without value estimates beyond RDR for posting

RDR Estimates for the Beam Delivery System and Experimental Hall

as of June 1, 2007

further developments are not included

lots of action, c.f. IRENG'07 Workshop

Peter H. Garbincius

Fermilab

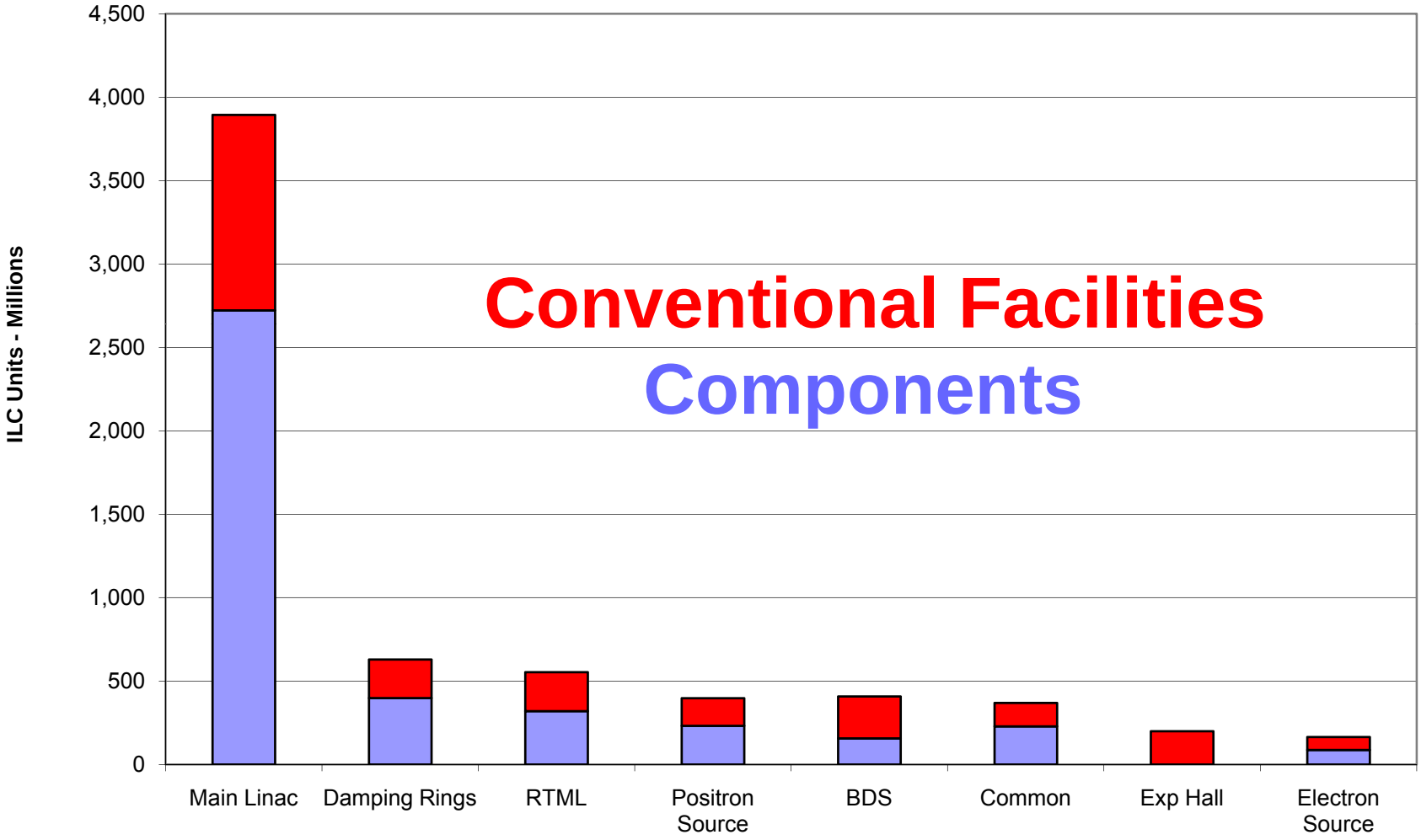
October 11, 2007

Contents & Preamble

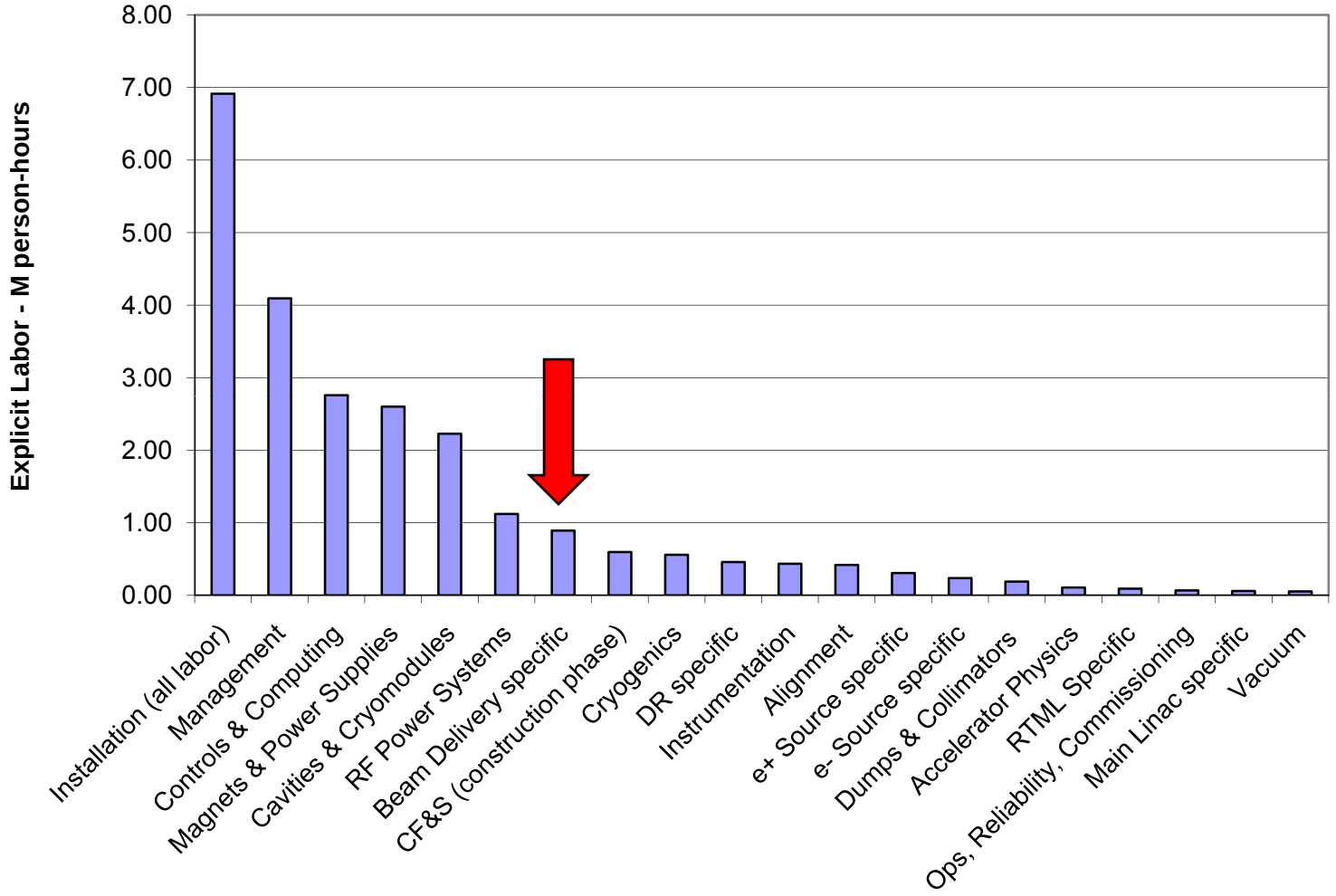
- Estimate information in the **RDR** => **PUBLIC**
- Est. **details** provided by Global & Technical Sys groups => **Confidential**
- Confidentiality Pledge – for "review access" – this meeting only, **don't post!**
- Estimates => RDR => BDS & Experimental Hall => GS & TS details
- ILC Value Unit = $ 1 in 2007 – Explicit Labor in units of K person-hours
- Estimates delivered in 2006 $, €, ¥ => translated & escalated to 2007 $
- Construction costs only, **no** R&D, pre-construction, commissioning, ops
- Estimate does **not** include contingency or escalation to construction year
- RDR, BDS/Exp Hall in 2007 $, avg ML escalation (2006 => 2007) = **4.7 %**
- Will show Global and Technical System estimate details in 2006 $,
  since that's the way estimates were sent, allow easy comparison
- BDS total: **406 M** ILCU ± 78 M ILCU ± 19.1% = ± 1σ (RMS)
- BDS avg CFS: 252 M ILCU ± 42 M ILCU ± 16.6%
- Exp Hall: **200 M** ILCU ± 31 M ILCU ± 15.4%

Exp Hall is **"bare" without "outfitting" for experiments** = all CF&S

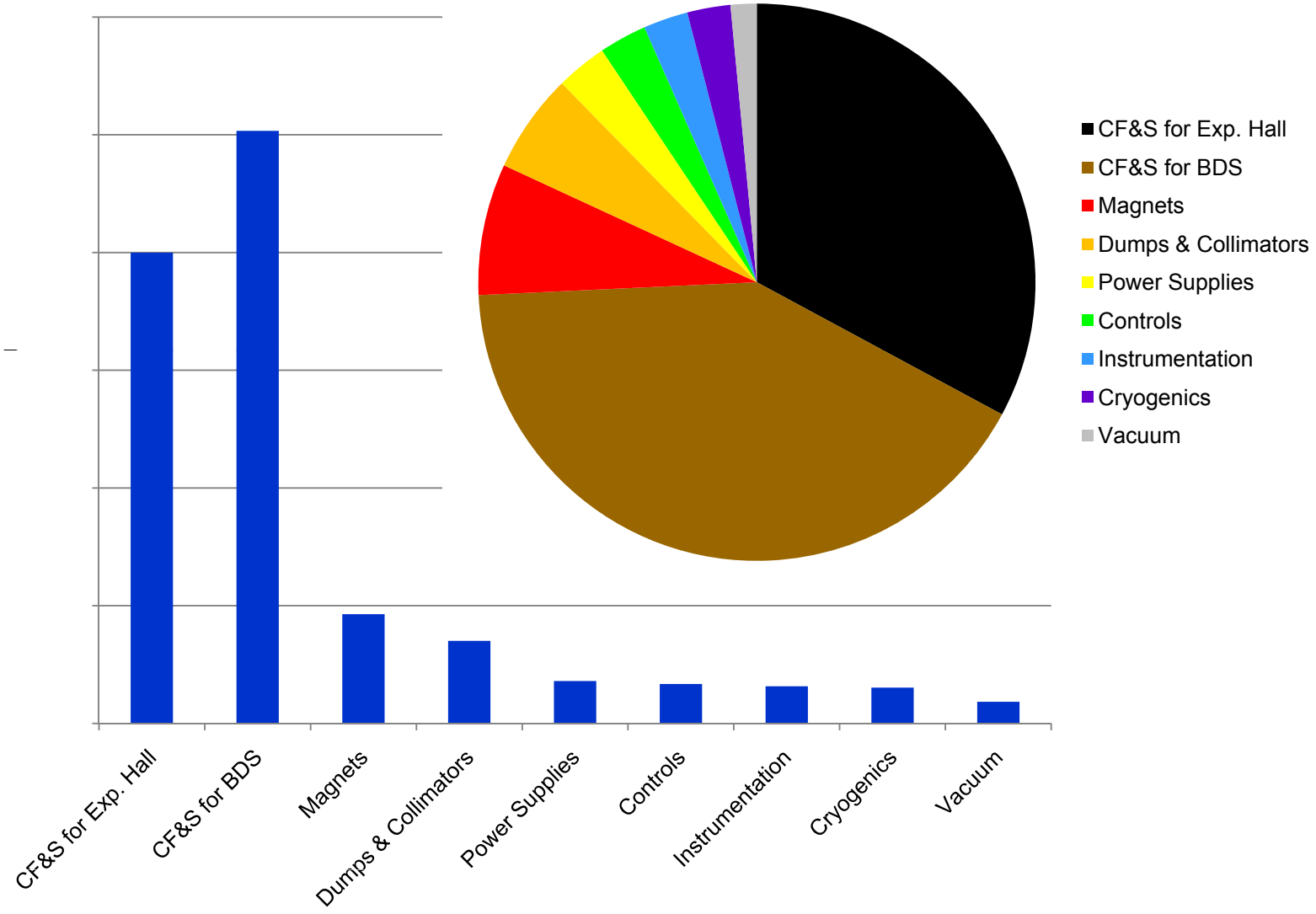
Total ILC Value Estimate = 6.62 B ILCU (2007)



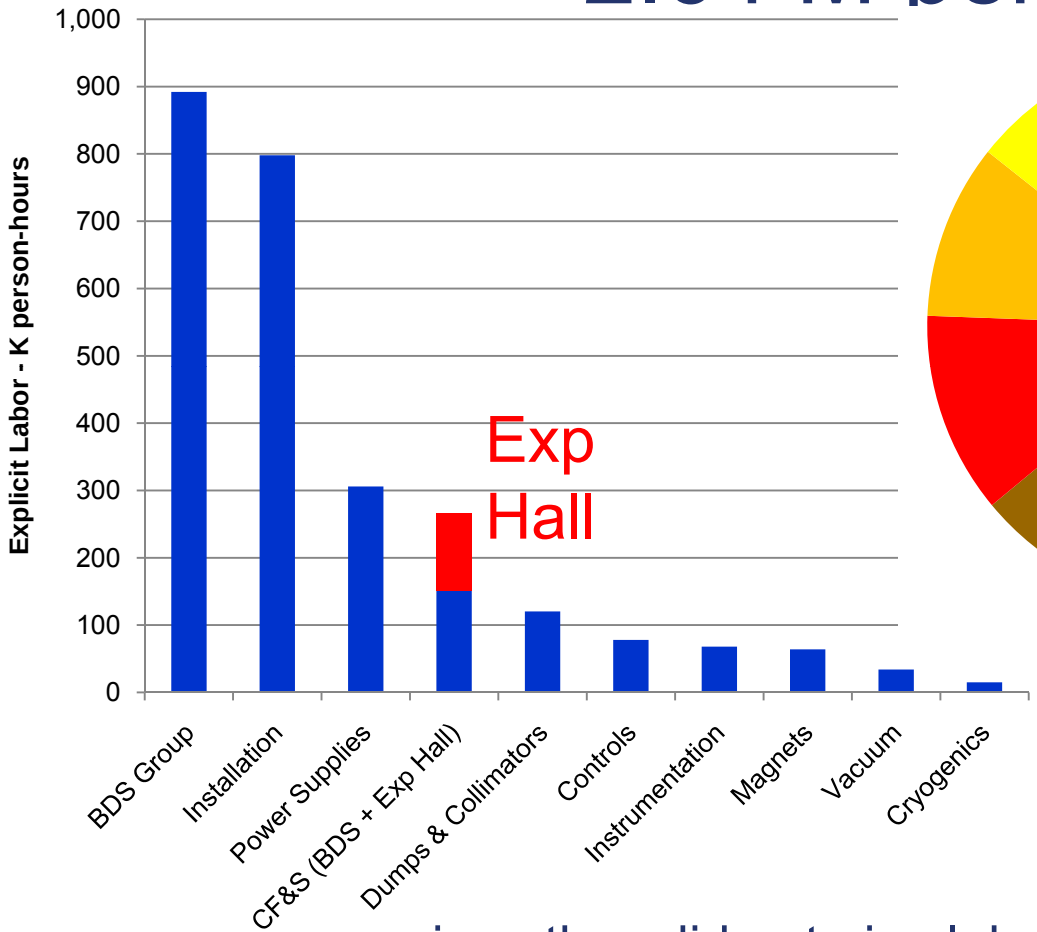
Total Explicit Labor Est. = **24.2 M** person-hrs

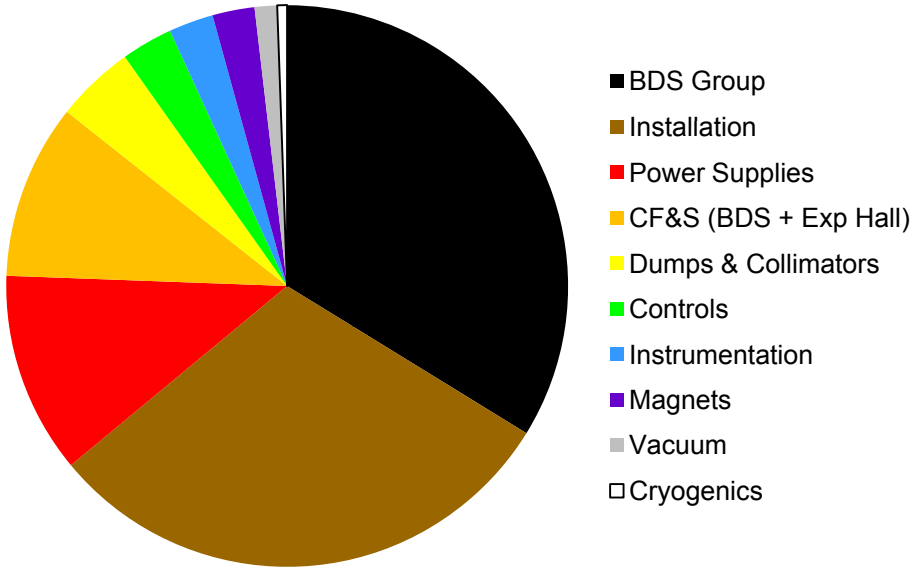


RDR Value for BDS & Exp Hall



BDS & Exp. Hall Explicit Labor
2.64 M person-hours





since they did not give labor estimates for AS,
I pro-rated Controls, PS, & Vacuum total labor

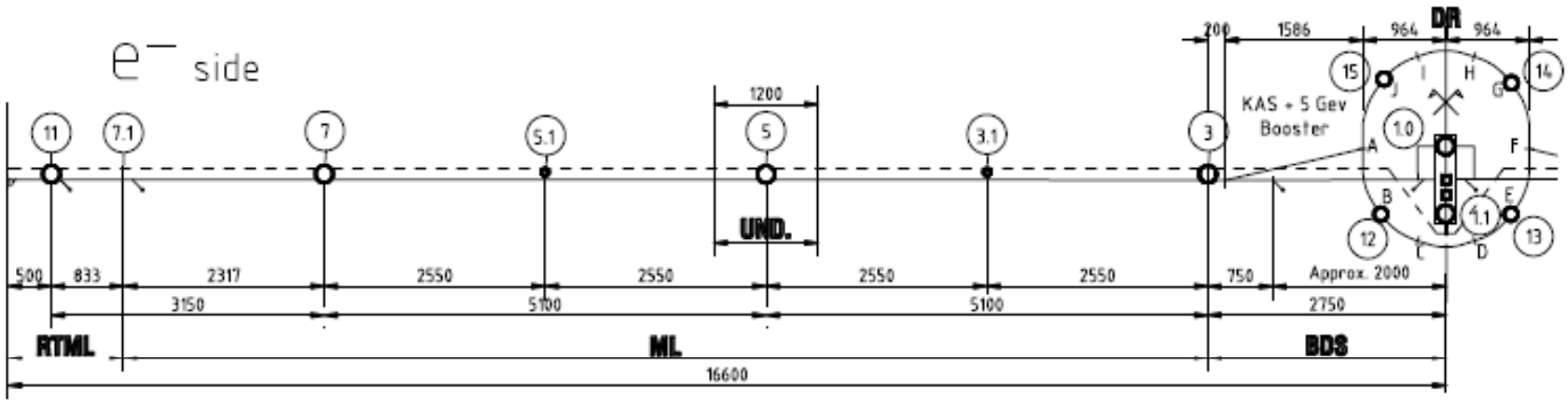
Notes on BDS & Exp Hall Value Est 2007

- CF&S: average over 3 regions - details below
- Controls: RF Φ dist + Front Ends + CRABs
- Installation: all costs are considered Labor
- See details below for:

  Instrumentation, Vacuum,

  Magnets, Power Supplies,

  Dumps & Collimimators, Cryo

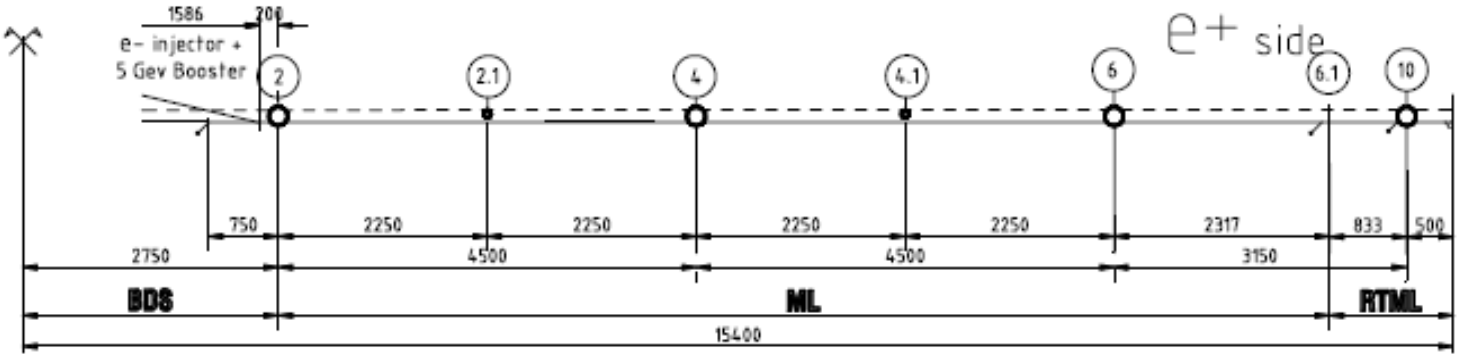


SITE / TUNNEL LENGTHS (m)

e⁻ side ML + RTML	e⁺ side ML + RTML	BDS + DR + sources	TOTAL
13 850 / 27 700	12 650 / 25 300	5500 / 20 900	32 000 / 73 900

TUNNELS

Area	e- inject.,KAS (beams)	DR	RTML beam + serv	ML beam + serv	BDS beam + serv	BDS Survey
Φm	4.5 + cavern	4.0	4.5 + 4.75	4.5 + 4.75	4.5 + 4.75	1.5 x 2.2



SHAFTS

Point	1.0	1.1	2	3	4	5	6	7	10	11	12/B	13/E	14/G	15/J
Φm	16	16	14	14	14	14	9	9	14	14	9	9	9	9

SURVEY BORINGS

Point	2.1, 3.1, 4.1, 5.1
Φm	0.80

SHAFT BASE CAVERNS

Point	2, 3, 4, 5, 6, 7, 10, 11
(LxWxH) m	50 x 16 x 18 + 3 storeys

DR ALCOVES

Point	A, D, F, H	12, 13, 14, 15
(LxWxH) m	16 x 8 x 8	46 x 10.5 x 10 + 1 storey

DETECTORS HALL

Point	1.0, 1.1
(LxWxH) m	detector 110 x 25 x 35

MAIN BEAM DUMPS

Point (2x)	1.0, 1.1, 6.1, 7.1, 10, 11
\	26 x 13 x 15 + 1 storey

ILC - UNDERGROUND STRUCTURES SCHEMATIC LAYOUT - PP ALTERNATIVE

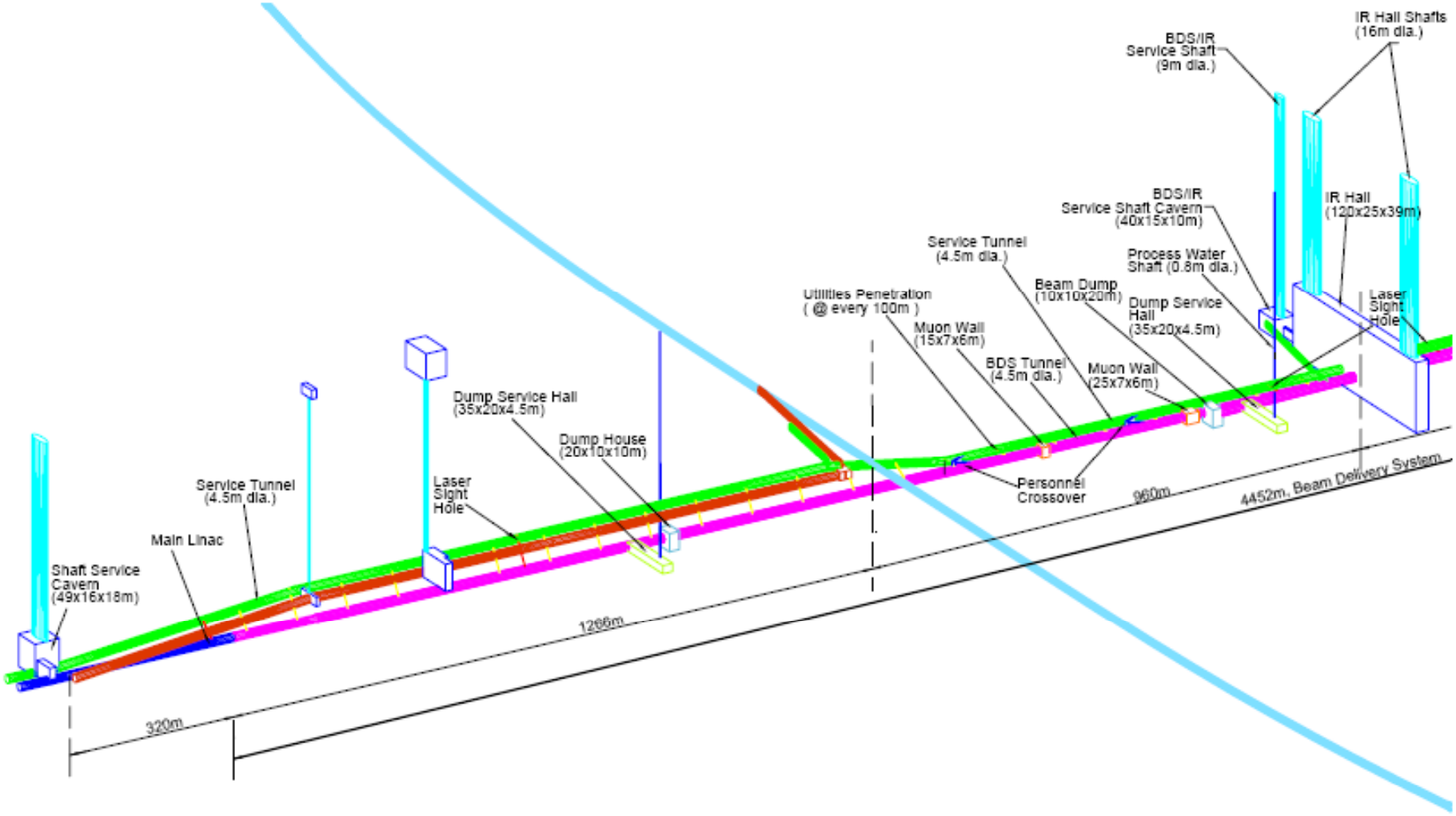
(2 mobile Detectors - Push Pull - CMS like) EUROPEAN REGION

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

SCALE : 1/50000(A3_FORMAT) DATE : 03-OCT-2006

LC-.CE-1.1649.0009 | SIZE 3 | INDICE A

Underground Construction for BDS & Exps



IR Region

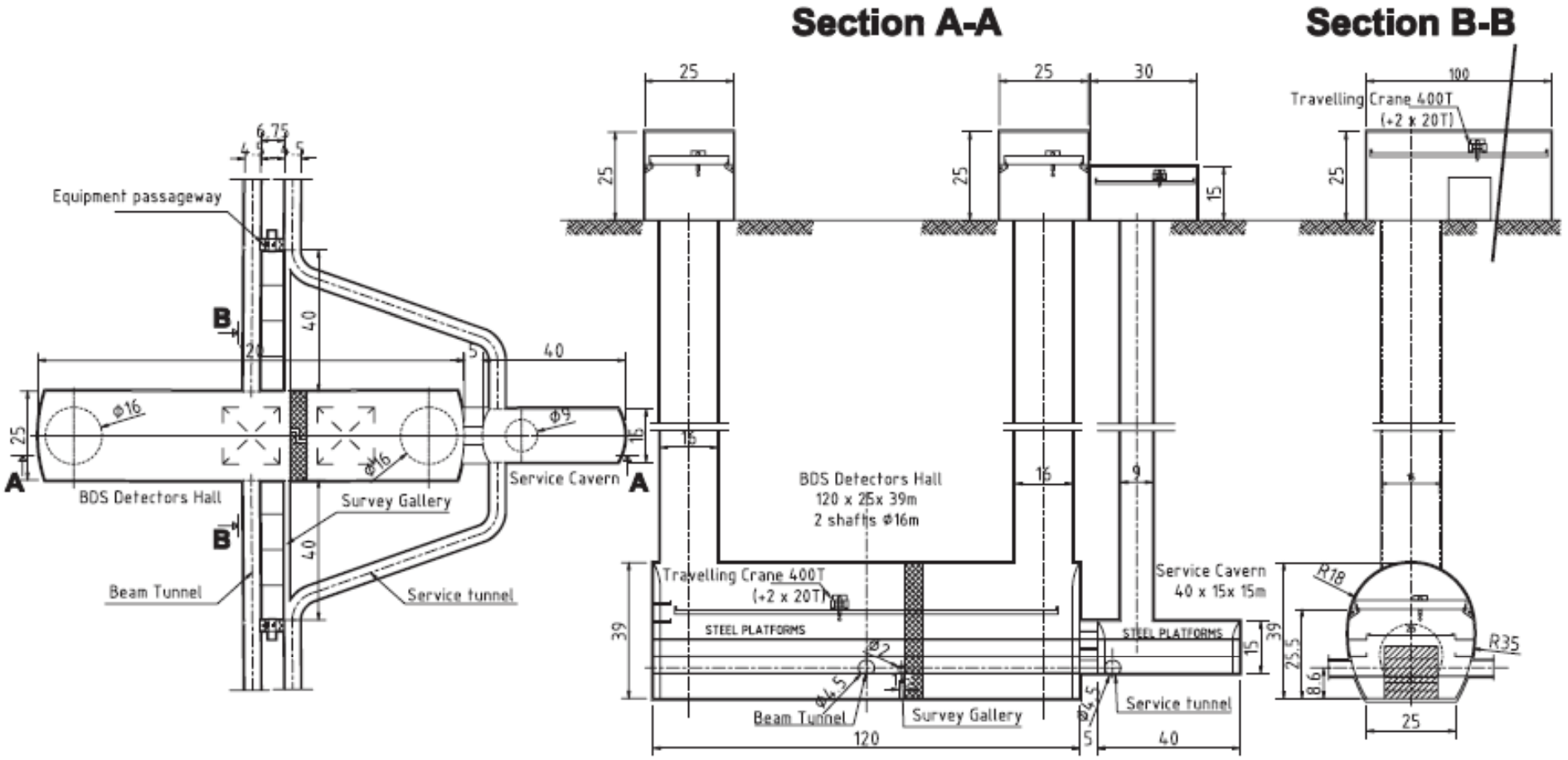
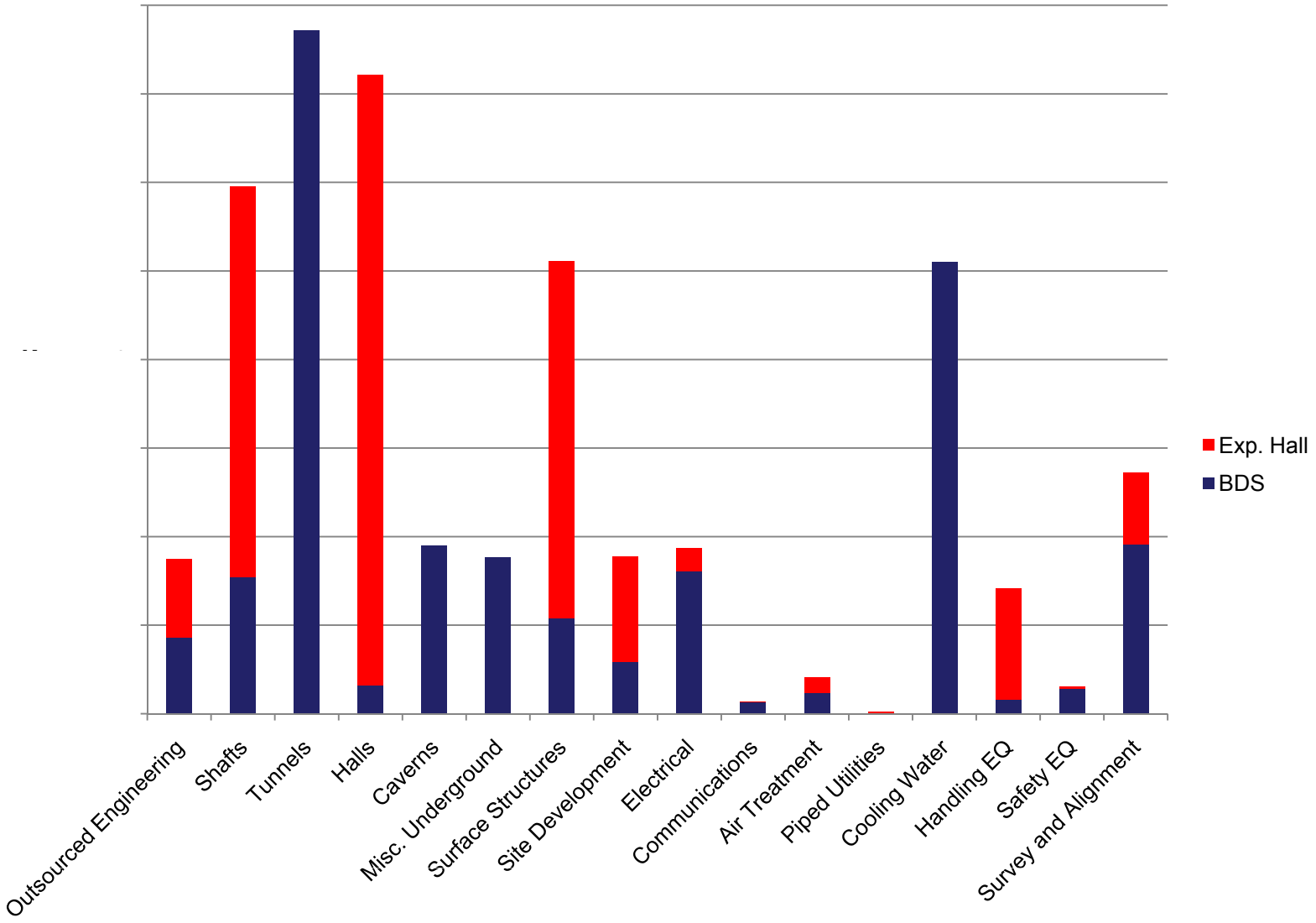


FIGURE 4.2-6. Schematic of the Physics Detector Hall, showing BDS service cavern arrangement

VALUE: BDS + Exp Hall



		5dec05 ILC CFS Americas - Jan 2006 US$ - Beam Delivery System	Quantity	Unit
1.7.1		**CIVIL ENGINEERING**		
1.7.1.1		Engineering, study work and documentation		
	1.7.1.1.1	In-house Engineering		*/ man-hr*
		In-house Engineering	4%	%
	1.7.1.1.2	Outsourced Consultancy Services		
		Outsourced Engineering	6%	%
1.7.1.2		Underground Facilities		
	1.7.1.2.1	Shafts		
		BDS/IR Service 9m dia. Shaft (425 vert ft)	129.5	vert m
		Surface Grouting of BDS 9m dia. Shaft (425 vert ft)	1	ea.
		BDS/IR 9m dia. Shaft, finishing (stairs, conc. wall, elev.#2)	130	vert m
		BDS 800mm dia. Process Water Shafts (4 x 425 vert ft)	518	vert m
		Surface Grouting of BDS Process Water Shafts (4 x 425 vert ft)	4	ea.
		BDS Underground Potable Water (BDS/IR Service Shaft)	1	ea.
		BDS Underground Sanitary Sewer (BDS/IR Service Shaft)	1	ea.
	1.7.1.2.2	Tunnels		
		e- BDS 4.5m Beam Tunnel, Point 3 to IR, TBM Exc. (7,301 lin ft)	2,226	lin m
		e- BDS 4.5m Service Tunnel, DR to IR, TBM Exc. (3,609 lin ft)	1,100	lin m
		e- BDS 4.5m Tunnels, Conc. Inv. (10,900 lin ft)	3,326	lin m
		e- BDS Extraction Beam Tunnel, Taper to 8 wide, D&B Exc. (984 lin ft ~ 3,814 CY	2,916	m^3
		e+ BDS 4.5m Beam Tunnel, Point 2 to IR, TBM Exc. (7,301 lin ft)	2,226	lin m
		e+ BDS 4.5m Service Tunnel, Point DR to IR, TBM Exc. (3,609 lin ft)	1,100	lin m
		e+ BDS 4.5m Tunnels, Conc. Inv. (10,900 lin ft)	3,326	lin m
		e+ BDS Extraction Beam Tunnel, Taper to 8 wide, D&B Exc. (984 lin ft ~ 3,814 CY	2,916	m^3
	1.7.1.2.3	Halls		
	1.7.1.2.4	Caverns		
		BDS/IR Service Shaft Base Cavern D&B Exc. (7,848 CY)	6,000	m^3
		Passage from BDS/IR Service Cavern to IR Hall (490 CY)	375	m^3
		Beam Dump, D&B Exc., (~1650m from IP) (e- BDS) (2,616 CY)	2,000	m^3
		Beam Dump Service Hall, D&B Exc., (~1650m from IP) (e- BDS) (4,120 CY)	3,150	m^3
		e- BDS 9m Muon Wall Alcove, D&B Exc. (824 CY)	630	m^3
		e- BDS 18m Muon Wall Alcove, D&B Exc. (1,373 CY)	1,050	m^3
		e+ Final Beam Dump, D&B Exc., (~300m from IP) (2,016 CY)	2,000	m^3
		e+ Final Beam Dump Service Hall, D&B Exc., (~300m from IP) (4,120 CY)	3,150	m^3
		Beam Dump, D&B Exc., (~1650m from IP) (e+ BDS) (3,034 CY)	2,320	m^3
		Beam Dump Service Hall, D&B Exc., (~1650m from IP) (e+ BDS) (4,863 CY)	3,718	m^3
		e+ BDS 9m Muon Wall Alcove, D&B Exc. (824 CY)	630	m^3
		e+ BDS 18m Muon Wall Alcove, D&B Exc. (1,373 CY)	1,050	m^3
		e- Final Beam Dump, D&B Exc., (~300m from IP) (2,016 CY)	2,000	m^3
		e- Final Beam Dump Service Hall, D&B Exc., (~300m from IP) (4,120 CY)	3,150	m^3

BDS CF&S components (5dec06 – Americas – 2006)

2006_1205_50%e ILC CFS Americas Single 14 Construction Cost Estimate.xls

	1.7.1.2.5	Miscellaneous works		
		e- BDS Personnel Crossovers, D&B Excavation (2 X 158 CY)	241	m^3
		e- BDS Utilities Penetration, Drill Excavation (22)	22	ea.
		e+ BDS Personnel Crossovers, D&B Excavation (2 X 158 CY)	241	m^3
		e+ BDS Utilities Penetration, Drill Excavation (22)	22	ea.
		e- BDS Laser Equipment Sight Holes (3)	3	ea.
		e+ BDS Laser Equipment Sight Holes (3)	3	ea.
1.7.1.3		Surface Structures - Beam Delivery System		
	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		
		Point 1.0 Cooling Towers & Pump Station Bldg. (7,500 sq ft)	697	sq m
		Point 1.0 Cooling Ventilation Building (2,500 sq ft)	232	sq m
	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		
		Point 1.0 Shaft Access Building (9,375 sq ft)	871	sq m
	1.7.1.3.10	Miscellaneous Buildings		
	1.7.1.3.11	User Facilities		
1.7.1.4		Site Development		

Exp. Hall CF&S components (5dec06 – Americas – 2006)

		5dec05 ILC CFS Americas - Jan 2006 US$ - Experimental Hall	Quantity	Unit
1.7.1		**CIVIL ENGINEERING**		
1.7.1.1		Engineering, study work and documentation		
	1.7.1.1.1	In-house Engineering		*/ man-hr*
		In-house Engineering	4%	%
	1.7.1.1.2	Outsourced Consultancy Services		
		Outsourced Engineering	6%	%
1.7.1.2		Underground Facilities		
	1.7.1.2.1	Shafts		
		Shafts, 16m dia. - Points 1.1 & 1.2 (2 x 425 vert ft)	259	vert m
		Surface Grouting of Points 1.1 and 1.2 16m dia. Shafts (2 x 425 vert ft)	2	ea.
		Points 1.1&1.2 - 16m dia. Shafts, finishing (stairs, conc. wall, elev.#2)	259	vert m
		IR Underground Potable Water (Points 1.1 & 1.2)	2	ea.
		IR Underground Sanitary Sewer (Points 1.1 & 1.2)	2	ea.
	1.7.1.2.2	Tunnels		
	1.7.1.2.3	Halls		
		IR Detector Hall, D&B Excavation 120x25x37m (151,941 CY)	116,167	m^3
		IR Detector Hall, Steel Platforms (incl. all fittings)	1	ea.
		IR Detector Hall, Steel Track Plates (20x80x.05m @ 8000 kg / m3)	640,000	kg
	1.7.1.2.4	Caverns		
	1.7.1.2.5	Miscellaneous works		

1.7.1.3		Surface Structures - Experimental Hall		
	1.7.1.3.1	Central Lab Buildings		
	1.7.1.3.2	Detector Assembly Buildings		
		Points 1.1 & 1.2 Detector Assembly Buildings (2 x 37,500 sq ft)	6,971	sq m
	1.7.1.3.3	Office Buildings		
	1.7.1.3.4	Service Buildings		
		Point 1.1 Machine & Detector Access Building (22,500 sq ft)	2,090	sq m
		Point 1.1 Electricity Service Building (1,500 sq ft)	139	sq m
		Point 1.1 Cooling Towers & Pump Station Building (7,500 sq ft)	697	sq m
		Point 1.2 Cooling Towers & Pump Station Building (7,500 sq ft)	697	sq m
		Point 1.1 Cooling Ventilation Building (2,500 sq ft)	232	sq m
		Point 1.2 Cooling Ventilation Building (2,500 sq ft)	232	sq m
	1.7.1.3.5	Cryo- Equipment Buildings		
	1.7.1.3.6	Control Buildings		
		Points 1.1 & 1.2 Control Detector and Machine Buildings (2 x 11,250 sq ft)	2,091	sq m
	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		
		GAZ & Survey Building (12,800 sq ft)	1,190	sq m
	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		
		Points 1.0, 1.1 Clearing, Grubbing, and Initial Site Preparation (2 sites)	2	ea.
	1.7.1.4.5	Utility Distribution		
		Points 1.0, 1.1 Utility Corridor (Gas, DWS, San., Storm, Elec., Comm.)	1	ea.
		Points 1.0, 1.1 Sanitary (assumed on FNAL site)	1	ea.
		Points 1.0, 1.1 DWS (assumed on FNAL site)	1	ea.
	1.7.1.4.6	Road, Sidewalks & Parking Areas		
		Points 1.0, 1.1 Service Roads (2 sites x 1250 lin ft / site)	762	lin m
		Points 1.0, 1.1 Paved Areas (2 sites x 8750 sy / site)	14,632	sq m
		Points 1.0, 1.1 Flatwork (2 sites x 2,500 sq ft / site)	465	sq m
	1.7.1.4.7	Landscaping		
		Points 1.0, 1.1 Landscaping	2	ea.
		Points 1.0, 1.1 Security Fencing (2 sites x 5,000 lin ft / site)	3,048	lin m
	1.7.1.4.8	Environmental		
		Points 1.0, 1.1 Sediment & Erosion Control (2 sites)	2	ea.
	1.7.1.4.9	Miscellaneous Site Works		

BDS & Exp Halls CF&S components #4 (avg - all regions)

- Cooling Water: **XX** M + 0 M ILC Units 2007

  10 MW LCW + **1** MW chilled water – Emil H. 8/23/07

  Emil H (10/11/07) says 51 M incl 36 MW for dumps
- Electrical: XX M + YY M
- Communications: XX M + YY M
- Air Handling: XX M + YY M
- Piped Utilities: 0 M + YY M
- Handling Equipment: XX M + YY M
- Safety Equipment: XX M + YY M
- Survey & Alignment: XX M + YY M

BDS Dumps & Collimators

Dumps and Collimators - RDR Config-v2_4may07.xls

Count of Eng_Name		Area
KeyW	Eng_Name	BDS
DUMP	Dump:Normal:Charged:500GeV:18MW	2
	Dump:TuneUp:Charged:500GeV:18MW	2
	Insertable_TuneUP_Stopper:500GeV:8kW	2
DUMP Total		6
ECOL	Coll:Cu:30RL:1jaw:10kW:H2O-cooled	2
	Coll:Cu:35RL:16mm-x-9mm:Uncooled	2
	Coll:Cu:30RL:1.0cmBore:10kW:H2O-cooled	22
	Coll:200cm:Al_balls:18cmBore:250kW:H2O-cooled	2
	Coll:200cm:Al_balls:21cmBore:250kW:H2O-cooled	2
	Coll:200cm:Al_balls:27cmBore:250kW:H2O-cooled	2
ECOL Total		32
RCOL	Coll:Ti:0.6RL:4Jaw:Uncooled	10
	Coll:Cu:30RL:4Jaw:10kW:H2O-cooled	8
	Coll:W:30RL:1.66cm_xgap:???W:H2O-cooled	2
	Coll:W:30RL:1.70cm_xgap:???W:H2O-cooled	2
	Coll:W:30RL:4Jaw:100W:H2O-cooled	8
	Coll:Ti:1.0RL:4Jaw:Uncooled	2
RCOL Total		32
STOP	PPS_Stopper_w_BTM	6
	MPS_Stopper_w_BTM, Fixed_Aperture	6
	MPS_Stopper_w_BTM, Variable_Aperture	2
STOP Total		14
Grand Total		84

BDS Cryogenics

ILC RDR Cryogenic Cost Estimate - 2006		ILC_WBS_Cryogenics-27Feb07.xls				
		2 x 250 GeV ILC				
Identifier	Item description	Unit	Materials & Services			Notes
			No. of units	FY06 M$ per unit	Total M&S M$	
1.7.2	**Cryogenic Plant & Distribution**					
1.7.2.1	**Cryogenic Plants**					
1.7.2.1.5	**Beam Delivery System cryogenics**					For costing assume one plant at one push-pull IR serving both sides
1.7.2.1.5.1	Beam delivery system refrigeration (1.8 K, 4.5 K, 40 - 80 K)	each	1			
1.7.2.1.5.2	BDS pumping system for 1.8 K (room temperature pumps)	each	2			Small heat loads at 1.8 K so room-T pumping like at test facilities
1.7.2.1.5.3	BDS cooling tower system	each	1			
1.7.2.1.5.4	BDS warm gas storage system	lot	1			Size storage for full inventory
1.7.2.1.5.5	BDS vertical piping	m	150			
1.7.2.1.5.6	BDS purification system	each	1			
1.7.2.1.5.7	BDS installation contracts	each	1			
1.7.2.1.5.8	BDS cryogenic control system	each	1			
1.7.2.1.5.9	BDS liquid helium storage system	lot	1			Size storage for full inventory
1.7.2.1.5.10	BDS miscellaneous (ODH, gas analysis, instrument air, etc.)	each	1			
1.7.2.1.5.11	BDS helium	K liters	2			2000 liters (=250 kg) per plant
1.7.2.2	**Cryogenic Distribution**					
1.7.2.2.5	**Beam Delivery System cryogenic distribution**					Assume one IR with push-pull detectors
1.7.2.2.5.1	BDS cryogenic distribution systems	each	1			
1.7.2.2.5.2	BDS crab cavity cryogenic end boxes	each	4			
1.7.2.2.5.3	BDS final focus cryogenic end boxes	each	4			
1.7.2.2.5.4	BDS octupole cryogenic end boxes	each	4			
1.7.2.2.5.5	BDS transfer lines	m	400			

BDS Magnets – no EDIA

Magnet Cost Summary by Area Region - Magnets_uberSummary_allStyles_070427_v5x.xls - 2006 estimates

Magnet Engineering Name (Style)	Revised Style List (070419)	Magnet Unit Cost	Number Req	Total Magnet Cost	Total Magnet Cost *EDI Removed (070419)*	Mover Unit Cost	No. Movers Req	Total Mover Cost	Stand Unit Cost	Total Stand Cost	Total Cost	Total Cost *EDI removed (070419)*
Beam Delivery System Magnets												
BDS Superconducting Magnets	BDS WBS No. & Mag. ID											
"Anti-Solenoid"	1.6.1.53 Antisolenoid		4									
"Tail Folding Octupole" (2.5m)	1.6.1.48 EO_SC14L2500; 1.6.1.50 EO_SC14L2500		8				8					
QF1 (assembly)	1.6.1.51a FD:QF1 assembly (stay in tunnel)		26				2					
QD0 (assembly)	1.6.1.51 FD:QD0 assembly (moves w.detector)		60				4					
BDS Conventional Magnets												
D66L100	1.6.1.65 Correctors		64									
D66L2334	1.6.1.11 D60L2400; 1.6.1.6 D25L2400; 1.6.1.3 D20L2400		114									
D45L1995	1.6.1.10 D40L2000		4									
D25L2375	1.6.1.8 D20L2400 BPC		24									
D24L2976V2	1.6.1.4a D20L3000; 1.6.1.5a D20L6000 ("split") (6m magnet = 2-3m dipoles)		12									
D172L1830	1.6.1.2 D170L2000		16									
D172L228	1.6.1.101 D174L400 WEX1,2_1,3		8									
D172L628	1.6.1.101 D174L800 WEX1,2_2		4									
D272L1728	D272L1728		8									
Q85L2960	1.6.1.37 Q80L3000		30				30					
Q16L992	1.6.1.41 Q12L1000		38				38					
QS16L492	1.6.1.21 Q12L500		8				8					
Q16L1992	1.6.1.20 Q12L2000		6				6					
Q24L1488	1.6.1.24 Q20L1500		8				8					
Q45L1980	1.6.1.33 Q40L2000		14				14					
Q30L1985	1.6.1.29 Q25L2000		14				14					
Q26L1990V1	1.6.1.25 Q20L2000		52				52					
Q65L1968	1.6.1.36 Q60L2000		6				6					
QS24L288	1.6.1.26 Q20L300		2				2					
Q90L2100	1.6.1.38 Q84L2106, L2143		10									
Q112L2244	1.6.1.18 Q104L2106, Q92L2106		4									
Q132L2134	1.6.1.19 Q124L2106		2									
Q150L1925	1.6.1.22 Q142L1949		2									
Q178L2011	1.6.1.23 Q170L1944		8									
SX85L958	1.6.1.46 SX80L1000		4				4					
SX24L988	1.6.1.42 SX20L1000		2				2					
SX30L970	1.6.1.43 SX25L1000		4				4					
EO30L790	1.6.1.47 EO14L1000; 1.6.1.49 EO14L1000		4				4					
5m Muon Spoiler	1.6.1.57a Mu wall 5m		2									

BDS Magnets – no EDIA

Kicker, Septum, and Pulsed Magnets												
Magnet Engineering Name (Style)	Revised Style List (070419)	Magnet Unit Cost	Number Req	Total Magnet Cost	Total Magnet Cost *EDI Removed (070419)*	Pulser Cost	No. Pulser Req	Total Pulser Cost	Stand Unit Cost	Total Stand Cost	Total Cost	Total Cost *EDI removed (070419)*
BDS Magnets												
Abort kicker (2m)			9				2					
Abort kicker (2m)			9				2					
Abort septum (10mm thick)			2				1					
Abort septum (10mm thick)			2				1					
Abort septum (20mm thick)			1				1					
Abort septum (20mm thick)			1				1					
Large sweeper			10				10					
Large sweeper			10				10					
Small sweeper			10				10					
Small sweeper			10				10					
BDS Kicker, Septm, and Pulsed Magnet Total			64				48					
Overall BDS Magnet Totals			636									

includes: conventional and SC magnets,
5 meter muon walls,
abort kickers, septa, pulsed sweepers,
stands, movers, and pulsers

BDS Power Supplies

07-02-28 ILC Magnet Power Supply List.xls

		Data													
Area	Section	Sum of Power Supply Quantity	Sum of DC Cable Cost	Sum of DC Power Cable Tray Cost (k$)	Sum of PowerSupply Cost (k$)	Sum of Controller Cost (k$)	Sum of Transductor Cost (k$)	Sum of PLC Cost (k$)	Sum of 50m of I & C Cables and Cable Tray (k$)	Sum of IGBT, Heatsink and Dump Resistor (k$)	Sum of Heater Firing Unit (k$)	Sum of FPGA PLC (k$)	Sum of Rack and Accessories Cost (k$)	Sum of AC Cable/Conduit Cost (k$)	Sum of System M & S Cost (k$)
BDS	e- 14mr1	179													
	e- Common	37													
	e+ 14mr1	179													
	e+ Common	37													
BDS Total		432													

2006 estimate

much more data 7.5 MB available from Paul Bellomo's spreadsheets

BDS Instrumentation

# of areas WBS	Beam Delivery System (1x 14mrad IP, PP)	Materials & Services Est 2006		
		unit cost	quantity	total cost
1	BDS - total Instrumentation			
6.1	Button/Stripline BPM		120	
6.2	Cavity BPM (L-Band)		42	
6.3	Cavity BPM (S-Band)		14	
6.4	Cavity BPM (C-Band)		262	
6.5	Laserwire (IP)		8	
6.6	OTR, OTRI - Andrei wanted 2 - PHG - 16march07		2	
6.7	X sync light		10	
6.8	DMC (cold, 3.9GHz)		2	
6.9	Toroid		10	
6.10	Pickup phase monitor		2	
6.11	BLM - ion chamber		10	
6.12	BLM - PMT - discrete IC		100	
6.13	Feedback - special		12	

Plus: Laser Polarimeters upstream (2007) **0.59**

Laser Polarimeters downstream (2007) **2**

Energy Spectrometer – placeholder (2007) **2**

BDS Vacuum

	12-Dec-06 *Updated after Valencia* *Only single IR 14 mr* *Optics ILCBDS2006e*	2006 est *cost Psh-pl*	* escalation *1.028* uncertainty	=> 2007 estimate
BDS WBS	***Description***	***total***	***± %***	***Source, ref***
1.6.2	**Vacuum System**			
1.6.2.1	Pumps (incl.controllers), 1575/side		25	Y.Suetsugu; 20061129
1.6.2.2	Manifold for gauges (6 ports) 14/side		25	Y.Suetsugu; 20061129
1.6.2.3	L-ang vlv for rough pump, 14/side		25	Y.Suetsugu; 20061129
1.6.2.4	Gate valve, 15/side		25	Y.Suetsugu; 20061129
1.6.2.5	Bellow chamber, 518/side		25	Y.Suetsugu; 20061129
1.6.2.6	Vacuum Gauge (incl. cntrllr) 14/side		25	Y.Suetsugu; 20061129
1.6.2.7	Vacuum Switch, 15/side		25	Y.Suetsugu; 20061129
1.6.2.8	Rougth pump (incl.cntrllr) 10/side		25	Y.Suetsugu; 20061129
1.6.2.9	Crotch, 5/side		25	Y.Suetsugu; 20061129
1.6.2.10	Bake heater (exc DL&SR) 2635m/side		25	Y.Suetsugu; 20061129
1.6.2.11	Insulator (except DL&SR) 2635m/sd		25	Y.Suetsugu; 20061129
1.6.2.12	Supports (pairs), 518/side		25	Y.Suetsugu; 20061129
1.6.2.13	Gasket, 2710/side		25	Y.Suetsugu; 20061129
1.6.2.14	Bolt, nut, 54200/side		25	Y.Suetsugu; 20061129
1.6.2.15	Interlock box (per 1GV), 15/side		25	Y.Suetsugu; 20061129
1.6.2.16	Chambers SS+Cu, 840m/side		25	Y.Suetsugu; 20061129
1.6.2.17	Chambers SS, 1720m/side		25	Y.Suetsugu; 20061129
1.6.2.18	Chambers Cu, 376m/side		25	Y.Suetsugu; 20061129
1.6.2.19	ED&I for vacuum system	set to zero	25	Y.Suetsugu; 12Dec, 30%

Next Steps: organizing for EDR

- The leading priority for allocating resources, both manpower and funding is the verification of cavity gradient …..

- We are organizing a Project Management Office with responsibility to provide a comprehensive, integrated, resource-loaded schedule using Primavera

for EDR, we need:

- updated value and labor estimates
  - but ***no overall increase!***

    Marc: a 10% decrease would be better!

    how much manpower will be available for this?
- better understanding of the cost risks =>

  distributions of probable costs

  => 90% or 95% upper confidence limit

  = what the funding agencies should be prepared to pay
- that comprehensive, resource-loaded schedule
- mitigation (or plan to mitigate) the technical risks

  as compiled in Ewan's Risk Register

BDS Technical Risks & Mitigation Paths from Ewan's at Orsay Cost Review

(1) Final Doublet Jitter – continued engineering and prototypes
(2) Beam Halo too large – install longer muon or magnetized walls
(3) Prompt Push-Pull Operations – detailed engineering
(4) Adequacy of Beam Dumps, windows, shielding
– longer tunnels, more shielding, etc.
(5) Laser Wire Diagnostics – engineering and prototypes, tunnel length
(6) Collimator Performance – measurements & studies
(7) Crab Cavity Performance – engineering and prototype tests
(8) Fast Feedback Performance – experiments & studies at ATF2 etc.
(9) Energy and Polarization – design and prototyping
(10) Performance of FF Optics – continued studies at ATF2
(11) FD size and 14 mrad – detailed engineering and prototyping

Beside cavity performance, I worry:

- That the unit cost per linear meter for TBM and other underground construction will be higher than our estimates
- Optimization of Conventional Facilities
- What are the next steps in development of estimates and cost/performance optimization?
- We have not included push-pull costs for detectors, nor outfitting of hall for experiments in estimates, did lengthen (by 10 m) & deepen (by 2 m) the exp. hall Andrei added $ xxx K placeholder for concrete wall neutron shield to CFS (1.6.6.19), but I *missed* catching that addition, and Andrei also missed that omission in the cross check!
- Remember, this is confidential estimating data, so **DO NOT POST** details on INDICO or elsewhere!