Focus Group A

Shallow Solutions Summary

J.Osborne CERN

ILC-GDE Dubna – 4-6 June 2008

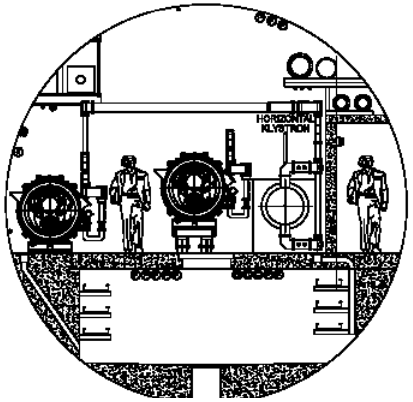
Mandate

- All 3 samples site in RDR are for deep-tunnel solutions
- Shallow Sites are to be studied in this group, with emphasis on cost savings
- Possible sites : JINR, DESY, FNAL, Japan..
- Tunnel configuration eg single tunnels such as XFEL, CLIC
- ILC-CLIC Collaboration

Topics

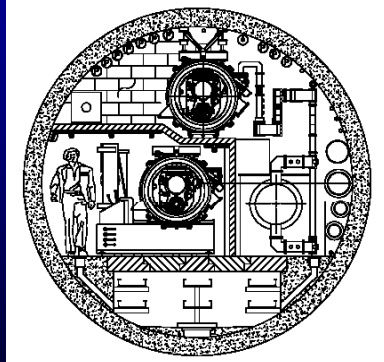
- Dubna Shallow Site, including cost estimate
- Shallow site and Deep tunnel solutions
- Shallow Site Interaction Region
- Japan Sites
- CLIC single tunnel solution
- XFEL single tunnel solution

Some Potential Cross-Sections

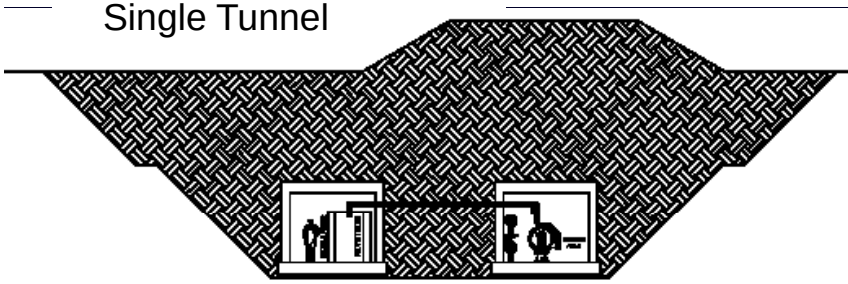


Single Tunnel

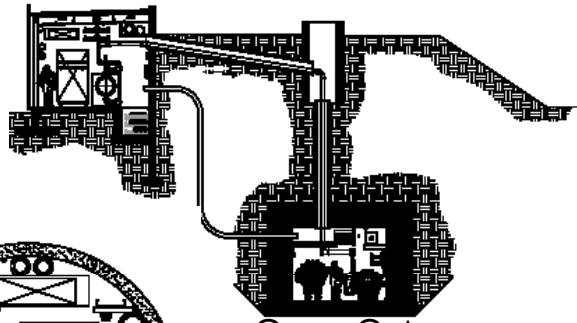
Open Cut



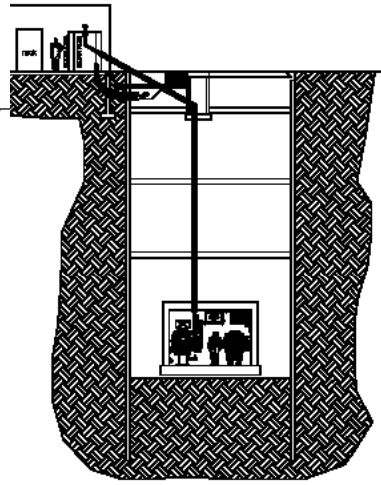
Single Tunnel



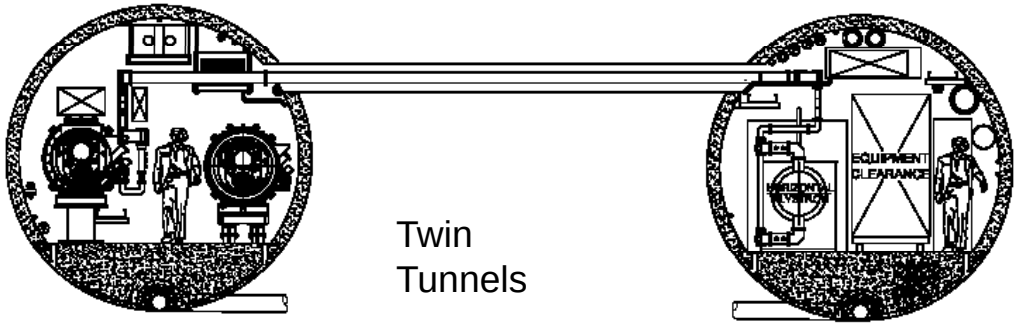
Open Cut Twin Enclosures



Open Cut



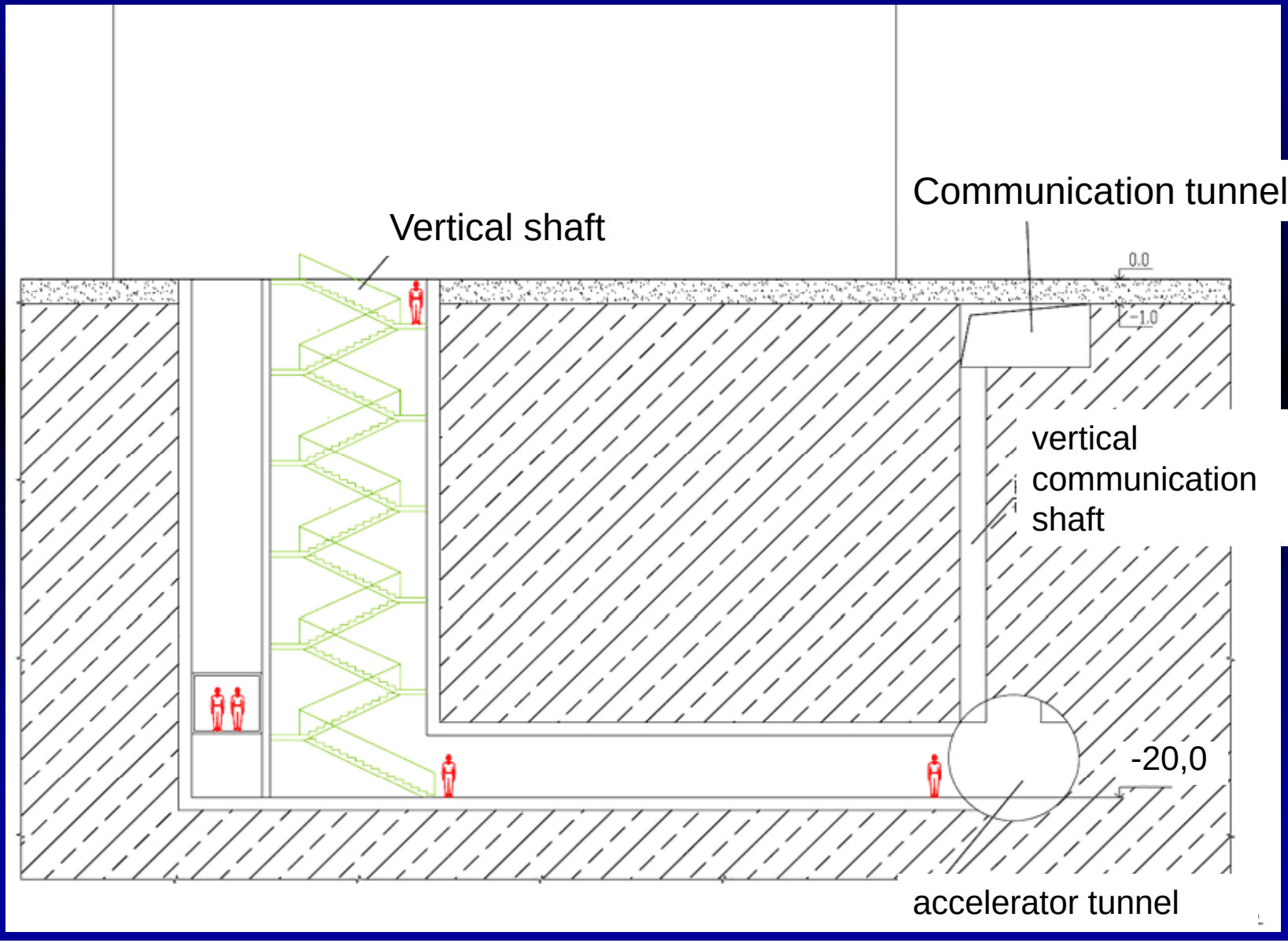
Braced Excavation



Twin
Tunnels

DUBNA

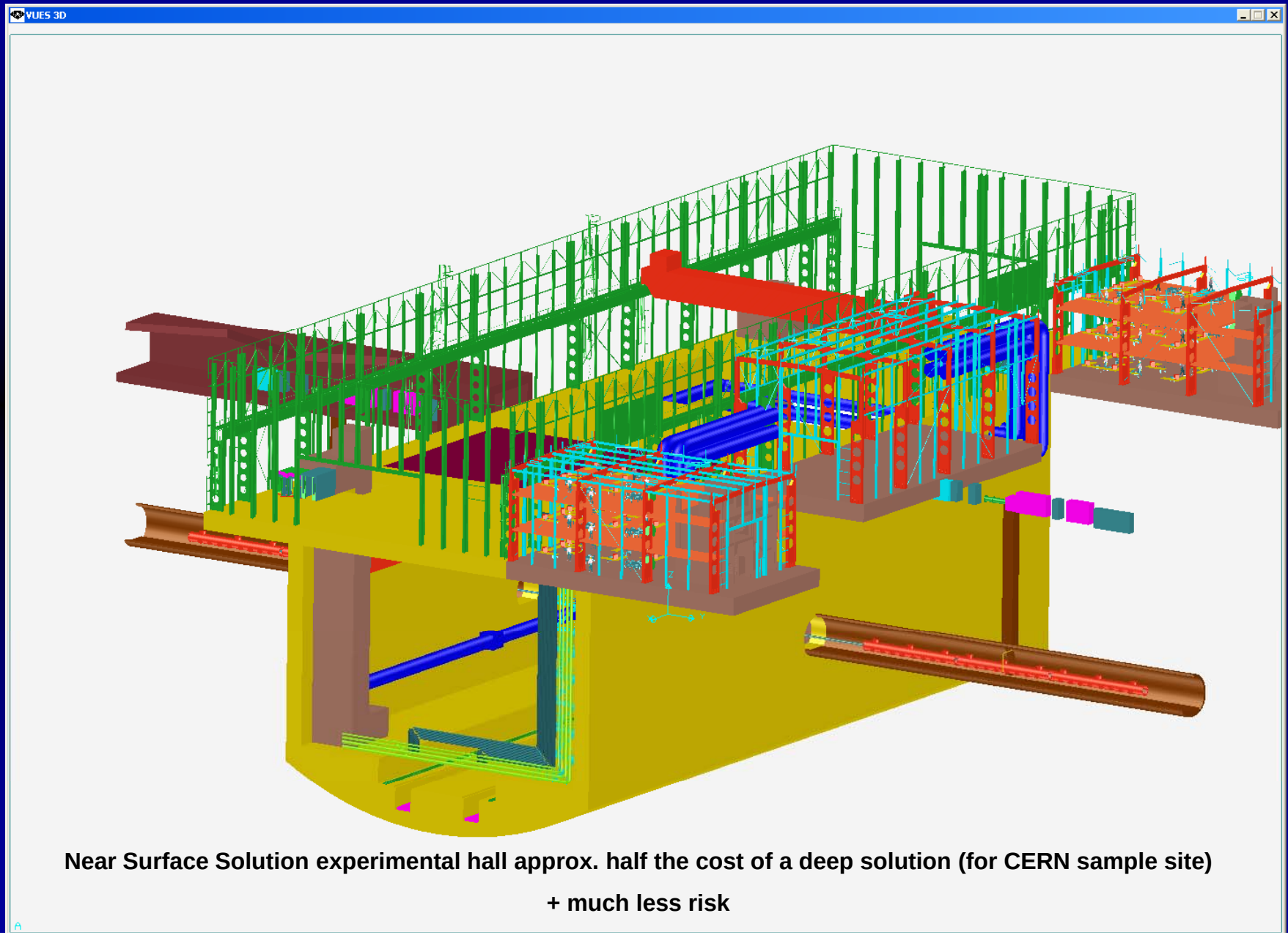
Proposed typical cross section
Beam tunnel 20m below surface



Dubna Shallow Site

- To replace 20m deep TBM tunnel with on-surface gallery for services (following land contours) would be substantially cheaper
- Pre-cast concrete modules would be fabricated (planning advantages)
- Once site investigation reports are available, Dubna experts could execute detailed costing exercise in 2 to 3 months…
- Approx 10% saving on total CFS costs for replacing one bored tunnel with surface gallery

Possible layout for interaction region for a Shallow Site



Near Surface Solution experimental hall approx. half the cost of a deep solution (for CERN sample site)

+ much less risk

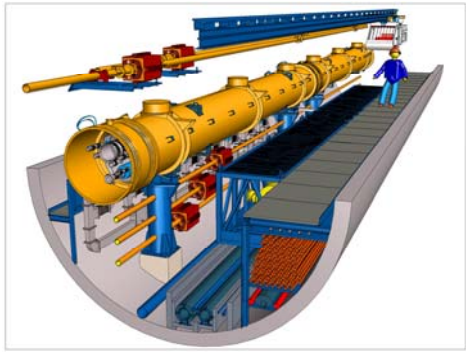
Japan Sites

- Based on experience in Japan, it is not considered practical, mainly on cost grounds, to further investigate cut/cover option
- Hard rock tunnels only require ‘simple’ sprayed lining
- Very expensive to create a stable, horizontal tunnel on surface (piles and retaining walls required)

Comparison between TESLA & ILC

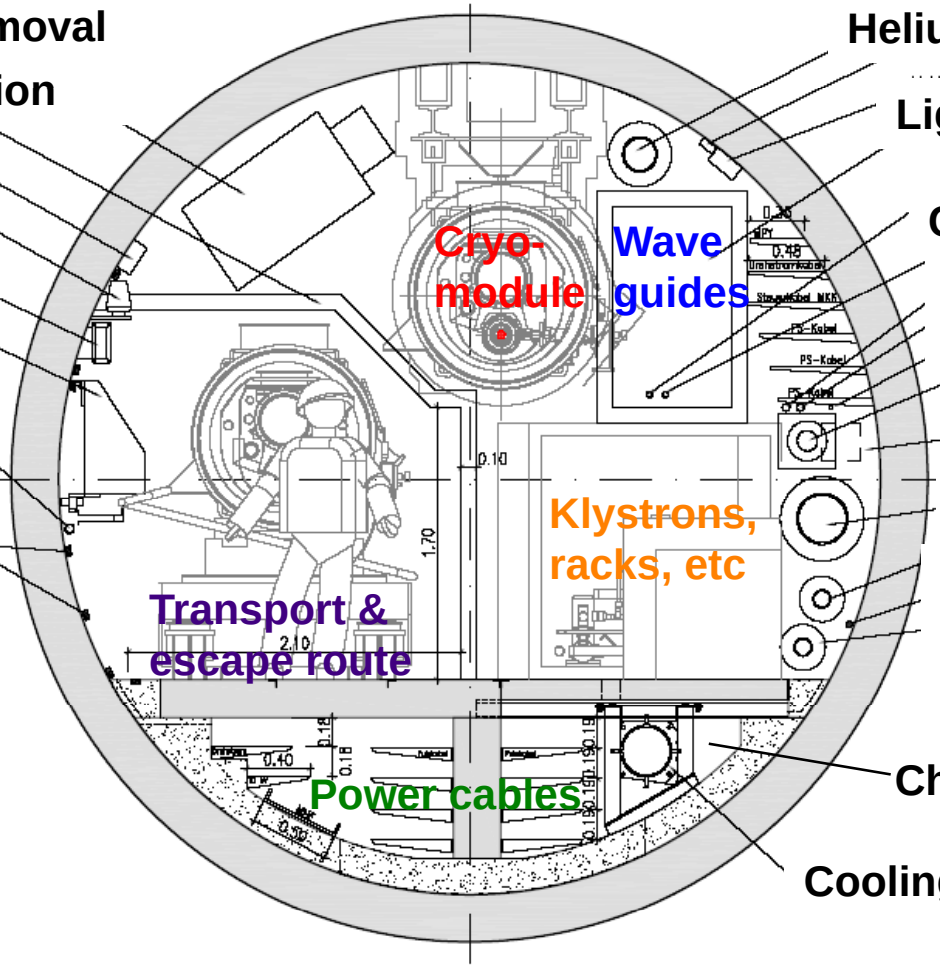
SingleTunnel v Double Tunnel at DESY
Extract 'Parametric Measures' W.Bialowons 5 June 2008

	TESLA TDR / M€	Scaled TESLA TDR / M$	ILC RDR / M$	Difference / M$
Total Cost	**3136** (1.6 M$/M€)	**5018**	**6620**	**1600**
Conventional Facilities	676 (CE+PW etc.)	1082	2472	1390
Underground Buildings		100 %	175 %	
Surface Buildings		100 %	240 %	
Consultant Engineering		100 %	1000 %	
Power Distribution		100 %	510 %	
Water Cooling		**100 (@150 MW)**	**382 (@180 MW)**	**282**
Cryogenic System	162	260	567	300
Cryo Plant*		12 x 100 %	10 x 200 %	



•However, RDR studies for shallow twin tunnel at DESY, came out more expensive than deep tunnels !!

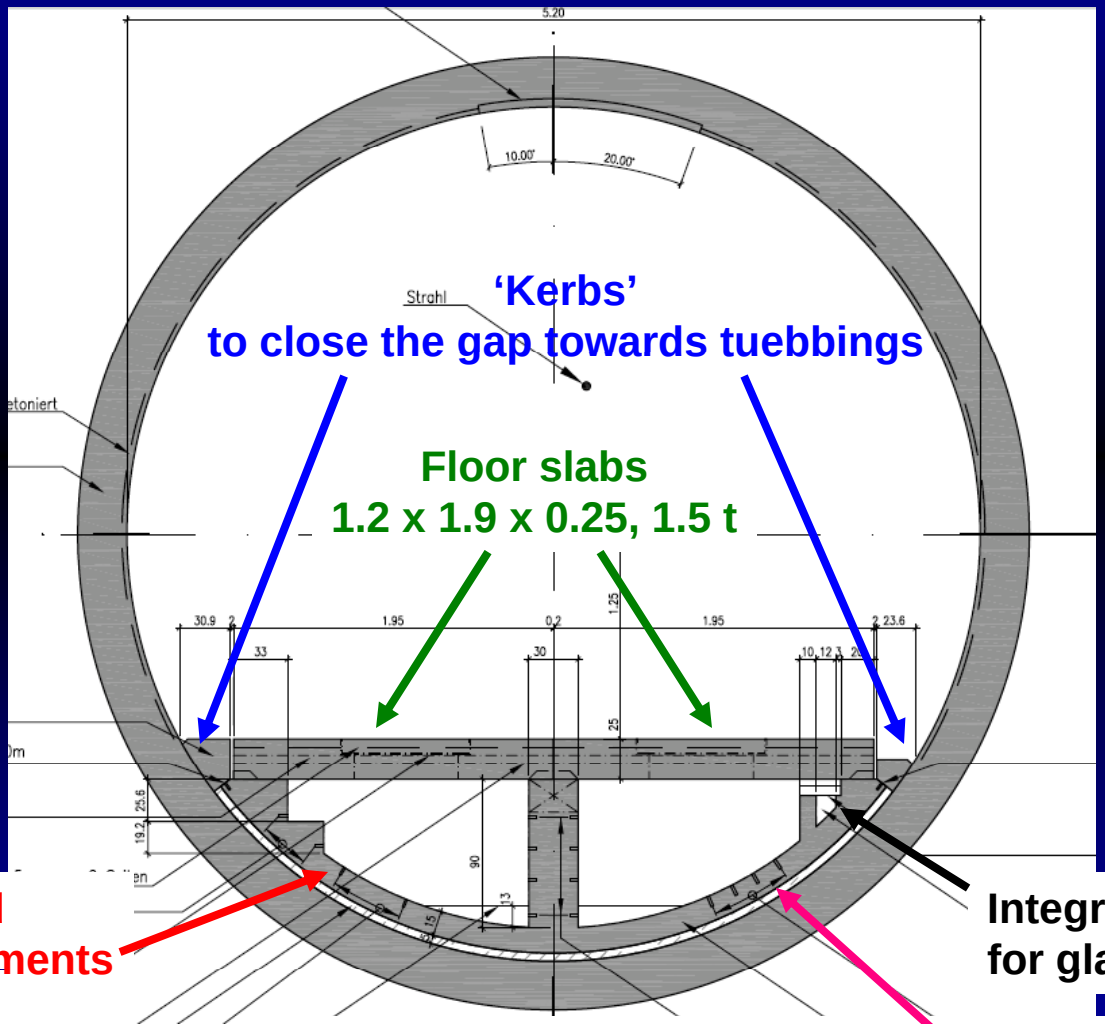
XFEL Tunnel cross-section



Duct for smoke removal
Fire safe separation
Lights
Alarm svstems
Phone
Survey trolley
Compressed air
Survey marks

Helium exhaust line
Lights
Cable trays
Water for cooling towers & 'normal' fire fighting
High pressure water for fire fighting
Cooling water 30° (ret.)
Cooling water 18° (ret.)
Cooling water 18° (in)
Channel for glass fibres
Cooling water 30° (in)

XFEL Complicated floor / underfloor construction



Floating pre-casted high precision segments 1.20 m in Z

Integrated channel for glass fibres

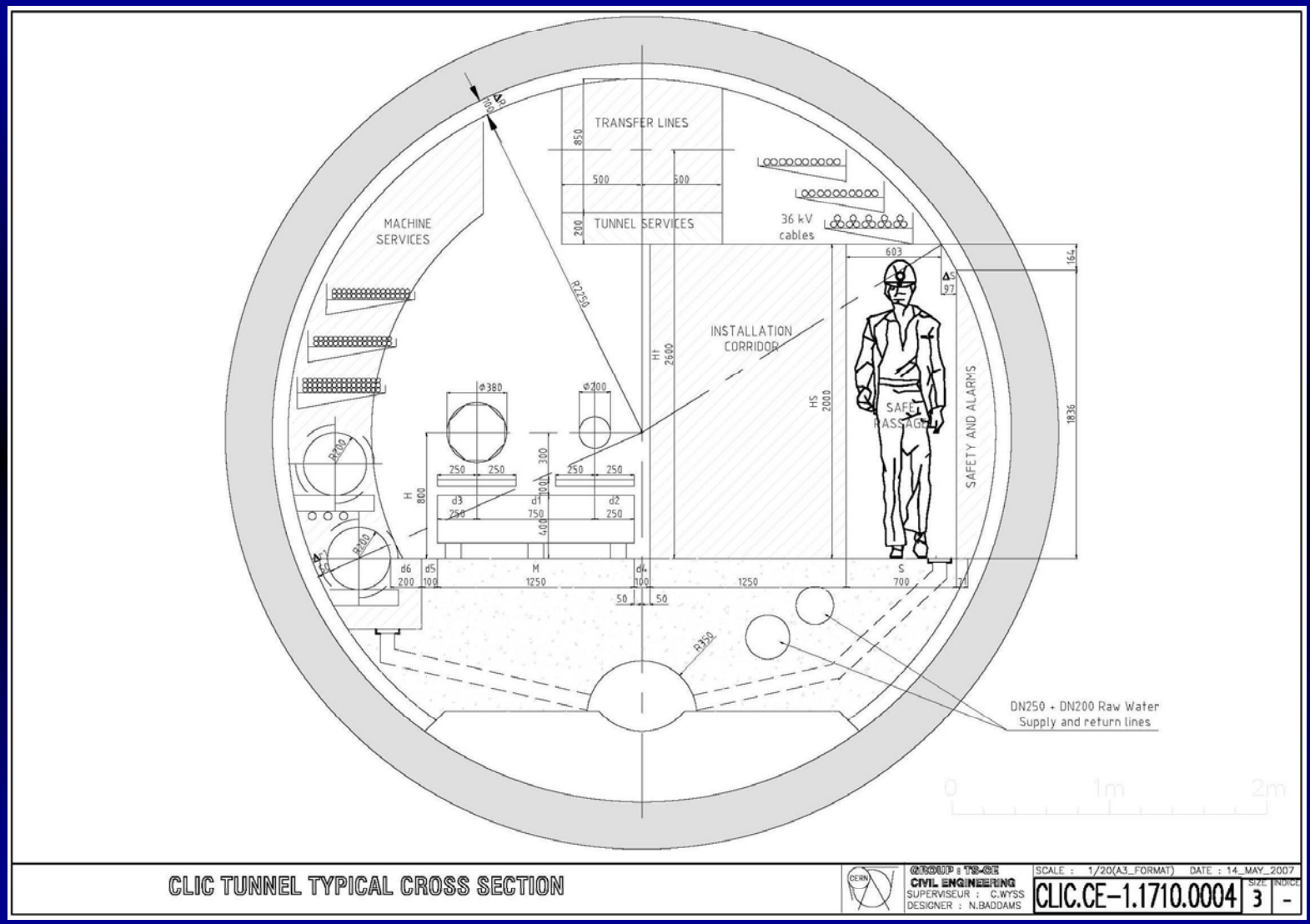
In-situ mortar layer for gap filling towards tuebbing shell

The European
X-Ray Laser Project XFEL X-Ray Free-Electron Laser

XFEL Challenges

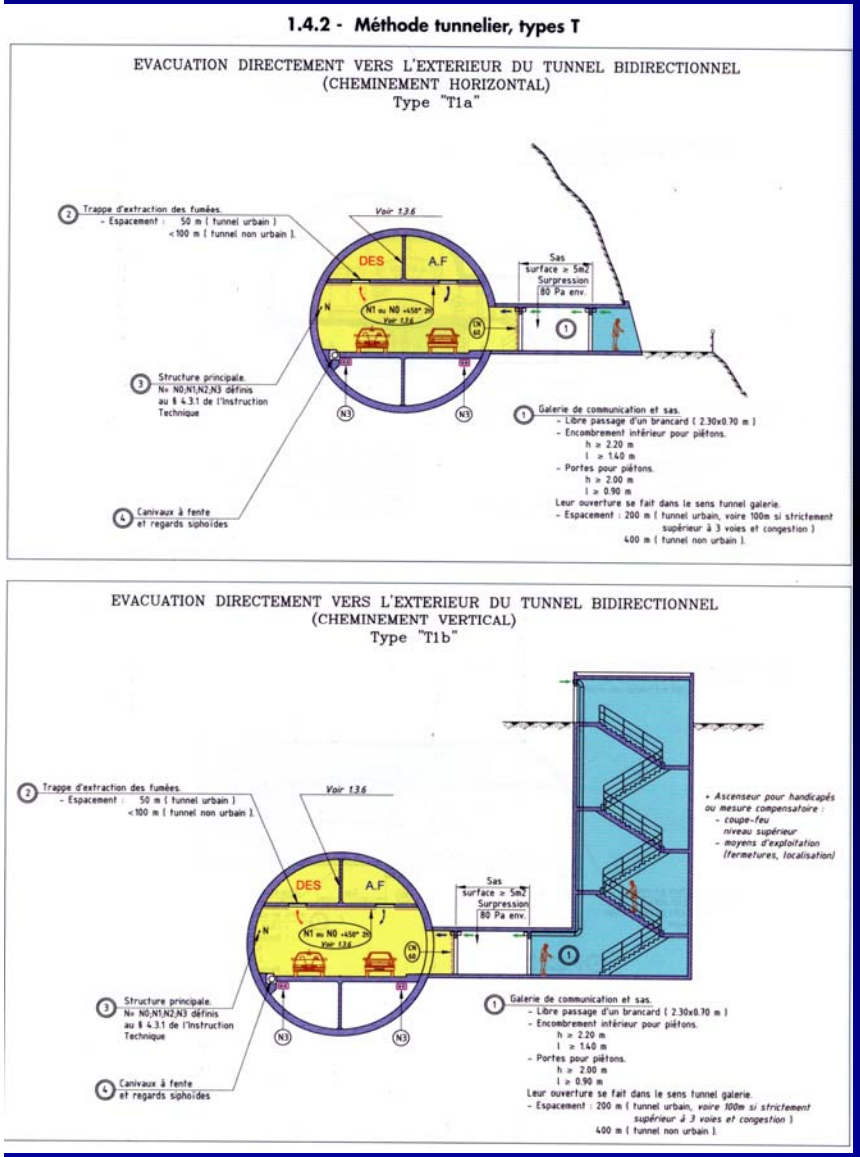
- Overall schedule 5 years from excavation to first beam for ≈ 3km machine
- Installation of underfloor services on critical path
- Difficult to access underfloor services once machine is installed

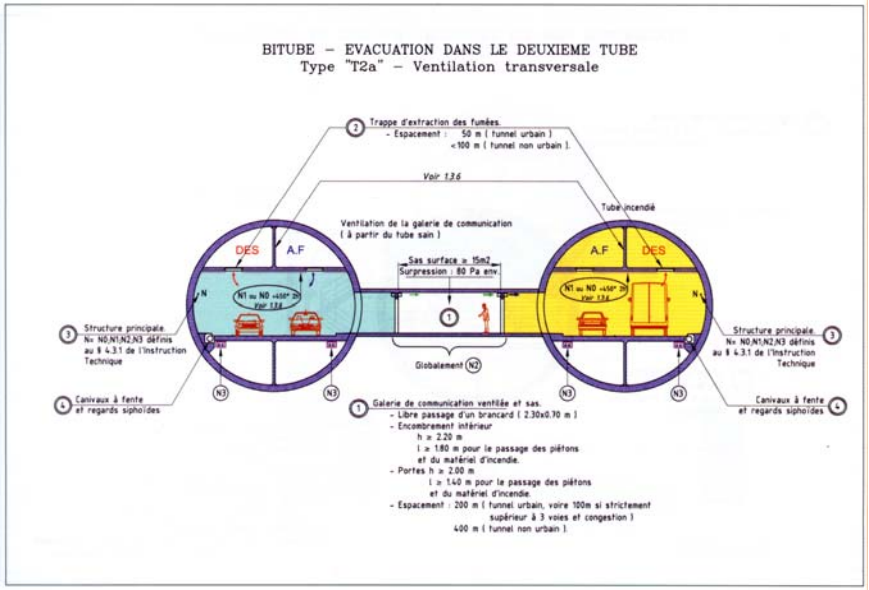
CLIC – Typical Cross Section

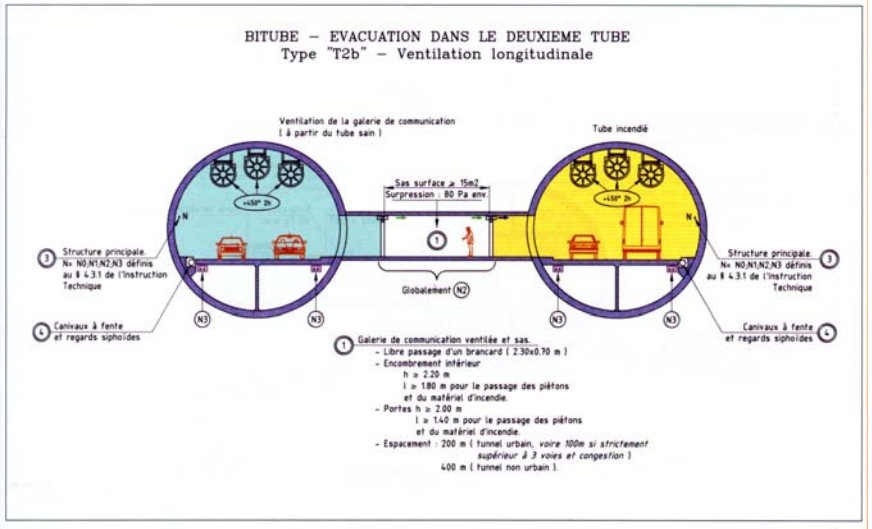


The challenge is to fit all the services in the smallest underground volume, whilst respecting the **relevant** safety legislation

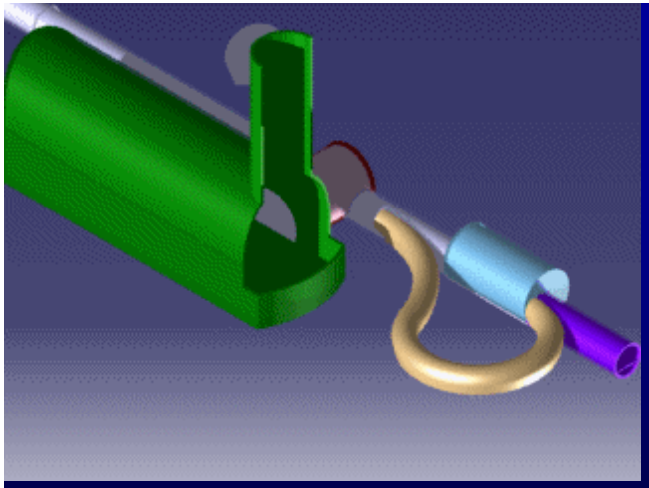
Possible Ventilation Systems for road tunnels
For ‘uniform site which legislation do we adopt’ ?



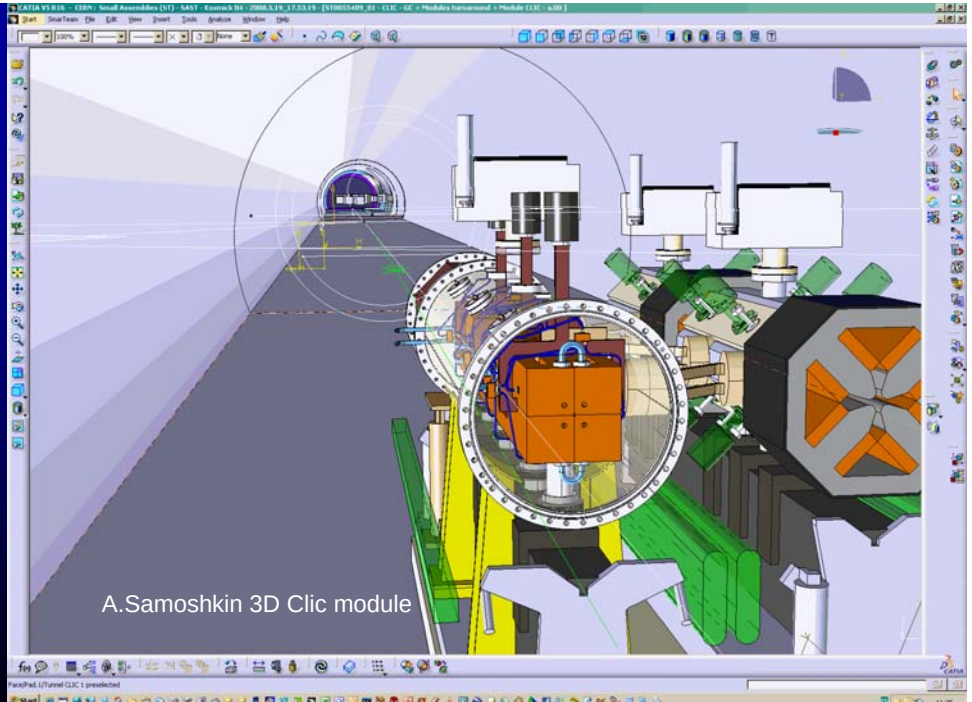


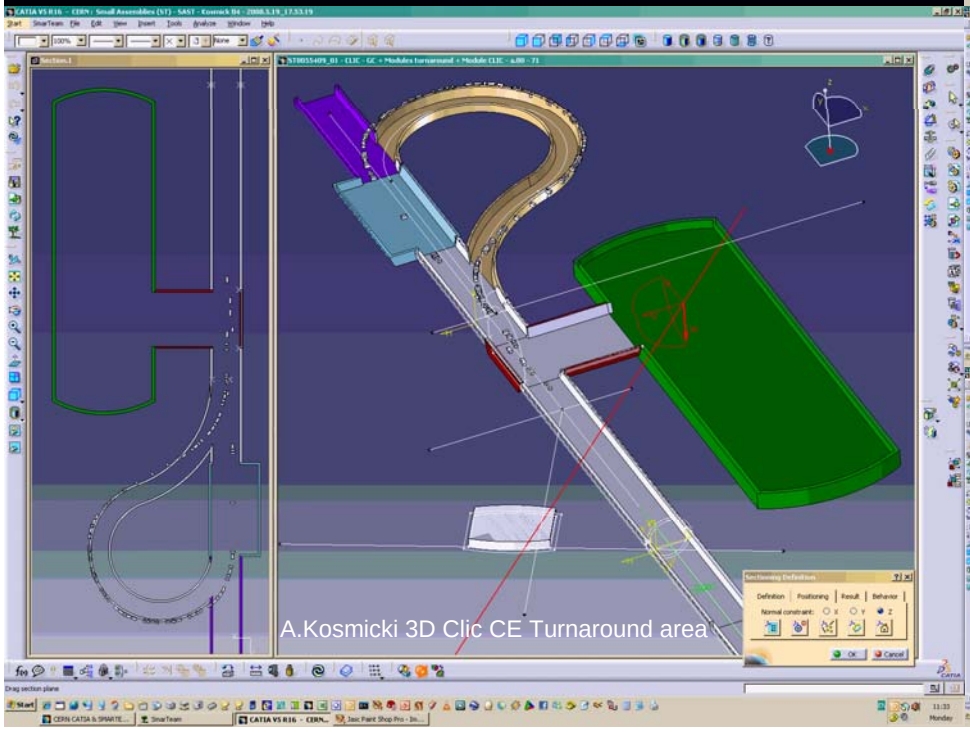


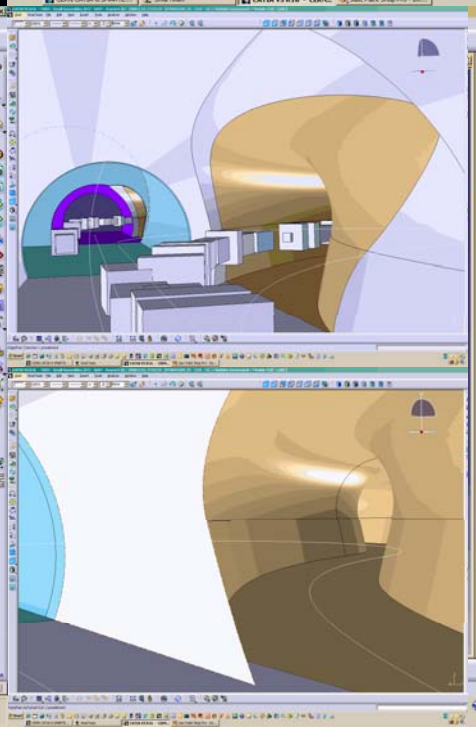
Extracted courtesy of ‘French Tunnelling Association : AFTES : Tunnels routiers : resistance au feu Jan 2008’

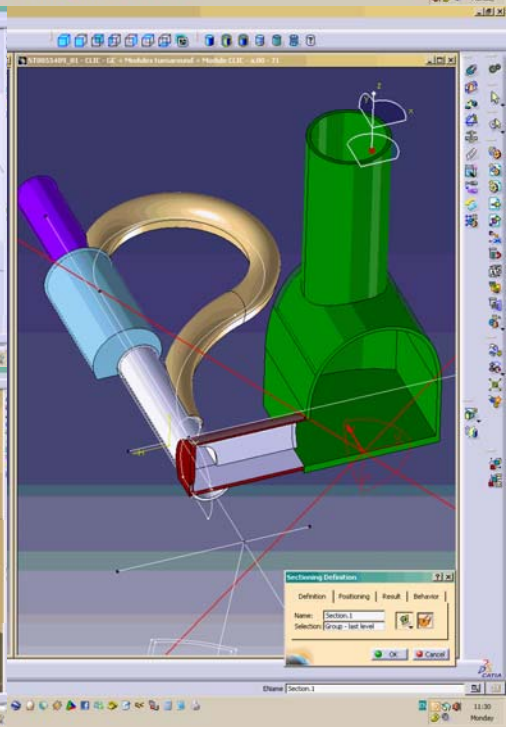


Integration of machine & services needed to define underground volumes









Cost Comparison

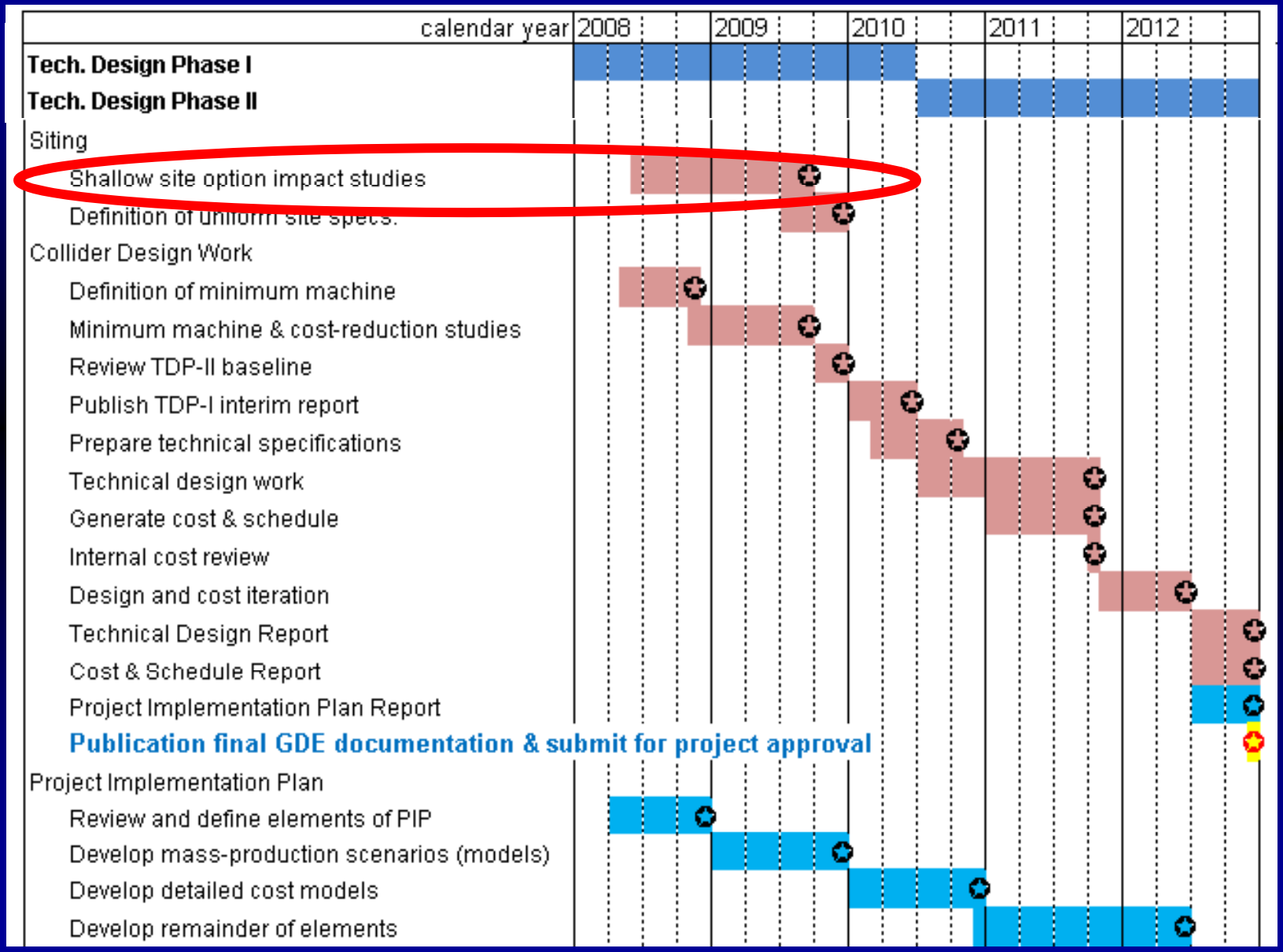
Extract 'Impact of 1 tunnel of Shallow Site' 5 June 2008 T.Lackowski

- Methods to compare various options incorporating both direct costs and the impacts on technical systems needs to be developed.
  - Items such as reliability, complexity of installation and operations can be translated into a cost. An inclusive comparison can not be accomplished by CF&S alone.
  - How far to develop the various option studies will need the guidance of Project Management and depend on the resources available.
  - Deep twin tunnels, near surface and single tunnel options have been discussed for years. We need to conclusively resolve which options are feasible and provide the best value. This may require defining more than one "uniform site". Ultimately Project Management will need to feel comfortable concurring with the analysis.

Requirement Matrix

	Sample sites Twin Deep TBM tunnels in RDR (CERN, KEK, FNAL)	Single Deep Bored Tunnel (eg CLIC type)	Single Beam Tunnel with Surface Gallery (eg Dubna)	Single Tunnel Shallow TBM (eg XFEL,TESLA)	Near Surface Open Cut (eg Hanford, Salt flats)
Shielding					
Egress Distance					
Equipment Arrangement					
Stability; Isolation from Vibrations					
Equipment Access					
Installation					
Environmental Impact					
Cost	1.0				

Design / Cost Reduction / PIP



Extracted from 'Report from PM' : 4 June 2006 N.Walker, M.Ross, A. Yamamoto

CLIC / ILC Collaboration for CFS works

Draft Mandate and Work Plan

Working Group Convenors : C.Hauviller & John Osborne (CERN), V.Kuchler (FNAL)

Presented at Collaboration meeting of 13 May 2008 at CERN

CLIC / ILC Collaboration for CFS Works

The following working groups already exist :

- The Conventional Facilities and Siting 'CFS Team' for ILC
- 'Civil Engineering and Services' CES for CLIC, based at CERN

These groups work independently on the civil engineering and services side of both projects.

However, it has been agreed that resources permitting, both groups will work together on areas of mutual interest for both projects, with participation from both sides at relevant meetings. Next CLIC CES meeting 11 June. CLIC Collaboration meeting in October 08.

CLIC : Civil Engineering and Services (CES) WG

CES Working Group Representatives :

Civil Engineering and Chairman	**J.Osborne**
CLIC Link Person	**H.Braun**
Cooling and Ventilation CV	**J.Inigo-Golfin / C.Martel**
Electricity EL	**K.Kahle**
Survey SU	**H.Mainaud Durand**
Controls, Safety ASE	**T.Pettersson**
Horizontal Handling HE	**K.Kershaw**
Vertical Handling HE	**I.Ruehl**
CE Layouts and cross-sections	**A.Kosmicki / D.Parchet**
SC Link Person	**R.Trant**
ILC members	**V.Kuchler (FNAL), A.Enomoto (KEK)**

Monthly and ad-hoc meetings.

Reporting to CLIC Technical Committee chaired by C.Hauviller.

CLIC Civil Engineering and Services (CES) WG

Mandate :

General Objective

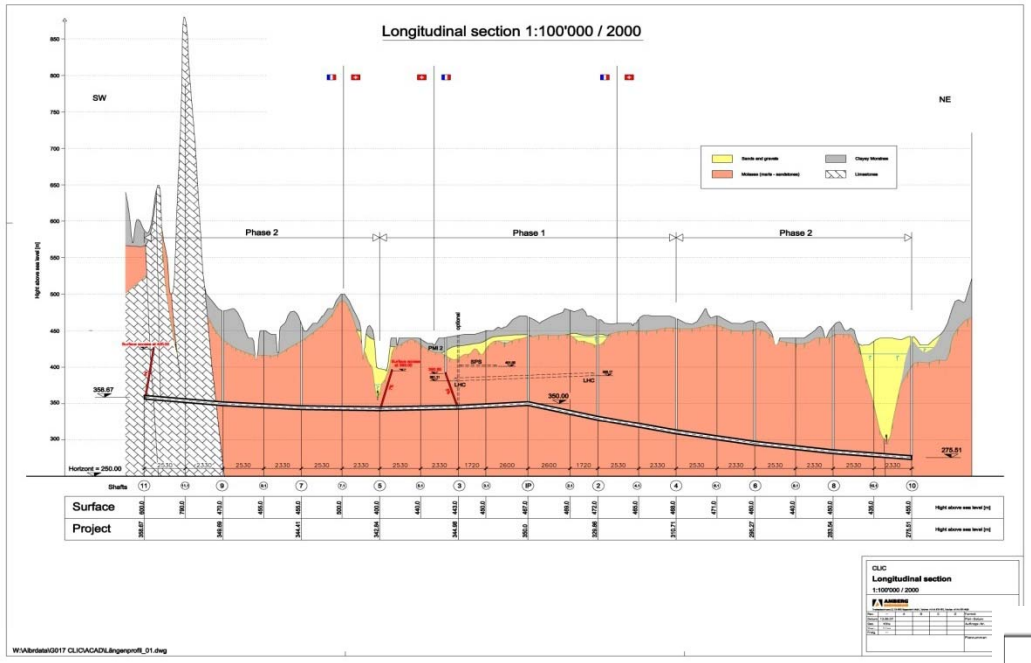
-Develop the existing layouts for the project from a civil engineering and technical services point of view, and work with the various actors towards a realistic design for the CDR in 2010.

Specific responsibilities:

-Work will concentrate on the tunnel cross section required to accommodate the machine and it's services (e.g. ventilation, electricity, survey, controls, safety and handling equipment)
-The overall layout for the civil engineering (surface buildings, injectors, turnaroud loops and accelerator tunnels) will be studied for the various energy ranges i.e. 500Gev, 1Tev and 3Tev.
-Develop a layout for the interaction region.
-Examine environmental aspects of the project.
-Work together with ILC on areas of synergy.

This group will report back to the CLIC Technical Committee.

Regular meetings are planned for once a month on 2nd Wednesday of the month 2:30pm.
First meeting 14 May
Ad-hoc meetings on dedicated subjects eg EL 4 April, CV 29 April….

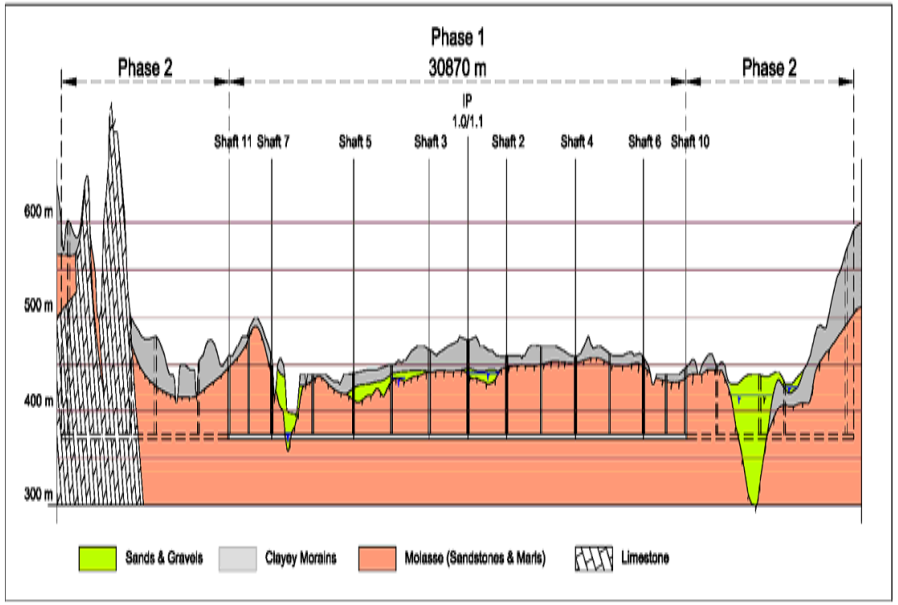


Study Example :

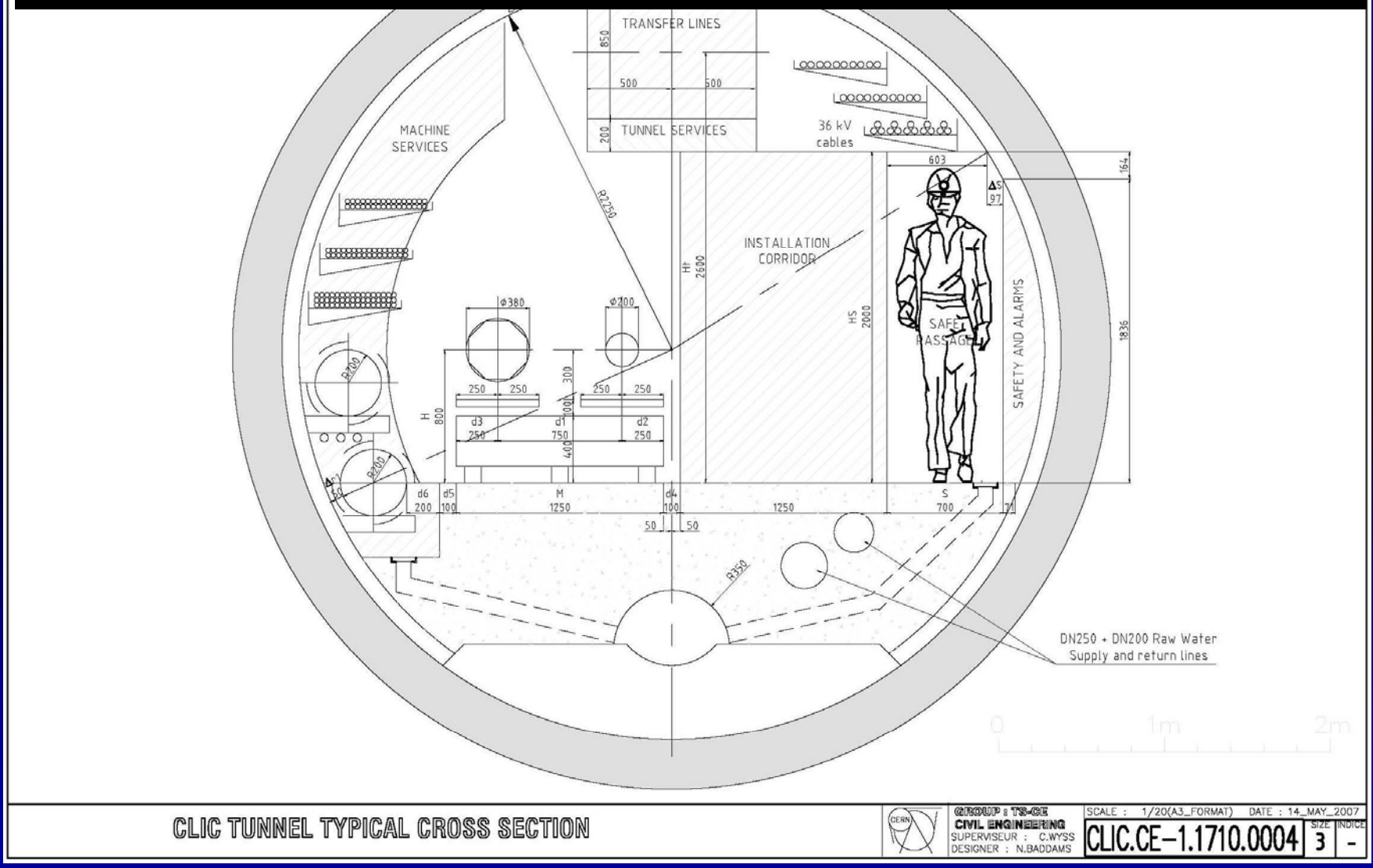
TBM technology advancements

Meeting with TBM manufacturer scheduled for 19 June 2008 :

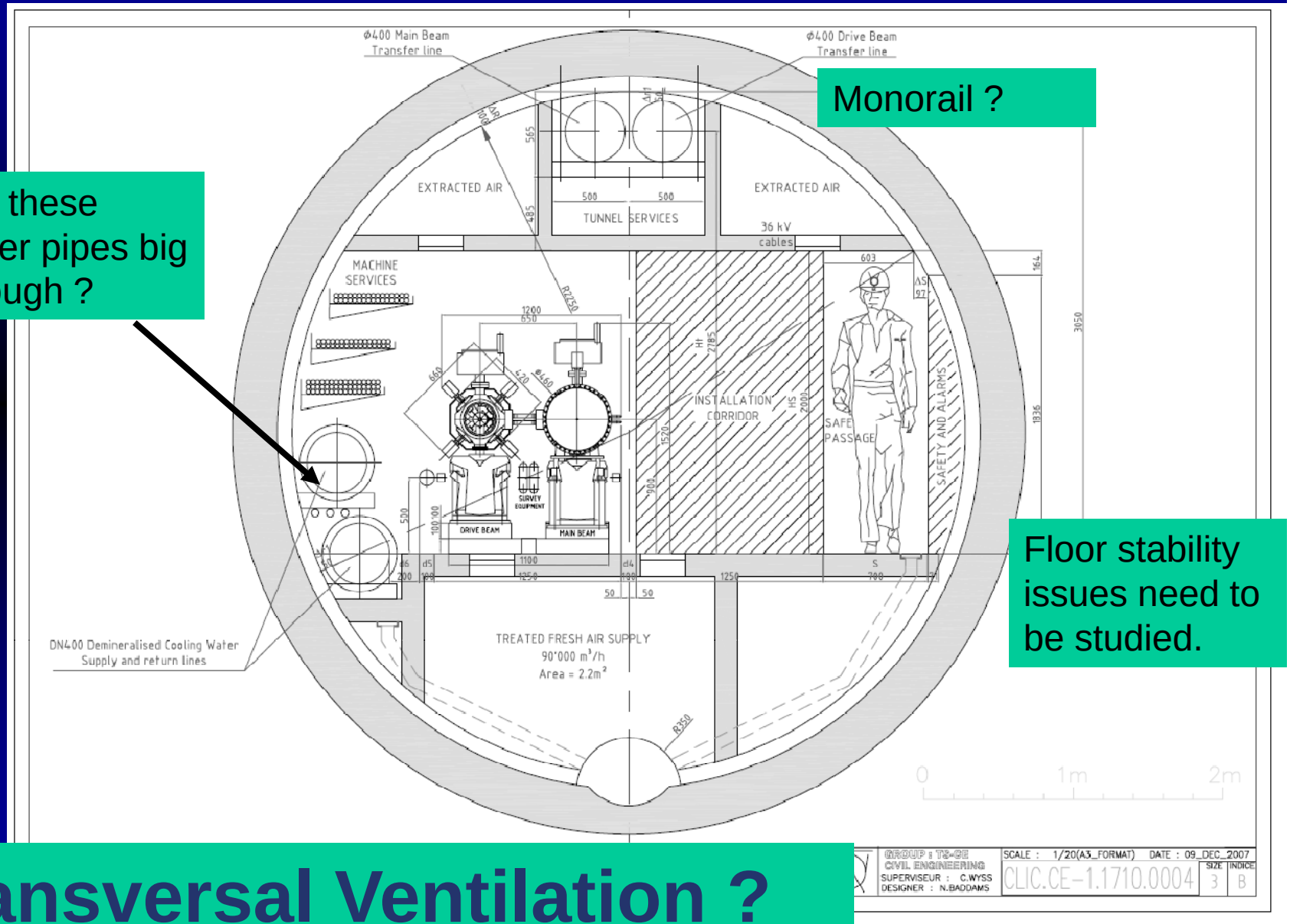
Uniform Site discussions



Study Example : CLIC – Typical Cross Section



CLIC – HVAC issues



Monorail ?

Are these water pipes big enough ?

Floor stability issues need to be studied.

Transversal Ventilation ?

ILC : Conventional Facilities and Siting (CFS) WG

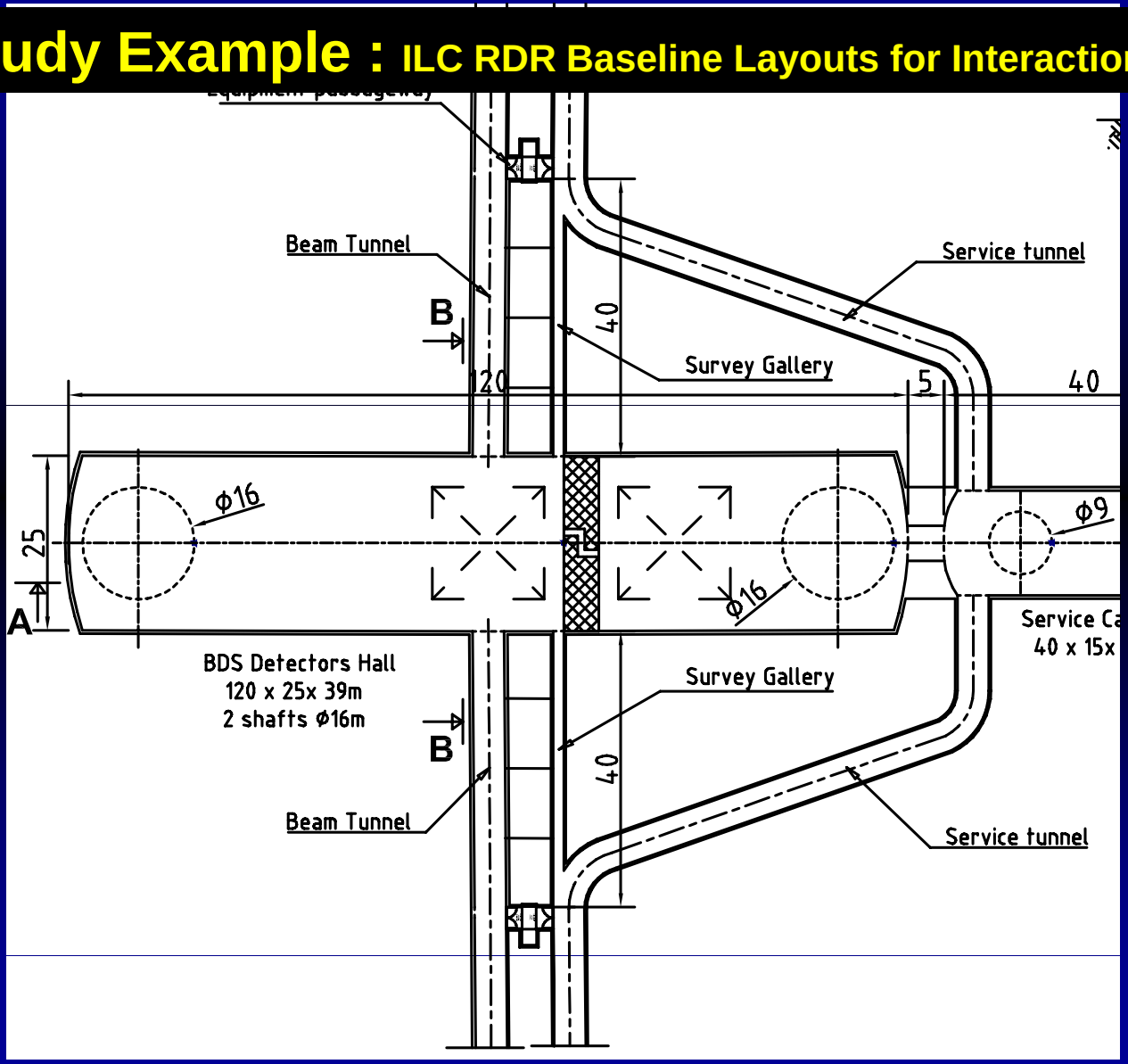
CFS Working Group Representatives :

CERN	**J.Osborne**
FNAL	**V.Kuchler, E.Huedem, T.Lackowski, L.Hammond**
KEK	**A.Enomoto, M.Tanaka**
JINR	**G.Shirkov, G.Trubnikov**

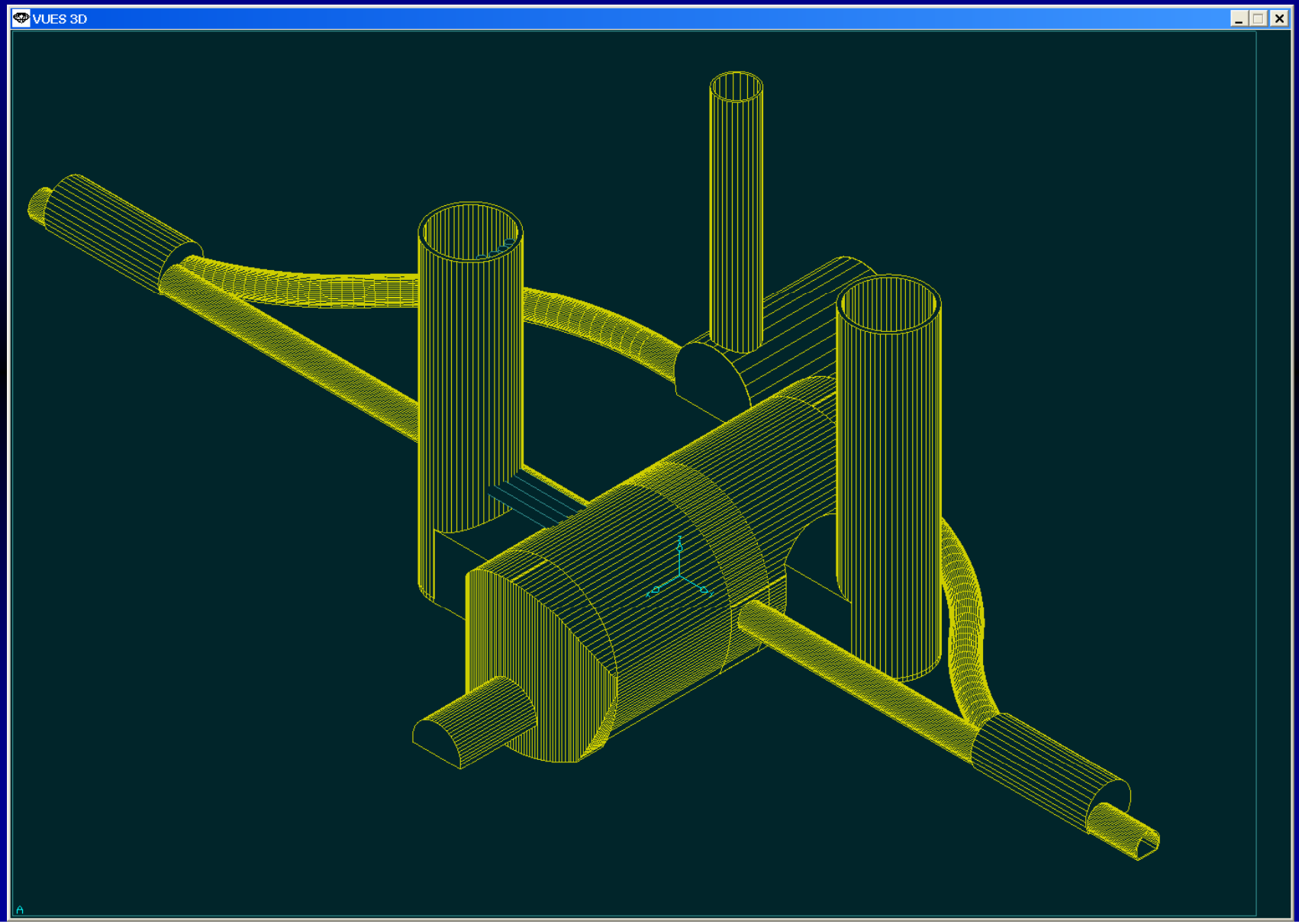
Project Management : M.Ross, J.Carwardine, P. Garbincius…..

Video Meetings every two week.

Study Example : ILC RDR Baseline Layouts for Interaction Region



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



CLIC / ILC Collaboration Mandate for CFS Works

- The following working groups already exist :

- 'Civil Engineering and Services' for CLIC, based at CERN
- The 'CFS Team' for ILC

DRAFT

These groups work independently on the civil engineering and services side of both projects.
However, it has been agreed that resources permitting, both groups will work together on areas of mutual interest for both projects, including :

- Civil Engineering Studies
  - Optimisation of Tunnel and Shaft diameters, distance between shafts (linked to safety)
  - Overall layout of the machine and interaction region infrastructure
  - Shallow site v Deep Tunnel Option
  - Single Tunnel v Double Tunnel
  - Safety issues such as emergency egress
  - Environmental issues

Etc.

- Other Infrastructure
  - Cooling Water ?
  - Power Distribution
  - Air Handling
  - Transport Issues
  - Radiation simulations / shielding ?

Etc.

- The progress of these working groups on areas of mutual interest will be reported at the ILC-GDE and CLIC Collaboration Meetings working towards CLIC CDR and ILC TDP Phase I in 2010.

- EU FP7 funding will accelerate the ILC studies

Conclusions

- Dubna solution looks very promising, but Site Investigation needed to allow detailed costing (using same RDR principles)
- CFS will develop ‘Requirement Matrix’ over coming months
- Ground rules need to be defined by PM team eg which solutions do we pursue the most given resource levels, which safety legislation do we adopt…..site stragey
- XFEL progress to be followed closely, particularly during installation phase
- 3d Integration studies for ILC need to developed to allow CFS to better determine underground volumes
- ILC/CLIC collaboration is a promising development in CFS field