

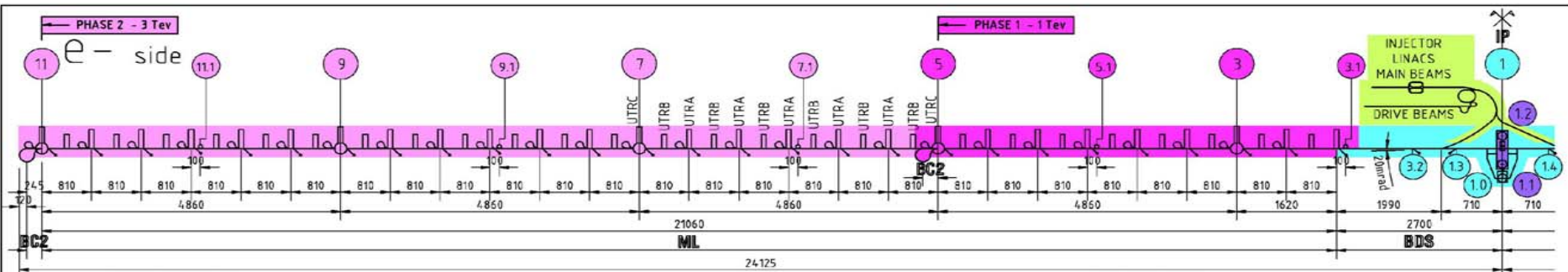
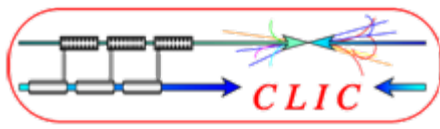
CLIC workshop – Working group: Two beam hardware and Integration

CLIC Civil Engineering Layouts & Tunnel Cross Section

John Osborne TS-CE

Acknowledgements : C.Wyss, J-L Baldy, N.Baddams

Civil Engineering Layouts & Tunnel Cross Section



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	6 480	5 400	6 480	2 216	1430	2 516	26 520
Phase 2	1508	490	14 335	-	14 335	-	-	-	30 668
Total	3016	980	20 815	5 400	20 815	2 216	1430	2 516	57 188

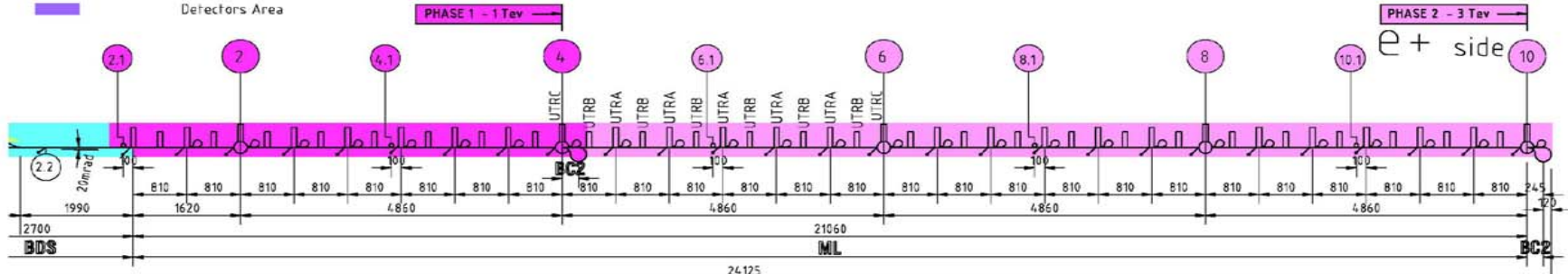
SITE LENGTHS (m)

	main beam turn-around	BC2	e- side ML	BDS	e+ side ML	TOTAL
Phase 1	240	490	6 480	5 400	6 480	19 090
Phase 2	240	490	14 215	-	14 215	29 160
Total	480	980	20 695	5 400	20 695	48 250

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	ø4.5 m

- Legend :** Phase 1 Phase 2
- Main/Drive beam Injectors
 - BDS
 - Detectors Area



SHAFTS

Point	1.0	1.1	1.2	2	3	4	6	7	8	9	10	11
øm	9	16	16	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	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	14 x 30 x
(LxWxH) m	25 x 9 x 7.2

UTRB CAVERNS

Nombre	16 x 36 x
(LxWxH) m	20 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 x 9 x 7.2 + 15 x 9 x 7.2

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 18 x 36 x
(LxWxH) m	6 x 9 x 5

DRIVE BEAM RETURN LOOP

Nombre	16 x 36 x
(LxWxH) m	63 x 2.4 x 3

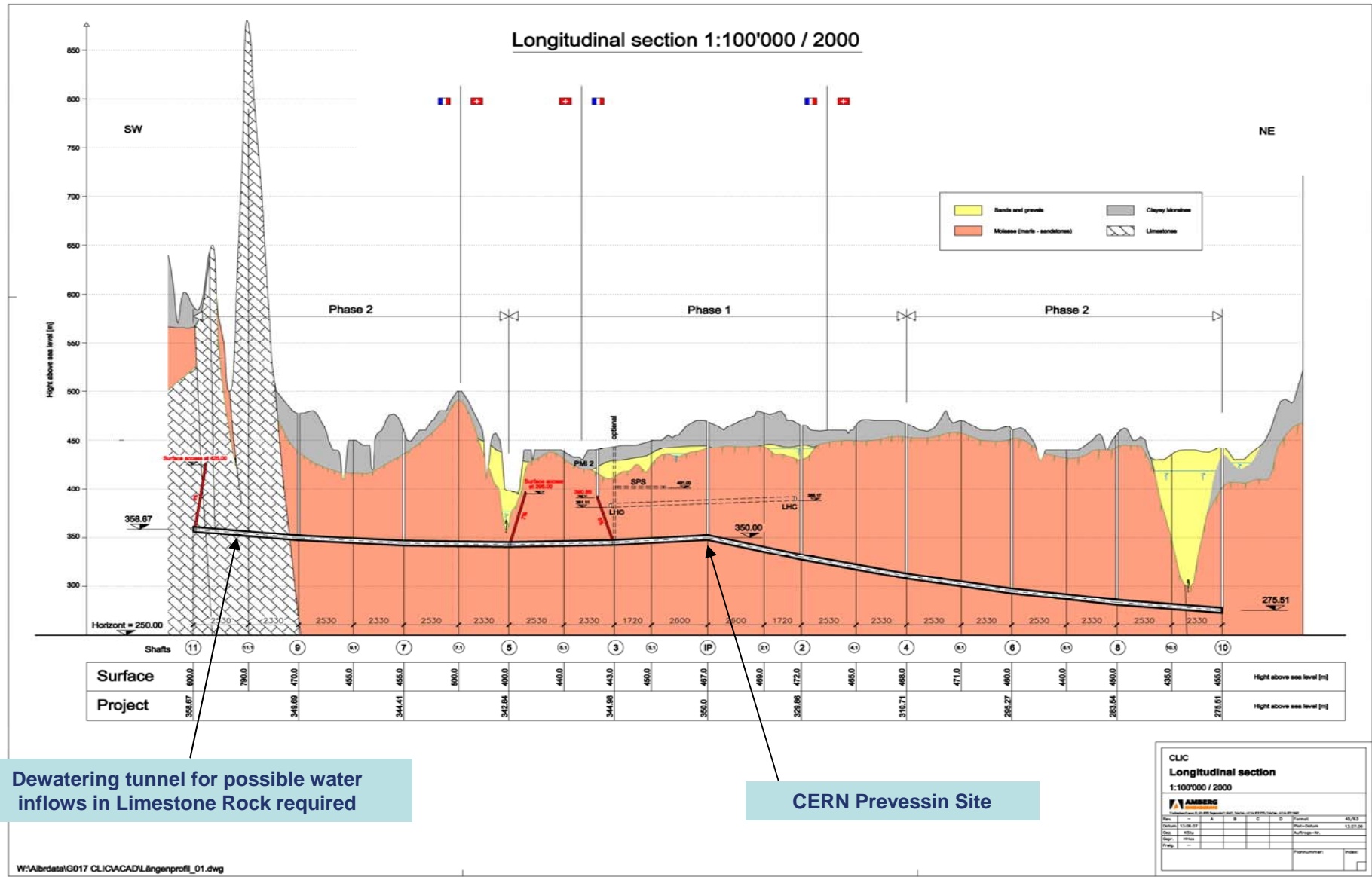
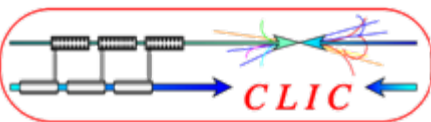
UTR = Underground Technical Room

CLIC - UNDERGROUND STRUCTURES SCHEMATIC LAYOUT(COLOURED BY ZONES)



SCALE : 1/62500(A3_FORMAT) DATE : 10_JULY_2007
 SUPERVISOR : J.L.BALDY
 DESIGNER : N.BADDAMS
 CLIC.CE-1.1749.0003 3 -

Civil Engineering Layouts & Tunnel Cross Section

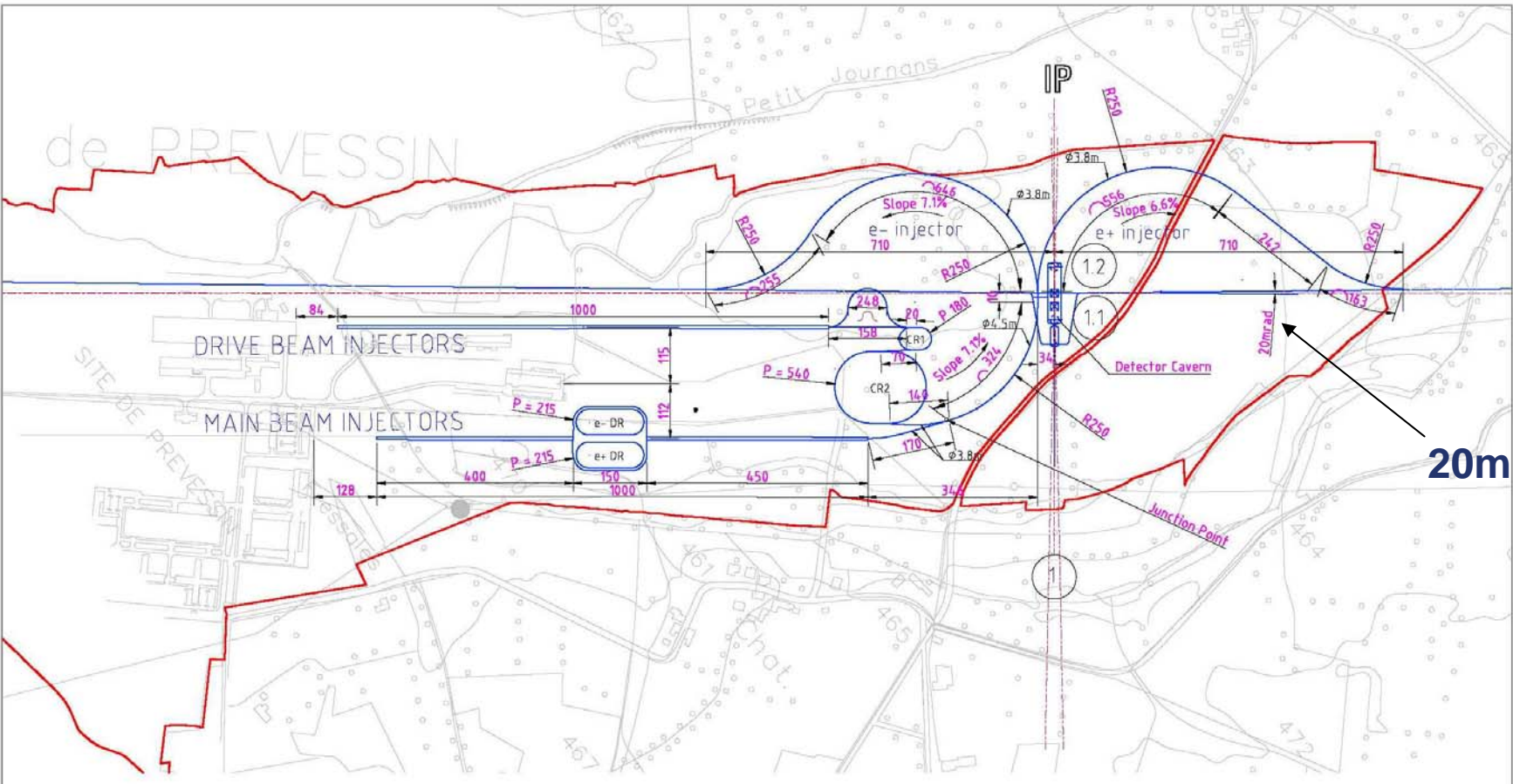
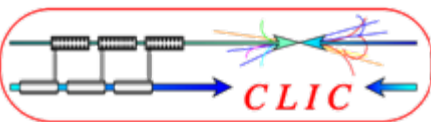


Dewatering tunnel for possible water inflows in Limestone Rock required

CERN Preessin Site

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Civil Engineering Layouts & Tunnel Cross Section



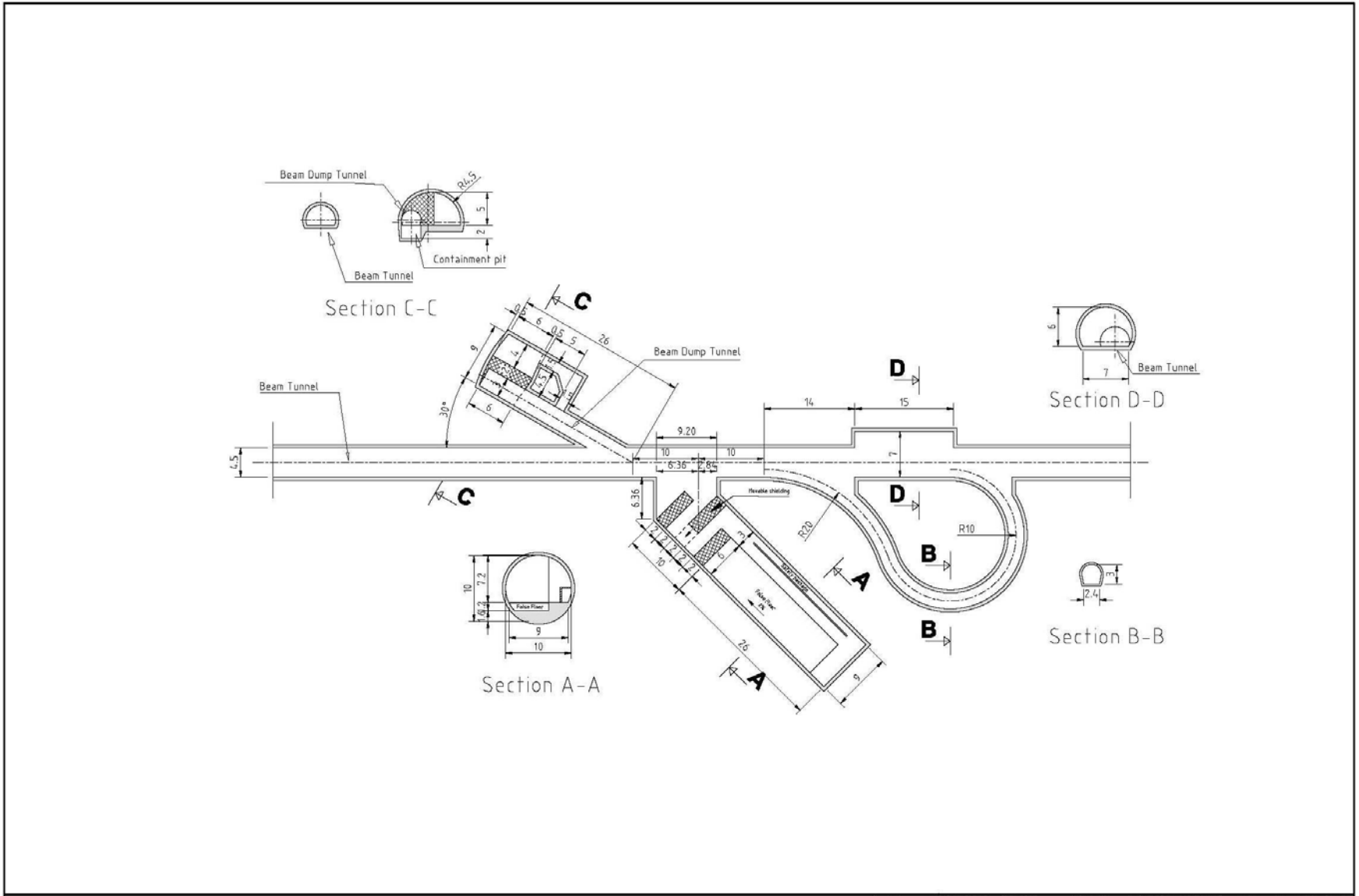
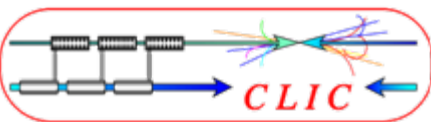
INJECTORS TUNNELS	DRIVE BEAM INJECTORS COMPLEX					MAIN BEAM INJECTORS COMPLEX						COMMON & FINAL TRANSFER TUNNELS (after Junction Point)		
	LINAC	DELAY LOOP	CR 1	CR 2	TT to Junction Point	LINAC 1	e- DR	e+ DR	DR Link	LINAC 2 + BC 1	TT to Junction Point	COMMON	e- TT	e+ TT
Length (l) m	1000	406	180	540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

CLIC- MAIN / DRIVE BEAM INJECTORS AND EXPERIMENTAL AREA LAYOUT



 SCALE : 18500(A3_FORMAT) DATE : 12_JUNE_2007
CIVIL ENGINEERING
 SUPERVISOR : J.L.BALDY
 DESIGNER : N.BADDAMS
 CLIC.CE-1.1799.0002 3 | D

Civil Engineering Layouts & Tunnel Cross Section



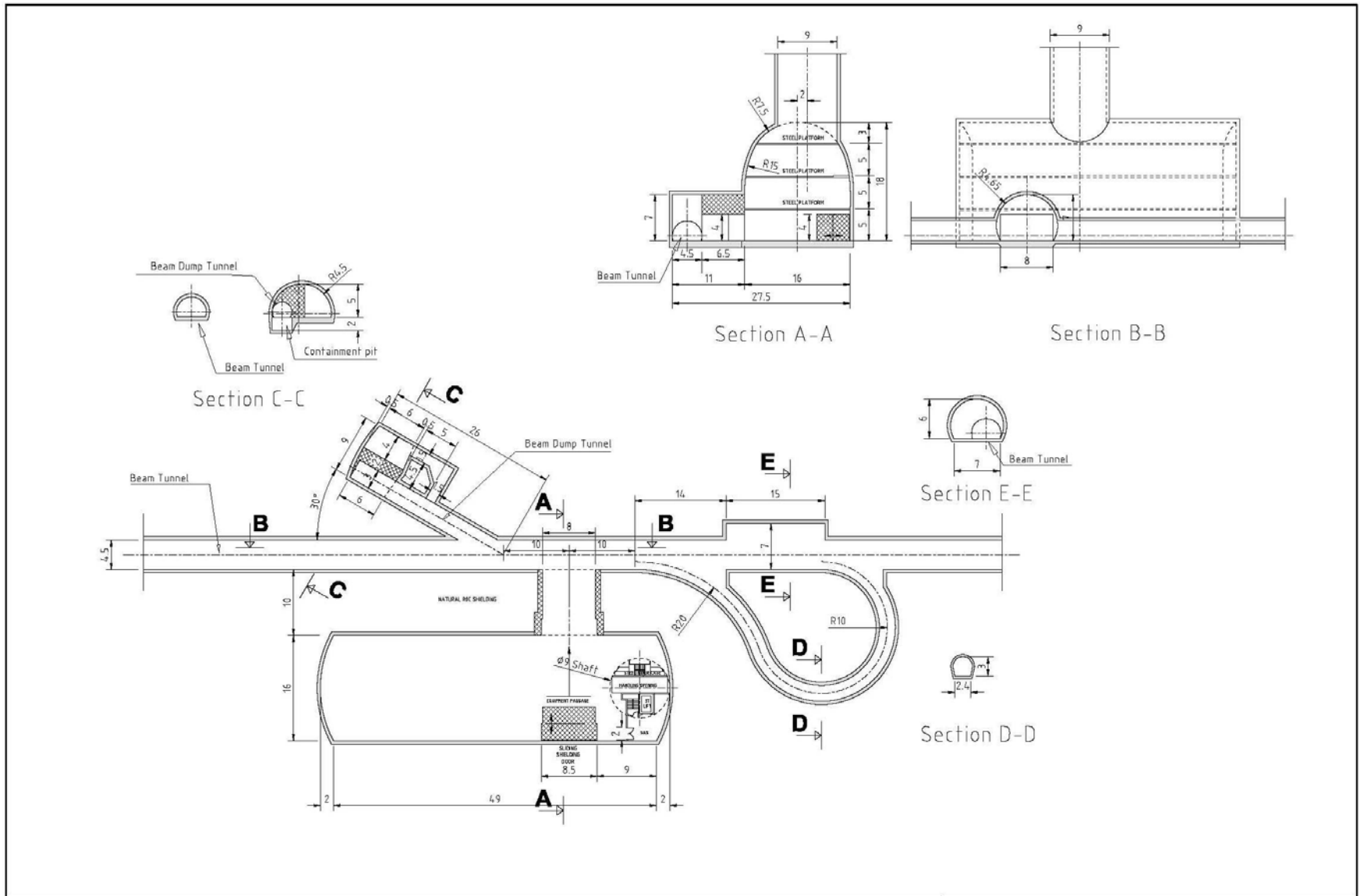
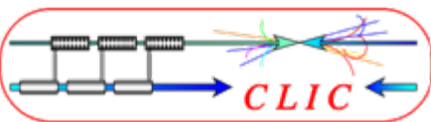
CLIC - ULTRA CAVERN, DRIVE BEAM LOOP AND BEAM DUMP



GROUP : TS-CE
CIVIL ENGINEERING
 SUPERVISEUR : J.L.BALDY
 DESIGNER : N.BADDAMS

SCALE : 1/500(A3_FORMAT) DATE : 22_MAY_2007
 CLIC-.CE-1.1710.0002 3 A

Civil Engineering Layouts & Tunnel Cross Section

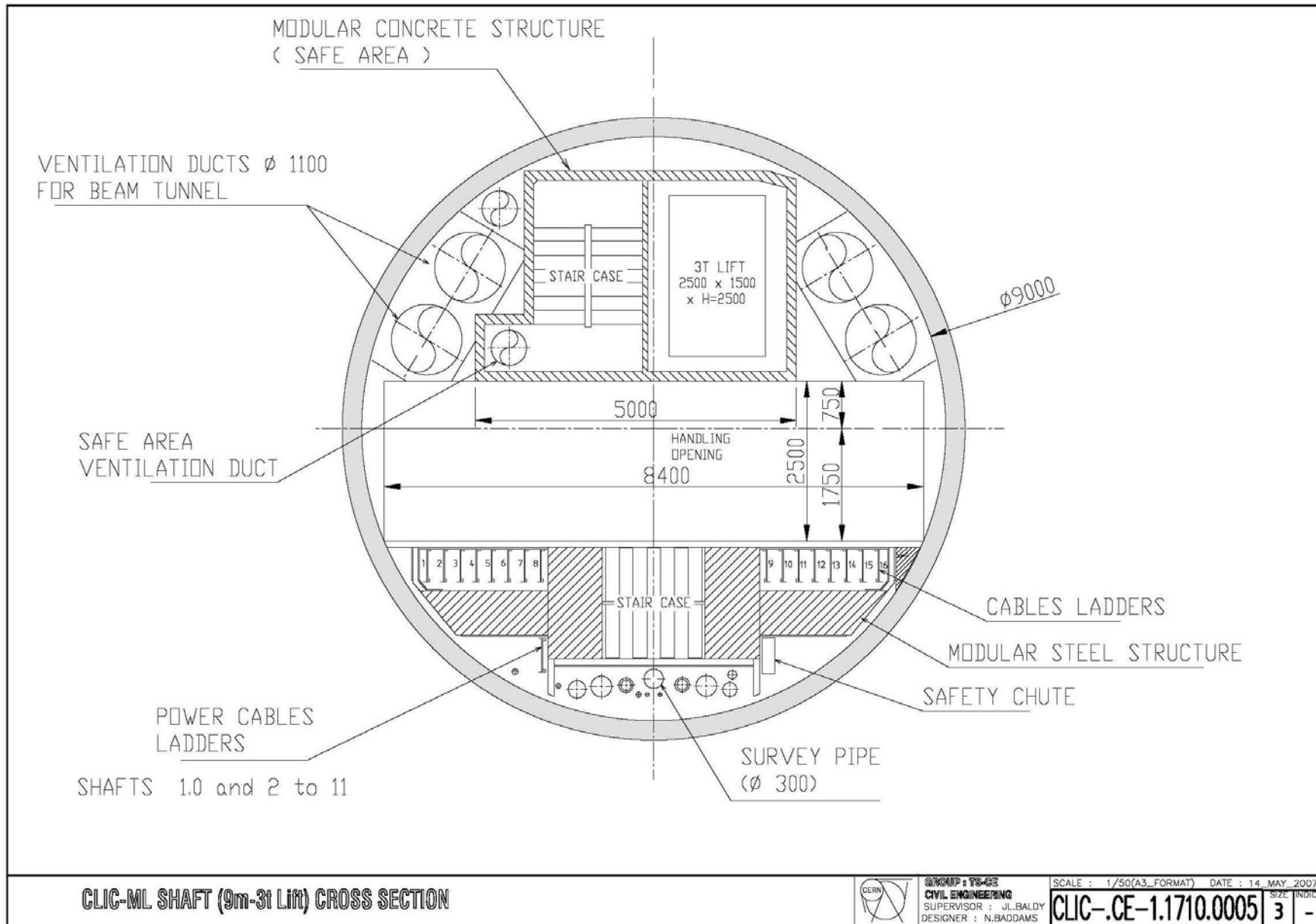
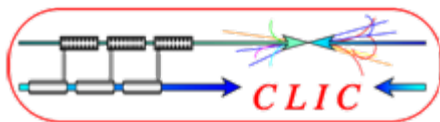


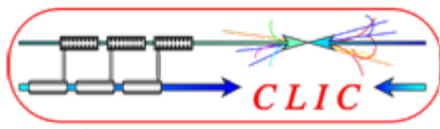
CLIC - UTRC CAVERN, DRIVE BEAM LOOP AND BEAM DUMP



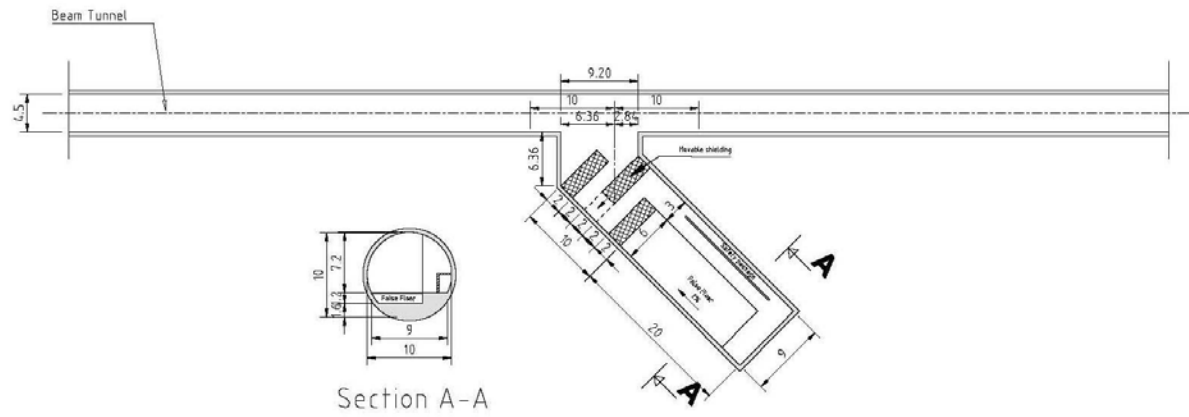
GROUP : TS-CE
CIVIL ENGINEERING
 SUPERVISEUR : J.L.BALDY
 DESIGNER : N.BADDAMS

SCALE : 1/500(A3_FORMAT) DATE : 22_MAY_2007
 SIZE INDEX
CLIC-.CE-1.1710.0001 3 A





UTRB Caverns to be deleted ?

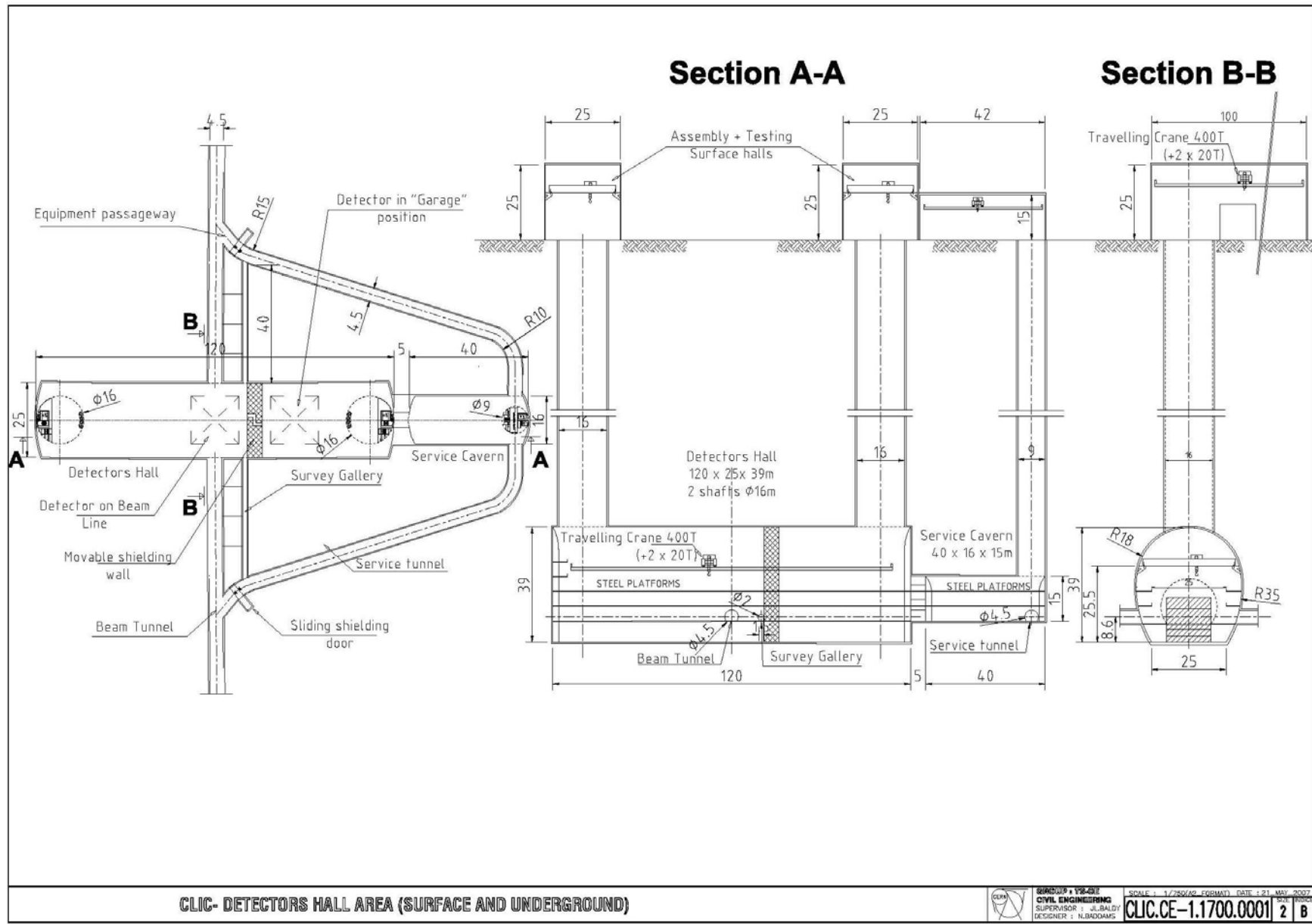
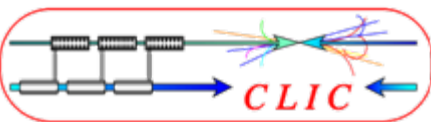


CLIC - UTRB CAVERN



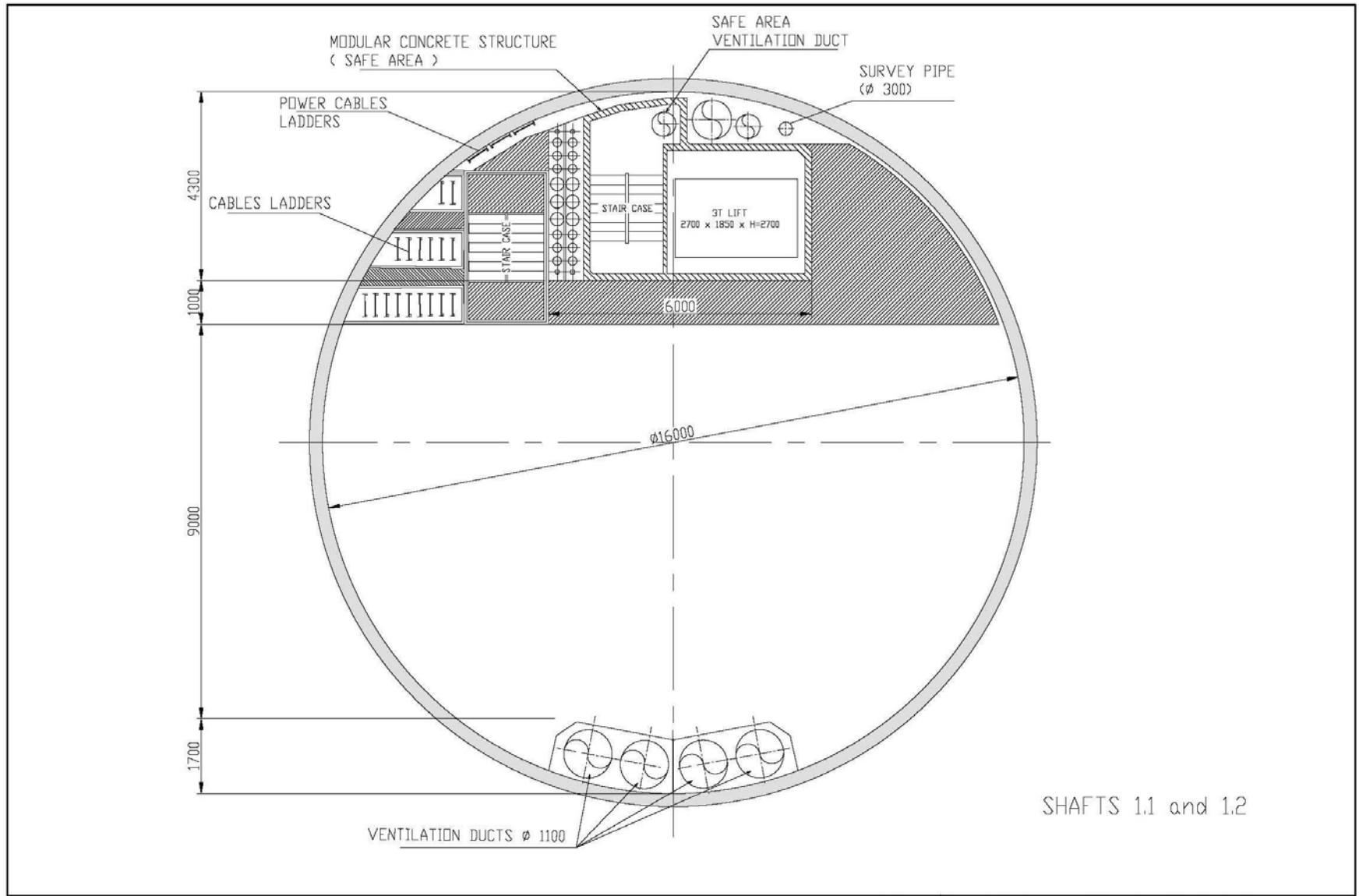
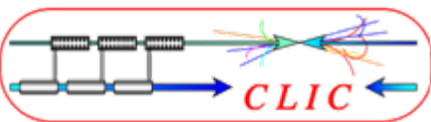
GROUP 8 TS-CE
CIVIL ENGINEERING
 SUPERVISEUR : J.L.BALDY
 DESIGNER : N.BADDAMS

SCALE : 1/500(A3_FORMAT) DATE : 14_MAY_2007
CLIC-.CE-1.1710.0003 SIZE INDICE
3 -



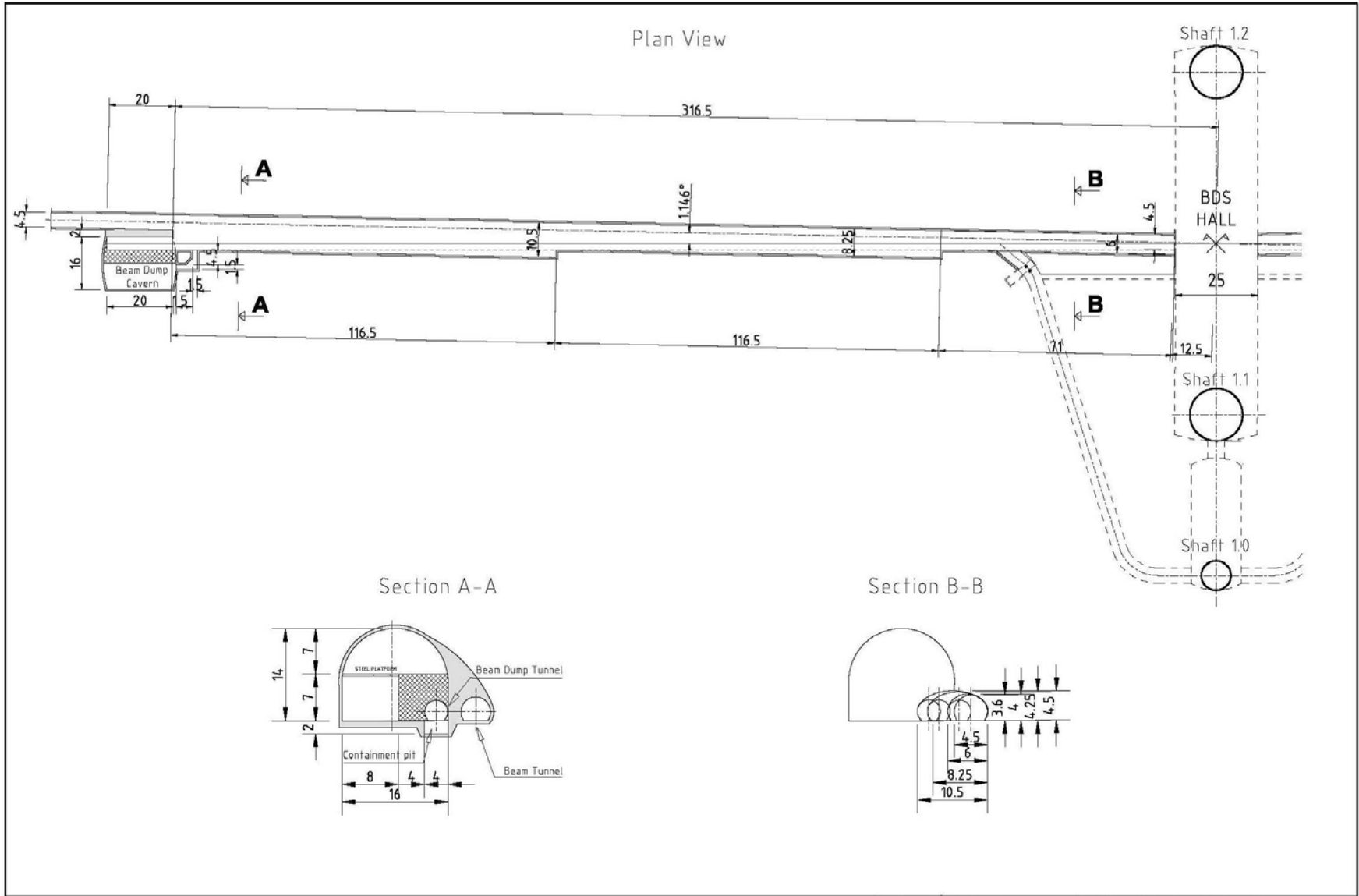
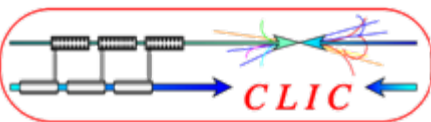
CLIC- DETECTORS HALL AREA (SURFACE AND UNDERGROUND)

	SURVEYOR : YR-01E CIVIL ENGINEERING SUPERVISOR : J.L.BALDY DESIGNER : N.BADOMG	SCALE : 1/750(A4 FORMAT) DATE : 21 MAY 2007 CLIC.CE-1.1700.0001 2 B
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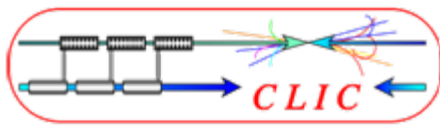
CLIC -DETECTOR SHAFT (16m-3t Lift) CROSS SECTION

	GROUP : TS-CE CIVIL ENGINEERING	SCALE : 1/75(A3_FORMAT) DATE : 14_MAY_2007
	SUPERVISOR : J.L.BALDY DESIGNER : N.BADDAMS	SIZE INVOICE CLIC.CE-1.1700.0002
	3 -	



CLIC-BDS MAIN BEAM DUMPS

	GROUP TS-CE CIVIL ENGINEERING	SCALE : 1/1000(A3_FORMAT) DATE : 22_MAY_2007
	SUPERVISOR : J.L.BALDY	SIZE INDEX
	DESIGNER : N.BADDAMS	3 A



- Possible Modifications to be studied on General Layouts :

- Delete UTRB Caverns

- Reduced Number of sectors to 24 (from 26) per side

- Increase drive beam sector length to 868m (from 810m)

Overall parameter

center of mass energy	3	TeV
main linac RF frequency	11.994	GHz
luminosity	5.9×10^{34}	$\text{cm}^{-2}\text{s}^{-1}$
unloaded/loaded gradient	120/100	MV/m
proposed site length	49.7	km
overall two linac length	41.7	km

Main linac

fill factor	78.6	
accelerator structure length	229	mm

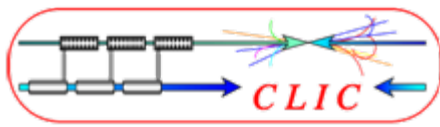
Decelerator

No. of drive beam sector/linac	24	
Drive beam sector length	868	m
No. of PETS per sector	1491	
Length of PETS (active)	213	mm
Nominal output RF power /PETS	136	MW
Transfer efficiency PETS - acc. structure	93.8	%
No. of acc. structure / PETS	2	
Main beam acc. power / PETS	2×63.9	MW
Energy (injection)	2.38	Gev
Energy (final)	238	MeV

Module

No. of module per sector	428
No. of module per linac	10275
No. of modules (2 linacs)	20549

	Acc. structure	PETS
No. per sector	2982	1491
No. per linac	71568	35784
No. (2 linacs)	143136	71568



• Tunnel Cross Section



ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

CLIC-Tech-Note-003

CLIC Technical Note

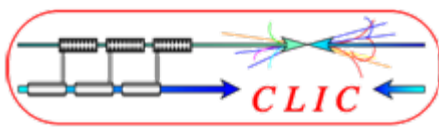
– Thanks to C.Wyss for carrying out this study up to now. In particular CLIC Technical Note :

– CLIC-Tech-Note-003 dated 20 August 2007

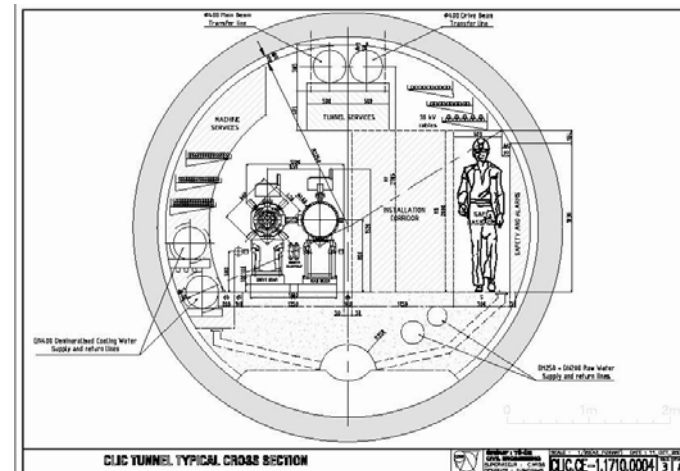
**Initial Considerations about the Cross-Section
of a Tunnel for CLIC**

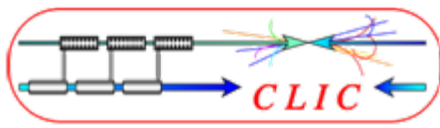
*C. Wyss
CERN, Geneva, Switzerland*

*Geneva, Switzerland
20 August 2007*



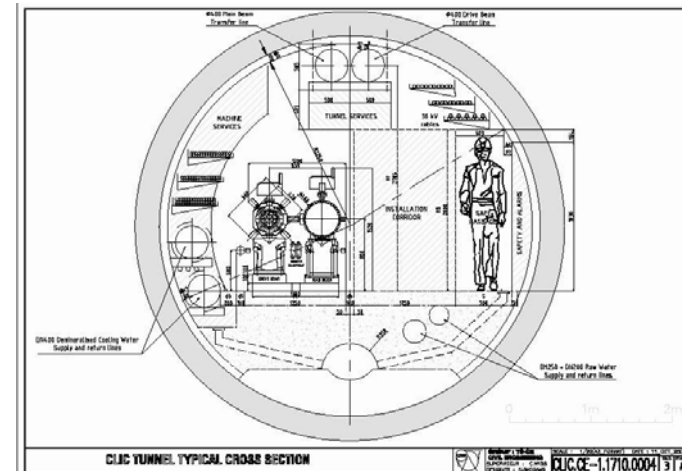
- The tunnel diameter has been initially dimensioned for the following items :
 - The CLIC machine, with their drive and main beam machine components.
 - The 2.4 GeV and 9 GeV transfer lines for the drive and main beams, respectively
 - An Installation corridor for the transportation of machine modules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

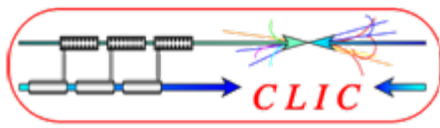




• Machine Services (1) :

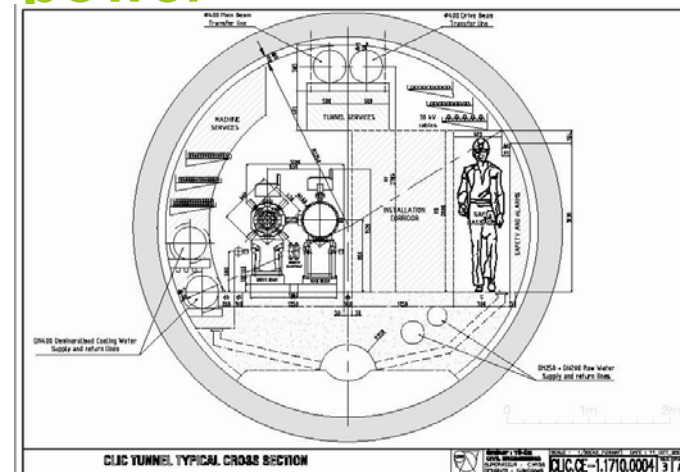
- Supply and return manifolds for demineralised water cooling.
- Raw water supply and return.
- Drainage pipe embedded in concrete invert for any water seepage
- Compressed air for PETS on/off mechanism
- Nitrogen distribution, if any
- One or two 40mm duct(s) for optical fibre links
- Two or three 500mm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

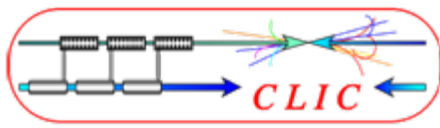




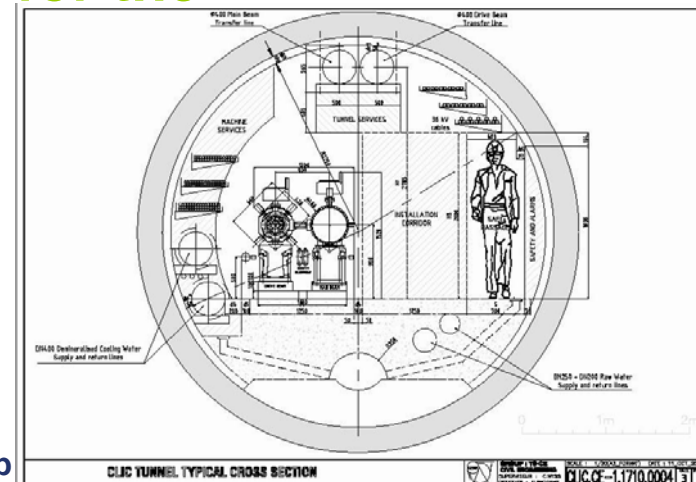
- Machine Services (2) :

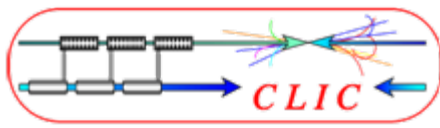
- A free section of at least 70cm width by 200cm for personnel passage between a module and the tunnel wall.
- One 500mm wide cable tray for low power and signal cables for the RF system
- One 500mm wide cable tray for beam instrumentation, survey and vacuum systems
- One 300mm wide cable tray for the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





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



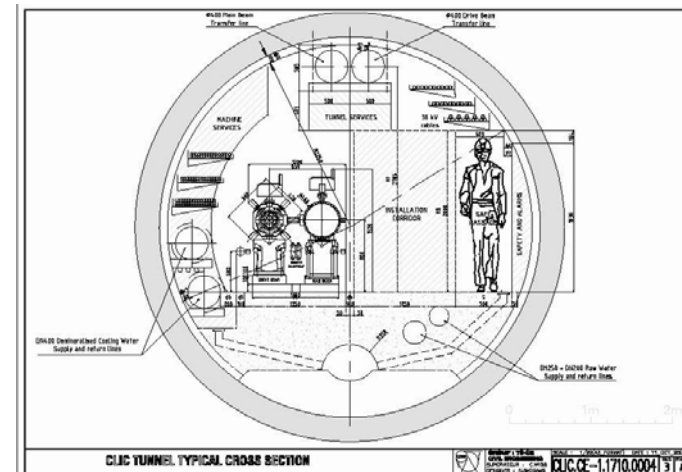


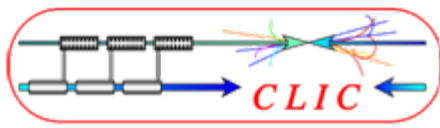
- Tunnel Services :

- Normal Lighting

- Leaky feeder for mobile telephones

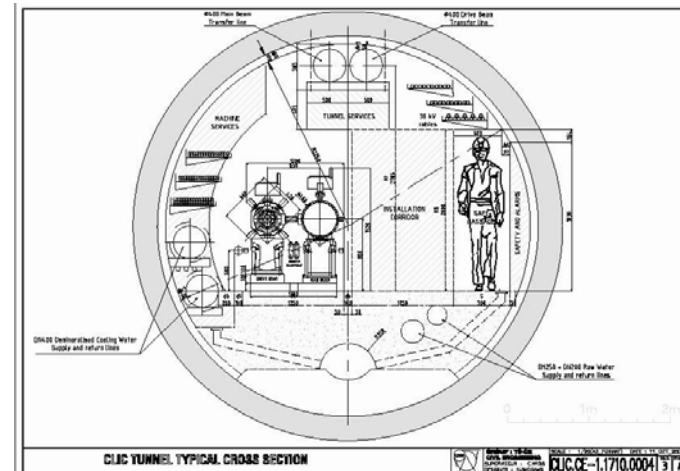
- Public address system

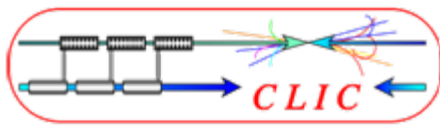




• Safety Systems :

- 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?

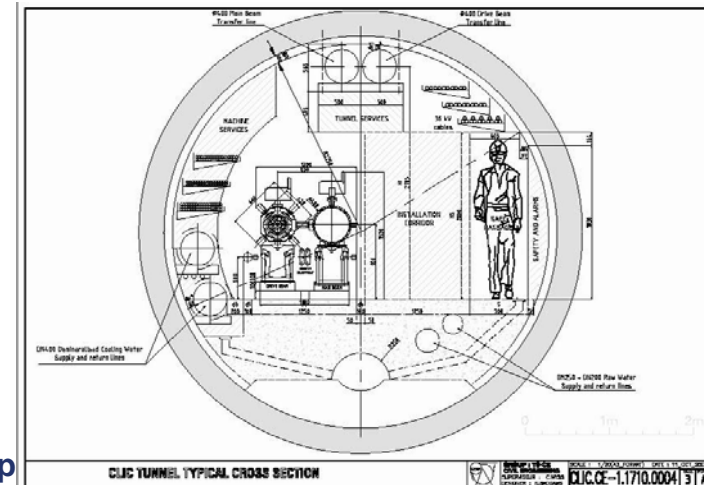


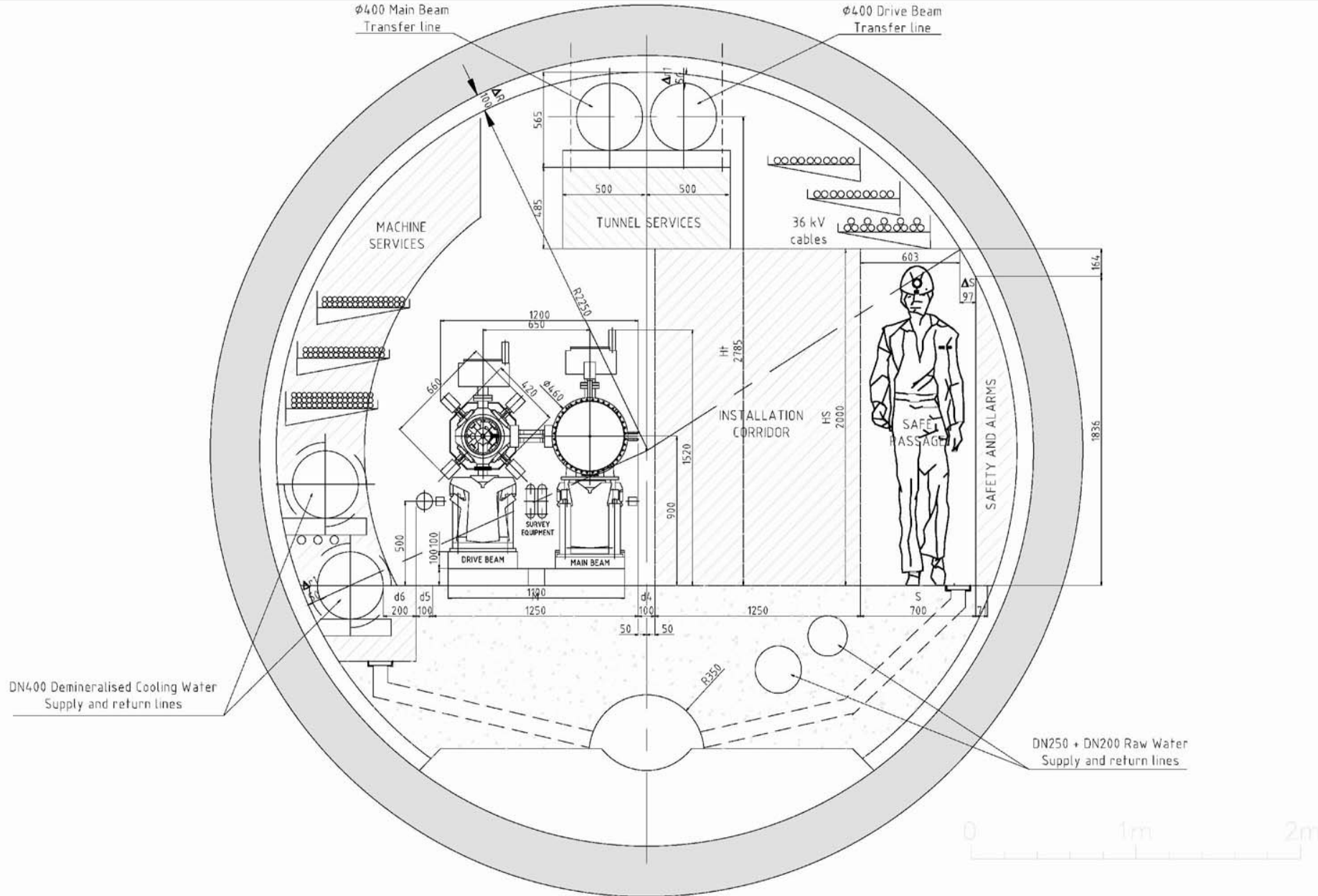


- Alignment and Tunnel tolerances

- Space has been recently allocated for alignment systems

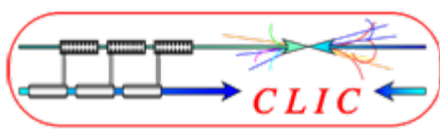
- A radial allowance for construction tolerances has been included (10cm)





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 INDICE 3 A
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- Further in-depth studies needed to better define tunnel cross section, in particular for :
 - **Demineralised Water (ΔT to be better understood) and maximum flow to avoid vibration problems.**
 - **Ventilation System to comply with current Safety requirements for emergency situations.**
 - **(see talk by J. Inigo-Golfin)**
 - **Next iteration deadline with updated parameters ?**