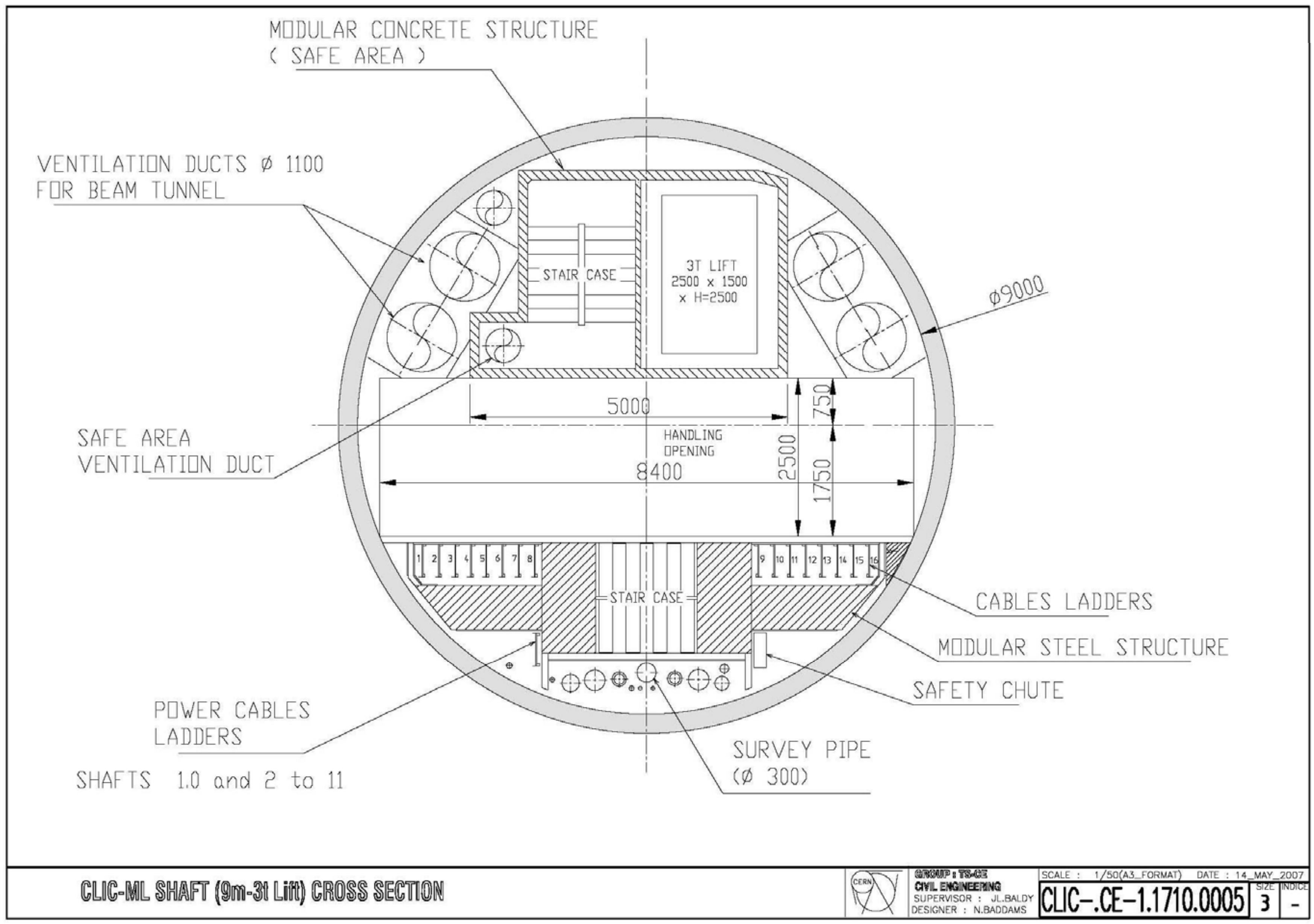
CLIC.CE-1.1799.0002 — SIZE 3 — INDICE D

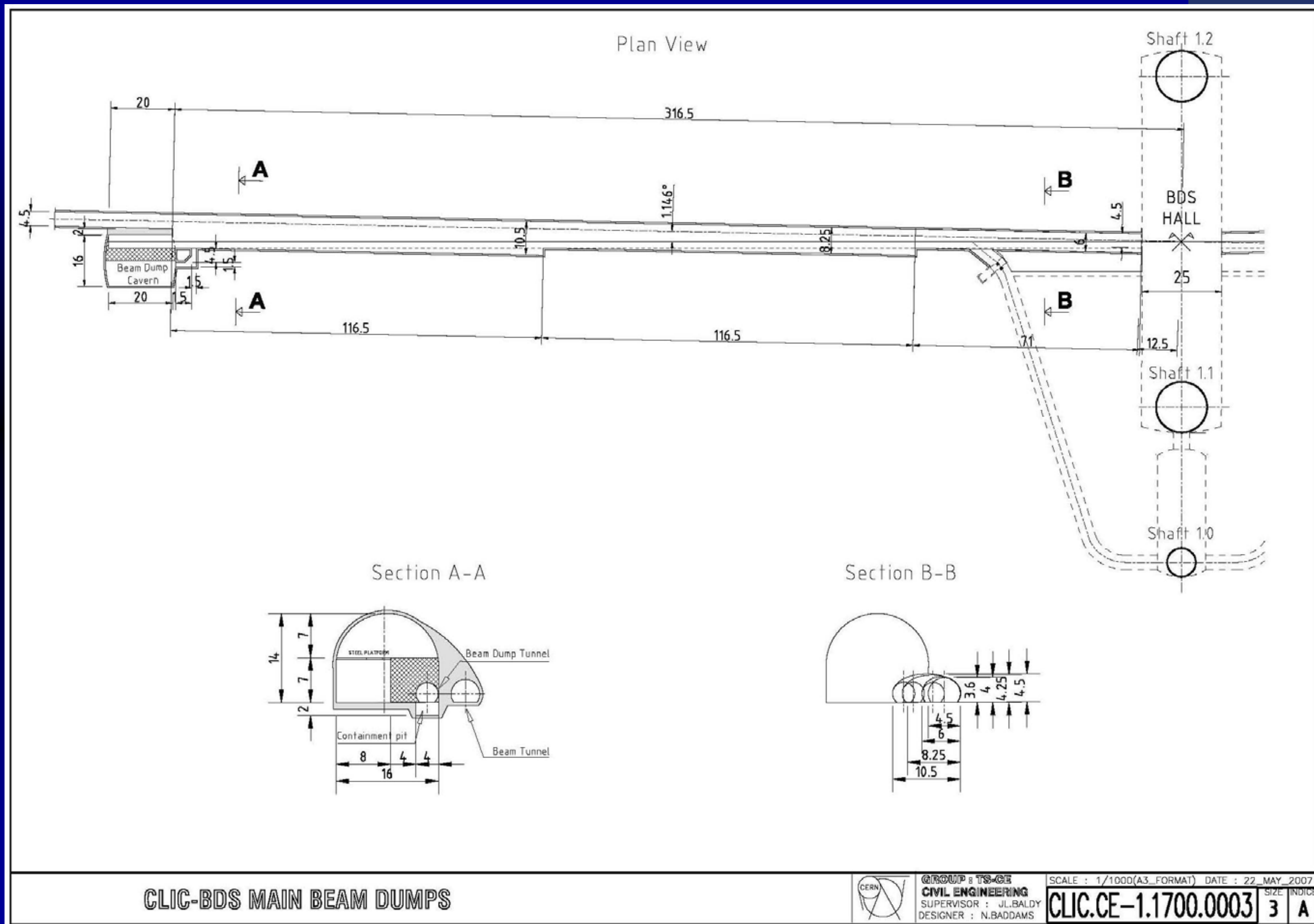


CLIC - UTRA CAVERN, DRIVE BEAM LOOP AND BEAM DUMP

CERN	GROUP : TS-CE CIVIL ENGINEERING SUPERVISEUR : JL.BALDY DESIGNER : N.BADDAMS	SCALE : 1/500(A3_FORMAT) DATE : 22_MAY_2007 CLIC-.CE-1.1710.0002	SIZE 3	INDICE A

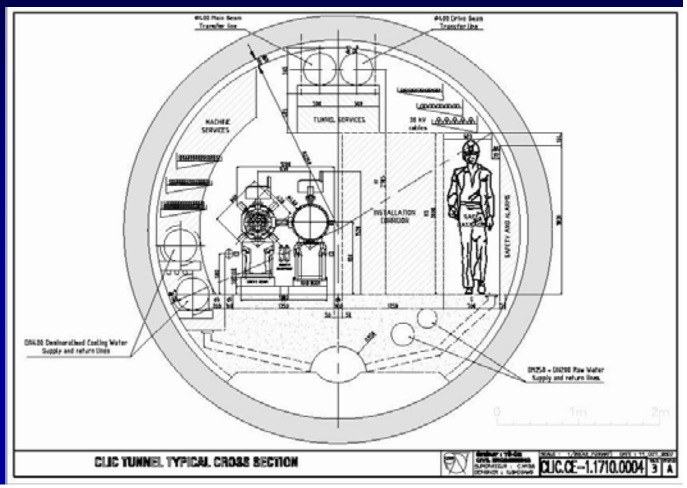

Section A-A
STEEL PLATFORM
R7.5
R15
Beam Tunnel
27.5
Section B-B
R4.65
Section C-C
Beam Dump Tunnel
R4.5
Containment pit
Beam Tunnel
Section E-E
Beam Tunnel
Section D-D
Beam Tunnel
Beam Dump Tunnel
NATURAL RBC SHIELDING
Ø9 Shaft
R20
R10
SLIDING SHIELDING DOOR
49
CLIC - UTRC CAVERN, DRIVE BEAM LOOP AND BEAM DUMP
GROUP : TS-CE
CIVIL ENGINEERING
SUPERVISEUR : JL.BALDY
DESIGNER : N.BADDAMS
SCALE : 1/500(A3_FORMAT)
DATE : 22_MAY_2007
CLIC-.CE-1.1710.0001
SIZE 3
INDICE A


MODULAR CONCRETE STRUCTURE
(SAFE AREA)
VENTILATION DUCTS Ø 1100
FOR BEAM TUNNEL
STAIR CASE
3T LIFT
2500 x 1500
x H=2500
Ø9000
5000
750
HANDLING
OPENING
2500
8400
1750
SAFE AREA
VENTILATION DUCT
1 2 3 4 5 6 7 8
9 10 11 12 13 14 15 16
STAIR CASE
CABLES LADDERS
MODULAR STEEL STRUCTURE
SAFETY CHUTE
POWER CABLES
LADDERS
SURVEY PIPE
(Ø 300)
SHAFTS 1.0 and 2 to 11
CLIC-ML SHAFT (9m-3t Lift) CROSS SECTION
CERN
GROUP : TS-CE
CIVIL ENGINEERING
SUPERVISOR : JL.BALDY
DESIGNER : N.BADDAMS
SCALE : 1/50(A3_FORMAT) DATE : 14_MAY_2007
CLIC-.CE-1.1710.0005
SIZE 3
INDICE -

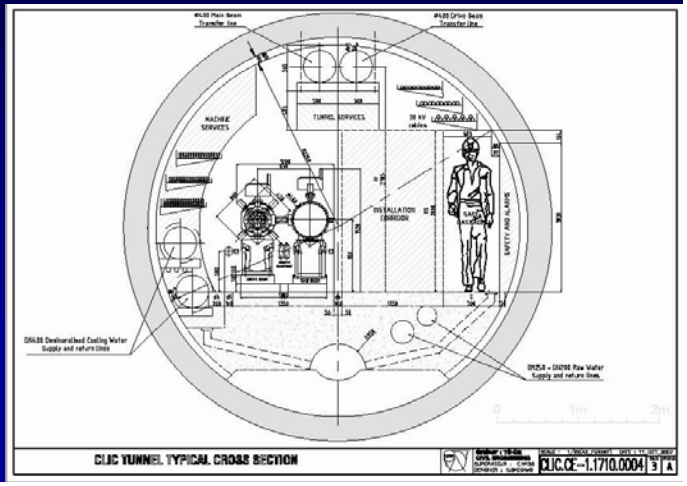

Plan View
Shaft 1.2
BDS HALL
Beam Dump Cavern
Shaft 1.1
Shaft 1.0
Section A-A
Section B-B
Beam Dump Tunnel
Containment pit
Beam Tunnel
CLIC-BDS MAIN BEAM DUMPS
GROUP : TS-CE
CIVIL ENGINEERING
SUPERVISOR : JL.BALDY
DESIGNER : N.BADDAMS
SCALE : 1/1000(A3_FORMAT) DATE : 22_MAY_2007
CLIC.CE-1.1700.0003
SIZE 3
INDICE A

- CLIC Tunnel Services & Cross Section

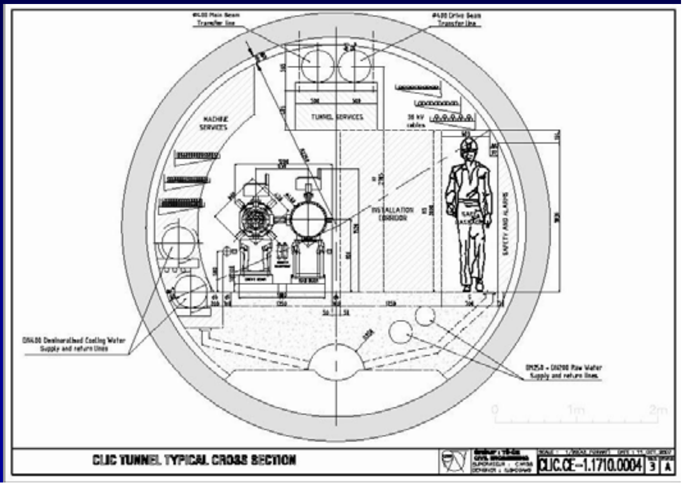
- The tunnel diameter has been initially dimensioned for the following items :
  - The CLIC machine, with their drive and main beam machine components.
  - The 2.4 GeV and 9 GeV transfer lines for the drive and main beams, respectively
  - An Installation corridor for the transportation of machine modules for installing and/or replacement.



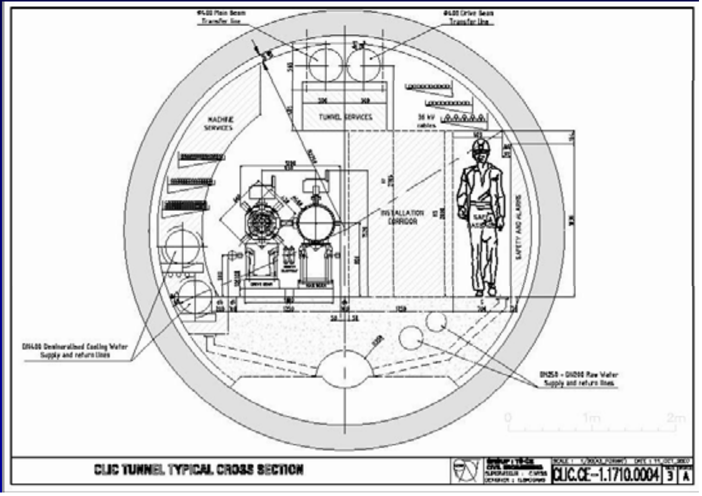
- Machine Services (1) :
  - Supply and return manifolds for demineralised water cooling.
  - Raw water supply and return.
  - Drainage pipe embedded in concrete invert for any water seepage
  - Compressed air for PETS on/off mechanism
  - Nitrogen distribution, if any
  - One or two 40mm duct(s) for optical fibre links
  - Two or three 500mm wide cable trays for dc power cables.



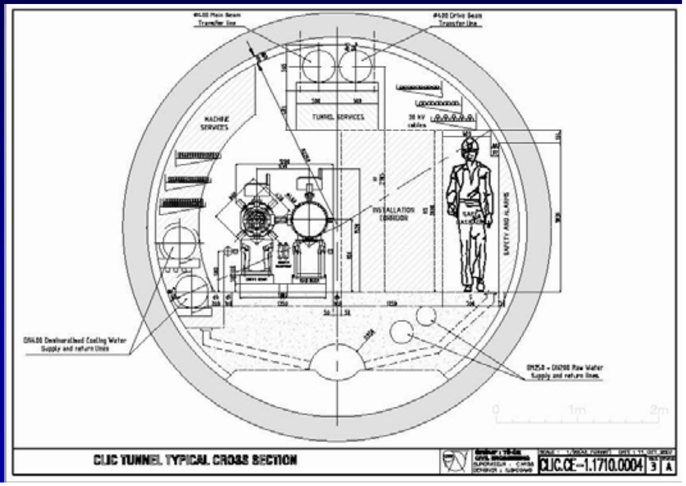
- Machine Services (2) :
  - A free section of at least 70cm width by 200cm for personnel passage between a module and the tunnel wall.
  - One 500mm wide cable tray for low power and signal cables for the RF system
  - One 500mm wide cable tray for beam instrumentation, survey and vacuum systems
  - One 300mm wide cable tray for the power cables of the transfer lines



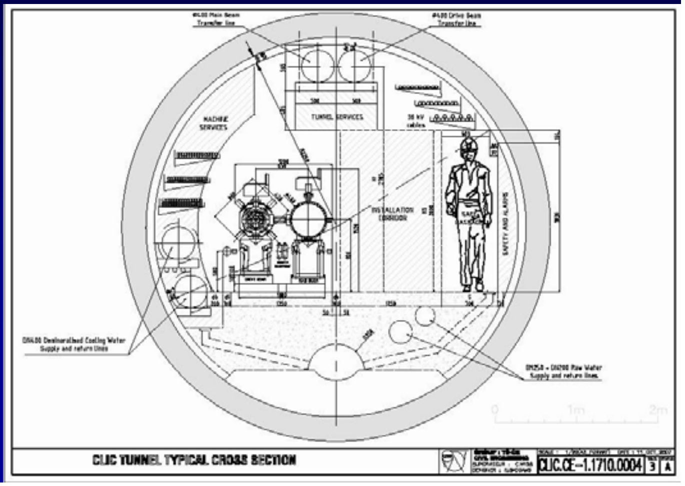
- Machine Services (3) :
  - One 200mm wide cable tray for the cables of the vacuum and beam instrumention systems of the transfer lines
  - The Low-Voltage (400V) distribution
  - 5 Cables for Medium Voltage (36KV). These cables will bring power from Prevessin Site central Area to other sites
  - Secure Low Voltage Electricity
  - Power for the transport vehicles
  - No mono-rail type transport included for the moment



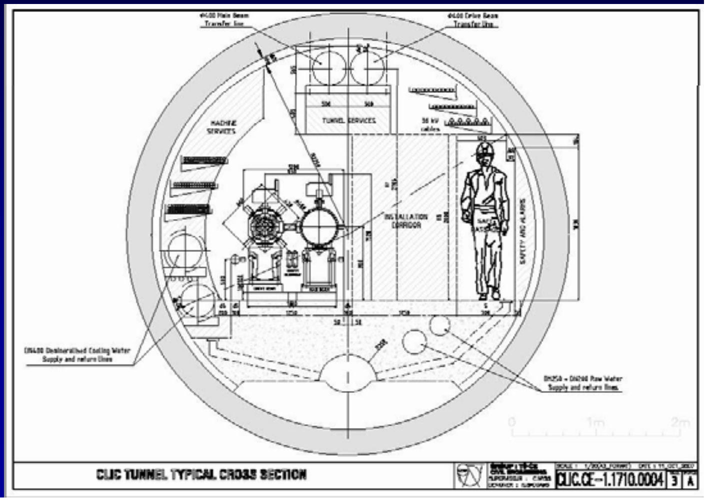
- Tunnel Services :
  - Normal Lighting
  - Leaky feeder for mobile telephones
  - Public address system

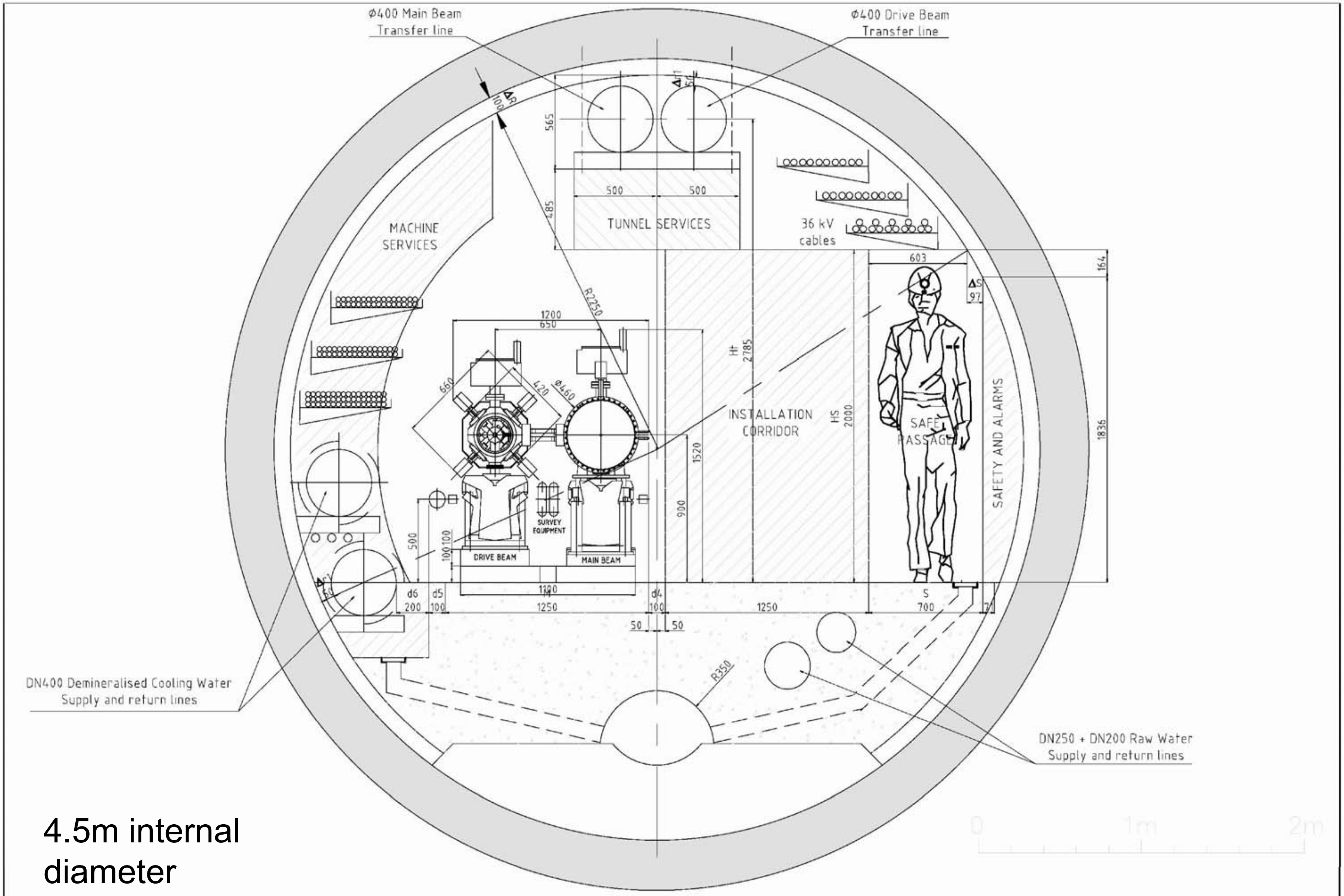


- Safety Systems :
  - Panels with emergency lighting, emergency stops, red telephones
  - Evacuation push-buttons (break glass type) and sirens
  - Emergency radio communication for fire brigade
  - Radiation monitors
  - Oxygen deficiency monitors?



- Alignment and Tunnel tolerances
  - Space has been recently allocated for alignment systems
  - A radial allowance for construction tolerances has been included (10cm)





4.5m internal diameter

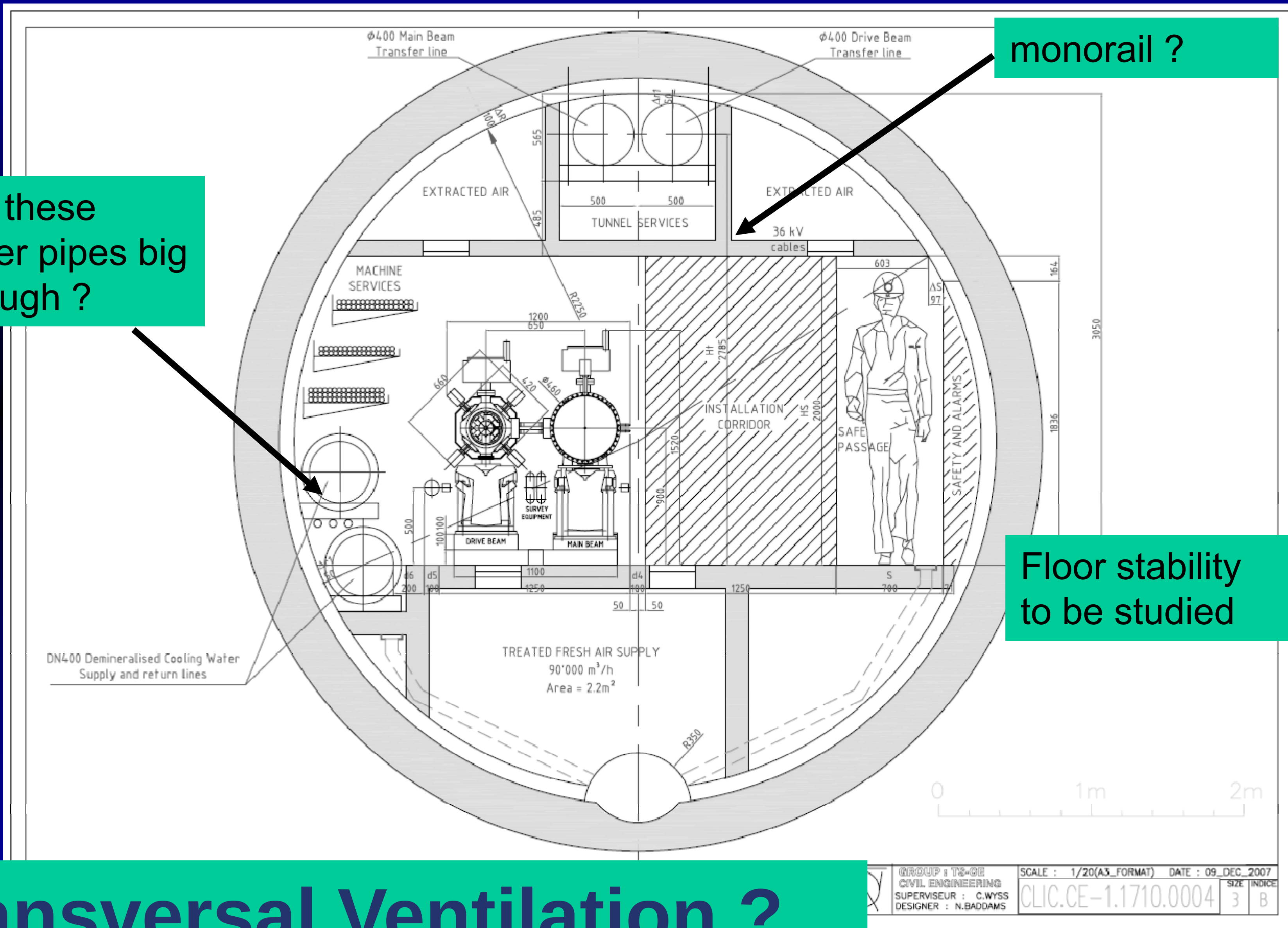
CLIC TUNNEL TYPICAL CROSS SECTION

GROUP : TS-CE
CIVIL ENGINEERING
SUPERVISEUR : C.WYSS
DESIGNER : N.BADDAMS

SCALE : 1/20(A3_FORMAT) DATE : 11_OCT_2007

CLIC.CE-1.1710.0004 SIZE 3 INDICE A

CLIC – CV issues



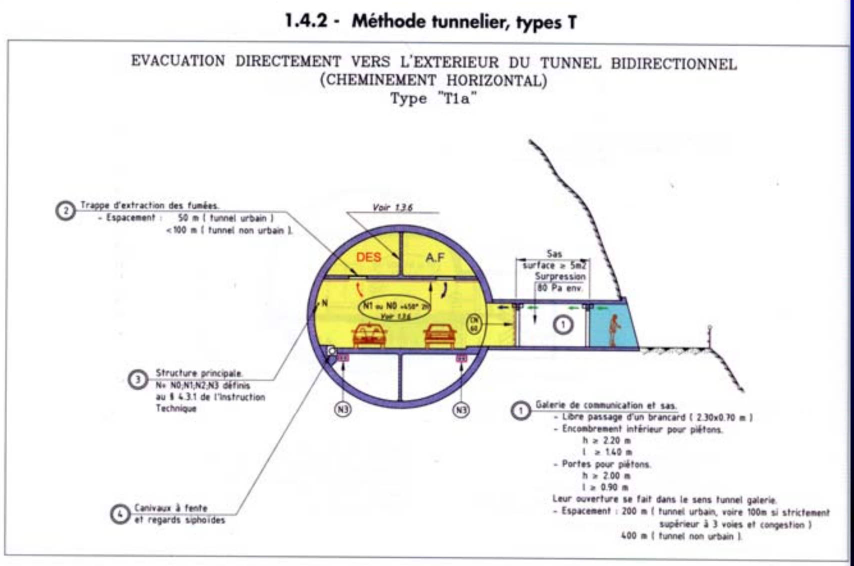
monorail ?

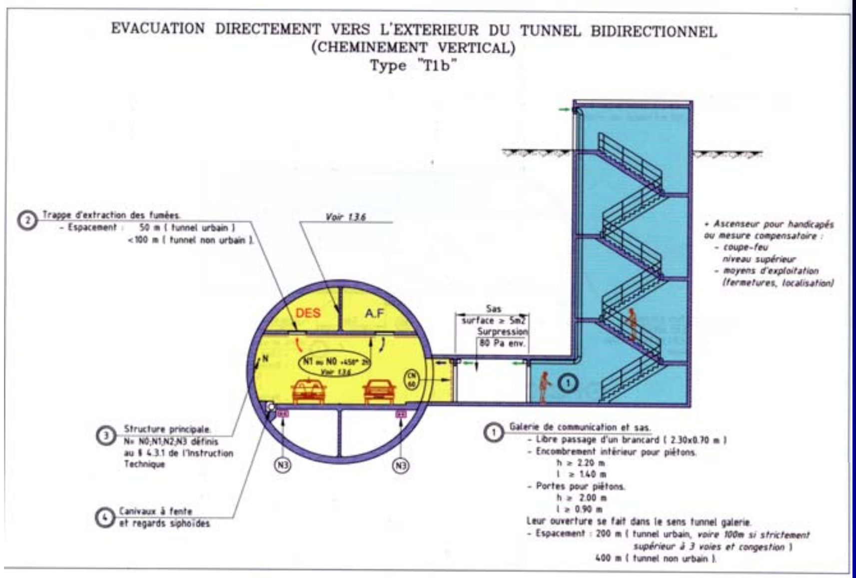
Are these water pipes big enough ?

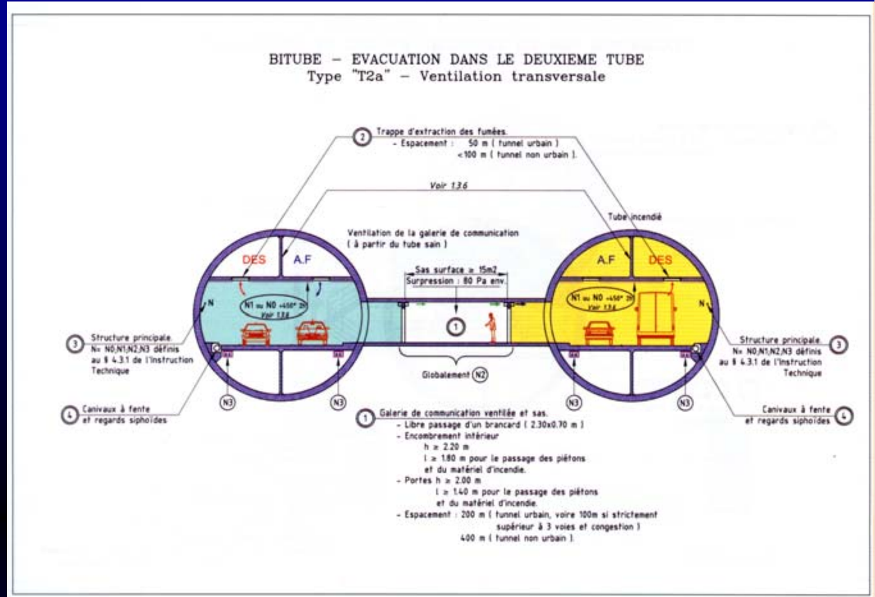
Floor stability to be studied

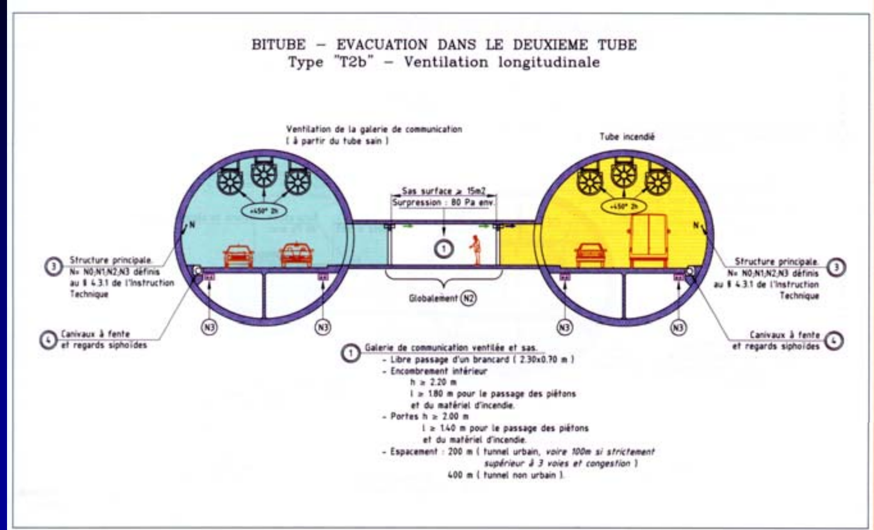
Transversal Ventilation ?

Possible Ventilation Systems for road tunnels







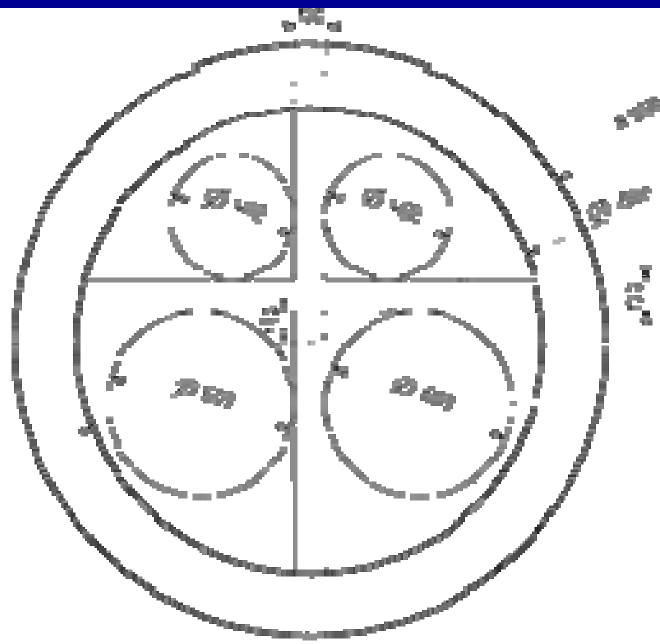


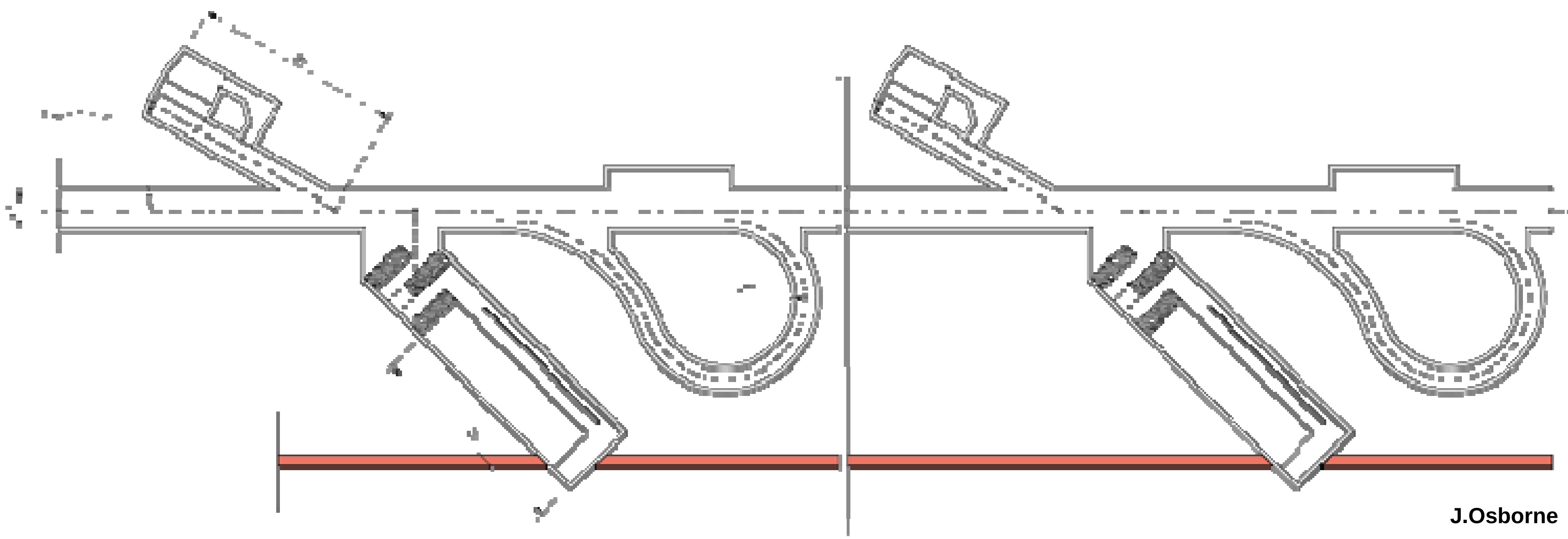
Extracted courtesy of 'French Tunnelling Association : AFTES : Tunnels routiers : resistance au feu Jan 2008'

CLIC Cooling Study

Proposed 1.5m diameter micro-tunnel for Cooling Pipes :

- Approx. cost for CE works 250MCHF
- Intermediate caverns would be needed for construction of micro tunnel
- Integration for cooling pipes is complicated
- Major impact on civil planning (excavated spoil through ‘completed’ structures)

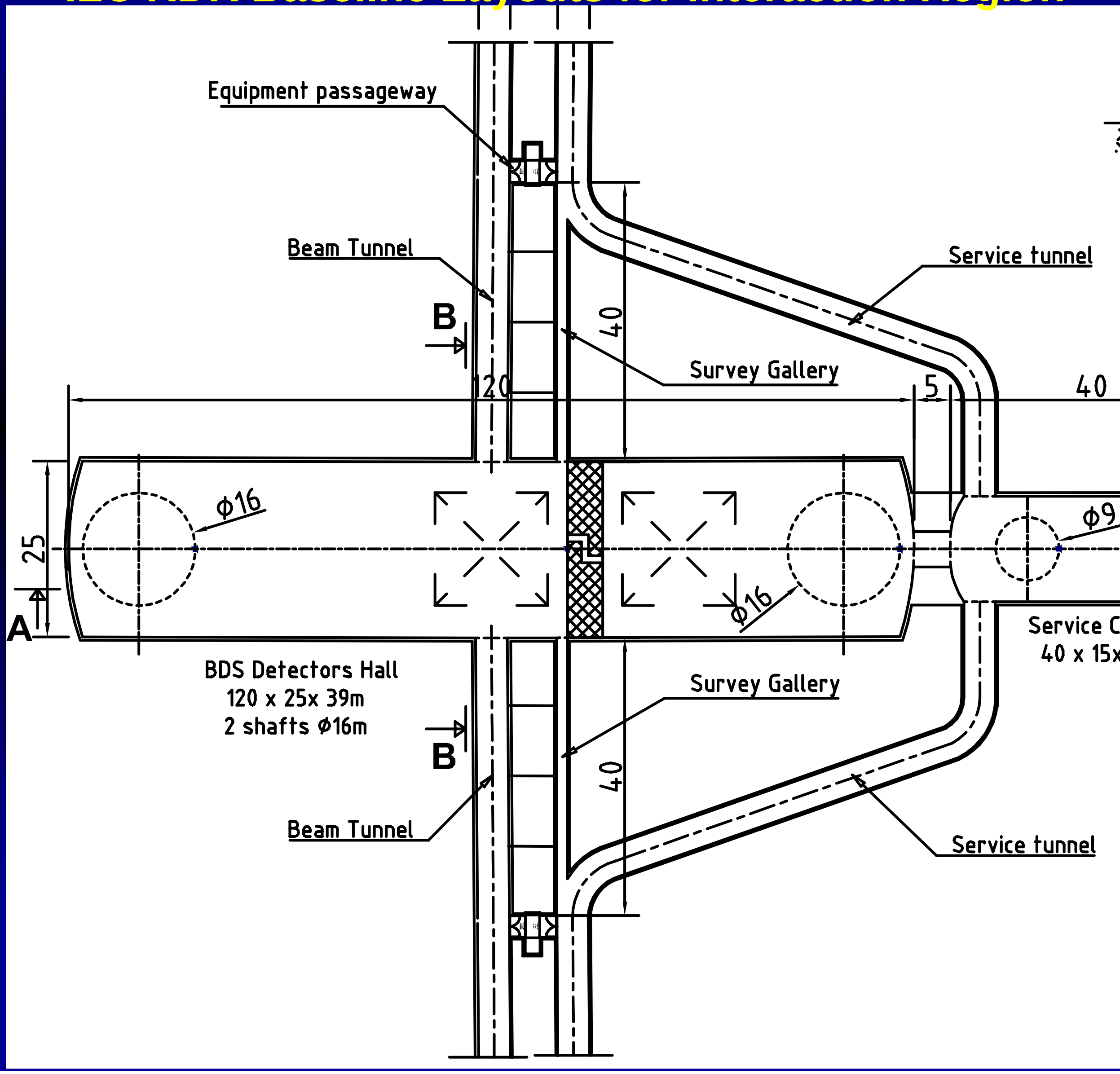




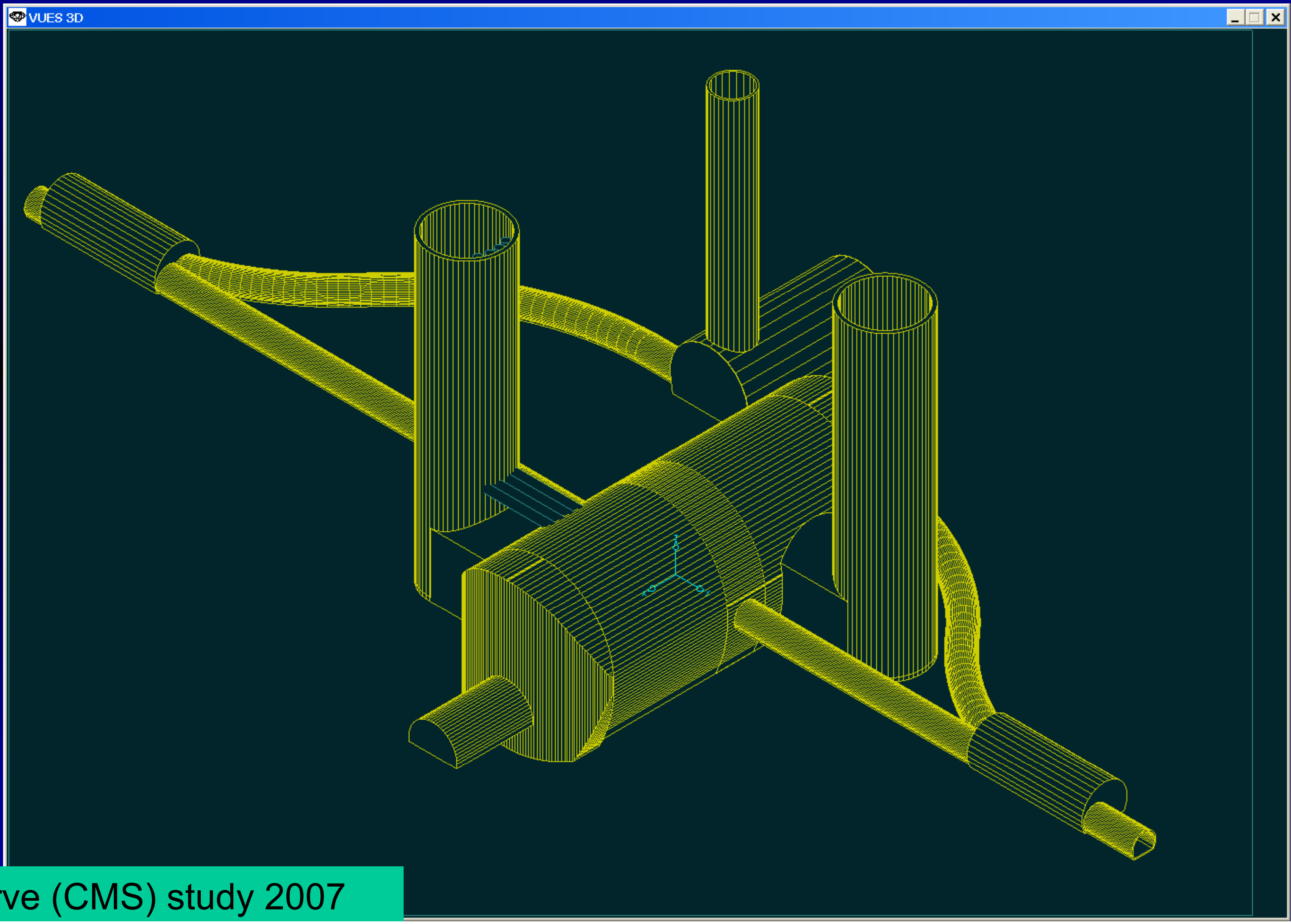
J.Osborne

2. Possible Layout for a Shallow Site Interaction Region

ILC RDR Baseline Layouts for Interaction Region

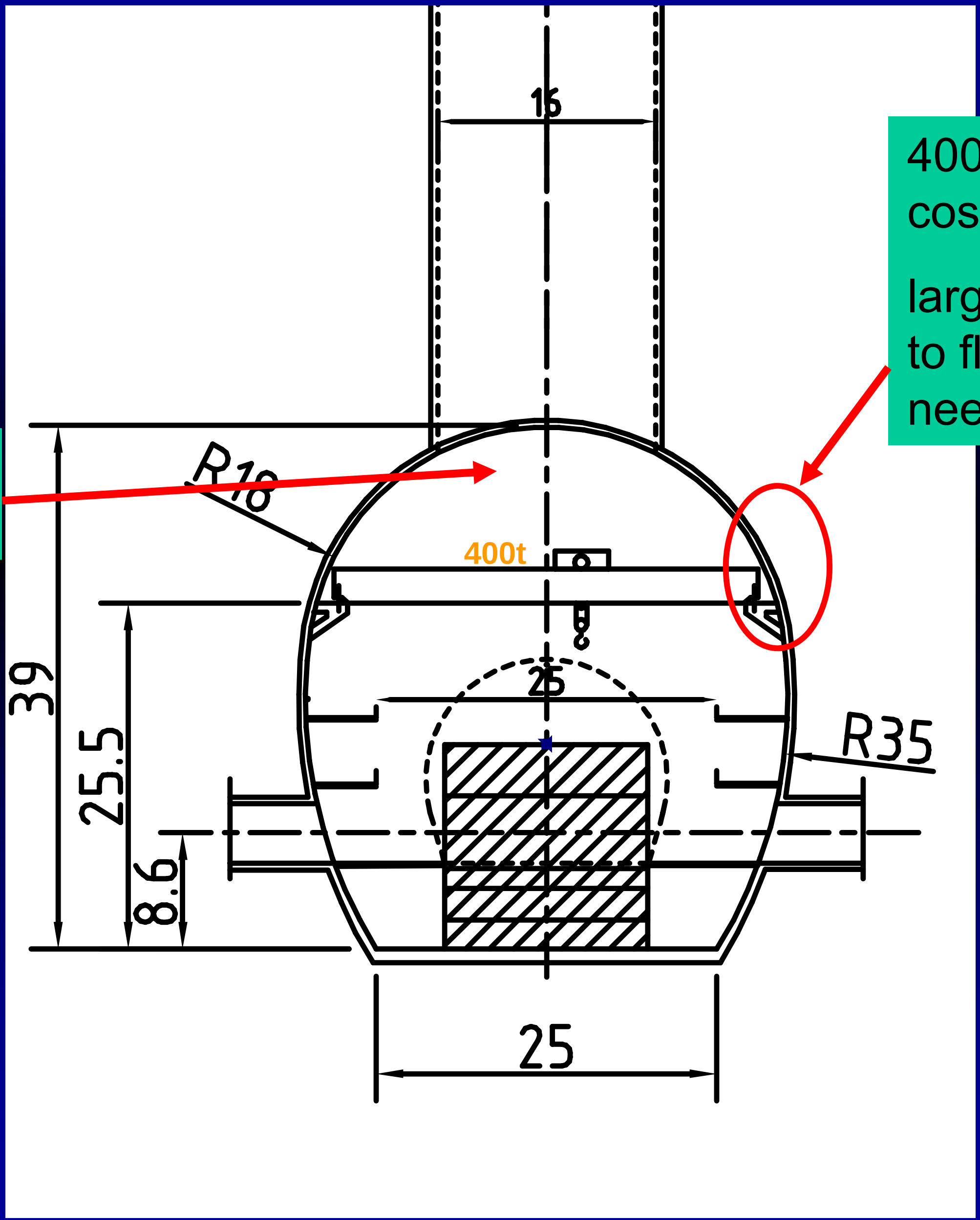


Possible layout for ILC Interaction Region for Deep Tunnel Solution using CMS concept



A.Herve (CMS) study 2007

RDR Baseline for IR cavern

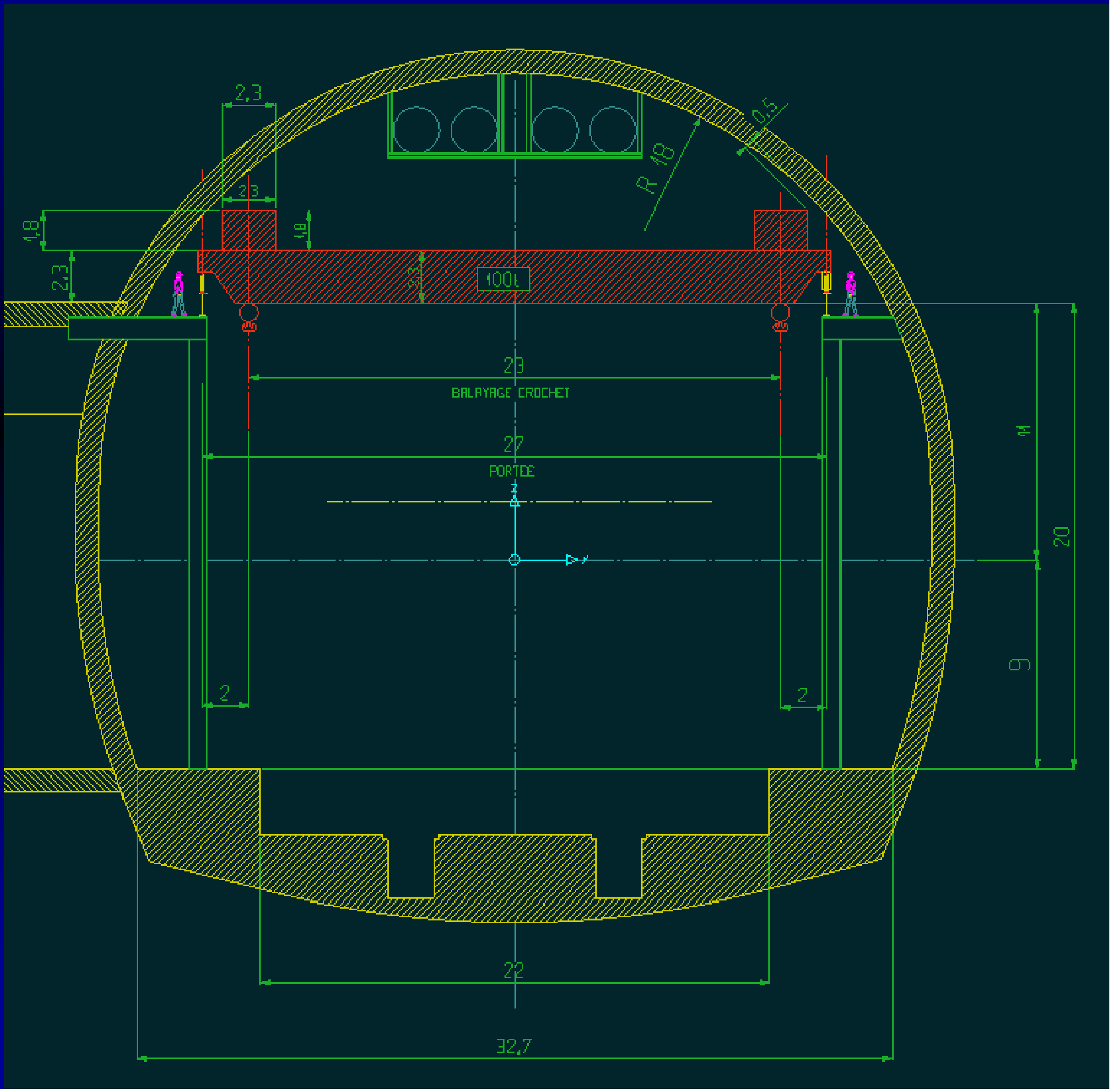


Lot of lost space

400 ton gantry crane is the cost driver

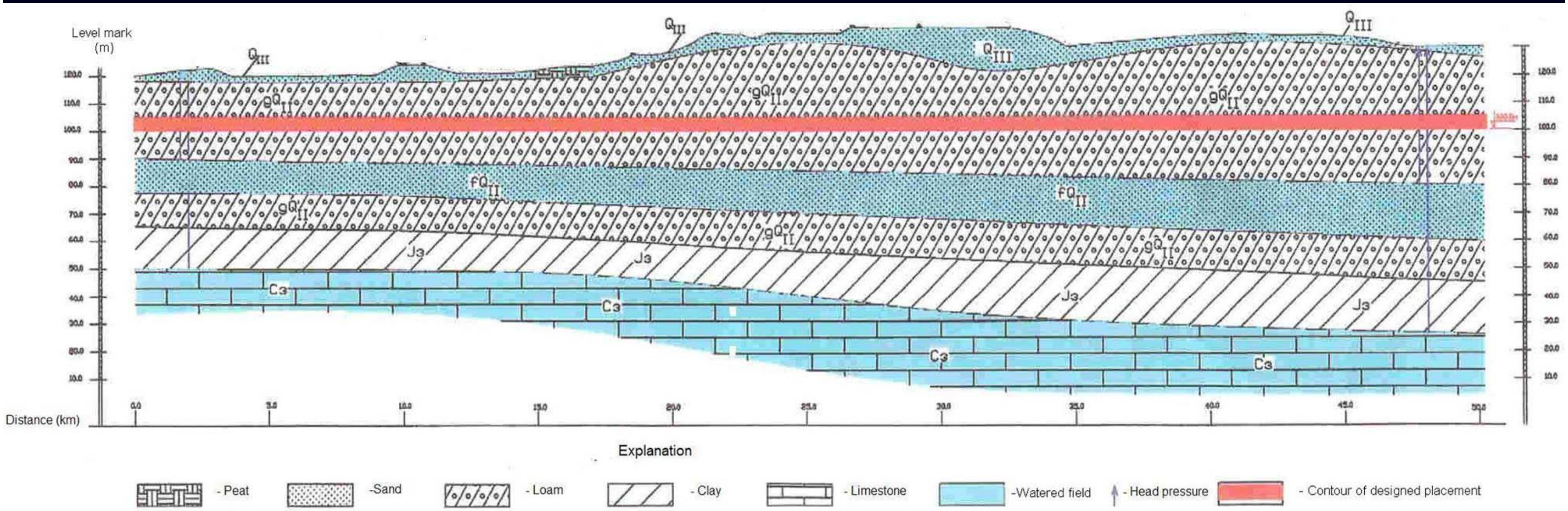
large steel columns down to floor level would be needed

Proposed new cross section for ILC Interaction Region

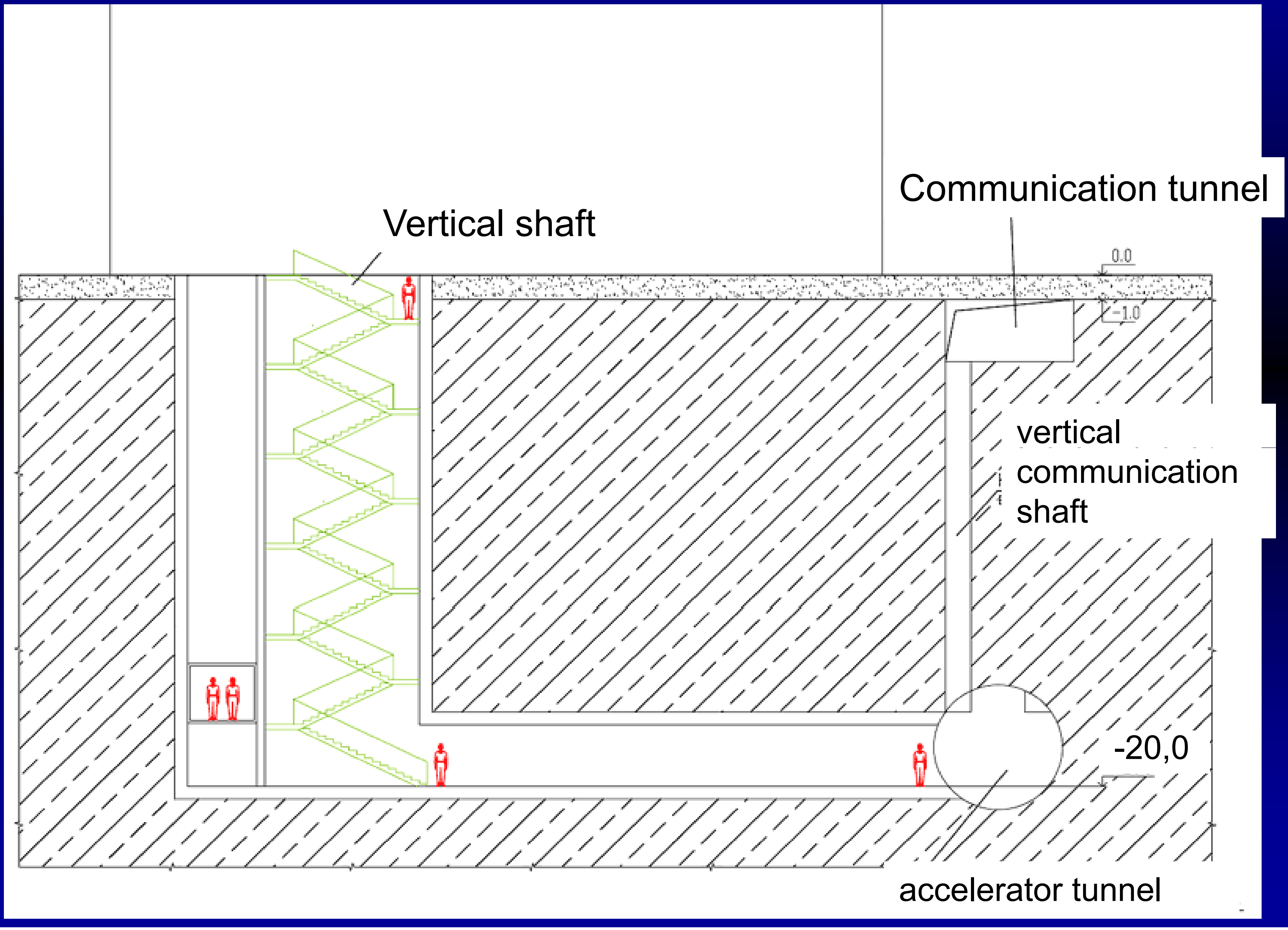


Proposed Dubna siting

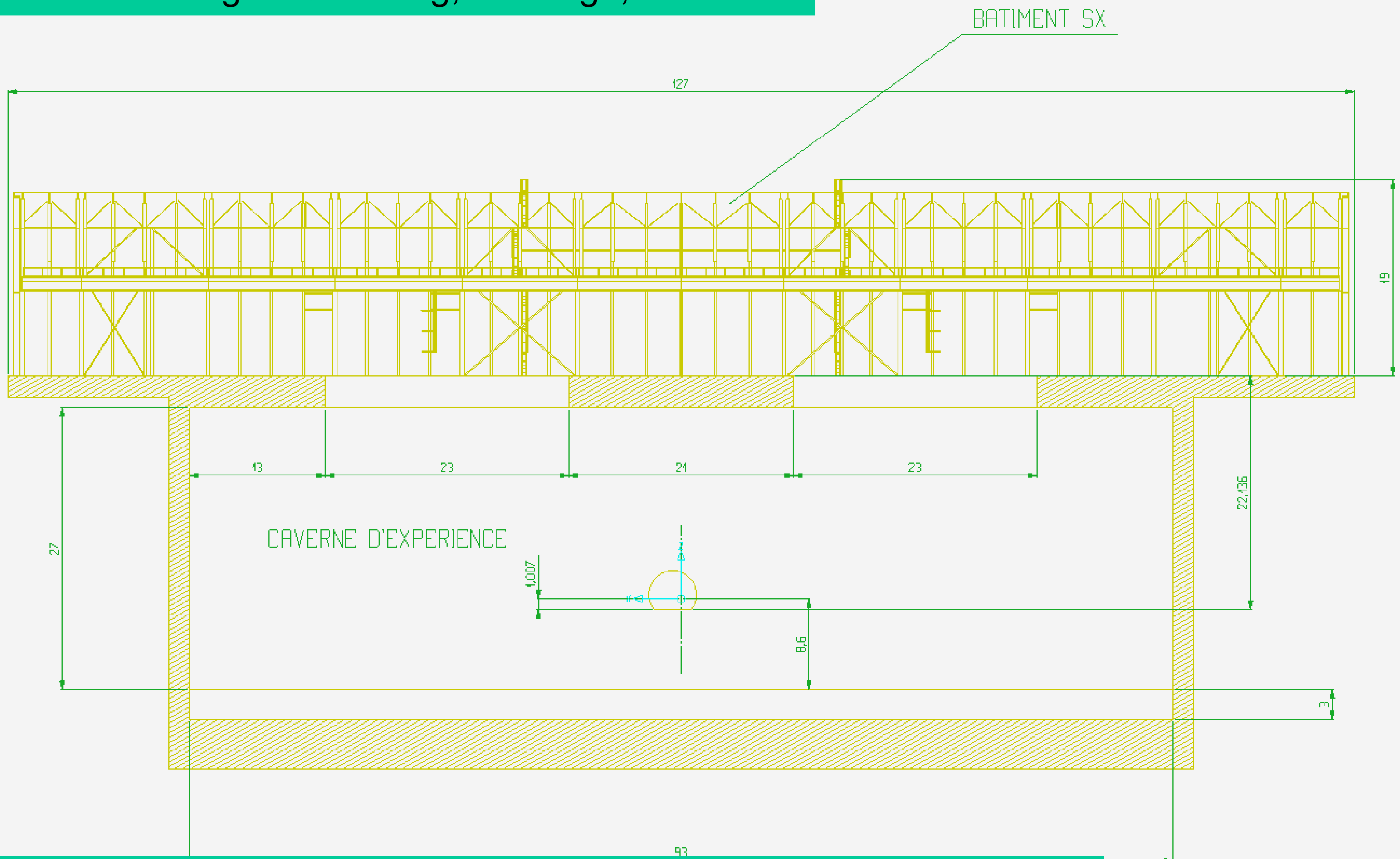
The ILC linear accelerator is proposed to be placed in the drift clay at the depth of 20 m (at the mark of 100.00 m) with the idea that below the tunnel there should be impermeable soil preventing from the underlying groundwater inrush. It is possible to construct tunnels of the accelerating complex using tunnel shields with a simultaneous wall timbering by tubing or falsework concreting.



Proposed Dubna typical cross section
Beam tunnel 20m below surface

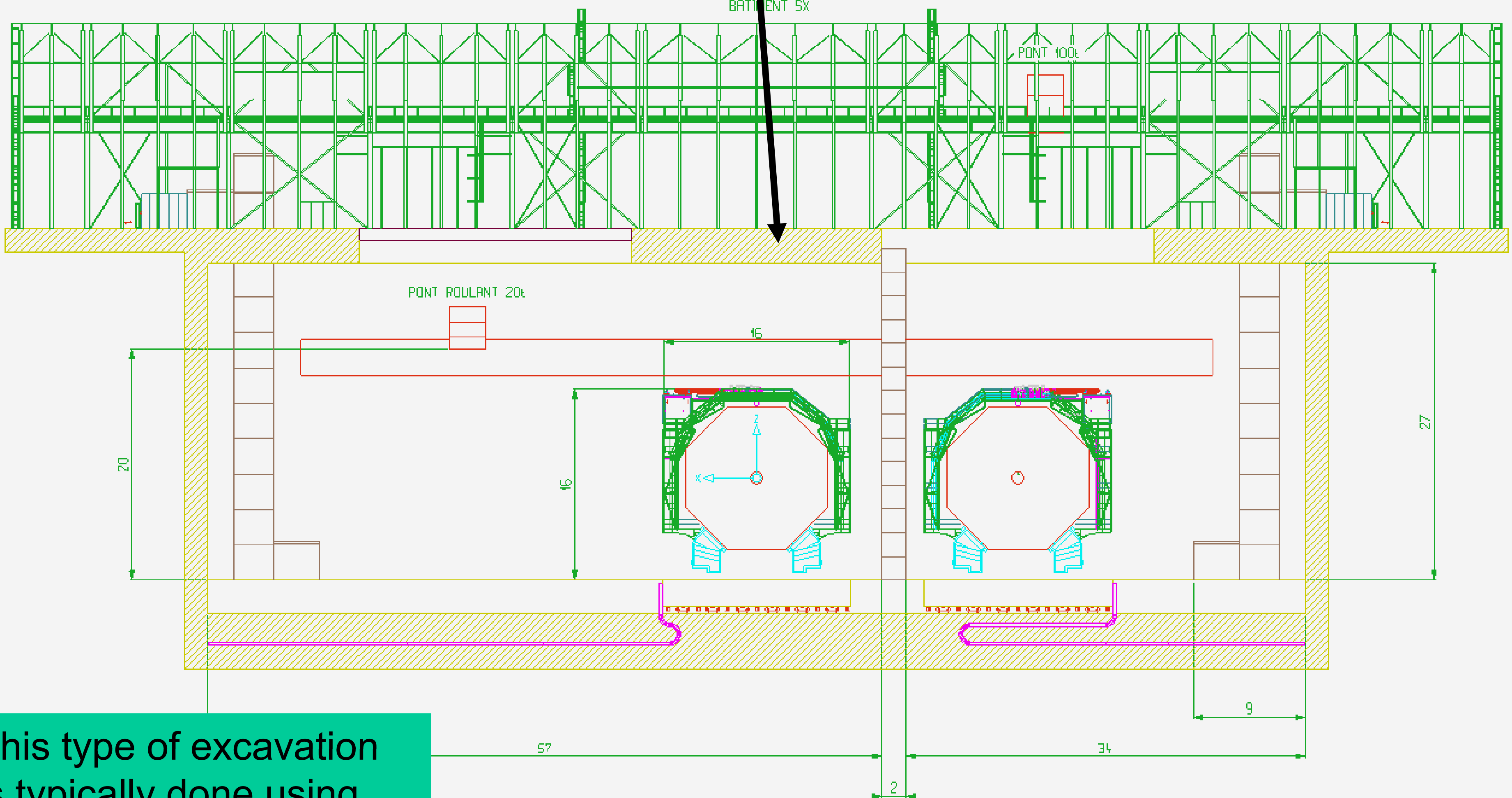


Surface building ≈ 130m long, 20m high, 40m wide



Sub-surface experimental hall ≈ 90m long, 30m deep, 35m wide

Permanent central propping needed due to large span via concrete slab



This type of excavation is typically done using 'diaphragm wall' technique

Diaphragm walling : excavation is supported via bentonite slurry, wall concreted in ‘panels’ down to required depth from surface

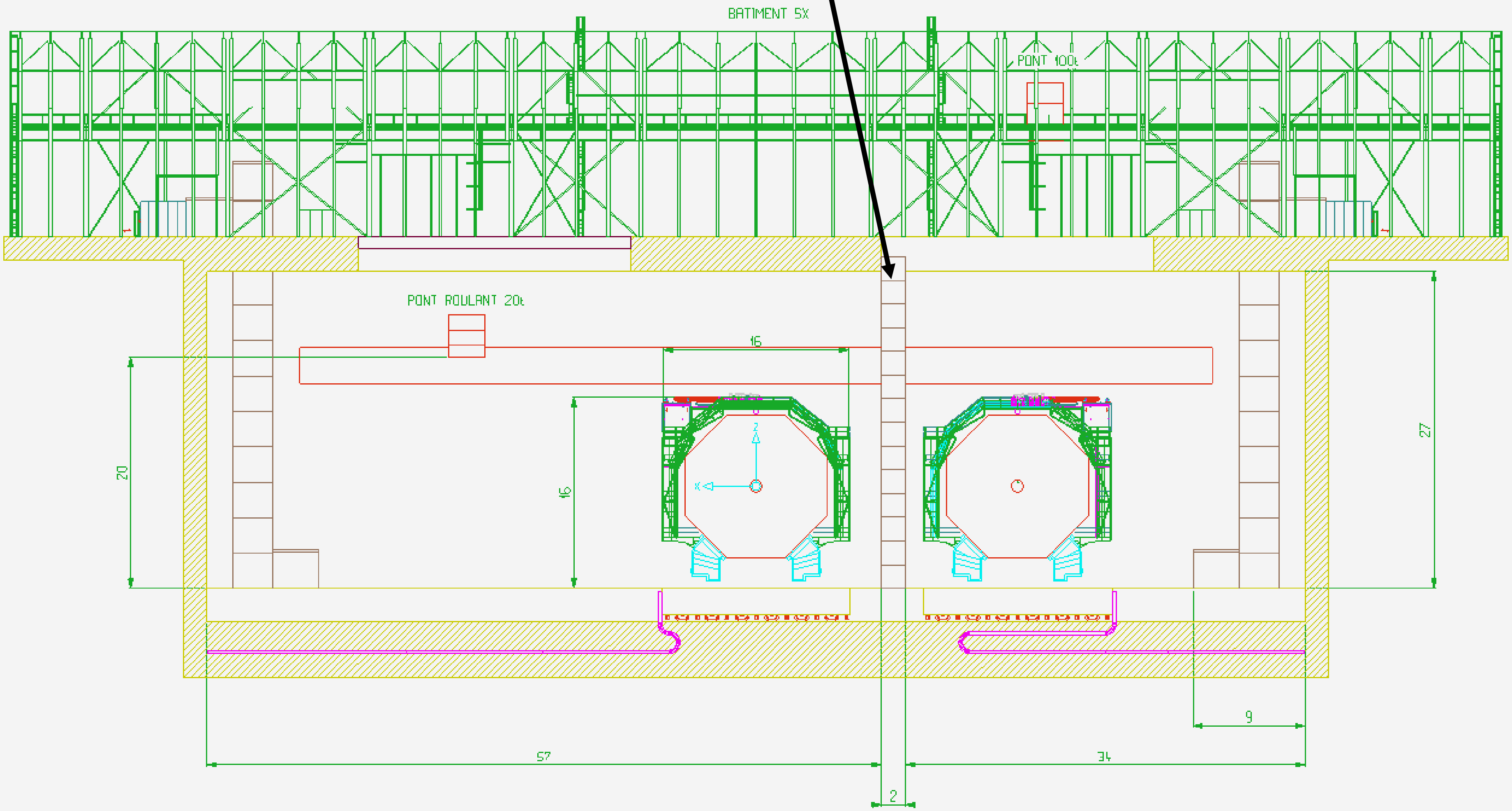
Shaft or hall excavation within concreted wall

TI2 Area - Start of excavation of PMI 2 shaft - February 17, 1999 - CERN ST-CE

TI2 Area - Excavation for PMI2 - February 26, 1999 - CERN ST-CE

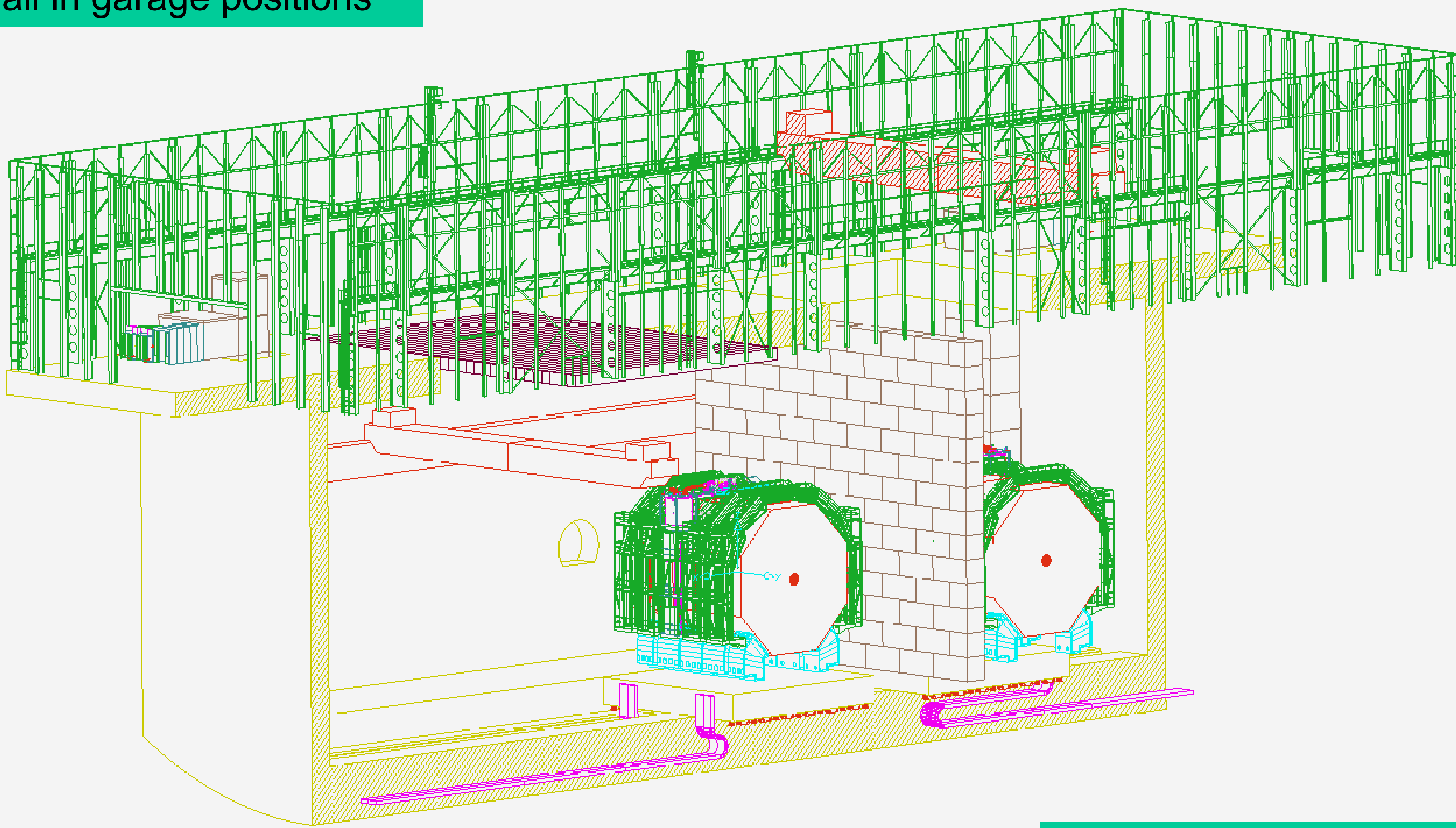
Shaft or hall excavation within concreted wall, often temporary internal struts are needed prior to permanent propping.

2m reserved for shielding

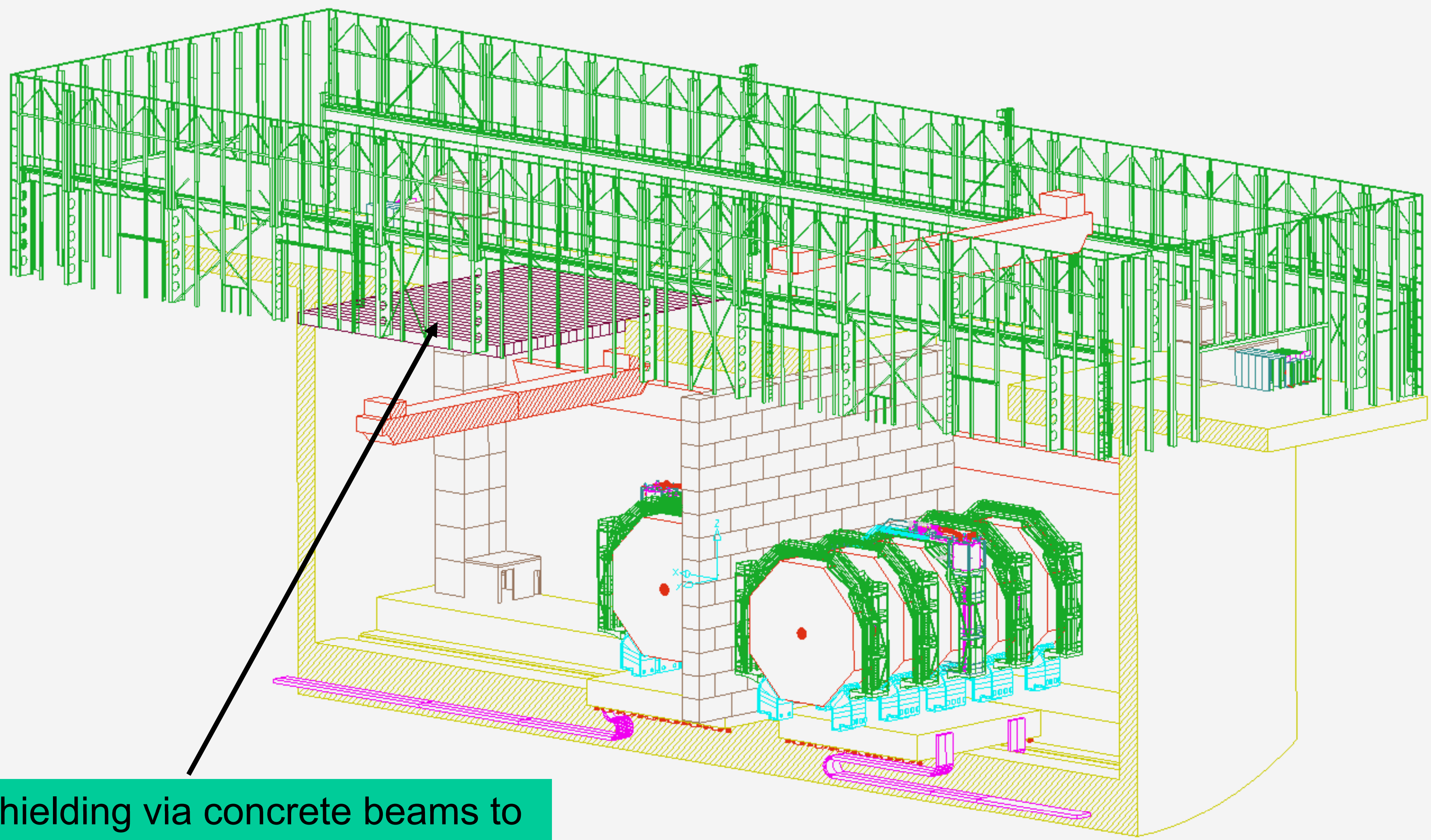


Push-Pull configuration on mobile platforms and cable chains for services

100ton gantry crane in surface building for detector assembly directly in experimental hall in garage positions

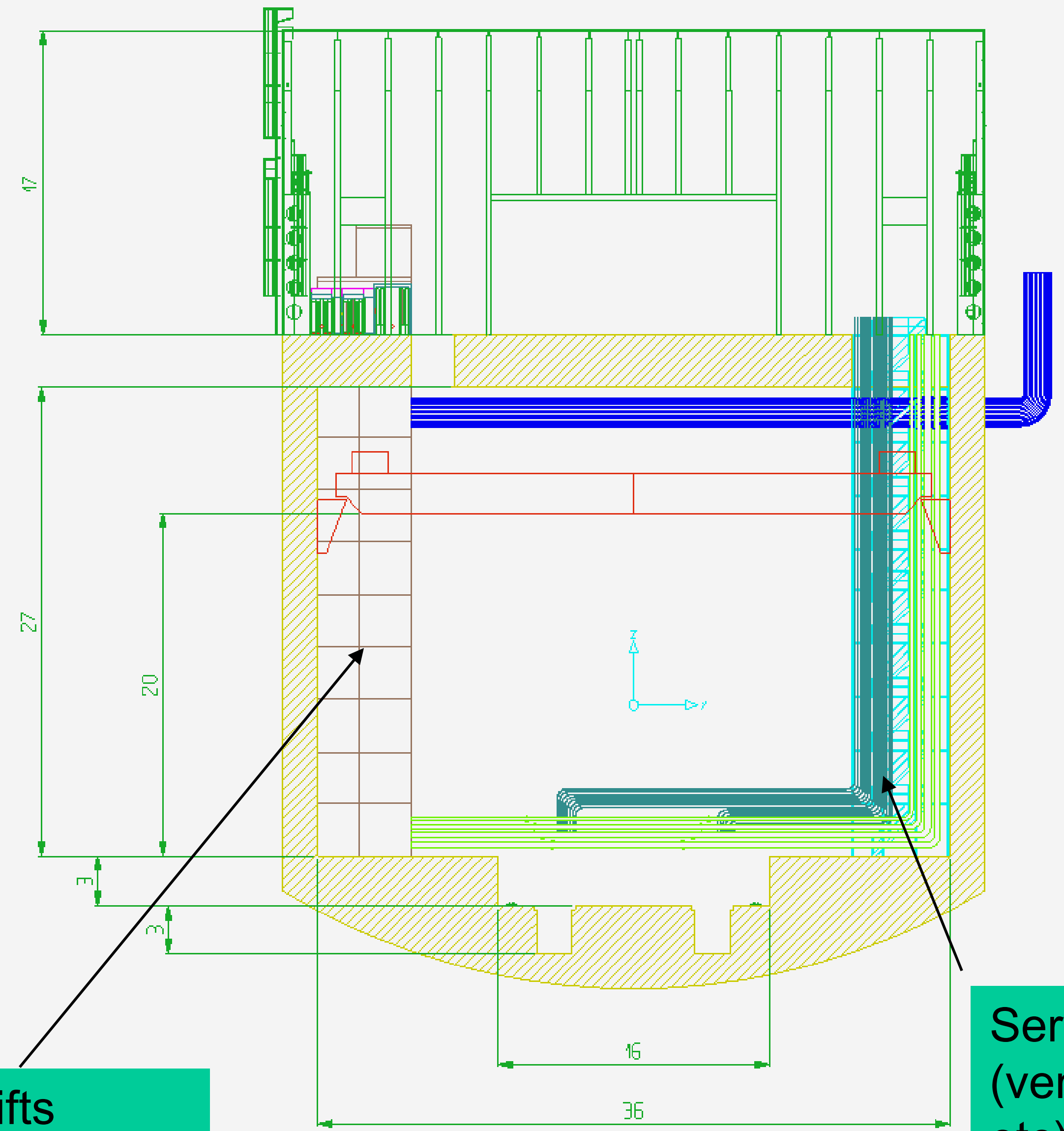


20ton crane in experimental hall



Shielding via concrete beams to close opening over 'on-line' detector (same shielding used for both detectors)

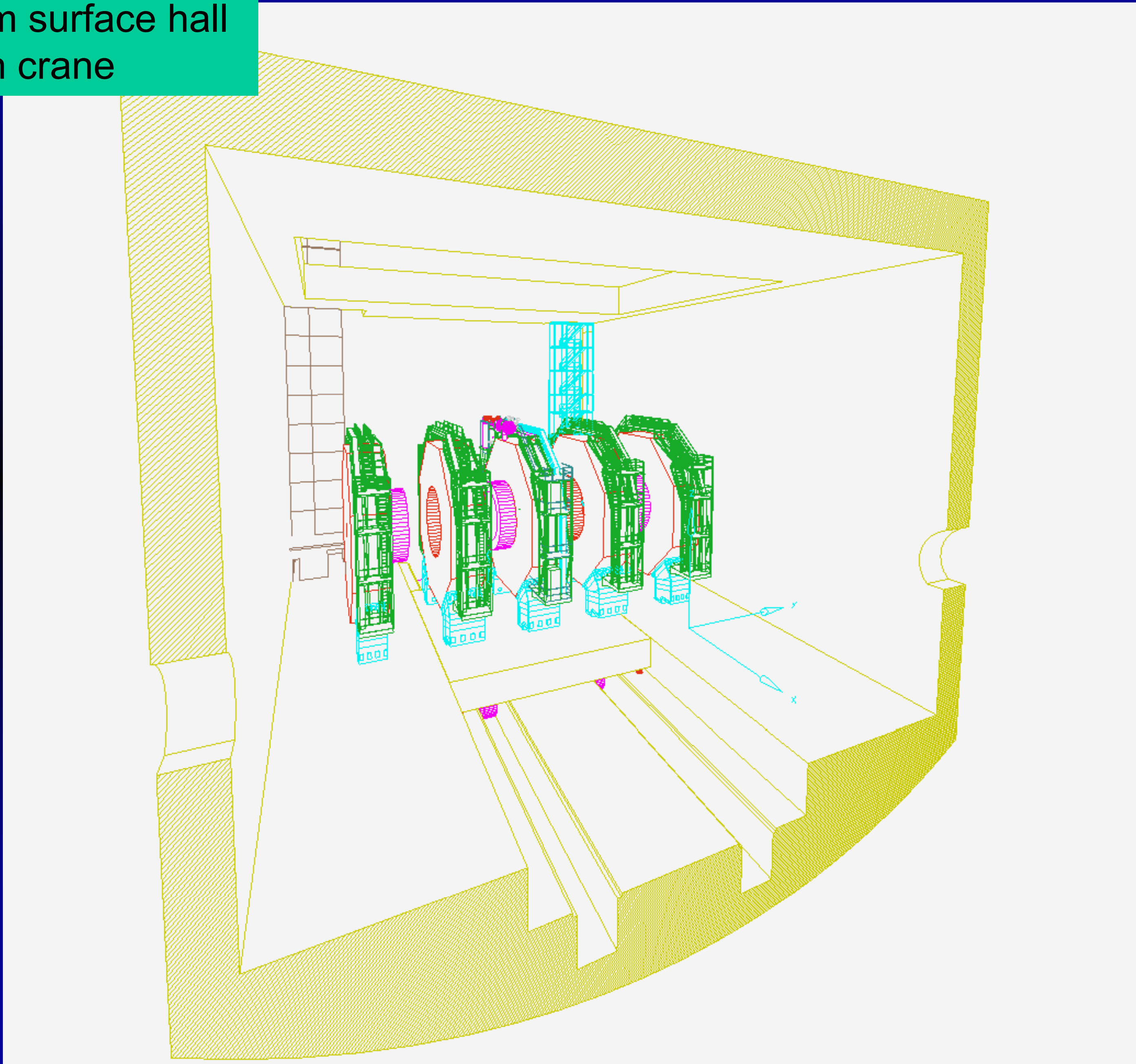
Hall dimensions based on GLD dimensions 2007

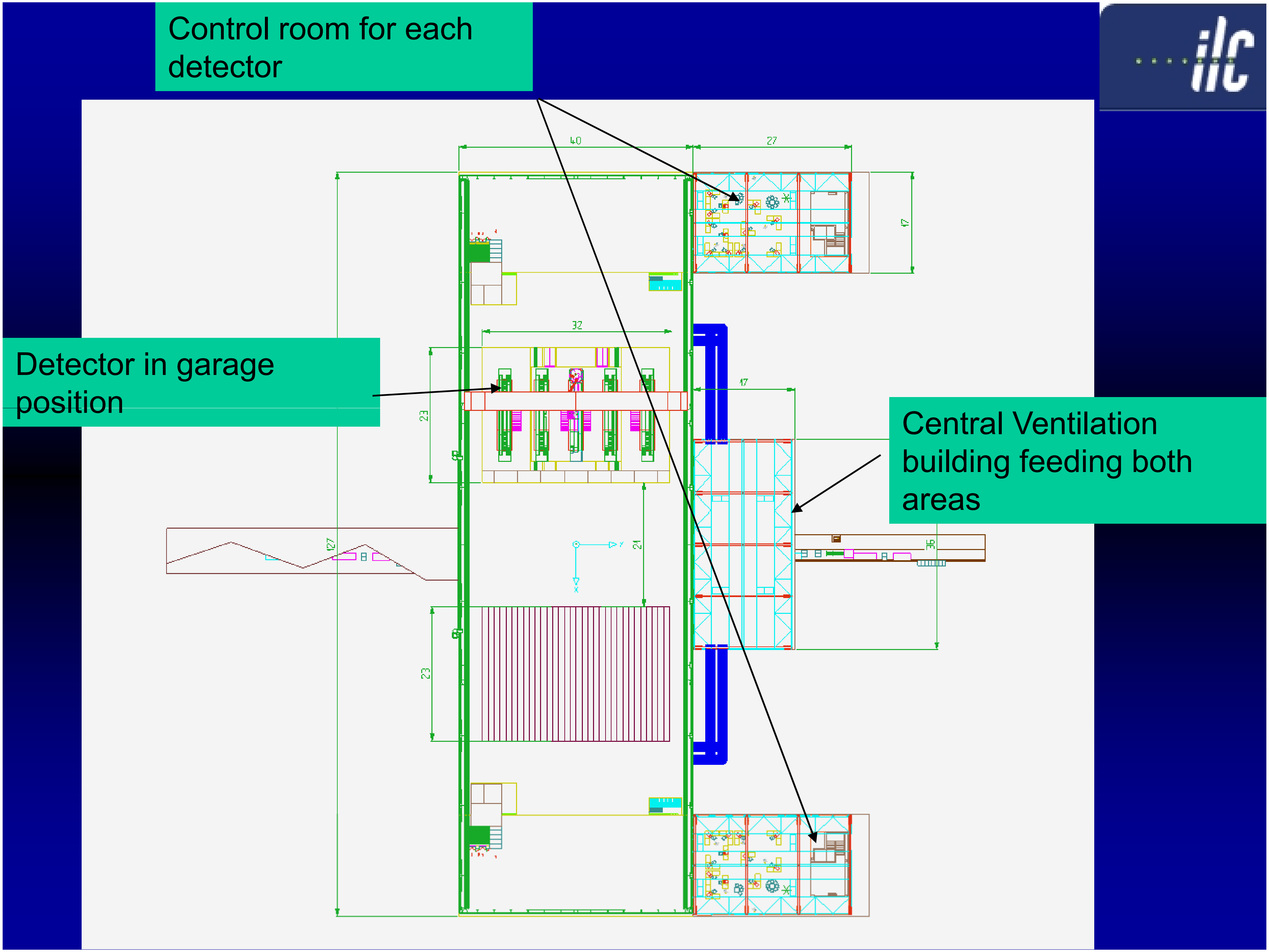


Two personnel lifts giving access/egress

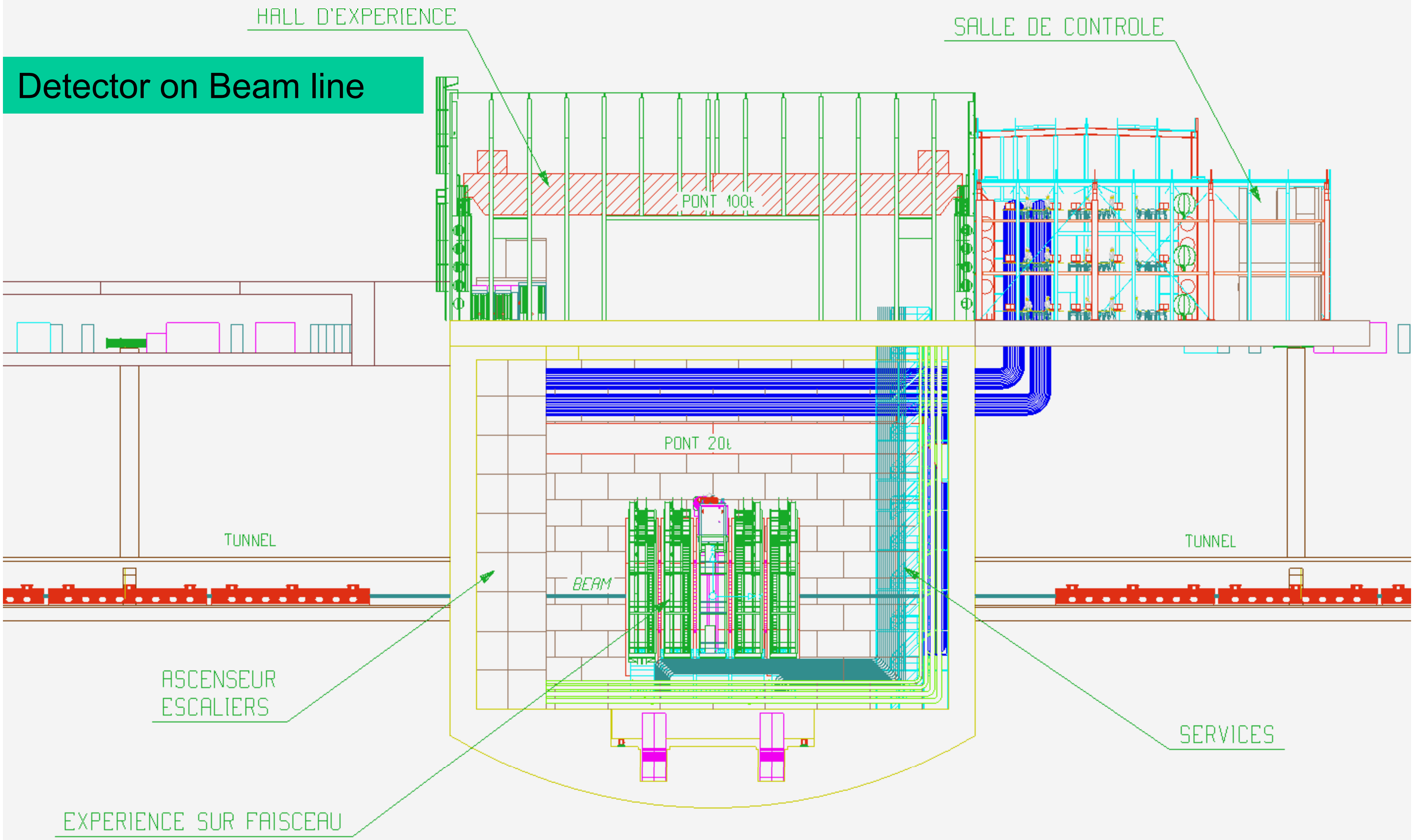
Services columns (ventilation, electricity etc)

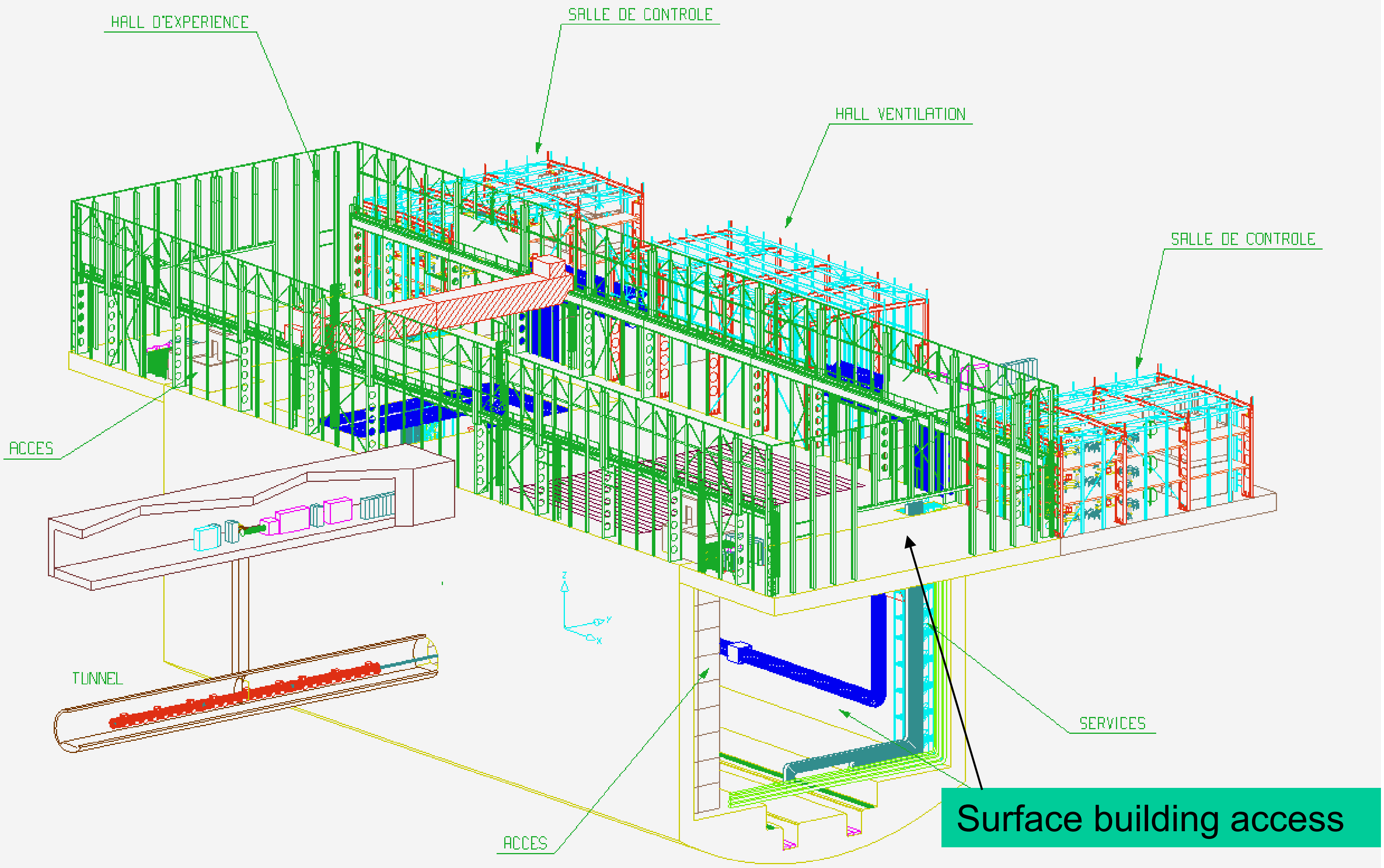
Detector in ‘garage’ position showing direct access from surface hall with 100ton crane

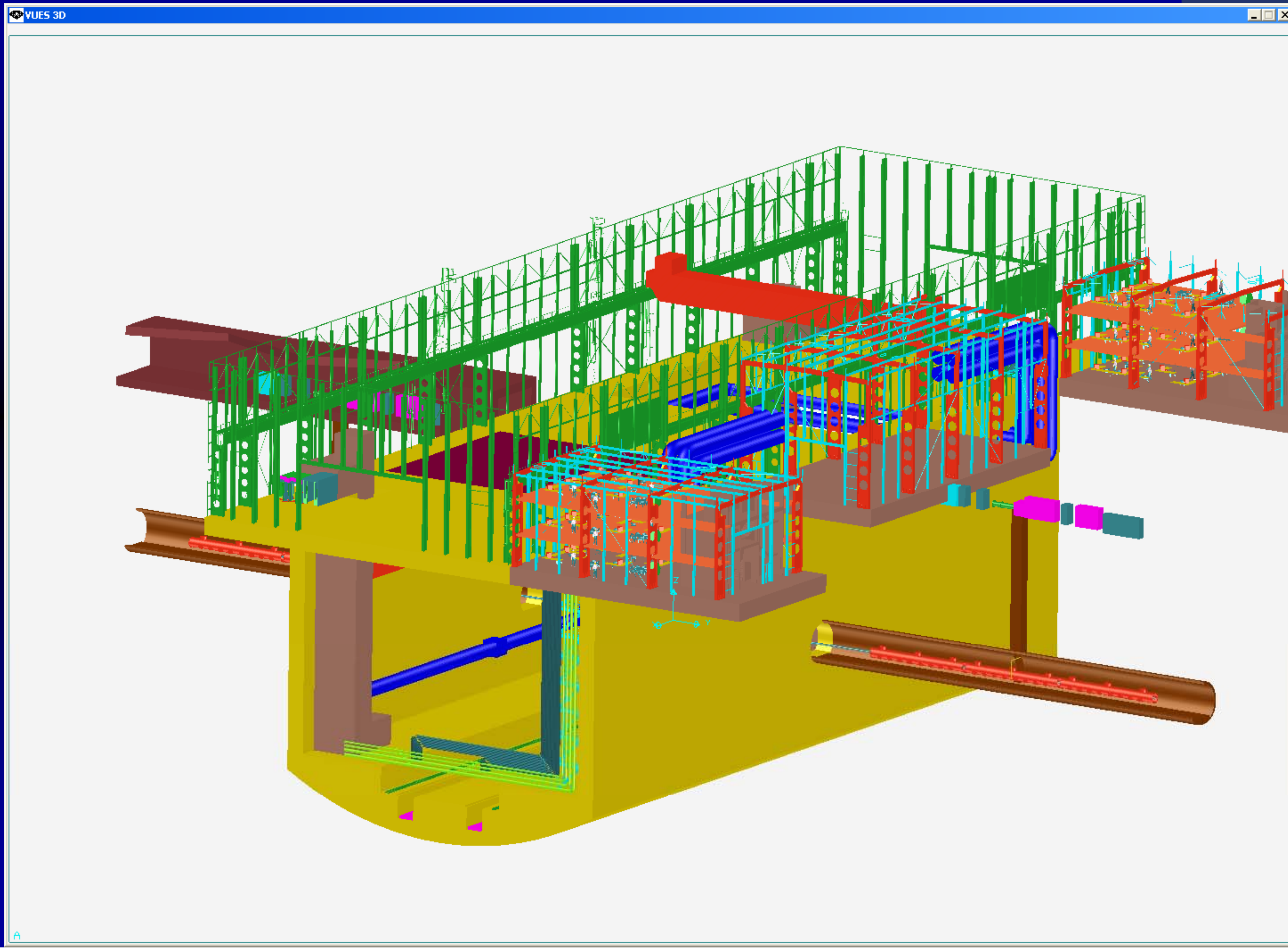



Control room for each detector
Detector in garage position
Central Ventilation building feeding both areas
40
27
17
32
23
17
127
21
35
23

Detector on Beam line




HALL D'EXPERIENCE
SALLE DE CONTROLE
HALL VENTILATION
SALLE DE CONTROLE
ACCES
TUNNEL
SERVICES
ACCES
Surface building access


VUES 3D