



Conventional Facilities & Siting “Breakout” Session

Power & Water: Marc Ross

General Features: Vic Kuchler & Peter Garbincius

GDE



WBS & suggested host contributions (~72%)

1.7 Conventional Facilities

1.7.1 CIVIL ENGINEERING

- 1.7.1.1 Engineering, study work and documentation
 - 1.7.1.1.1 In-house Engineering
 - 1.7.1.1.2 Outsourced Consultancy Services
- 1.7.1.2 Underground Facilities
 - 1.7.1.2.1 Shafts
 - 1.7.1.2.2 Tunnels
 - 1.7.1.2.3 Halls
 - 1.7.1.2.4 Caverns
 - 1.7.1.2.5 Miscellaneous works
- 1.7.1.3 Surface Structures
 - 1.7.1.3.1 Central Lab Buildings
 - 1.7.1.3.2 Detector Assembly Buildings
 - 1.7.1.3.3 Office Buildings
 - 1.7.1.3.4 Service Buildings
 - 1.7.1.3.5 Cryo- Equipment Buildings
 - 1.7.1.3.6 Control Buildings
 - 1.7.1.3.7 Workshops
 - 1.7.1.3.8 Site Access Control Buildings
 - 1.7.1.3.9 Shaft Access Buildings
 - 1.7.1.3.10 Miscellaneous Buildings
 - 1.7.1.3.11 User Facilities
- 1.7.1.4 Site Development
 - 1.7.1.4.1 Off-site Site work
 - 1.7.1.4.2 Network of Monuments
 - 1.7.1.4.3 Construction Support
 - 1.7.1.4.4 Site Preparation
 - 1.7.1.4.5 Utility Distribution
 - 1.7.1.4.6 Road, Sidewalks & Parking Areas
 - 1.7.1.4.7 Landscaping
 - 1.7.1.4.8 Environmental
 - 1.7.1.4.9 Miscellaneous Site Works

1.7.2 ELECTRICAL

- 1.7.2.1 Engineering, study work and documentation
 - 1.7.2.1.1 In-house Engineering
 - 1.7.2.1.2 Outsourced Consultancy Services
- 1.7.2.2 High Voltage Equipment, Power Distribution
 - 1.7.2.2.1 Main Substation
 - 1.7.2.2.2 Distribution Substations
 - 1.7.2.2.3 Medium Voltage Distribution & Transforming Units
- 1.7.2.3 Low Voltage Equipment, Power Distribution
- 1.7.2.4 Emergency Power Sources
- 1.7.2.5 Power Network monitoring
- 1.7.2.6 Power network monitoring
- 1.7.2.7 Communication equipment
 - 1.7.2.7.1 Telephone equipment
 - 1.7.2.7.2 Public address and other communication equipment

1.7.3 AIR TREATMENT EQUIPMENT

- 1.7.3.1 Engineering, study work and documentation
 - 1.7.3.1.1 In-house Engineering
 - 1.7.3.1.2 Outsourced Consultancy Services
- 1.7.3.2 HVAC Equipment
 - 1.7.3.2.1 OA & Exhaust Air Processing
 - 1.7.3.2.2 Air-conditioning for Tunnels
 - 1.7.3.2.3 Air-conditioning for General Areas

1.7.4 PIPED UTILITIES

- 1.7.4.1 Engineering, study work and documentation
 - 1.7.4.1.1 In-house Engineering
 - 1.7.4.1.2 Outsourced Consultancy Services
- 1.7.4.2 Plumbing
 - 1.7.4.2.1 Potable Water
 - 1.7.4.2.2 Sanitary Sewer
 - 1.7.4.2.3 Sump Systems
- 1.7.4.3 Fire Suppression
- 1.7.4.4 Fuel System Distribution

1.7.5 PROCESS (COOLING) WATER

- 1.7.5.1 Engineering, study work and documentation
 - 1.7.5.1.1 In-house engineering
 - 1.7.5.1.2 Outsourced Consultancy Services
- 1.7.5.2 Primary Stations
 - 1.7.5.2.1 Cooling Towers & Pumping Stations
 - 1.7.5.2.2 Primary Stations and Piping
- 1.7.5.3 Secondary Stations
 - 1.7.5.3.1 Demineralized Water Stations & Distribution Piping
 - 1.7.5.3.2 Chilled Water Stations and Distribution Piping
 - 1.7.5.3.3 Water Stations and Distribution Piping
 - 1.7.5.3.4 Compressed Air
 - 1.7.5.3.5 Process Water Distribution

1.7.6 HANDLING EQUIPMENT

- 1.7.6.1 Engineering, study work and documentation
 - 1.7.6.1.1 In-house engineering
 - 1.7.6.1.2 Outsourced Consultancy Services
- 1.7.6.2 Lifts
- 1.7.6.3 Electrical Overhead Traveling Cranes
- 1.7.6.4 Hoists
- 1.7.6.5 Auxiliary Lifting Equipment
- 1.7.6.6 Road Transport and Handling Equipment
- 1.7.6.7 Underground Transport Equipment

1.7.7 SAFETY EQUIPMENT

- 1.7.7.1 Engineering, study work and documentation
 - 1.7.7.1.1 In-house engineering
 - 1.7.7.1.2 Outsourced Consultancy Services
- 1.7.7.2 Safety Alarms
- 1.7.7.3 Safety Access Control
- 1.7.7.4 Other Safety Equipment

1.7.8 SURVEY AND ALIGNMENT

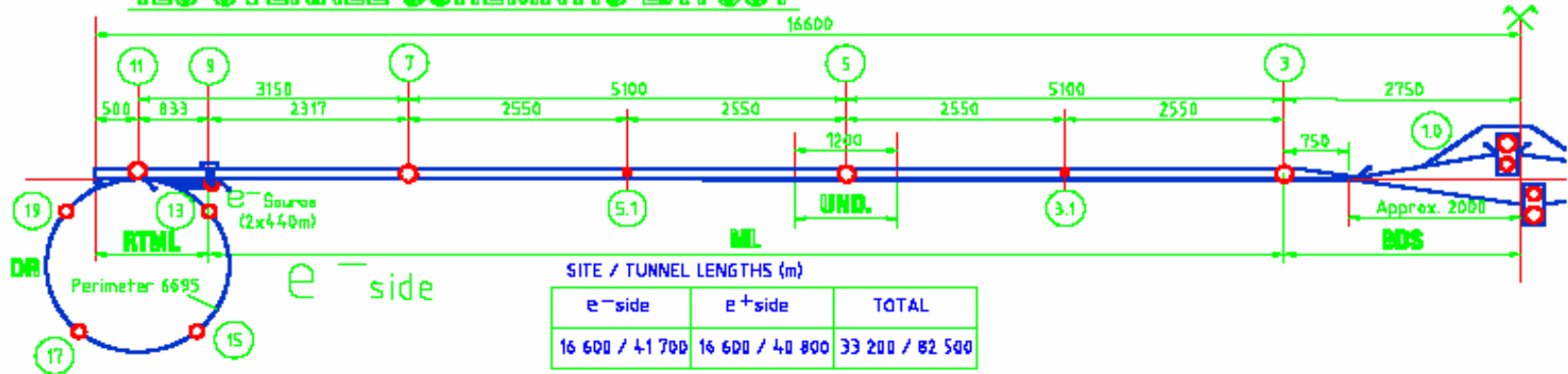
- 1.7.8.1 Engineering and R&D work
 - 1.7.8.1.1 In-house Engineering
 - 1.7.8.1.2 Outsourced Consultancy Services
- 1.7.8.2 Geodesy and Networks
- 1.7.8.3 Metrology of the Components
- 1.7.8.4 As built measurements and integration
- 1.7.8.5 Alignment of the components
- 1.7.8.6 Metrology for the final focus areas
- 1.7.8.7 Metrology for the detectors and exp. areas
- 1.7.8.8 Software, database and informatics



Underground Construction - CERN

ILC OVERALL SCHEMATIC LAYOUT

EUROPEAN REGION - 2 June 2006

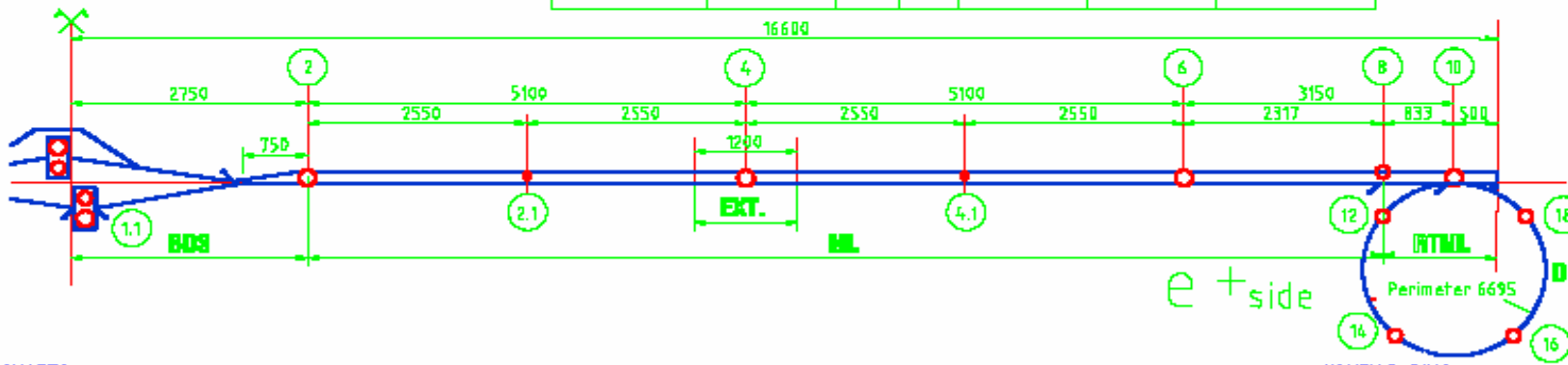


SITE / TUNNEL LENGTHS (m)

e ⁻ side	e ⁺ side	TOTAL
16 600 / 41 700	16 600 / 40 800	33 200 / 82 500

TUNNELS

Area	e ⁻ beam + serv	DR e ⁻	DR e ⁺	RTML beam + serv	ML beam + serv	BDS beam + e ⁺ bypass
φm	4.5	4.0	4.0	5.0	5.0	5.0



SHAFTS

Point	1.0	1.1	2	3	4	5	6	7	8	9	10	11	12/J	13/J	14/G	15/G	16/E	17/E	18/B	19/B
φm	15+9	15+9	14	14	14	14	14	14	9	9	14	14	9	9	6.5	6.5	9	9	6.5	6.5

SHAFT BASE CAVERNS

Point	2, 3, 4, 5, 6, 7, 10, 11	8, 9(RTML)
(LxWxH) m	50 x 14.5 x 18 + 3 storeys	35 x 15 x 15 + 2 storeys

DR ALCOVES

Point	A, D, F, H	B, E, G, J
(LxWxH) m	18 x 8 x 8	18 x 10.5 x 10 + 1 storey

EXP. HALLS

Point	1.0, 1.1
(LxWxH) m	detector: 54 x 32 x 35 service: 35 x 18 x 18

SURVEY BORINGS

Point	2.1, 3.1, 4.1, 5.1
φm	0.80

BEAM DUMPS

Point	1.0, 1.1, 8, 9, 10, 11
	(10M)



Tunnels & Miscellaneous

Tunnels	length	Diameter - meters		
		4.0	5.0	6.5
DR e-	6,695	X		
DR e+	6,695	X		
Beam tunnels	37,297		X	X
E- source tunnels	994			
E+ tunnel	5,962	X		
Service tunnel	34,200		X	
linking galleries and passageways	2,399			
total TBM tunnels	90,849	drill & blast tunnels		3,393

Miscellaneous works	exc. volume	dimensions - meters				
		long	wide	long	wide	high
e- source without tunnels	14,312	110.0	18.0		19.0	13.0
continued e- source		27.0			19.0	13.0
undulator hall #1	2,681	74.0	28.0		11.0	18.0
undulator hall #2		60.0			11.0	9.0
undulator hall #3		74.0	20.0		11.0	12.0
alcoves without shaft	282	18.0	8.0			8.0
wave guides	2,480					
		cavern		junction		
Beam dumps	43,366	26.0	18.5	374.0	8.3	5.5
linking DR to Beam tunnels	56,403	100.0	5.0	80.0	11.0	5.5



Halls & Caverns

Halls / Caverns	exc. volume	long	wide	high
shaft cavern 1 E+ &Service tunnel	20,894	52.0	17.5	19.5
and Service tunnel		18.5	17.5	10.0
hall P.1 big	94,992	72.0	32.0	35.0
hall P.1.1 big	94,992	72.0	32.0	35.0
cavern P.2	18,308	54.0	16.0	18.0
cavern P.2.1	915	16.0	8.0	6.0
cavern P.3	18,308	54.0	16.0	18.0
cavern P.3.1	915	16.0	8.0	6.0
cavern P.4	18,308	54.0	16.0	18.0
cavern P.4.1	915	16.0	8.0	6.0
cavern P.5	18,308	54.0	16.0	18.0
cavern P.5.1	915	16.0	8.0	6.0
cavern P.6	18,308	54.0	16.0	18.0
cavern P.7	18,308	54.0	16.0	18.0
cavern P.8	12,883	38.0	16.0	18.0
cavern P.9	12,883	38.0	16.0	18.0
cavern P.10	18,308	54.0	16.0	18.0
cavern P.11	18,308	54.0	16.0	18.0
cavern P.12/J	6,330	51.0	10.5	10.0
cavern P.13/J	6,330	51.0	10.5	10.0
cavern P.14/G	3,848	31.0	10.5	10.0
cavern P.15/G	3,848	31.0	10.5	10.0
cavern P.16/E	6,330	51.0	10.5	10.0
cavern P.17/E	6,330	51.0	10.5	10.0
cavern P.18/B	3,848	31.0	10.5	10.0
cavern P.19/B	3,848	31.0	10.5	10.0



Shafts

MAC_CERN_17july06.xls - PHG removed costs

Shafts	diameter	length	Diameter - meters			
			0.8	9.0	14.0	15.0
shafts diameter 9	9.0	99.10		X		
P.1.0 big	15.0	82.00				X
P.1.1 big	15.0	82.00				X
P.2	14.0	72.00			X	
P.2.1	0.8	105.00	X			
P.3	14.0	72.00			X	
P.3.1	0.8	85.00	X			
P.4	14.0	92.00			X	
P.4.1	0.8	85.00	X			
P.5	14.0	62.00			X	
P.5.1	0.8	95.00	X			
P.6	14.0	52.00			X	
P.7	14.0	72.00			X	
P.8	9.0	52.00		X		
P.9	9.0	130.00		X		
P.10	14.0	42.00			X	
P.11	14.0	102.00			X	
P.12/J	9.0	60.00		X		
P.13/J	9.0	110.00		X		
P.14/G	9.0	70.00		X		
P.15/G	9.0	120.00		X		
P.16/E	9.0	50.00		X		
P.17/E	9.0	95.00		X		
P.18/B	9.0	60.00		X		
P.19/B	9.0	105.00		X		



139 Surface Buildings!

		area	# bldgs	total area
1.7.1.3	Surface Structures		139	98,475
1.7.1.3.1	Central Lab Buildings	sq m	4	9,767
general	Point 1 Reception Building (10,218 sq ft)	949		
general	Point 1 Office Machine & Technical Building (39,006 sq ft)	3,624		
general	Point 1 Central Laboratory Building (48,265 sq ft)	4,484		
general	Point 1 Fire Brigade Safety & Medical Building (7,644 sq ft)	710		
1.7.1.3.2	Detector Assembly Buildings		2	4,998
Exp	Point 1.0 Detector Assembly Building (26,896 sq ft)	2,499		
Exp	Point 1.1 Detector Assembly Building (26,896 sq ft)	2,499		
1.7.1.3.3	Office Buildings		10	2,023
RTML	Points 8 - 11 Office Buildings (4 x 2,178 sq ft)	809		
ML	Points 2-7 Office Buildings (6 x 2,178 sq ft)	1,214		
1.7.1.3.4	Service Buildings		41	29,623
DR	Points 12, 13, 16, 17 Electrical Service Buildings (4 x 2,178 sq ft)	809		
RTML	Points 8 - 11 Electrical Service Buildings (4 x 6,419 sq ft)	2,386		
RTML	Points 8 - 11 Cooling Towers & Pump Station Bldgs. (4 x 6,900 sq ft)	2,564		
RTML	Points 8 - 11 Cooling Ventilation Building (4 x 8,036 sq ft)	2,986		
ML	Points 2-7 Electrical Service Buildings (6 x 6,419 sq ft)	3,578		
ML	Points 2-7 Cooling Towers & Pump Stations Bldgs. (6 x 6,900 sq ft)	3,846		
ML	Points 2-7 Cooling Ventilation Buildings (6 x 8,036 sq ft)	4,480		
Exp	Point 1.0 Machine & Detector Access Building (21,804 sq ft)	2,025		
Exp	Point 1.1 Machine & Detector Access Building (21,804 sq ft)	2,025		
Exp	Point 1.0 Electricity Service Building (13,002 sq ft)	1,208		
Exp	Point 1.0 Cooling Towers & Pump Station Building (7,875 sq ft)	731		
Exp	Point 1.1 Cooling Towers & Pump Station Building (7,875 sq ft)	731		
Exp	Point 1.0 Cooling Ventilation Building (12,136 sq ft)	1,127		
Exp	Point 1.1 Cooling Ventilation Building (12,136 sq ft)	1,127		
1.7.1.3.5	Cryo- Equipment Buildings		16	7,375
RTML	Points 8 - 9 Cryo - Warm Compressor Buildings (2 x 2,695 sq ft)	501		
RTML	Points 8 - 9 Cryo - Surface Cold Box Building (2 x 4,802 sq ft)	892		
ML	Points 2-7 Cryo - Warm Compressor Building (6 x 4,312 sq ft)	2,404		
ML	Points 2-7 Cryo - Surface Cold Box Building (6 x 6,419 sq ft)	3,578		
1.7.1.3.6	Control Buildings		1	1,249
Exp	Point 1.0 Control Detector Building (13,448 sq ft)	1,249		
1.7.1.3.7	Workshops		15	24,773
DR	Points 12, 13, 16, 17 Workshop Buildings (4 x 13,448 sq ft)	4,996		
RTML	Points 8 - 11 Workshop Buildings - M & D (4 x 13,448 sq ft)	4,997		
ML	Points 2-7 Workshop Bldg. - Machine & Detector (6 x 13,448 sq ft)	7,496		
general	Point 1 Workshop Building - Machine & Detector (78,406 sq ft)	7,284		
1.7.1.3.8	Site Access Control Buildings		20	1,954
DR	Points 12 - 19 Site Access Buildings (8 x 1,089 sq ft)	808		
RTML	Points 8 - 11 Site Access Buildings (4 x 1,089 sq ft)	404		
ML	Points 2-7 Site Access Buildings (6 x 1,089 sq ft)	607		
Exp	Point 1.0 Experimental Area Access Building (368 sq ft)	34		
general	Point 1 Site Access Building (1,089 sq ft @ \$192 / sq ft)	101		
1.7.1.3.9	Shaft Access Buildings		28	13,224
DR	Points 12, 13, 16, 17 Shaft Access Buildings (4 x 10,742 sq ft)	998		
DR	Points 14, 15, 18, 19 Shaft Access Buildings (4 x 2,401 sq ft)	223		
RTML	Points 8 - 11 Shaft Access Buildings (4 x 10,742 sq ft)	3,992		
RTML	Points 8 - 11 Personnel Facilities Buildings (4 x 2,178 sq ft)	809		
ML	Points 2-7 Shaft Access Buildings (6 x 10,742 sq ft)	5,988		
ML	Points 2-7 Personnel Facilities Buildings (6 x 2,178 sq ft)	1,214		
1.7.1.3.10	Miscellaneous Buildings		0	0
1.7.1.3.11	User Facilities		2	3,489
general	Point 1 Restaurant & Cafeteria Building (13,448 sq ft)	1,249		
general	Point 1 Hostel Building (24,108 sq ft)	2,240		

Relative Cost per sq. meter

