INTERNAL NOTE -- DISTRIBUTION AUTHORIZATION REQUIRED

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GEM Cost and Schedule Summary Book

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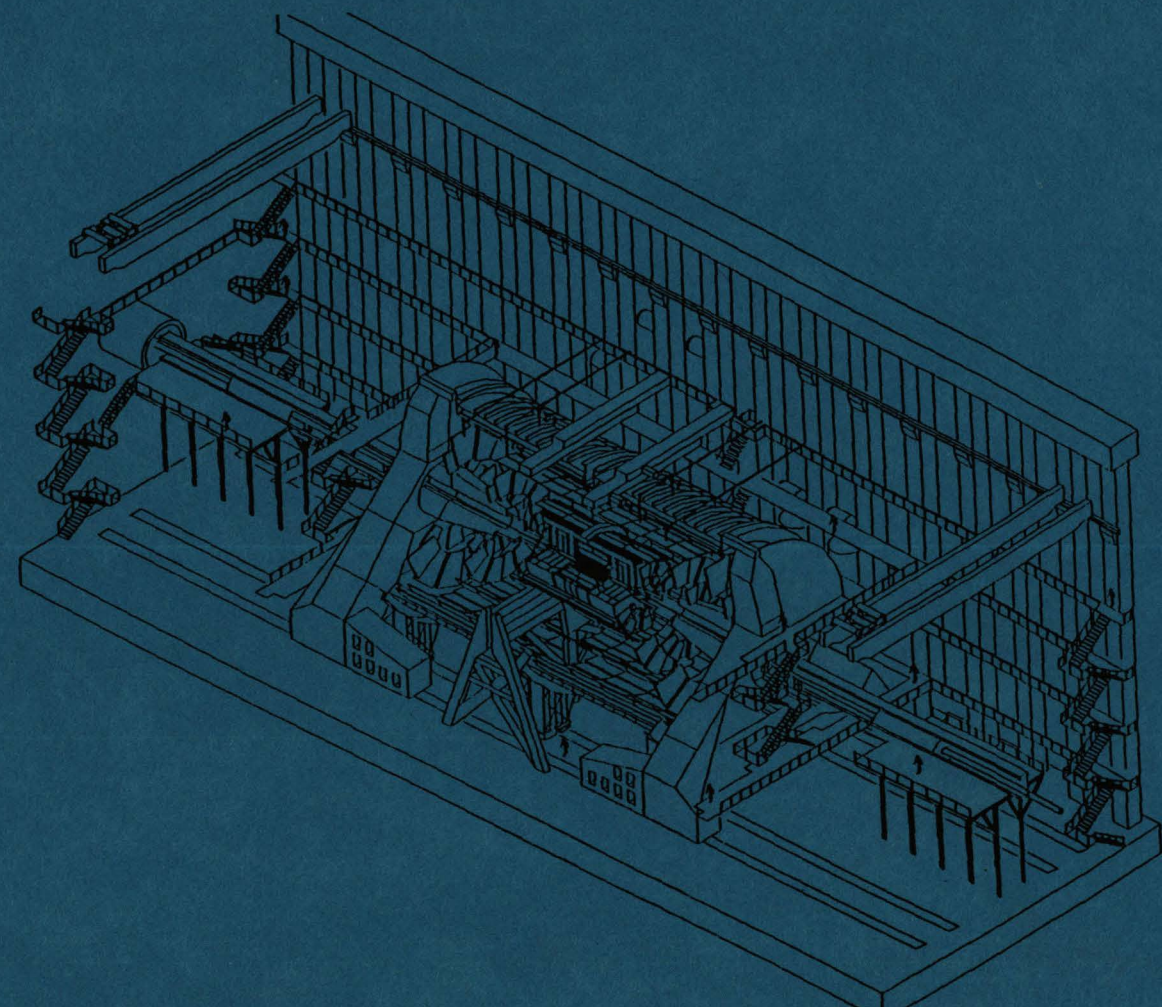

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April 27, 1993
GEM--IN-93-30

GEM Cost and Schedule Summary Book

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gem DETECTOR PROJECT

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

GEM DETECTOR SYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
	-GEM DETECTOR SYSTEM	00	274,531	3,657,544	167,306	441,837	6,029	1%	103,362	23%	551,228
10	-CENTRAL TRACKER	01	12,168	190,275	9,786	21,954	0	0%	5,369	25%	27,324
20	-CALORIMETER	01	68,570	1,012,430	37,976	106,546	0	0%	28,870	27%	135,415
30	-MUON	01	40,631	891,791	36,819	77,449	0	0%	20,897	27%	98,347
40	-MAGNET	01	64,787	348,234	33,232	98,019	6,029	6%	21,277	21%	125,325
50	-ELECTRONICS	01	52,619	465,971	22,552	75,171	0	0%	17,100	23%	92,272
60	-COMPUTER & CONTROLS	01	10,390	168,299	5,478	15,869	0	0%	3,591	23%	19,460
70	-INTERFACE SYSTEMS	01	21,814	122,305	3,567	25,381	0	0%	4,433	18%	29,813
90	-PROJECT MANAGEMENT	01	3,551	458,239	17,897	21,448	0	0%	1,825	9%	23,274

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

GEM DETECTOR SYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
	-GEM DETECTOR SYSTEM	00	274,531	3,657,544	167,306	441,837	6,029	1%	103,362	23%	551,228
10	-CENTRAL TRACKER	01	12,168	190,275	9,786	21,954	0	0%	5,369	25%	27,324
10.01	-RESEARCH & DEVELOPMENT	02	1,286	29,236	1,797	3,083	0	0%	0	0%	3,083
10.02	-SILICON TRACKER SYSTEM (STS)	02	7,116	59,628	3,344	10,461	0	0%	3,003	29%	13,463
10.03	-INTERPOLATING PAD TRACKER (IPC)	02	3,032	44,140	1,870	4,902	0	0%	1,360	28%	6,262
10.04	RESERVED	02	0	0	0	0	0	0%	0	0%	0
10.05	RESERVED	02	0	0	0	0	0	0%	0	0%	0
10.06	-STS / IPC ASSEMBLY (uphole)	02	455	29,840	1,108	1,563	0	0%	444	28%	2,007
10.07	-INSTALLATION AND FINAL TEST (downhole)	02	115	7,611	340	455	0	0%	164	36%	619
10.08	-PROJECT MANAGEMENT	02	68	15,710	984	1,052	0	0%	400	38%	1,452
10.09	-CONCEPTUAL/PRELIMINARY DESIGN	02	96	4,111	343	439	0	0%	0	0%	439
20	-CALORIMETER	01	68,570	1,012,430	37,976	106,546	0	0%	28,870	27%	135,415
20.01	-RESEARCH & DEVELOPMENT	02	4,634	69,375	2,092	6,726	0	0%	1,883	28%	8,609
20.02	-INNER BARREL CALORIMETRY	02	13,586	168,510	5,890	19,476	0	0%	5,412	28%	24,888
20.03	-SCINTILLATING BARREL CALORIMETRY	02	8,731	120,758	5,159	13,889	0	0%	4,128	30%	18,017
20.04	-ENDCAP CALORIMETRY	02	15,447	320,285	11,961	27,408	0	0%	7,642	28%	35,050
20.05	-FORWARD HADRONIC CALORIMETRY	02	7,310	32,607	1,266	8,577	0	0%	2,466	29%	11,042
20.06	-PASSIVE ABSORBER	02	779	32,640	1,331	2,111	0	0%	752	36%	2,862
20.07	-VACUUM	02	76	17,082	583	659	0	0%	224	34%	883
20.08	-CRYOGENICS	02	11,954	19,800	499	12,453	0	0%	2,565	21%	15,018
20.09	-INSTR. POWER & OPERATIONAL CONTROL	02	215	1,735	52	266	0	0%	73	27%	339
20.10	-FINAL ASSEMBLY	02	509	17,361	511	1,020	0	0%	429	42%	1,449
20.11	-HALL INSTALLATION	02	1,532	67,381	2,092	3,624	0	0%	1,383	38%	5,007
20.12	-CALIBRATION AND TEST BEAM PROGRAM	02	3,618	25,267	701	4,319	0	0%	1,143	27%	5,462
20.13	-SUBSYSTEM MANAGEMENT	02	62	89,947	3,975	4,038	0	0%	565	14%	4,603

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

GEM DETECTOR SYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
20.14	-CONCEPTUAL/PRELIMINARY DESIGN	02	117	29,683	1,864	1,981	0	0%	205	10%	2,186
30	-MUON	01	40,631	891,791	36,819	77,449	0	0%	20,897	27%	98,347
30.01	-RESEARCH & DEVELOPMENT	02	1,958	62,977	4,550	6,508	0	0%	0	0%	6,508
30.02	-BARREL REGION	02	27,914	470,928	15,728	43,642	0	0%	13,174	30%	56,817
30.03	-END CAP REGION	02	9,336	225,218	7,975	17,312	0	0%	5,216	30%	22,528
30.04	-INSTALLATION	02	779	70,223	3,557	4,336	0	0%	1,308	30%	5,644
30.05	-PROJECT MANAGEMENT	02	435	37,921	3,297	3,732	0	0%	373	10%	4,105
30.06	CONCEPTUAL/PRELIMINARY DESIGN	02	208	24,525	1,712	1,920	0	0%	826	43%	2,746
40	-MAGNET	01	64,787	348,234	33,232	98,019	6,029	6%	21,277	21%	125,325
40.01	-RESEARCH & DEVELOPMENT	02	1,563	0	1,641	3,204	0	0%	64	2%	3,268
40.02	-DESIGN COMPLETION	02	922	58,575	3,796	4,718	374	8%	1,136	22%	6,227
40.03	-FABRICATION AND ASSEMBLY	02	60,749	159,177	4,883	65,632	5,059	8%	17,940	25%	88,631
40.04	-INSTALLATION AND SYSTEM TESTING FAB/ASSY	02	987	58,302	1,784	2,770	214	8%	673	23%	3,656
40.05	-PROJECT MANAGEMENT	02	121	72,180	5,877	5,997	383	6%	1,160	18%	7,540
40.06	-MAGNET CONC/PRELIM DESIGN	02	446	0	15,252	15,698	0	0%	305	2%	16,002
50	-ELECTRONICS	01	52,619	465,971	22,552	75,171	0	0%	17,100	23%	92,272
50.01	-RESEARCH AND DEVELOPMENT	02	1,433	57,809	4,051	5,484	0	0%	462	8%	5,946
50.02	-FRONT END	02	39,856	219,208	9,991	49,846	0	0%	12,155	24%	62,002
50.03	-DATA ACQUISITION SYSTEM	02	6,940	83,096	3,717	10,657	0	0%	2,317	22%	12,974
50.04	-TRIGGER	02	3,996	65,724	2,698	6,694	0	0%	1,740	26%	8,434
50.05	-INTEGRATION	02	31	17,098	732	763	0	0%	63	8%	826
50.06	-PROJECT MANAGEMENT	02	363	23,036	1,364	1,727	0	0%	363	21%	2,090
60	-COMPUTER & CONTROLS	01	10,390	168,299	5,478	15,869	0	0%	3,591	23%	19,460
60.01	-RESEARCH AND DEVELOPMENT	02	2,176	47,640	1,487	3,662	0	0%	666	18%	4,328
60.02	-GLOBAL CONTROL SYSTEM	02	1,150	48,702	1,454	2,603	0	0%	444	17%	3,047

GEM COST ESTIMATE SUMMARY

4/26/93

GEM DETECTOR SYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
60.03	-ONLINE COMPUTING SYSTEM	02	6,381	47,944	1,424	7,804	0	0%	2,222	29%	10,026
60.04	-NETWORK AND COMMUNICATIONS	02	658	15,476	429	1,086	0	0%	188	17%	1,274
60.05	PROJECT MANAGEMENT	02	27	8,537	686	713	0	0%	71	10%	785
70	-INTERFACE SYSTEMS	01	21,814	122,305	3,567	25,381	0	0%	4,433	18%	29,813
70.01	-CENTRAL DETECTOR SUPPORT (CDS)	02	3,414	14,500	665	4,079	0	0%	701	17%	4,780
70.02	-BEAM PIPE	02	1,958	3,101	114	2,072	0	0%	331	16%	2,403
70.03	-DETECTOR ACCESS EQUIPMENT	02	1,622	2,578	39	1,661	0	0%	332	20%	1,993
70.04	-DETECTOR SAFETY SYSTEMS	02	968	11,784	358	1,325	0	0%	159	12%	1,484
70.05	-UTILITY SERVICES	02	2,833	7,749	271	3,104	0	0%	661	21%	3,765
70.06	-CRANES	02	5,439	0	0	5,439	0	0%	544	10%	5,983
70.07	-AUXILIARY EQUIPMENT	02	1,437	9,480	340	1,777	0	0%	462	26%	2,239
70.08	-GAS SERVICES	02	1,478	7,726	205	1,683	0	0%	311	19%	1,995
70.09	-SURVEY ALIGNMENT SYSTEMS	02	467	17,392	438	906	0	0%	91	10%	996
70.10	-MAGNETIC SHIELDING SYSTEMS	02	268	0	0	268	0	0%	64	24%	332
70.11	-TEST BEAM / CALIBRATION HALL	02	1,632	16,831	294	1,927	0	0%	531	28%	2,457
70.12	-DETECTOR CABLE AND PLUMBING ROUTING, DESIG	02	299	31,163	841	1,141	0	0%	246	22%	1,387
70.13	RESERVED	02	0	0	0	0	0	0%	0	0%	0
90	-PROJECT MANAGEMENT	01	3,551	458,239	17,897	21,448	0	0%	1,825	9%	23,274
90.01	PROJECT MANAGEMENT, PLANNING, & CONTROLS	02	1,163	152,392	5,956	7,119	0	0%	641	9%	7,760
90.02	ENGINEERING & INTEGRATION	02	2,077	185,706	8,751	10,828	0	0%	975	9%	11,803
90.03	ENVIRONMENTAL SAFETY & HEALTH / QA	02	0	38,630	1,777	1,777	0	0%	107	6%	1,884
90.04	ADMINISTRATION	02	312	81,512	1,413	1,724	0	0%	104	6%	1,828

GEM DETECTOR SYSTEM COST ESTIMATE SUMMARY

22-Apr-93

(Costs in millions of FY93 dollars)

Procurements/Fabrication	252	
Installation/Assembly	56	
Subtotal (Procurements and Labor)	308	
EDIA	111	(36%)*
Direct Costs	419	
Contingency	103	(25%)
Subtotal	522	
R&D	29	(9%)*
TOTAL GEM DETECTOR SYSTEM FY93 $M	551	

* % of subtotal (Procurements and Labor)

GEM DETECTOR SYSTEM COST ESTIMATE SUMMARY

22-Apr-93

(Costs in millions of FY90 dollars)

Procurements/Fabrication	228	
Installation/Assembly	51	
Subtotal (Procurements and Labor)	279	
EDIA	101	(36%)*
Direct Costs	380	
Contingency	93	(24%)
Subtotal	473	
R&D	26	(9%)*
TOTAL GEM DETECTOR SYSTEM FY90 $M	499	

* % of subtotal (Procurements and Labor)

GEM DETECTOR COST SUMMARY

4/25/93

WBS	Item	Eng/Des k$	M&S k$	Inspection Admin k$	Proc/Fab Material k$	Assembly k$	Installation k$	Subtotal Labor k$	Subtotal Material k$	Subtotal Lab & Mat'l k$	Conting. k$	Total k$
	GEM DETECTOR SUMMARY	**85,377**	**12,173**	**29,464**	**263,418**	**48,686**	**8,747**	**168,496**	**279,370**	**447,866**	**103,362**	**551,228**
10	**CENTRAL TRACKER**	**6,073**	**1,404**	**1,109**	**10,346**	**2,723**	**300**	**9,786**	**12,168**	**21,954**	**5,369**	**27,323**
20	**CALORIMETER**	**12,899**	**1,015**	**4,339**	**67,550**	**18,149**	**2,593**	**37,976**	**68,570**	**106,546**	**28,869**	**135,415**
30	**MUON**	**10,805**	**1,379**	**6,712**	**37,358**	**20,229**	**966**	**36,819**	**40,631**	**77,449**	**20,897**	**98,347**
40	**MAGNET**	**21,793**	**3,461**	**7,311**	**64,208**	**4,803**	**2,472**	**34,422**	**69,626**	**104,048**	**21,277**	**125,325**
50	**ELECTRONICS**	**17,112**	**943**	**2,356**	**52,326**	**1,125**	**1,309**	**22,552**	**52,619**	**75,171**	**17,100**	**92,272**
60	**COMPUTING**	**5,034**	**202**	**21**	**10,190**	**421**	**0**	**5,478**	**10,390**	**15,869**	**3,591**	**19,460**
70	**INTERFACE**	**1,132**	**218**	**245**	**21,441**	**1,237**	**1,107**	**3,566**	**21,814**	**25,380**	**4,433**	**29,813**
90	**PROJECT MANAGEMENT**	**10,528**	**3,551**	**7,369**	**0**	**0**	**0**	**17,897**	**3,551**	**21,448**	**1,825**	**23,274**
	GEM DETECTOR CONSTRUCTION	52,892	8,559	28,835	252,627	47,619	8,629	133,707	265,453	399,160	98,952	498,113
10	CENTRAL TRACKER	4,130	731	1,109	9,439	2,723	300	7,646	10,786	18,433	5,369	23,802
20	CALORIMETER	10,333	827	4,135	62,987	17,082	2,475	34,020	63,819	97,838	26,781	124,620
30	MUON	4,687	943	6,569	35,628	20,229	966	30,557	38,465	69,021	20,072	89,093
40	MAGNET	4,900	1,452	7,311	64,208	4,803	2,472	17,529	67,617	85,146	20,909	106,055
50	ELECTRONICS	13,634	694	2,075	50,850	1,125	1,309	18,501	51,186	69,687	16,638	86,325
60	COMPUTING	3,548	143	21	8,074	421	0	3,992	8,215	12,206	2,925	15,132
70	INTERFACE	1,132	218	245	21,441	1,237	1,107	3,566	21,814	25,380	4,433	29,813
90	PROJECT MANAGEMENT	10,528	3,551	7,369	0	0	0	17,897	3,551	21,448	1,825	23,274
	GEM DETECTOR R&D	13,458	2,748	485	10,792	1,067	118	15,618	13,050	28,668	3,075	31,743
10	CENTRAL TRACKER	1,599	577	0	907	0	0	1,797	1,286	3,083	0	3,083
20	CALORIMETER	702	71	205	4,563	1,067	118	2,092	4,634	6,726	1,883	8,609
30	MUON	4,550	228	0	1,730	0	0	4,550	1,958	6,508	0	6,508
40	MAGNET	1,641	1,563	0	0	0	0	1,641	1,563	3,204	64	3,268
50	ELECTRONICS	3,479	249	281	1,476	0	0	4,051	1,433	5,484	462	5,946
60	COMPUTING	1,487	59	0	2,116	0	0	1,487	2,175	3,662	666	4,328
70	INTERFACE	0	0	0	0	0	0	0	0	0	0	0
90	PROJECT MANAGEMENT	0	0	0	0	0	0	0	0	0	0	0
	GEM DETECTOR C&P/D	19,027	866	144	0	0	0	19,171	866	20,037	1,335	21,373
10	CENTRAL TRACKER	343	96	0	0	0	0	343	96	439	0	439
20	CALORIMETER	1,864	117	0	0	0	0	1,864	117	1,981	205	2,186
30	MUON	1,568	208	144	0	0	0	1,712	208	1,920	826	2,745
40	MAGNET	15,252	446	0	0	0	0	15,252	446	15,698	304	16,002
50	ELECTRONICS	0	0	0	0	0	0	0	0	0	0	0
60	COMPUTING	0	0	0	0	0	0	0	0	0	0	0
70	INTERFACE	0	0	0	0	0	0	0	0	0	0	0
90	PROJECT MANAGEMENT	0	0	0	0	0	0	0	0	0	0	0

5.2.2.505.1 GEM DETECTOR COST SUMMARY FY93

4/25/93

	Engineering/design			M&S	Inspection/Admin			Proc/Fab	Assembly					Installation					Totals				
	Labor	Rate	Total	Material	Labor	Rate	Total	Material	Labor	Rate	Subtotal	Material	Total	Labor	Rate	Subtotal	Material	Total	Labor	Material	Subtotal	Conting.	Total
Item	my	k$/my	k$	k$	my	k$/my	k$	k$	my	k$/my	k$	k$	k$	my	k$/my	k$	k$	k$	k$	k$	k$	k$	k$
Central Tracker Const	37	111	4,130	731	11	97	1,109	9,439	34	63	2,106	616	2,723	4	82	300	0	300	7,646	10,786	18,433	5,369	23,802
Central Tracker R&D	15	109	1,599	577	0	0	0	907	0	0	0	0	0	0	0	0	0	0	1,797	1,286	3,083	0	3,083
Central Tracker C&P/D	2	148	343	96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	343	96	439	0	439
Calorimeter Const	105	99	10,333	827	63	65	4,135	62,987	283	60	17,077	5	17,082	41	61	2,475	0	2,475	34,020	63,819	97,838	26,781	124,620
Calorimeter R&D	8	87	702	71	5	45	205	4,563	22	48	1,067	0	1,067	2	48	118	0	118	2,092	4,634	6,726	1,883	8,609
Calorimeter C&P/D	17	111	1,864	117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,864	117	1,981	205	2,186
Muon Const	42	112	4,687	943	54	123	6,569	35,628	318	58	18,403	1,826	20,229	16	56	899	67	966	30,557	38,465	69,021	20,072	89,093
Muon R&D	36	128	4,550	228	0	0	0	1,730	0	0	0	0	0	0	0	0	0	0	4,550	1,958	6,508	0	6,508
Muon C&P/D	13	121	1,568	208	1	159	144	0	0	0	0	0	0	0	0	0	0	0	1,712	208	1,920	826	2,745
Magnet Const	37	133	4,900	1,452	53	138	7,311	64,208	69	52	3,578	1,225	4,803	30	57	1,740	733	2,472	17,529	67,617	85,146	20,909	106,055
Magnet R&D	0	0	1,641	1,563	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,641	1,563	3,204	64	3,268
Magnet C&P/D	0	0	15,252	446	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15,252	446	15,698	304	16,002
Electronics Const	147	93	13,634	694	23	91	2,075	50,850	4	51	184	941	1,125	26	48	1,261	49	1,309	18,501	51,186	69,687	16,638	86,325
Electronics R&D	28	124	3,479	249	2	127	281	1,476	0	0	0	0	0	0	0	0	0	0	4,051	1,433	5,484	462	5,946
Electronics C&P/D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computing Const	57	62	3,548	143	1	40	21	8,074	10	42	421	0	421	0	0	0	0	0	3,992	8,215	12,206	2,925	15,132
Computing R&D	27	55	1,487	59	0	0	0	2,116	0	0	0	0	0	0	0	0	0	0	1,487	2,175	3,662	666	4,328
Computing C&P/D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interface Sys Const	16	72	1,132	218	3	75	245	21,441	25	46	1,162	75	1,237	21	48	1,027	80	1,107	3,566	21,814	25,380	4,433	29,813
Interface Sys R&D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interface Sys C&P/D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project Mgmt Const	127	83	10,528	3,551	132	56	7,369	0	0	0	0	0	0	0	0	0	0	0	17,897	3,551	21,448	1,825	23,274
Project Mgmt R&D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Project Mgmt C&P/D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUBSYSTEMS SUMMARY																							
CENTRAL TRACKER	54	112	6,073	1,404	11	97	1,109	10,346	34	63	2,106	616	2,723	4	82	300	0	300	9,786	12,168	21,954	5,369	27,323
CALORIMETER	129	100	12,899	1,015	68	64	4,339	67,550	306	59	18,144	5	18,149	43	60	2,593	0	2,593	37,976	68,570	106,546	28,869	135,415
MUON	90	120	10,805	1,379	55	123	6,712	37,358	318	58	18,403	1,826	20,229	16	56	899	67	966	36,819	40,631	77,449	20,897	98,347
MAGNET	37	591	21,793	3,461	53	138	7,311	64,208	69	52	3,578	1,225	4,803	30	57	1,740	733	2,472	34,422	69,626	104,048	21,277	125,325
ELECTRONICS	175	98	17,112	943	25	94	2,356	52,326	4	51	184	941	1,125	26	48	1,261	49	1,309	22,552	52,619	75,171	17,100	92,272
COMPUTING	84	60	5,034	202	1	40	21	10,190	10	42	421	0	421	0	---	0	0	0	5,478	10,390	15,869	3,591	19,460
INTERFACE	16	72	1,132	218	3	75	245	21,441	25	46	1,162	75	1,237	21	48	1,027	80	1,107	3,566	21,814	25,380	4,433	29,813
PROJECT MGMT	127	83	10,528	3,551	132	56	7,369	0	0	---	0	0	0	0	---	0	0	0	17,897	3,551	21,448	1,825	23,274
GEM DETECTOR SYSTEM	712	120	85,377	12,173	348	85	29,464	263,418	765	58	43,998	4,688	48,686	141	56	7,818	928	8,747	168,496	279,370	447,866	103,362	551,228

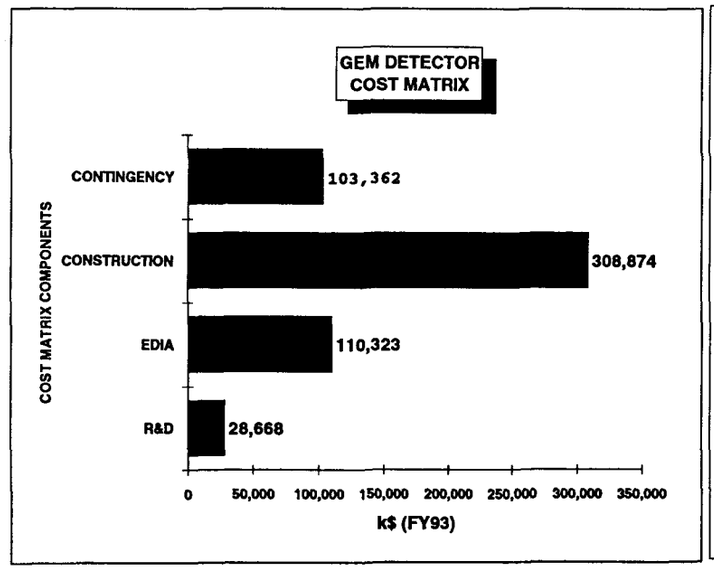
COST MATRIX COMPONENTS

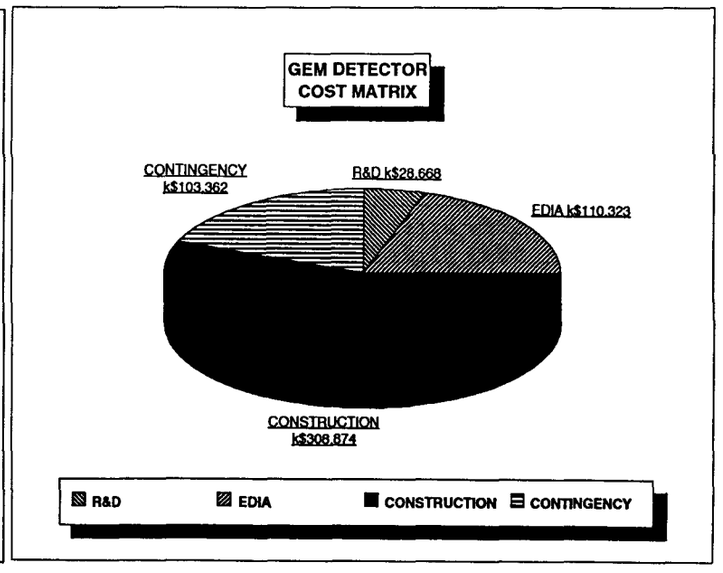
GEM DETECTOR SYSTEM

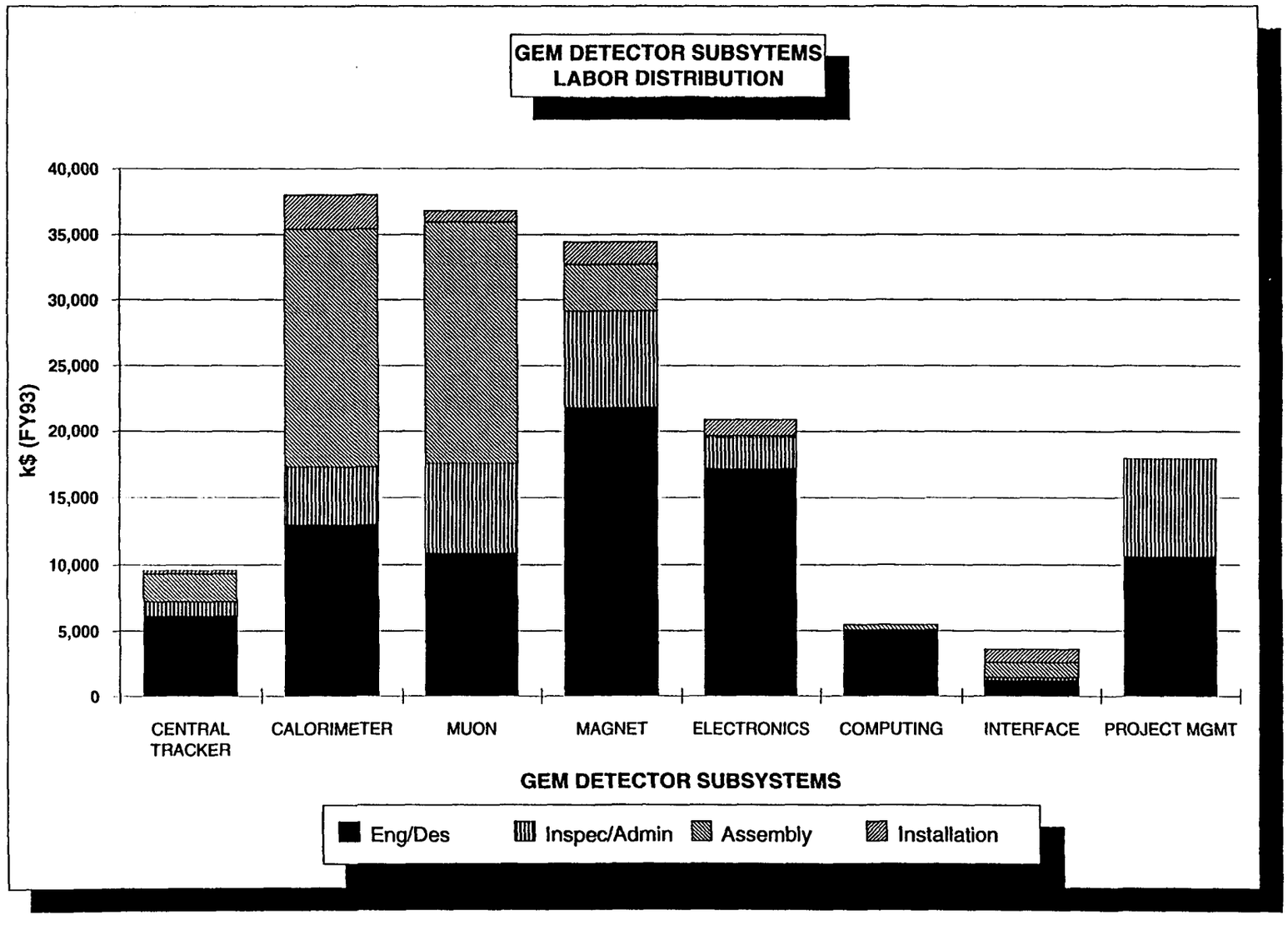
	85,377 Eng/Des	12,173 M&S	29,464 Inspec/Admin	263,418 Pr/Fab	57,433 Inst/Assy	103,362 Conting	551,228 Total
R&D	13,458	2,748	485	10,792	1,185	3,075	31,743
Concep/Pre Design	19,027	866	144	0	0	1,335	21,373
Construction	52,892	8,559	26,835	252,627	56,248	98,952	498,113

R&D %= 9.28% EDIA %= 35.72% Contingency %= 24.66%

$$\text{R\&D \%} = \frac{\text{R\&D}}{\text{Construction}} \qquad \text{EDIA \%} = \frac{\text{EDIA}}{\text{Construction}} \qquad \text{Contingency \%} = \frac{\text{Contingency}}{\text{Construction + EDIA}}$$

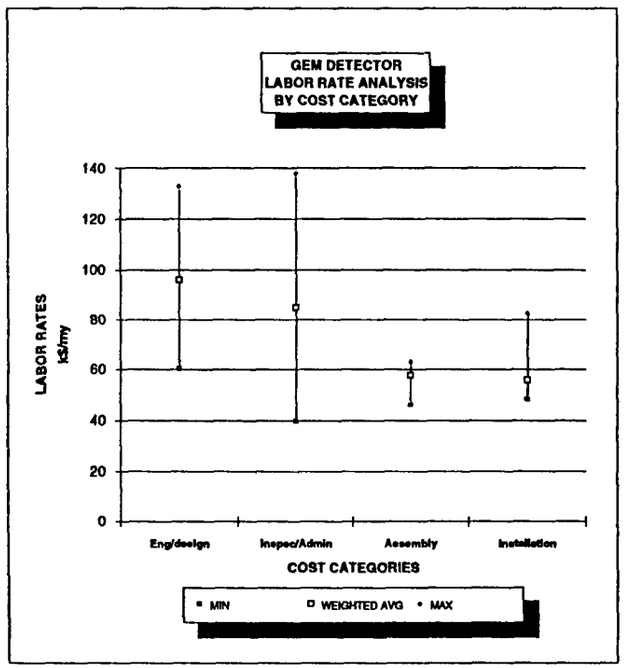


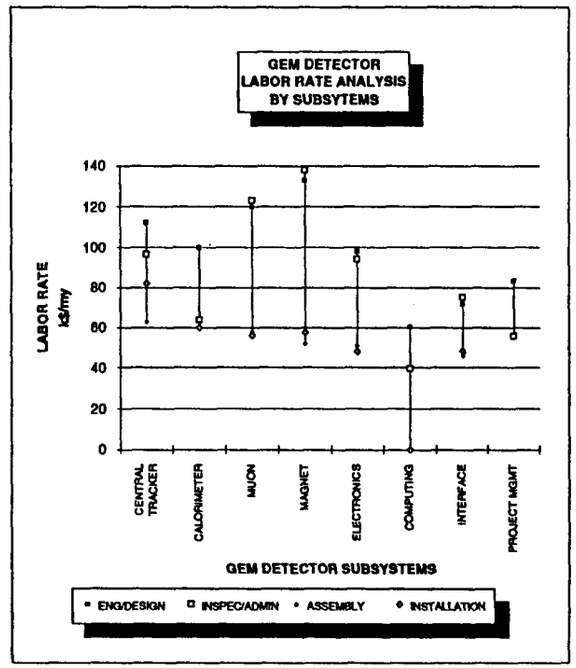



GEM DETECTOR SUBSYTEMS
LABOR DISTRIBUTION
k$ (FY93)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
CENTRAL TRACKER
CALORIMETER
MUON
MAGNET
ELECTRONICS
COMPUTING
INTERFACE
PROJECT MGMT
GEM DETECTOR SUBSYSTEMS
Eng/Des
Inspec/Admin
Assembly
Installation

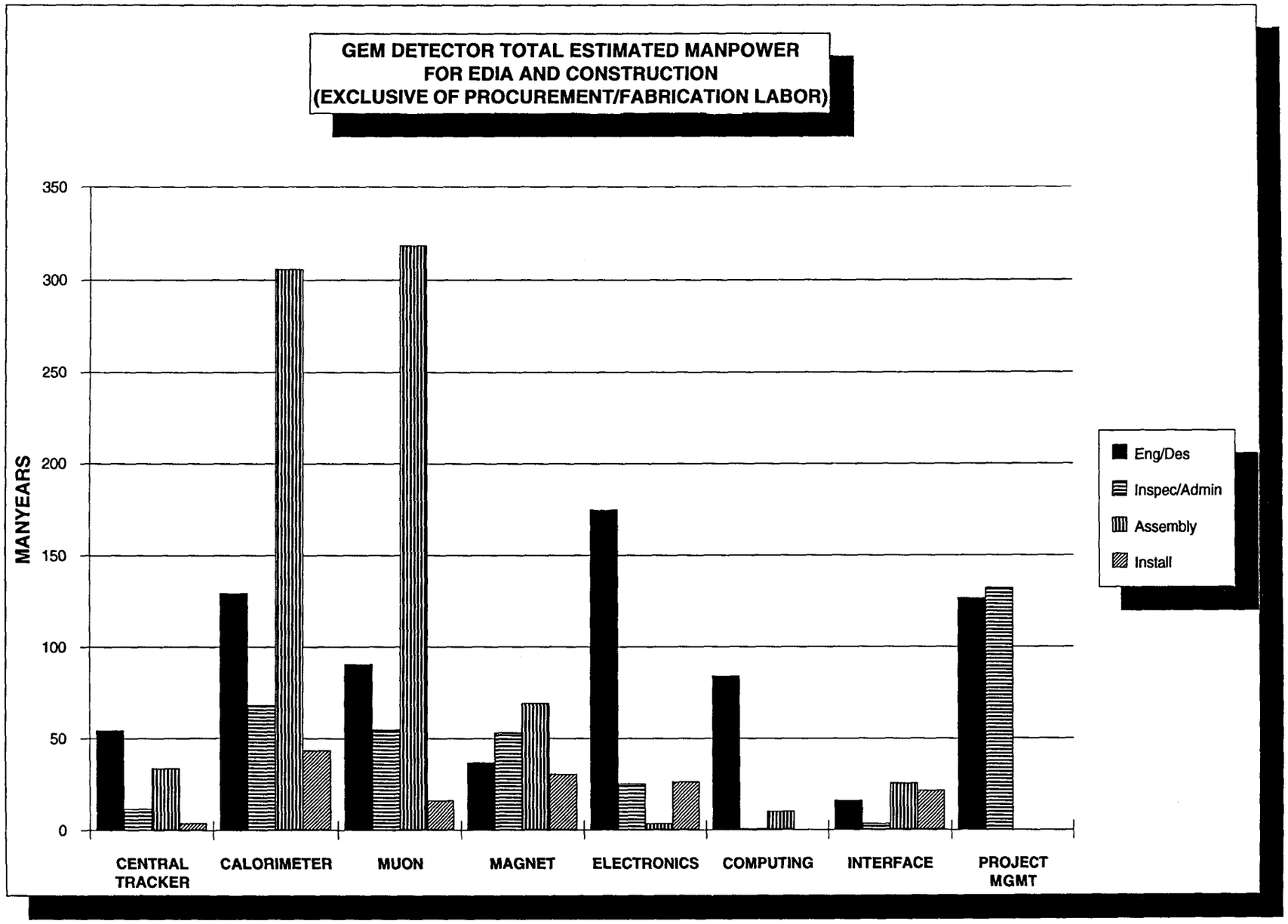
GEM DETECTOR LABOR RATE ANALYSIS

	COST CATEGORIES							
	Eng/design		Inspec/Admin		Assembly		Installation	
	Labor	Rate	Labor	Rate	Labor	Rate	Labor	Rate
SUBSYSTEMS	my	k$/my	my	k$/my	my	k$/my	my	k$/my
CENTRAL TRACKER	54	112	11	97	34	63	4	82
CALORIMETER	129	100	68	64	306	59	43	60
MUON	90	120	55	123	318	58	16	56
MAGNET	37	133	53	138	69	52	30	57
ELECTRONICS	175	98	25	94	4	51	26	48
COMPUTING	84	60	1	40	10		0	---
INTERFACE	16	72	3	75	25	46	21	48
PROJECT MGMT	127	83	132	56	0		0	
MIN		60		40		46		48
WEIGHTED AVG		96		85		57		56
MAX		133		138		63		82

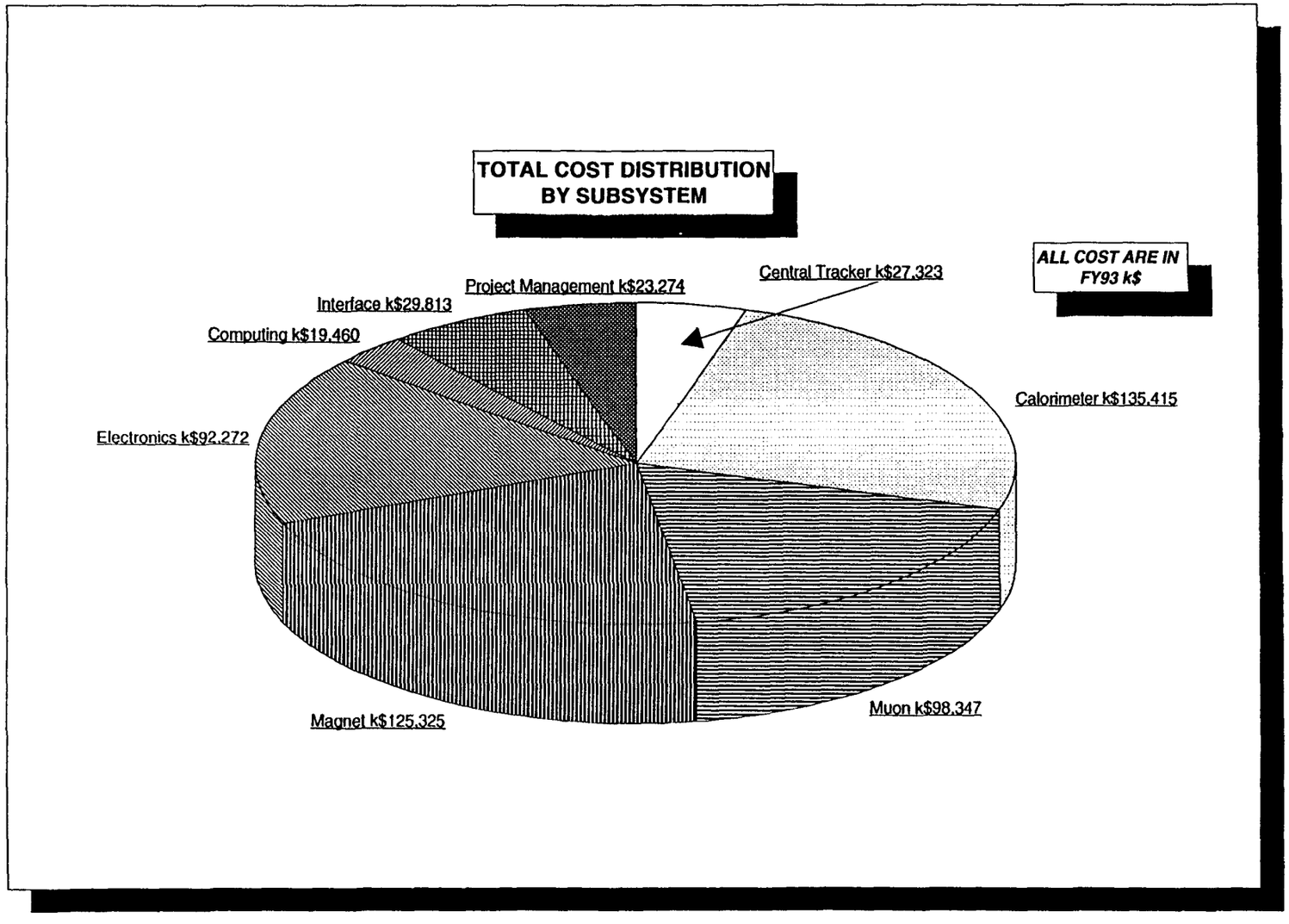


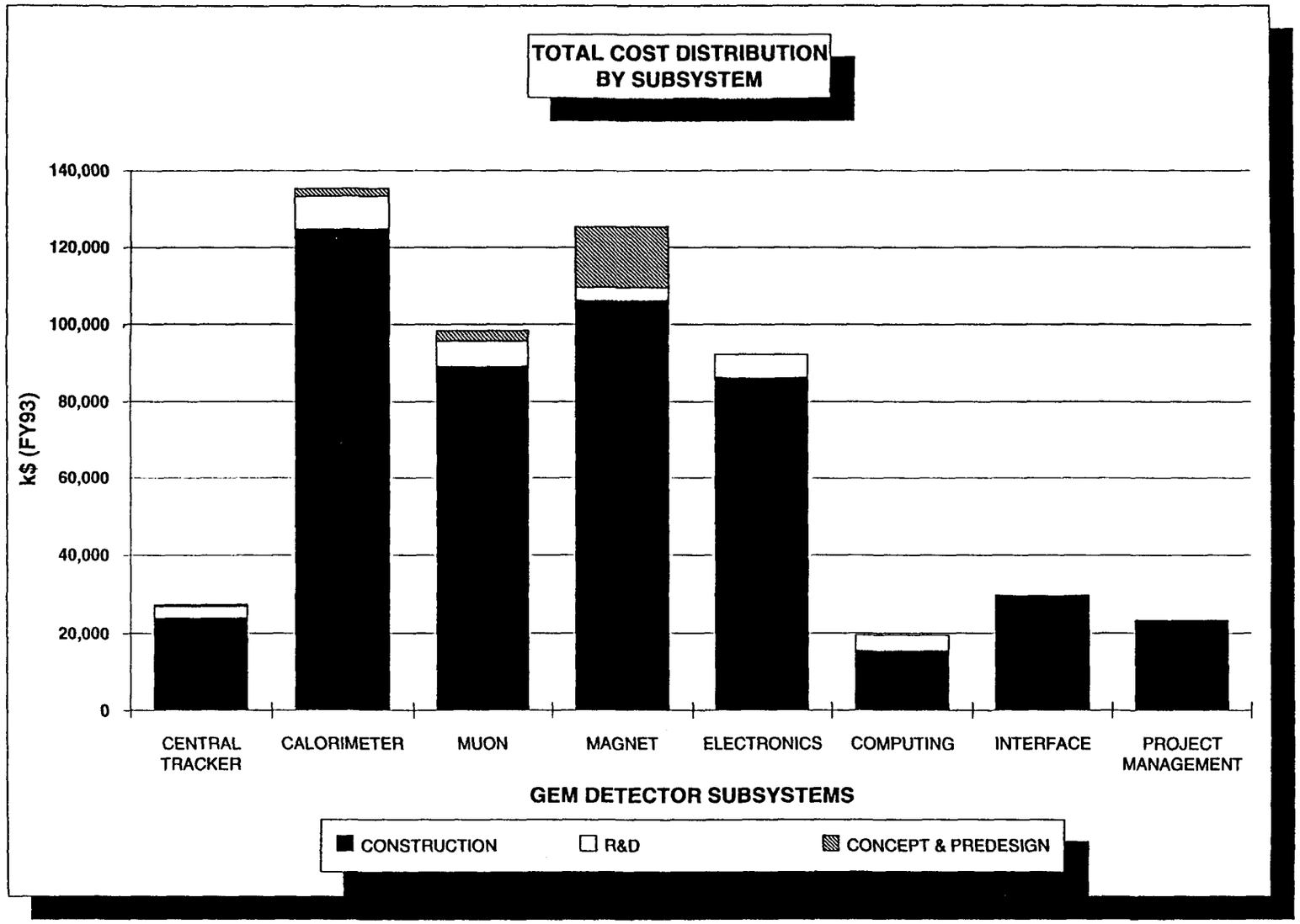


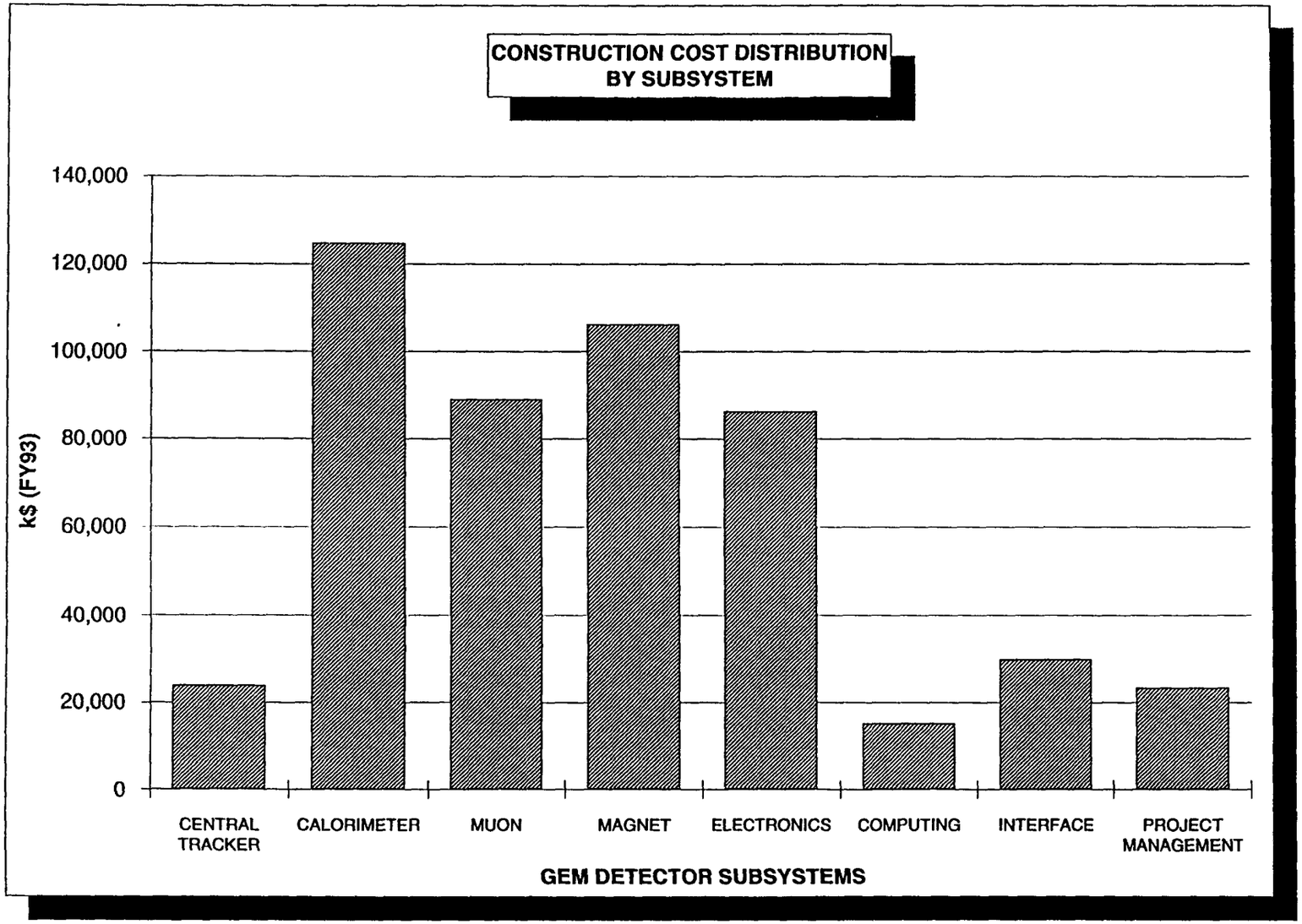
4/27/93

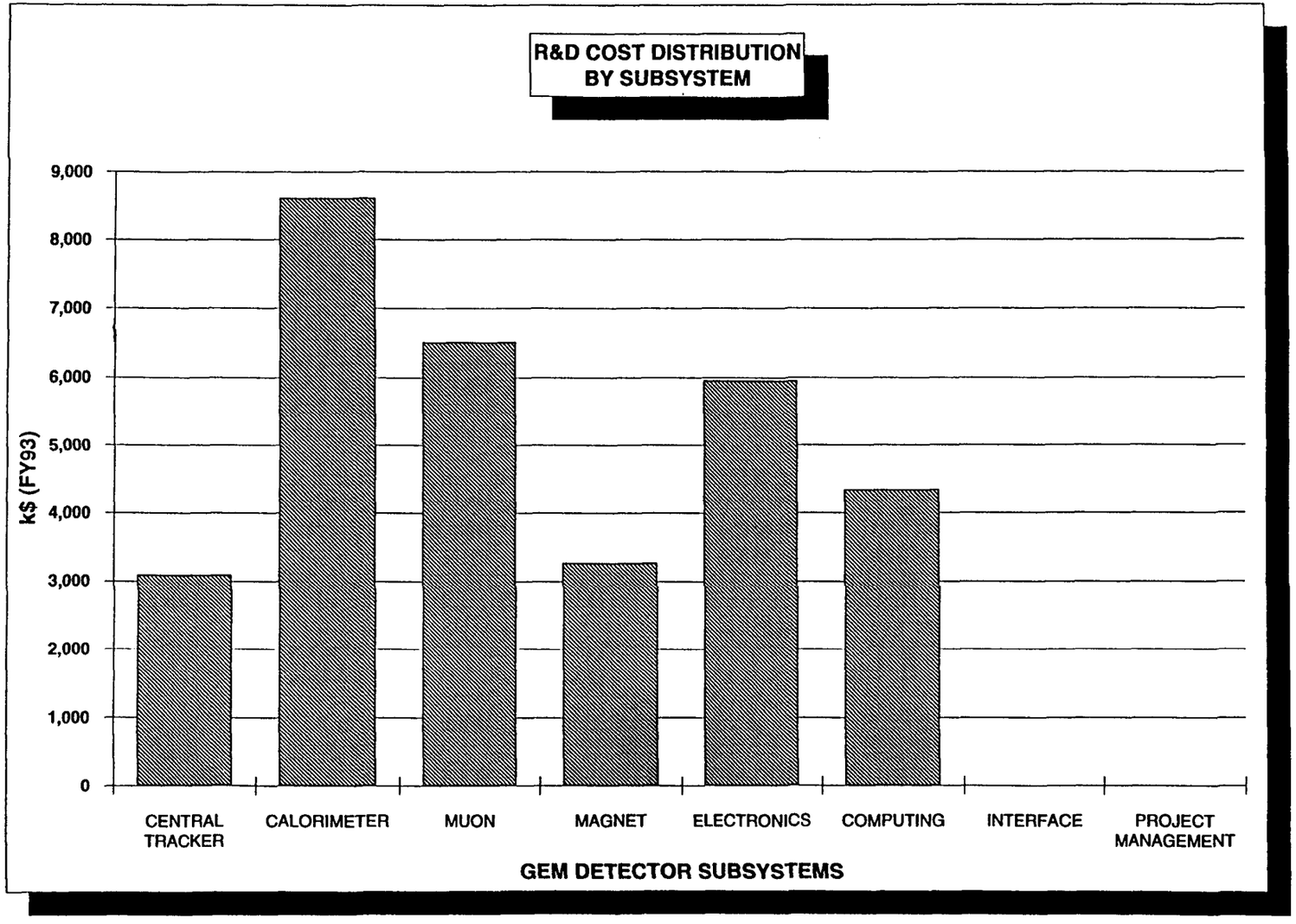


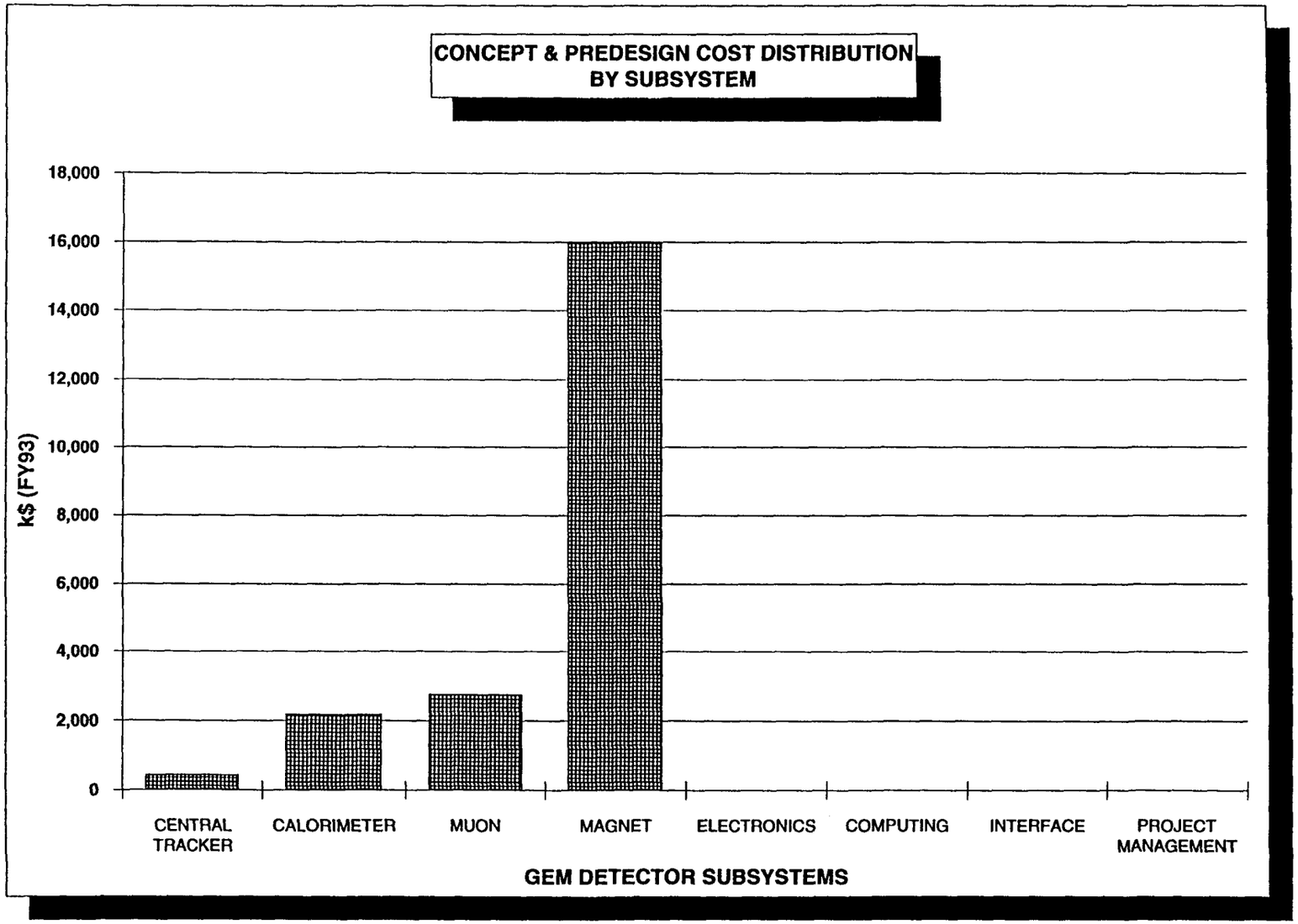
GEM DETECTOR PROJECT


TOTAL COST DISTRIBUTION
BY SUBSYSTEM
ALL COST ARE IN
FY93 k$
Central Tracker k$27,323
Project Management k$23,274
Interface k$29,813
Computing k$19,460
Calorimeter k$135,415
Electronics k$92,272
Muon k$98,347
Magnet k$125,325


TOTAL COST DISTRIBUTION
BY SUBSYSTEM
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
k$ (FY93)
CENTRAL TRACKER
CALORIMETER
MUON
MAGNET
ELECTRONICS
COMPUTING
INTERFACE
PROJECT MANAGEMENT
GEM DETECTOR SUBSYSTEMS
CONSTRUCTION
R&D
CONCEPT & PREDESIGN


CONSTRUCTION COST DISTRIBUTION
BY SUBSYSTEM
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
k$ (FY93)
CENTRAL TRACKER
CALORIMETER
MUON
MAGNET
ELECTRONICS
COMPUTING
INTERFACE
PROJECT MANAGEMENT
GEM DETECTOR SUBSYSTEMS

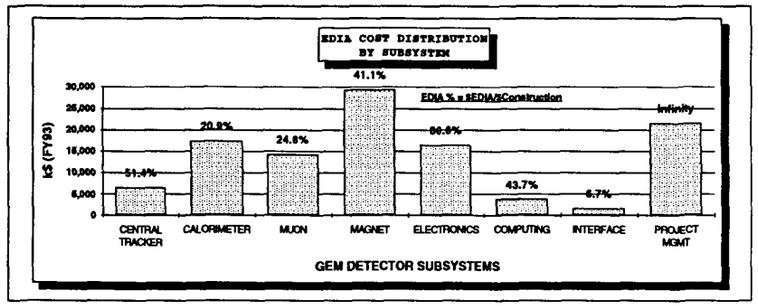

R&D COST DISTRIBUTION
BY SUBSYSTEM
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
k$ (FY93)
CENTRAL TRACKER
CALORIMETER
MUON
MAGNET
ELECTRONICS
COMPUTING
INTERFACE
PROJECT MANAGEMENT
GEM DETECTOR SUBSYSTEMS

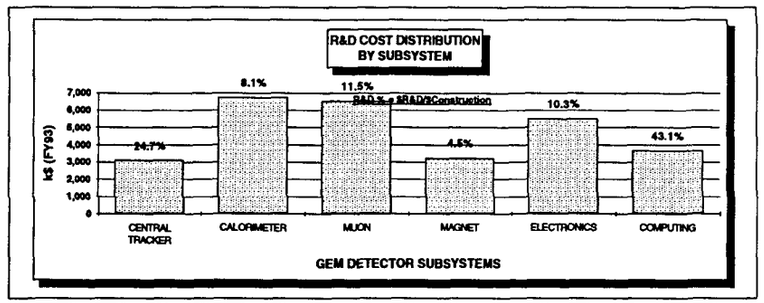

CONCEPT & PREDESIGN COST DISTRIBUTION
BY SUBSYSTEM
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
k$ (FY93)
CENTRAL TRACKER
CALORIMETER
MUON
MAGNET
ELECTRONICS
COMPUTING
INTERFACE
PROJECT MANAGEMENT
GEM DETECTOR SUBSYSTEMS

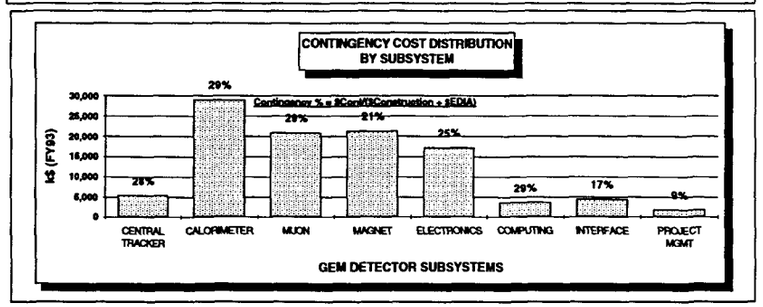
EDIA, R&D and Contingency Analysis (FY93)

4/27/93

	Total Cost - K$ (w/contingency)	Total Cost - K$ (w/o contingency)	Construction Cost - K$ (Pr/Fab/Inst/Assy)	EDIA - K$ (no R&D)	EDIA% (% of construction)	R&D - K$	R&D % (% of Const)	Contingency - K$	Contingency % %(Total-R&D)
GEM DETECTOR SYSTEM	551,228	447,866	308,874	110,323	35.7%	28,668	9.3%	103,362	25%
CENTRAL TRACKER	27,323	21,954	12,461	6,410	51.4%	3,083	24.7%	5,369	28%
CALORIMETER	135,415	106,546	82,544	17,276	20.9%	6,726	8.1%	28,869	29%
MUON	98,347	77,449	56,823	14,119	24.8%	6,508	11.5%	20,897	29%
MAGNET	125,325	104,048	71,483	29,361	41.1%	3,204	4.5%	21,277	21%
ELECTRONICS	92,272	75,171	53,285	16,402	30.8%	5,484	10.3%	17,100	25%
COMPUTING	19,460	15,869	8,495	3,711	43.7%	3,662	43.1%	3,591	29%
INTERFACE	29,813	25,380	23,784	1,596	6.7%	0	0.0%	4,433	17%
PROJECT MGMT	23,274	21,448	0	21,448	0.0%	0	0.0%	1,825	9%







OPEN PLAN

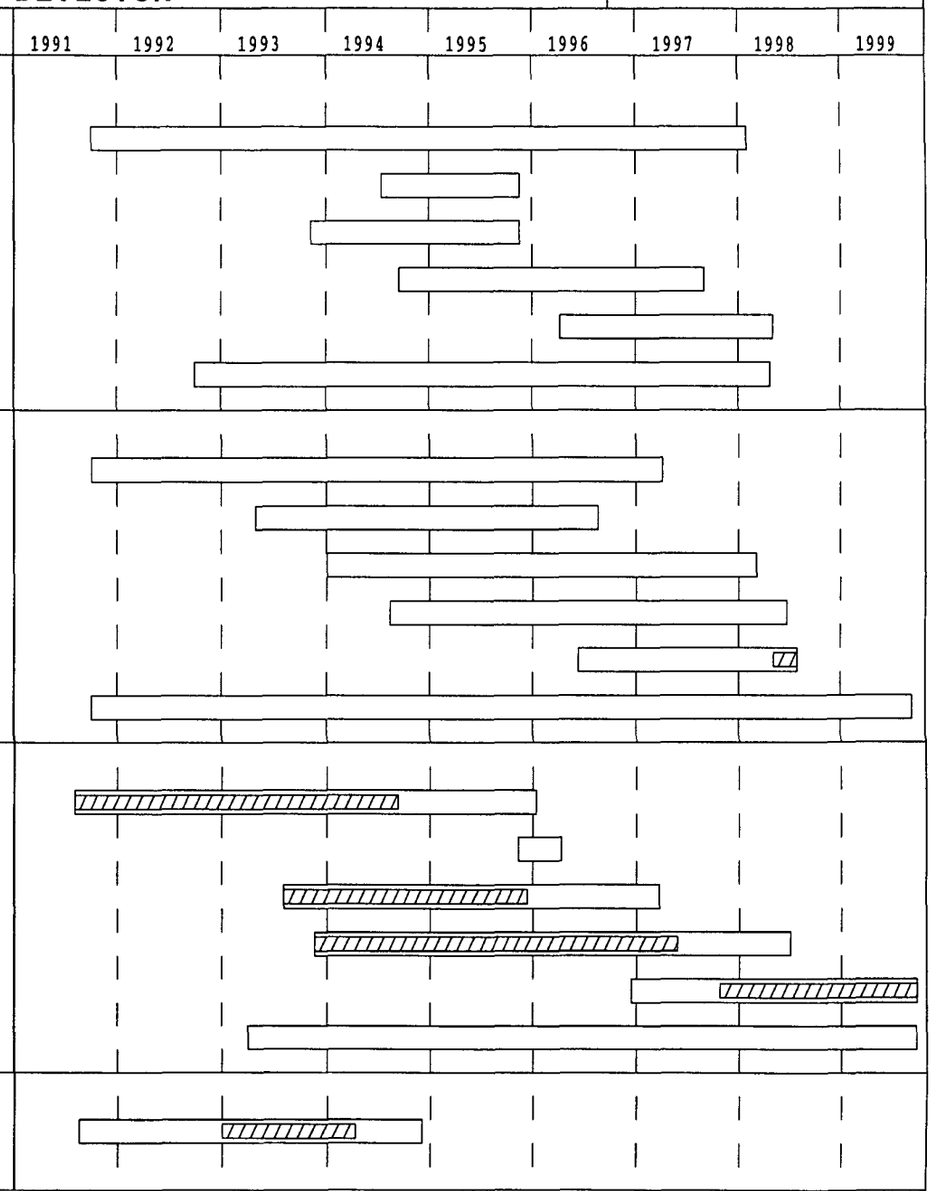
Project: GEM_0426
Report: TDR_SUM1
Status as of: 15AUG91
Current Date: 27APR93
Page: 1

LEVEL I SUMMARY BASELINE SCHEDULE

522 GEM DETECTOR

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
522.5010 TRACKING SYSTEMS			
DESIGN	01OCT91	29JAN98	
PROCUREMENT	13JUL94	16NOV95	
FABRICATION	09NOV93	16NOV95	
ASSEMBLY	13SEP94	28AUG97	
INSTALLATION	09APR96	01MAY98	
LEVEL OF EFFORT (LOE)	01OCT92	22APR98	
522.5020 CALORIMETRY SYSTEMS			
DESIGN	01OCT91	31MAR97	
PROCUREMENT	30APR93	19AUG96	
FABRICATION	03JAN94	04MAR98	
ASSEMBLY	10AUG94	19JUN98	
INSTALLATION	10JUN96	27JUL98	
LEVEL OF EFFORT (LOE)	01OCT91	16SEP99	
522.5030 MUON SYSTEMS			
DESIGN	01AUG91	11JAN96	
PROCUREMENT	09NOV95	10APR96	
FABRICATION	03AUG93	18MAR97	
ASSEMBLY	18NOV93	29JUN98	
INSTALLATION	13DEC96	30SEP99	
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
522.5040 MAGNETS			
DESIGN	15AUG91	01DEC94	



Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

OPEN PLAN

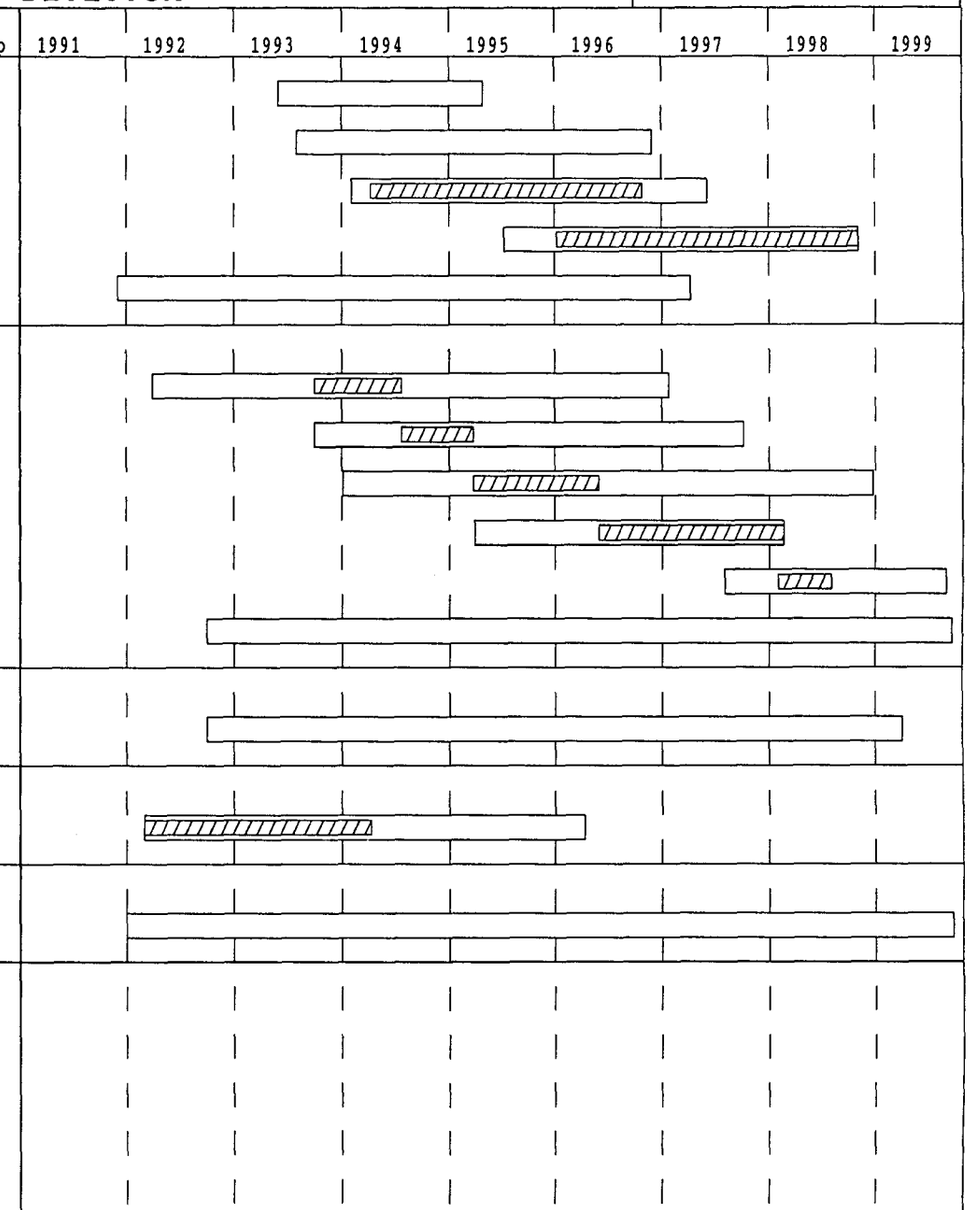
Project: GEM_0426
Report: TDR_SUM1
Status as of: 15AUG91
Current Date: 27APR93
Page: 2

LEVEL I SUMMARY BASELINE SCHEDULE

522 GEM DETECTOR

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	01JUN93	26APR95	
FABRICATION	02AUG93	27NOV96	
ASSEMBLY	02FEB94	30MAY97	
INSTALLATION	07JUL95	30OCT98	
LEVEL OF EFFORT (LOE)	02DEC91	03APR97	
522.5050 ELECTRONIC SYSTEMS			
DESIGN	01APR92	22JAN97	
PROCUREMENT	01OCT93	01OCT97	
FABRICATION	03JAN94	21DEC98	
ASSEMBLY	27MAR95	16FEB98	
INSTALLATION	28JUL97	06SEP99	
LEVEL OF EFFORT (LOE)	01OCT92	28SEP99	
522.5060 DETECTOR COMPUTING	01OCT92	05APR99	
522.5070 INTERFACE SYSTEMS			
CONSTRUCTION	02MAR92	08APR96	
522.5090 PROJECT MGT & DETECTOR INTEGT	01JAN92	30SEP99	



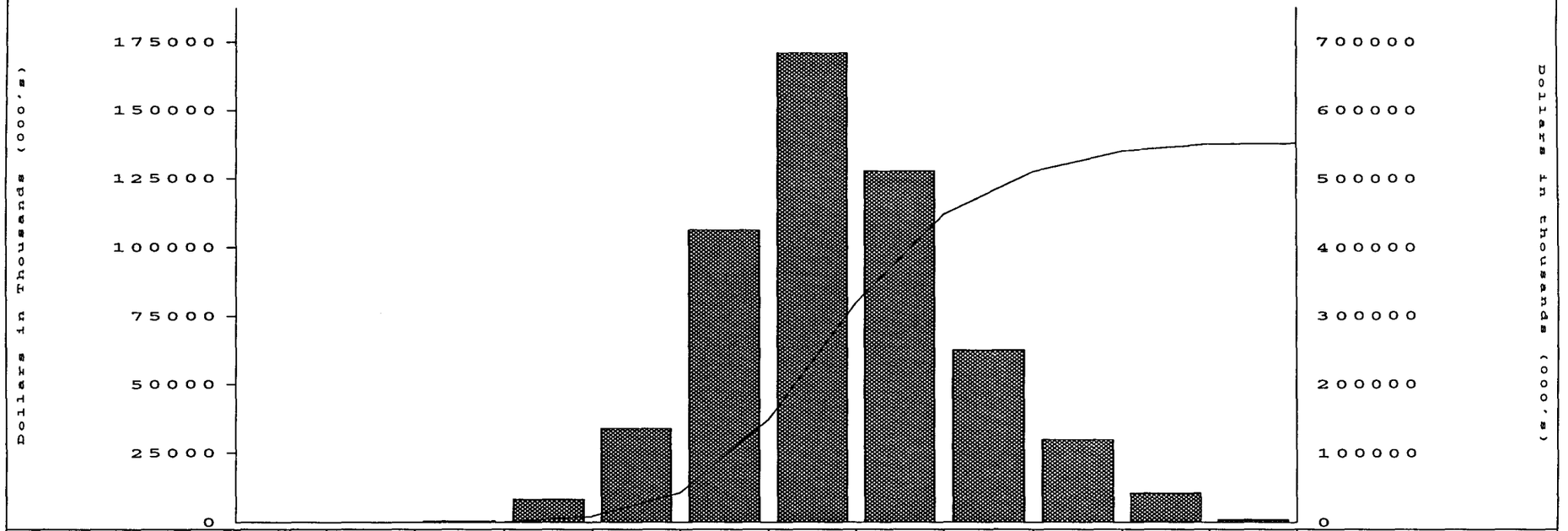
Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

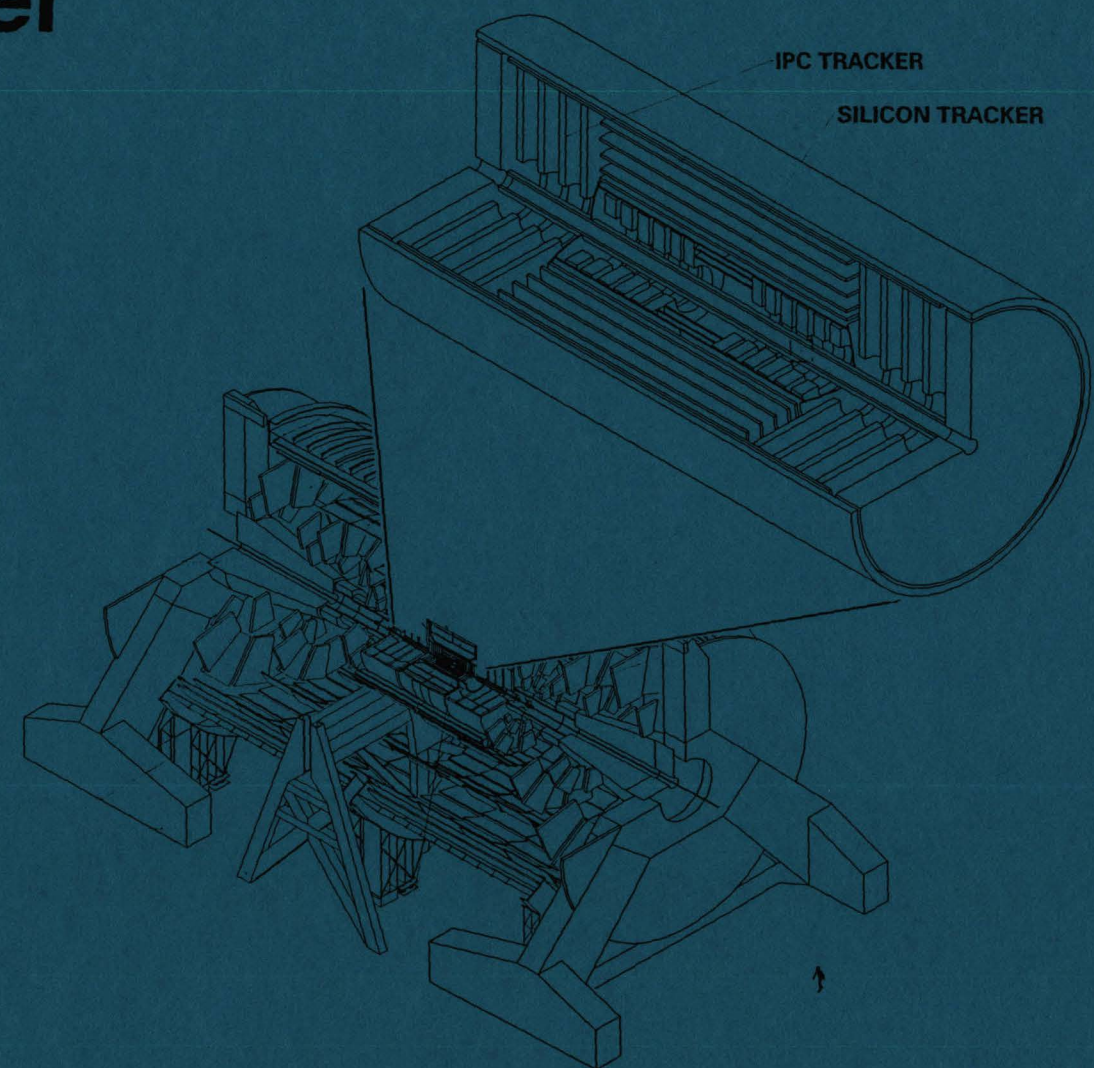
GEM Detector Report: GEM_FY	GEM DETECTOR WBS 522.50 - DETECTORS & EXPERIMENTALS SYS	Date: 27APR93 Project: GEM_0426



		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00
Incr Bud	$100k	4	83	339	1062	1708	1278	625	299	105	9
Cum Bud	$100k	4	87	426	1488	3196	4474	5099	5397	5502	5512

WBS 522.5010	$27,323,488	TRACKING SYSTEMS
WBS 522.5020	$135,415,178	CALORIMETRY SYSTEMS
WBS 522.5030	$98,346,729	MUON SYSTEMS
WBS 522.5040	$125,324,910	MAGNETS
WBS 522.5050	$92,271,560	ELECTRONIC SYSTEMS
WBS 522.5060	$19,415,423	DETECTOR COMPUTIN
WBS 522.5070	$29,813,084	INTERFACE SYSTEMS
WBS 522.5090	$23,273,612	PROJECT MGT & DETECT

Tracker

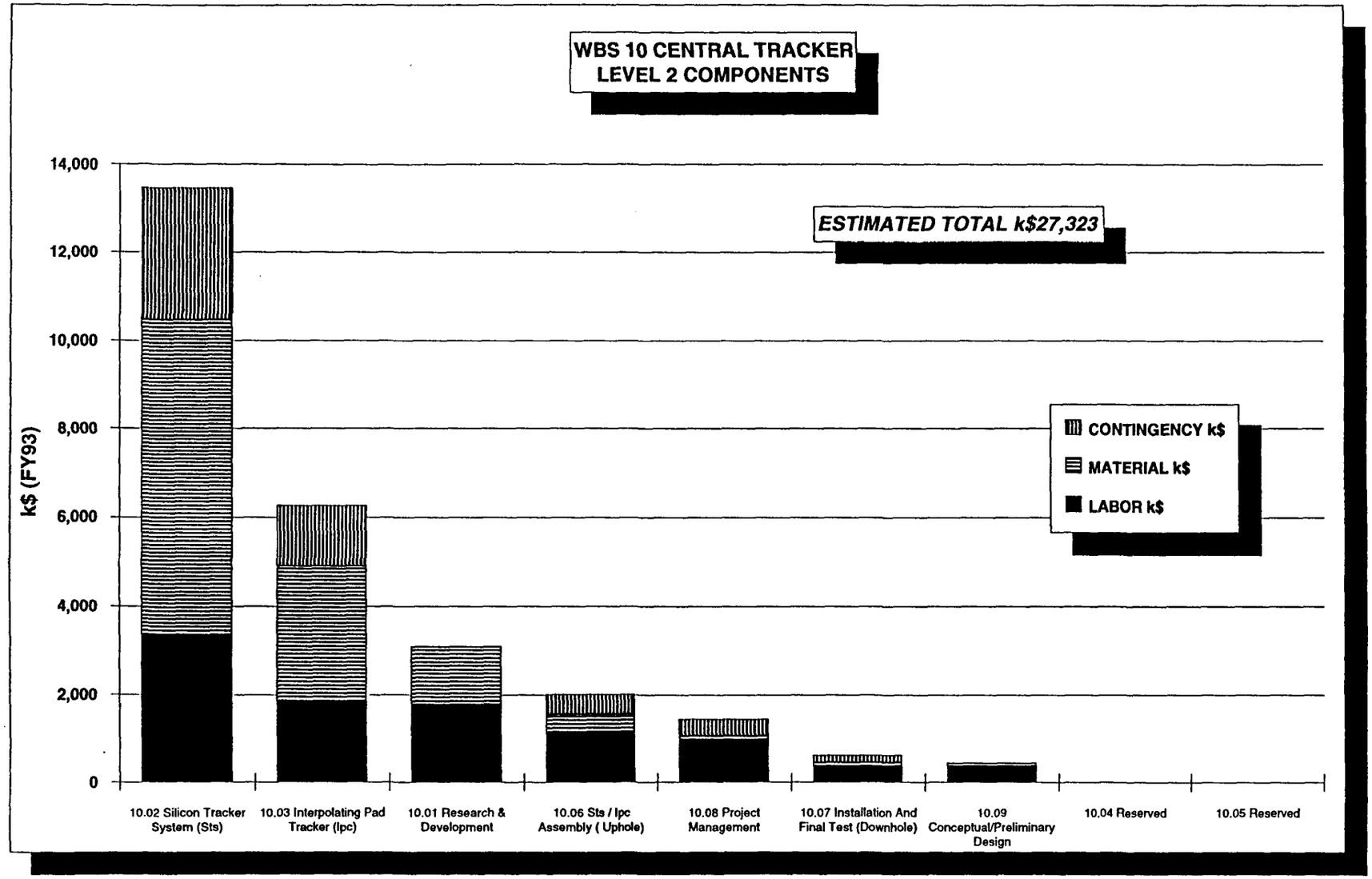


gem γeμ

Superconducting ***Super Collider***

Central Tracker Physical Parameters Table

	Silicon Microstrip Inner Tracker	Interpolating Pad Chamber
Outer Radius	35 cm	95 cm
Inner Radius	10 cm	35 cm
Length	200 cm	300 cm
Weight	TBD	TBD
Resolution	10 Microns	50 microns
Alignment Stability	10 microns	25 microns



GEM DETECTOR PROJECT

GEM COST ESTIMATE SUMMARY

4/25/93

CENTRAL TRACKER SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
10	-CENTRAL TRACKER	01	12,168	190,275	9,786	21,954	5,369	25%	27,324
10.01	-RESEARCH & DEVELOPMENT	02	1,286	29,236	1,797	3,083	0	0%	3,083
10.01.1	-SILICON TRACKER SYSTEM R & D	03	774	14,449	873	1,647	0	0%	1,647
10.01.1.1	STS R & D - OVERALL STS DESIGN	04	13	1,063	64	76	0	0%	76
10.01.1.2	STS R & D - SI WAFER R & D AND PROTOTYPE	04	190	1,728	110	301	0	0%	301
10.01.1.3	STS R & D - COOLING SYS. R & D AND PROTOTYP	04	178	3,225	198	376	0	0%	376
10.01.1.4	STS R & D - SUPPORT SYS. R & D AND PROTOTYP	04	213	4,439	273	485	0	0%	485
10.01.1.5	STS R & D - INTERNAL ALIGNMENT SYS. R & D A	04	83	2,188	125	207	0	0%	207
10.01.1.6	STS R & D - INNER SHELL TEST ASSY.	04	97	1,806	104	202	0	0%	202
10.01.2	-IPC TRACKER R & D	03	128	14,787	924	1,052	0	0%	1,052
10.01.2.1	SUPERLAYER MODULES	04	128	8,860	490	617	0	0%	617
10.01.2.2	SUPPORT STRUCTURE	04	0	3,544	260	260	0	0%	260
10.01.2.3	IPC COOLING DISTRIBUTION	04	0	1,192	87	87	0	0%	87
10.01.2.4	IPC GAS SYSTEM	04	0	1,192	87	87	0	0%	87
10.01.3	RESERVED	03	0	0	0	0	0	0%	0
10.01.4	RESERVED	03	0	0	0	0	0	0%	0
10.01.5	BEAM TESTS	03	384	0	0	384	0	0%	384
10.02	-SILICON TRACKER SYSTEM (STS)	02	7,116	59,628	3,344	10,461	3,003	29%	13,463
10.02.1	-STS SILICON DETECTOR	03	3,649	6,334	414	4,063	1,219	30%	5,282
10.02.1.1	CENTRAL REGION WAFERS	04	808	0	108	916	275	30%	1,191
10.02.1.2	-FORWARD REGION WAFERS	04	2,140	0	117	2,257	677	30%	2,934
10.02.1.2.1	1-4 x 6 cm FORWARD REGION WAFERS	05	970	0	117	1,087	326	30%	1,414
10.02.1.2.2	2-4 cm TAPERED FWD REGION WAFERS	05	286	0	0	286	86	30%	372
10.02.1.2.3	3-6 cm TAPERED FWD REGION WAFERS	05	714	0	0	714	214	30%	928
10.02.1.2.4	4-6 cm TAPERED FWD REGION WAFERS	05	170	0	0	170	51	30%	221

GEM COST ESTIMATE SUMMARY

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CENTRAL TRACKER SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
10.02.1.3	SILICON DETECTOR PROTOTYPES	04	218	0	0	218	65	30%	284
10.02.1.4	-LADDER ASSEMBLY	04	483	6,334	189	671	201	30%	873
10.02.1.4.1	PROTOTYPE LADDER ASSEMBLY	05	91	0	0	91	27	30%	119
10.02.1.4.2	CENTRAL REGION LADDER ASSEMBLY	05	75	1,438	43	118	35	30%	153
10.02.1.4.3	FORWARD REGION LADDER ASSEMBLY	05	254	4,896	146	400	120	30%	520
10.02.1.4.4	LADDER ASSEMBLY TOOLING	05	62	0	0	62	19	30%	81
10.02.2	-STS MECHANICAL COMPONENTS	03	2,539	33,892	1,833	4,372	1,262	29%	5,633
10.02.2.1	-CENTRAL REGION	04	657	9,110	489	1,145	312	27%	1,457
10.02.2.1.1	CENTRAL REGION COOLING RINGS	05	353	2,823	166	519	145	28%	664
10.02.2.1.2	CENTRAL REGION KINEMATIC MOUNTS	05	83	1,315	68	151	39	26%	190
10.02.2.1.3	CENTRAL REGION LADDER SUB-ASSEMBLY	05	42	2,704	139	180	68	38%	248
10.02.2.1.4	CENTRAL REGION ASSEMBLY TOOLING	05	179	2,268	117	296	59	20%	355
10.02.2.2	-FORWARD REGION	04	579	11,644	591	1,170	402	34%	1,572
10.02.2.2.1	FORWARD REGION COOL RINGS	05	369	3,430	196	565	215	38%	780
10.02.2.2.2	FORWARD REGION KINETIC MOUNTS	05	123	1,481	76	199	52	26%	250
10.02.2.2.3	FORWARD REGION LADDER SUB-ASSEMBLY	05	21	5,273	249	270	86	32%	356
10.02.2.2.4	FORWARD REGION ASSEMBLY TOOLING	05	67	1,460	70	136	49	36%	185
10.02.2.3	-CENTRAL REGION SUPPORT CYLINDERS	04	177	3,851	220	397	108	27%	505
10.02.2.3.1	CENTRAL REGION SUPPORT CYLINDERS	05	124	2,061	113	237	57	24%	294
10.02.2.3.2	CENTRAL REGION CYLINDER KINETIC MOUNTS	05	53	1,790	107	159	51	32%	211
10.02.2.4	-SPACE FRAME	04	544	4,460	246	790	212	27%	1,003
10.02.2.4.1	SPACE FRAME TUBES	05	166	1,007	57	223	54	24%	276
10.02.2.4.2	SPACE FRAME JOINTS	05	265	1,007	57	321	90	28%	411
10.02.2.4.3	SPACE FRAME SPOKES	05	27	815	46	73	20	28%	93
10.02.2.4.4	SPACE FRAME KINEMATIC MOUNTS	05	86	1,631	87	173	49	28%	222

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CENTRAL TRACKER SUBSYSTEM

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
10.02.2.5	-GAS ENCLOSURES	04	582	4,827	288	870	228	26%	1,097
10.02.2.5.1	OUTER GAS ENCLOSURE	05	372	2,344	141	513	123	24%	636
10.02.2.5.2	INNER GAS ENCLOSURE	05	75	1,188	75	150	30	20%	179
10.02.2.5.3	END GAS ENCLOSURE	05	135	1,295	72	207	75	36%	282
10.02.3	-STS COOLING DISTRIBUTION SYSTEM	03	262	4,985	311	573	112	20%	685
10.02.3.1	STS INTERNAL COOLING	04	17	992	59	77	12	16%	89
10.02.3.2	STS EXTERNAL COOLING	04	245	3,992	252	496	99	20%	596
10.02.4	STS NITROGEN GAS SYSTEM	03	58	1,914	89	147	29	20%	176
10.02.5	-STS ALIGNMENT SYSTEM & INSTRUMENTATION	03	550	11,122	637	1,187	355	30%	1,542
10.02.5.1	ASSEMBLY - OPTICAL ALIGNMENT SYSTEM	04	414	6,891	397	811	227	28%	1,038
10.02.5.2	INTERNAL OPTICAL MONITORING SYSTEM	04	137	4,231	240	376	128	34%	504
10.02.6	STS SHIPPING	03	59	1,382	60	119	26	22%	146
10.03	-INTERPOLATING PAD TRACKER (IPC)	02	3,032	44,140	1,870	4,902	1,360	28%	6,262
10.03.1	-IPC SUPERLAYER MODULES	03	1,686	25,712	900	2,587	725	28%	3,311
10.03.1.1	-BARREL MODULES	04	990	11,456	455	1,446	394	27%	1,840
10.03.1.1.1	-MECHANICAL	05	766	2,312	134	900	264	29%	1,164
10.03.1.1.1.1	-CATHODE PC BOARDS	06	223	363	21	244	59	24%	303
10.03.1.1.1.1.1	PRINTED CIRCUIT SUBSTRATE	07	100	186	11	111	22	20%	133
10.03.1.1.1.1.2	FINISHED CIRCUIT BOARD	07	123	177	10	133	37	28%	170
10.03.1.1.1.2	ANODE WIRE SUPPORT FRAMES	06	57	177	10	67	16	24%	83
10.03.1.1.1.3	CATHODE SUPPORT FRAMES	06	29	177	10	39	12	32%	51
10.03.1.1.1.4	HARDBACK CORES	06	208	177	10	219	70	32%	288
10.03.1.1.1.5	ANODE WIRES	06	17	177	10	27	4	14%	31
10.03.1.1.1.6	MODULE GAS PLENUMS	06	4	177	10	14	3	24%	18
10.03.1.1.1.7	GAS WINDOW SUPPORT FRAMES	06	8	177	10	18	5	28%	23

CENTRAL TRACKER SUBSYSTEM

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
10.03.1.1.1.8	GAS WINDOW	06	7	177	10	17	4	24%	21
10.03.1.1.1.9	CONTINUOUS CATHODE PLANE	06	42	177	10	52	17	32%	69
10.03.1.1.1.10	END PLATES	06	84	177	10	94	39	42%	133
10.03.1.1.1.11	-BARREL MODULE DOUBLET HARDWARE	06	67	177	10	77	21	27%	98
10.03.1.1.1.11.1	MODULE DOUBLET STRUT	07	27	89	5	32	9	27%	41
10.03.1.1.1.11.2	MODULE DOUBLET TUBE	07	40	89	5	45	12	27%	57
10.03.1.1.1.12	ALIGNMENT PINS, ETC.	06	21	177	10	32	13	40%	44
10.03.1.1.2	-ELECTRICAL	05	95	532	31	126	51	41%	177
10.03.1.1.2.1	HIGH VOLTAGE DISTRIBUTION	06	42	177	10	52	23	44%	75
10.03.1.1.2.2	LOW VOLTAGE DISTRIBUTION	06	42	177	10	52	23	44%	75
10.03.1.1.2.3	ELECTRICAL ASSY. AND INTERFACE	06	11	177	10	21	5	24%	26
10.03.1.1.3	MODULE SUB-ASSEMBLY	05	23	7,372	247	269	43	16%	313
10.03.1.1.4	SUB-ASSEMBLY TOOLING AND FIXTURES	05	107	1,240	43	150	36	24%	187
10.03.1.2	-ENDCAP MODULES	04	696	14,256	445	1,141	330	29%	1,471
10.03.1.2.1	-MECHANICAL	05	537	2,038	108	645	194	30%	839
10.03.1.2.1.1	-CATHODE PC BOARDS	06	151	354	20	170	48	28%	218
10.03.1.2.1.1.1	PRINTED CIRCUIT SUBSTRATE	07	68	177	10	78	22	28%	100
10.03.1.2.1.1.2	FINISHED CIRCUIT BOARD	07	83	177	9	92	26	28%	118
10.03.1.2.1.2	ANODE WIRE SUPPORT FRAMES	06	38	177	9	48	12	24%	59
10.03.1.2.1.3	CATHODE WIRE SUPPORT FRAMES	06	21	177	9	30	10	32%	40
10.03.1.2.1.4	HARDBACK CORES	06	254	177	9	264	84	32%	348
10.03.1.2.1.5	ANODE WIRES	06	7	177	9	17	3	16%	19
10.03.1.2.1.6	MODULE GAS PLENUMS	06	2	177	9	11	3	24%	14
10.03.1.2.1.7	GAS WINDOW SUPPORT FRAMES	06	6	177	9	16	4	28%	20
10.03.1.2.1.8	GAS WINDOW	06	6	177	9	16	4	28%	20

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
10.03.1.2.1.9	CONTINUOUS CATHODE PLANE	06	29	177	9	38	12	32%	51
10.03.1.2.1.10	END PLATES	06	7	177	9	17	7	42%	24
10.03.1.2.1.11	ALIGNMENT PINS, ETC.	06	15	89	5	19	8	40%	27
10.03.1.2.2	-ELECTRICAL	05	69	443	23	92	39	43%	131
10.03.1.2.2.1	HIGH VOLTAGE DISTRIBUTION	06	29	177	9	38	17	44%	54
10.03.1.2.2.2	LOW VOLTAGE DISTRIBUTION	06	29	177	9	38	17	44%	54
10.03.1.2.2.3	ELECTRICAL ASSY. AND INTERFACE	06	12	89	5	17	6	36%	22
10.03.1.2.3	MODULE SUB-ASSEMBLY	05	24	10,712	277	301	72	24%	373
10.03.1.2.4	SUB-ASSEMBLY TOOLING AND FIXTURES	05	67	1,063	37	103	25	24%	128
10.03.2	-STS / IPC SUPPORT STRUCTURE	03	696	11,536	614	1,310	399	31%	1,710
10.03.2.1	BULKHEADS	04	95	2,428	132	227	73	32%	299
10.03.2.2	INNER CYLINDER	04	46	2,215	123	169	54	32%	223
10.03.2.3	OUTER CYLINDER	04	125	2,250	121	246	79	32%	324
10.03.2.4	END CAP SUPPORT STRUCTURE	04	327	2,304	118	445	143	32%	588
10.03.2.5	-KINEMATIC MOUNTS / ATTACHMENTS	04	50	1,063	65	115	37	32%	152
10.03.2.5.1	MOUNTS - IPC ENDCAPS TO BARREL	05	20	354	22	42	13	32%	55
10.03.2.5.2	MOUNTS - BARREL TO CALORIMETER	05	15	354	22	37	12	32%	49
10.03.2.5.3	MOUNTS - STS TO IPC	05	15	354	22	36	12	32%	48
10.03.2.6	POLYETHELYNE SHIELD	04	53	567	29	82	7	8%	89
10.03.2.7	STS / IPC SUPPORT STRUCTURE ASSEMBLY	04	1	709	25	26	8	31%	35
10.03.3	IPC COOLING DISTRIBUTION SYSTEM	03	313	2,304	120	433	56	13%	489
10.03.4	IPC GAS SYSTEM	03	72	2,481	125	196	47	24%	244
10.03.5	IPC ALIGNMENT SYSTEMS	03	208	1,063	56	264	105	40%	369
10.03.6	IPC SHIPPING	03	57	1,046	55	113	27	24%	140
10.04	RESERVED	02	0	0	0	0	0	0%	0

GEM COST ESTIMATE SUMMARY

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CENTRAL TRACKER SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
10.05	RESERVED	02	0	0	0	0	0	0%	0
10.06	-STS / IPC ASSEMBLY (uphole)	02	455	29,840	1,108	1,563	444	28%	2,007
10.06.1	-STS ASSEMBLY AND CHECK	03	212	12,355	484	696	209	30%	905
10.06.1.1	CENTRAL REGION ASSEMBLY & CHECK	04	47	1,594	73	120	36	30%	157
10.06.1.2	FORWARD REGION ASSEMBLY & CHECK	04	51	2,287	106	157	47	30%	204
10.06.1.3	SPACE FRAME ASSEMBLY & CHECK	04	70	2,411	111	181	54	30%	235
10.06.1.4	GAS ENCLOSURE ASSEMBLY & CHECK	04	44	6,063	195	239	72	30%	310
10.06.2	-IPC ASSEMBLY AND CHECK	03	7	10,716	350	357	111	31%	468
10.06.2.1	-BARREL PAD TRACKER ASSEMBLY AND CHECK	04	3	5,595	164	167	52	31%	218
10.06.2.1.1	BARREL MODULE DOUBLET INSTALL INTO S.S.	05	1	2,999	96	97	30	31%	126
10.06.2.1.2	BARREL MODULE GAS CONNECTION	05	1	266	10	11	3	31%	14
10.06.2.1.3	BARREL MODULE HV (anode) CONNECTIONS	05	1	266	10	11	3	31%	14
10.06.2.1.4	BARREL MODULE LV (electronics) CONNECTIO	05	1	1,799	38	38	12	31%	50
10.06.2.1.5	BARREL MODULE LV (signal) CONNECTION	05	1	266	10	11	3	31%	14
10.06.2.2	-ENDCAP PAD TRACKER ASSEMBLY	04	5	5,121	186	191	59	31%	250
10.06.2.2.1	ENDCAP MODULE CAN ASSEMBLY	05	1	354	15	16	5	31%	21
10.06.2.2.2	ENDCAP MODULES SUB-ASSY. INTO ENDCAP CAN	05	1	2,304	105	106	33	31%	139
10.06.2.2.3	ENDCAP MODULE GAS CONNECTIONS	05	1	266	10	11	3	31%	14
10.06.2.2.4	ENDCAP MODULE HV (anode) CONNECTIONS	05	1	266	10	11	3	31%	14
10.06.2.2.5	ENDCAP MODULE LV (electronics) CONNECTIO	05	1	1,666	35	36	11	31%	48
10.06.2.2.6	ENDCAP MODULE LV (signal) CONNECTIONS	05	1	266	10	11	3	31%	15
10.06.3	STS / IPC INTEGRATION	03	95	4,102	143	237	64	27%	301
10.06.4	CALIBRATION AND BEAM TESTS	03	141	2,667	132	273	60	22%	333
10.07	-INSTALLATION AND FINAL TEST (downhole)	02	115	7,611	340	455	164	36%	619
10.07.1	DETECTOR INSTALLATION	03	105	6,867	299	404	145	36%	549

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
10.07.2	SAFETY SYSTEMS TEST AND VERIFICATION	03	0	354	21	21	8	36%	29
10.07.3	FINAL ALIGNMENT CHECK	03	10	390	20	30	11	36%	41
10.08	-PROJECT MANAGEMENT	02	68	15,710	984	1,052	400	38%	1,452
10.08.1	-STS TRACKER MGT.	03	52	4,465	327	379	144	38%	524
10.08.1.1	STS SUBSYSTEM MANAGEMENT AND ADMIN.	04	13	1,116	82	95	36	38%	131
10.08.1.2	STS RESOURCE MANAGEMENT	04	13	1,116	82	95	36	38%	131
10.08.1.3	STS E, S & H COMPLIANCE CONTROLS	04	13	1,116	82	95	36	38%	131
10.08.1.4	STS QUALITY ASSURANCE	04	13	1,116	82	95	36	38%	131
10.08.2	-IPC TRACKER MGT.	03	16	5,387	313	328	125	38%	453
10.08.2.1	IPC SUBSYSTEM MANAGEMENT AND ADMIN.	04	4	1,347	78	82	31	38%	113
10.08.2.2	IPC RESOURCE MANAGEMENT	04	4	1,347	78	82	31	38%	113
10.08.2.3	IPC E, S & H COMPLIANCE CONTROLS	04	4	1,347	78	82	31	38%	113
10.08.2.4	IPC QUALITY ASSURANCE	04	4	1,347	78	82	31	38%	113
10.08.3	SUBSYSTEM INTEGRATION MGT.	03	0	5,857	345	345	131	38%	475
10.09	-CONCEPTUAL/PRELIMINARY DESIGN	02	96	4,111	343	439	0	0%	439
10.09.1	-SILICON TRACKER SYSTEM C/PD	03	83	2,835	208	291	0	0%	291
10.09.1.1	SILICON DETECTOR	04	10	0	0	10	0	0%	10
10.09.1.2-8	OTHER STS MECHANICAL	04	73	2,835	208	280	0	0%	280
10.09.2	-IPC TRACKER C/PD	03	13	1,276	94	106	0	0%	106
10.09.2.1	IPC MECHANICAL	04	13	1,276	94	106	0	0%	106
10.09.3	RESERVED	03	0	0	0	0	0	0%	0
10.09.4	RESERVED	03	0	0	0	0	0	0%	0
10.09.5	BEAM TESTS C/PD	03	0	0	42	42	0	0%	42

OPEN PLAN

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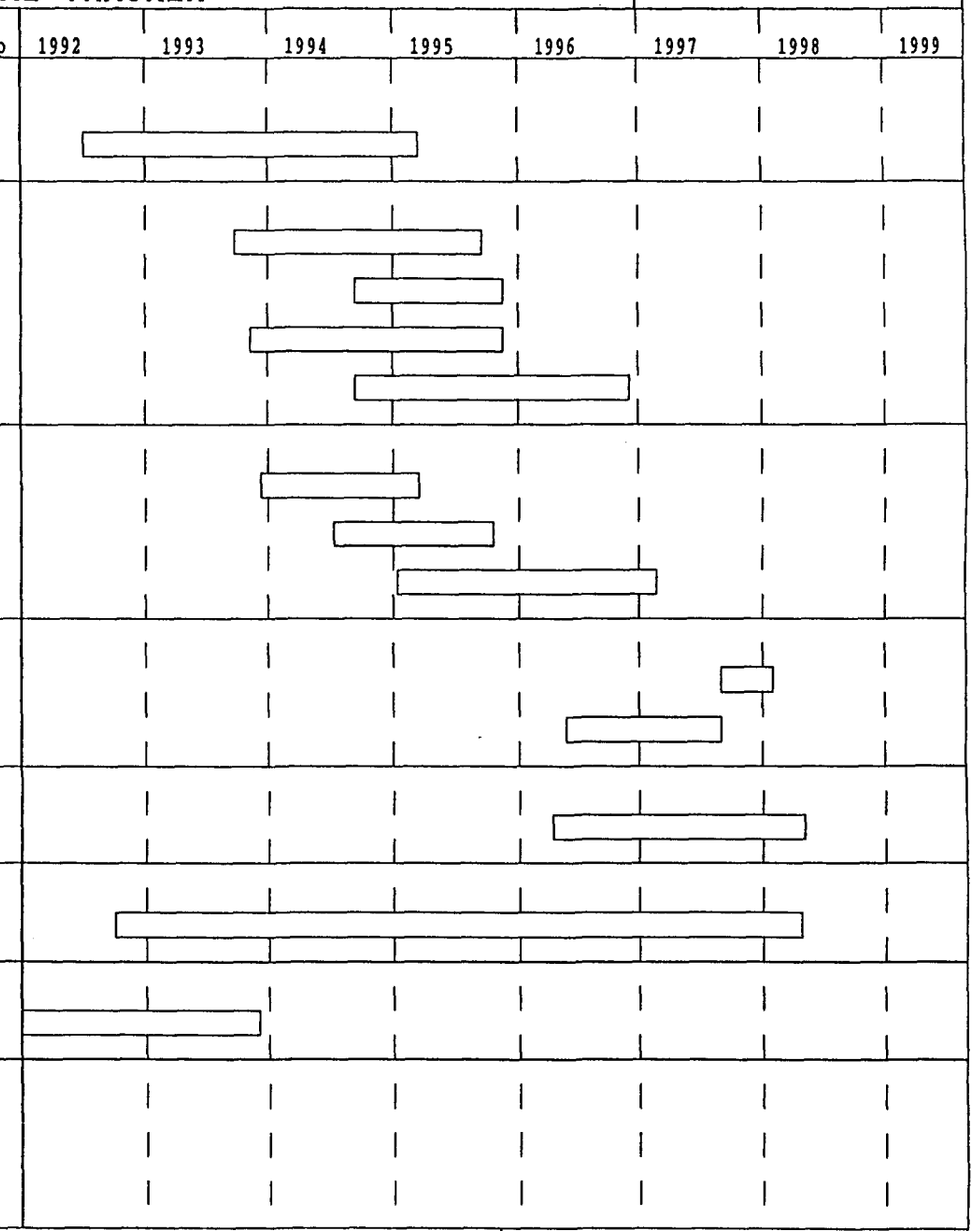
LEVEL II SUMMARY BASELINE SCHEDULE

10 CENTRAL TRACKER

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
WBS:10.01 RESEARCH AND DEVELOPMENT			
DESIGN	03JUL92	15MAR95	
WBS:10.02 SILICON TRACKER SYSTEM (STS)			
DESIGN	23SEP93	15SEP95	
PROCUREMENT	13SEP94	16NOV95	
FABRICATION	09NOV93	16NOV95	
ASSEMBLY	13SEP94	03DEC96	
WBS:10.03 INTERPOLATING PAD TRACKER (IPC)			
DESIGN	09DEC93	15MAR95	
PROCUREMENT	13JUL94	17OCT95	
ASSEMBLY	13JAN95	20FEB97	
WBS:10.06 STS/IPC ASSEMBLY (UPHOLE)			
DESIGN	29AUG97	29JAN98	
ASSEMBLY	21MAY96	28AUG97	
WBS:10.07 INSTALLATION & FINAL TEST (DOWNHOLE)			
INSTALLATION	09APR96	01MAY98	
WBS:10.08 PROJECT MANAGEMENT			
LEVEL OF EFFORT (LOE)	01OCT92	22APR98	
WBS:10.09 CONCEPTUAL/PRELIM DESIGN			
DESIGN	01OCT91	01DEC93	



Legend
Baseline
Critical
Float
☆ Baseline ▽ Projected ▼ Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

OPEN PLAN

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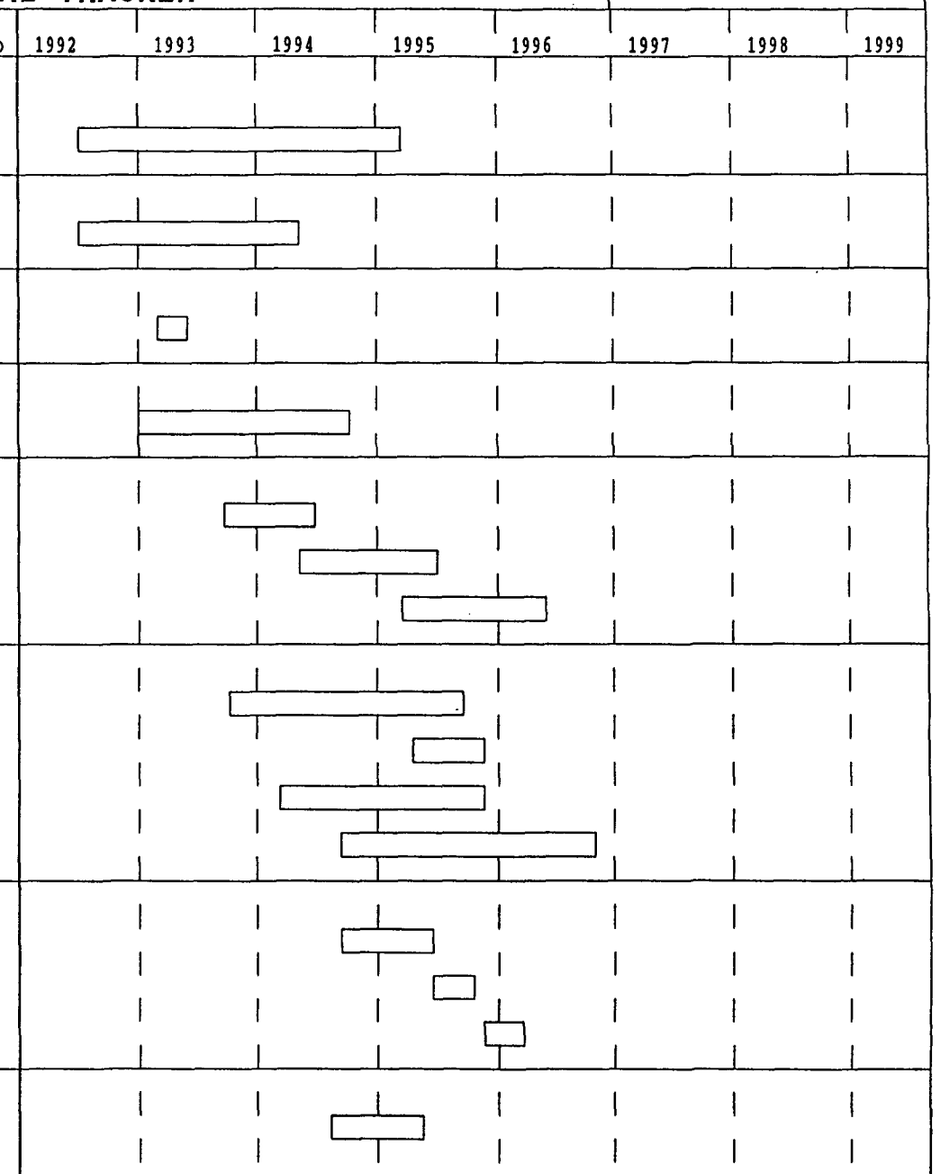
LEVEL III SUMMARY BASELINE SCHEDULE

10 CENTRAL TRACKER

GEM DETECTOR

Summary Description	Baseline Start	Baseline Finish	%Comp
WBS:10.01.1 SILICON TRACKER SYSTEM R&D			
DESIGN	03JUL92	15MAR95	
WBS:10.01.2 IPC TRACKER R&D			
DESIGN	03JUL92	11MAY94	
WBS:10.01.3 STS ELECTRONICS			
DESIGN	01MAR93	31MAY93	
WBS:10.01.5 BEAM TESTS			
DESIGN	01JAN93	10OCT94	
WBS:10.02.1 STS SILICON DETECTOR			
DESIGN	23SEP93	27JUN94	
FABRICATION	12MAY94	30JUN95	
ASSEMBLY	16MAR95	31MAY96	
WBS:10.02.2 STS MECHANICAL COMPONENTS			
DESIGN	08OCT93	15SEP95	
PROCUREMENT	17APR95	16NOV95	
FABRICATION	11MAR94	16NOV95	
ASSEMBLY	13SEP94	01NOV96	
WBS:10.02.3 STS COOLING DISTRIBUTION SYSTEM			
DESIGN	13SEP94	15JUN95	
PROCUREMENT	16JUN95	17OCT95	
ASSEMBLY	17NOV95	19MAR96	
WBS:10.02.4 STS NITROGEN GAS SYSTEM			
DESIGN	12AUG94	16MAY95	



Legend: Baseline, Critical, Float, Baseline, Projected, Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

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OPEN PLAN

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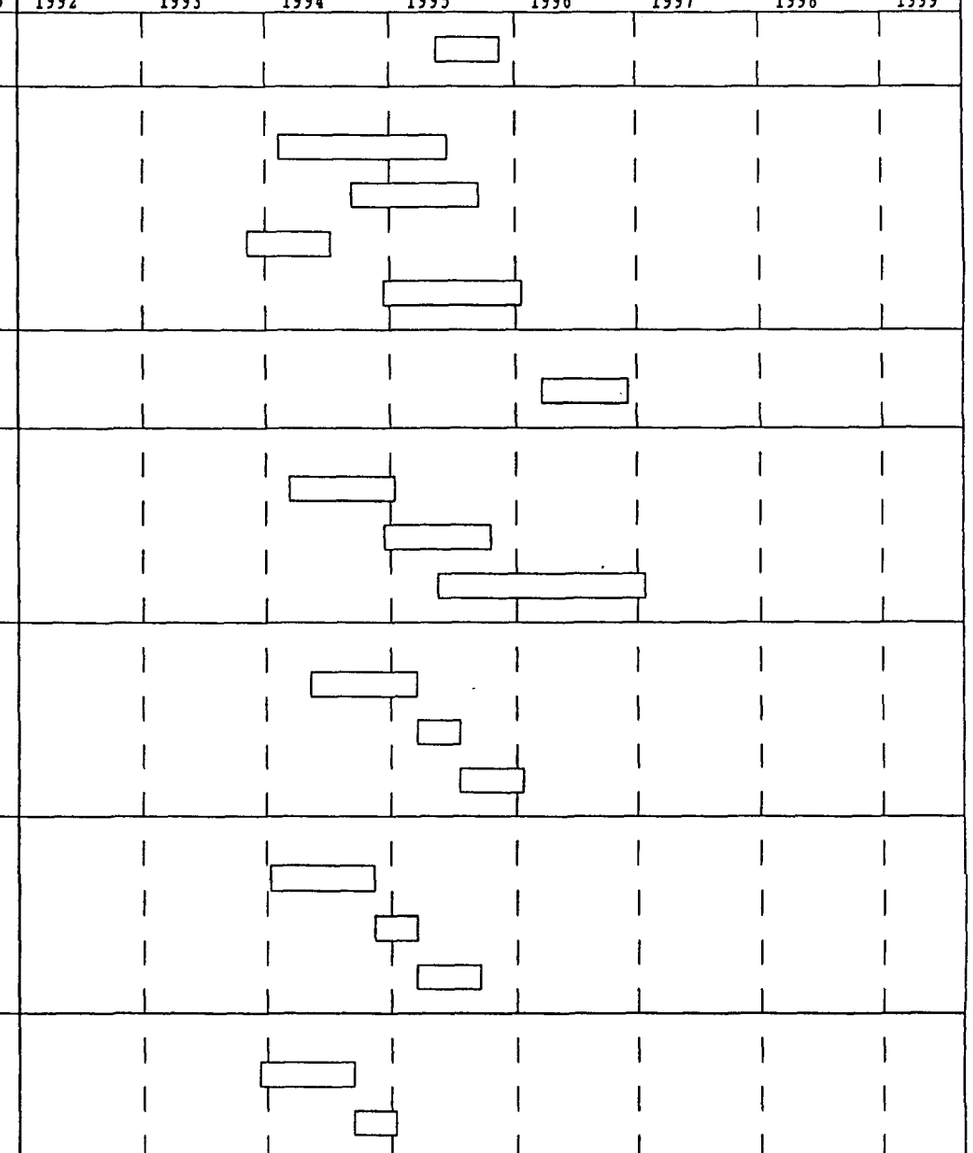
LEVEL III SUMMARY BASELINE SCHEDULE

10 CENTRAL TRACKER

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	17MAY95	16NOV95	
WBS:10.02.5 STS ALIGN SYS & INSTRUMENTATION			
DESIGN	09FEB94	15JUN95	
PROCUREMENT	13SEP94	15SEP95	
FABRICATION	09NOV93	12JUL94	
ASSEMBLY	14DEC94	17JAN96	
WBS:10.02.6 STS SHIPPING			
ASSEMBLY	20MAR96	03DEC96	
WBS:10.03.1 IPC SUPERLAYER MODULES			
DESIGN	11MAR94	12JAN95	
PROCUREMENT	14DEC94	17OCT95	
ASSEMBLY	17MAY95	21JAN97	
WBS:10.03.2 STS/IPC SUPPORT STRUCTURE			
DESIGN	12MAY94	15MAR95	
PROCUREMENT	16MAR95	17JUL95	
ASSEMBLY	18JUL95	17JAN96	
WBS:10.03.3 IPC COOLING DISTRIBUTION SYSTEM			
DESIGN	10JAN94	11NOV94	
PROCUREMENT	14NOV94	15MAR95	
ASSEMBLY	16MAR95	15SEP95	
WBS:10.03.4 IPC GAS SYSTEM			
DESIGN	09DEC93	12SEP94	
PROCUREMENT	13SEP94	12JAN95	



Legend: Baseline, Critical, Float
☆ Baseline ▽ Projected ▼ Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

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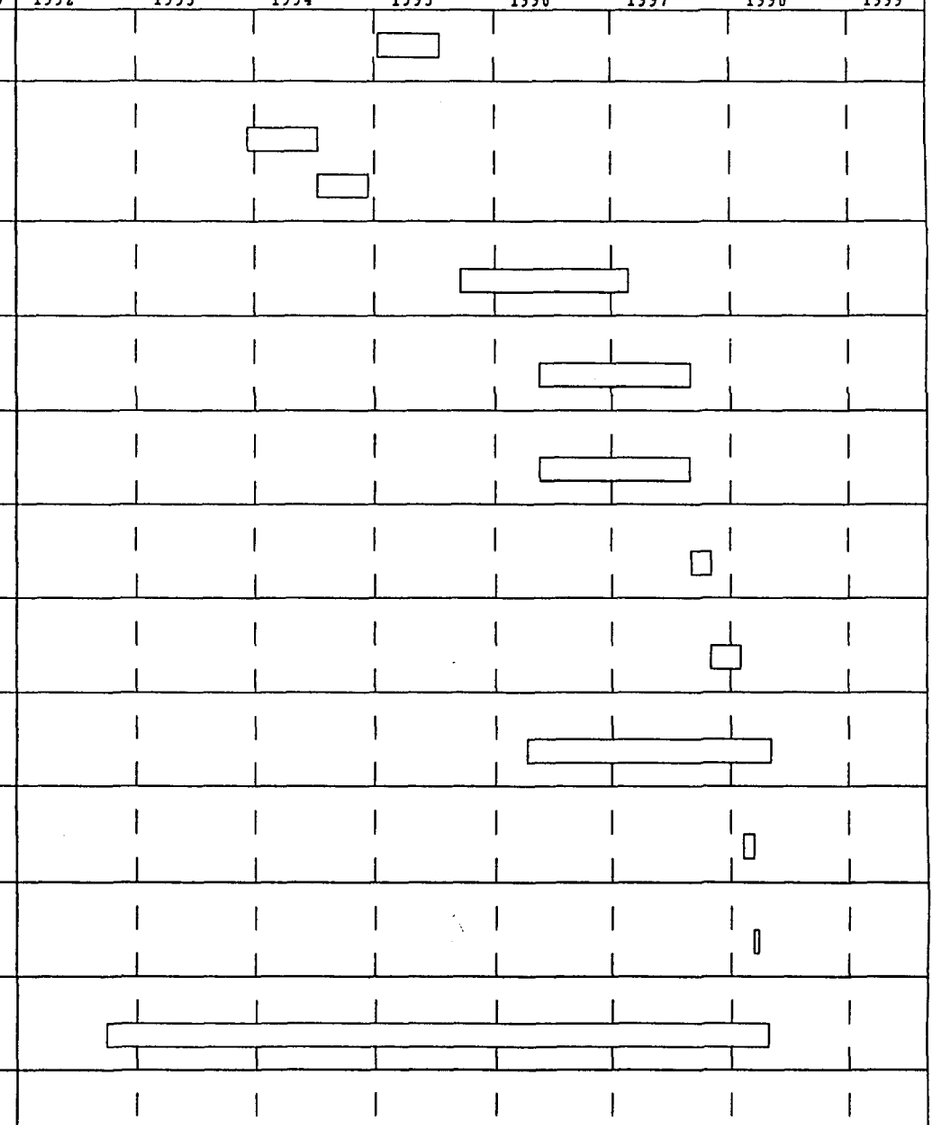
LEVEL III SUMMARY BASELINE SCHEDULE

10 CENTRAL TRACKER

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
ASSEMBLY	13JAN95	17JUL95	
WBS:10.03.5 IPC ALIGNMENT SYSTEMS			
DESIGN	09DEC93	12JUL94	
PROCUREMENT	13JUL94	13DEC94	
WBS:10.03.6 IPC SHIPPING			
ASSEMBLY	18SEP95	20FEB97	
WBS:10.06.1 STS ASSEMBLY AND CHECK			
ASSEMBLY	21MAY96	28AUG97	
WBS:10.06.2 IPC ASSEMBLY AND CHECK			
ASSEMBLY	21MAY96	25AUG97	
WBS:10.06.3 STS/IPC INTEGRATION			
DESIGN	29AUG97	29OCT97	
WBS:10.06.4 CALIBRATION AND BEAM TESTS			
DESIGN	30OCT97	29JAN98	
WBS:10.07.1 DETECTOR INSTALLATION			
INSTALLATION	09APR96	01MAY98	
WBS:10.07.2 SAFETY SYSTEMS TEST & VERIFICATION			
INSTALLATION	06FEB98	09MAR98	
WBS:10.07.3 FINAL ALIGNMENT CHECK			
INSTALLATION	10MAR98	24MAR98	
WBS:10.08.1 STS TRACKER MANAGEMENT			
LEVEL OF EFFORT (LOE)	01OCT92	22APR98	
WBS:10.08.2 IPC TRACKER MANAGEMENT			



Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

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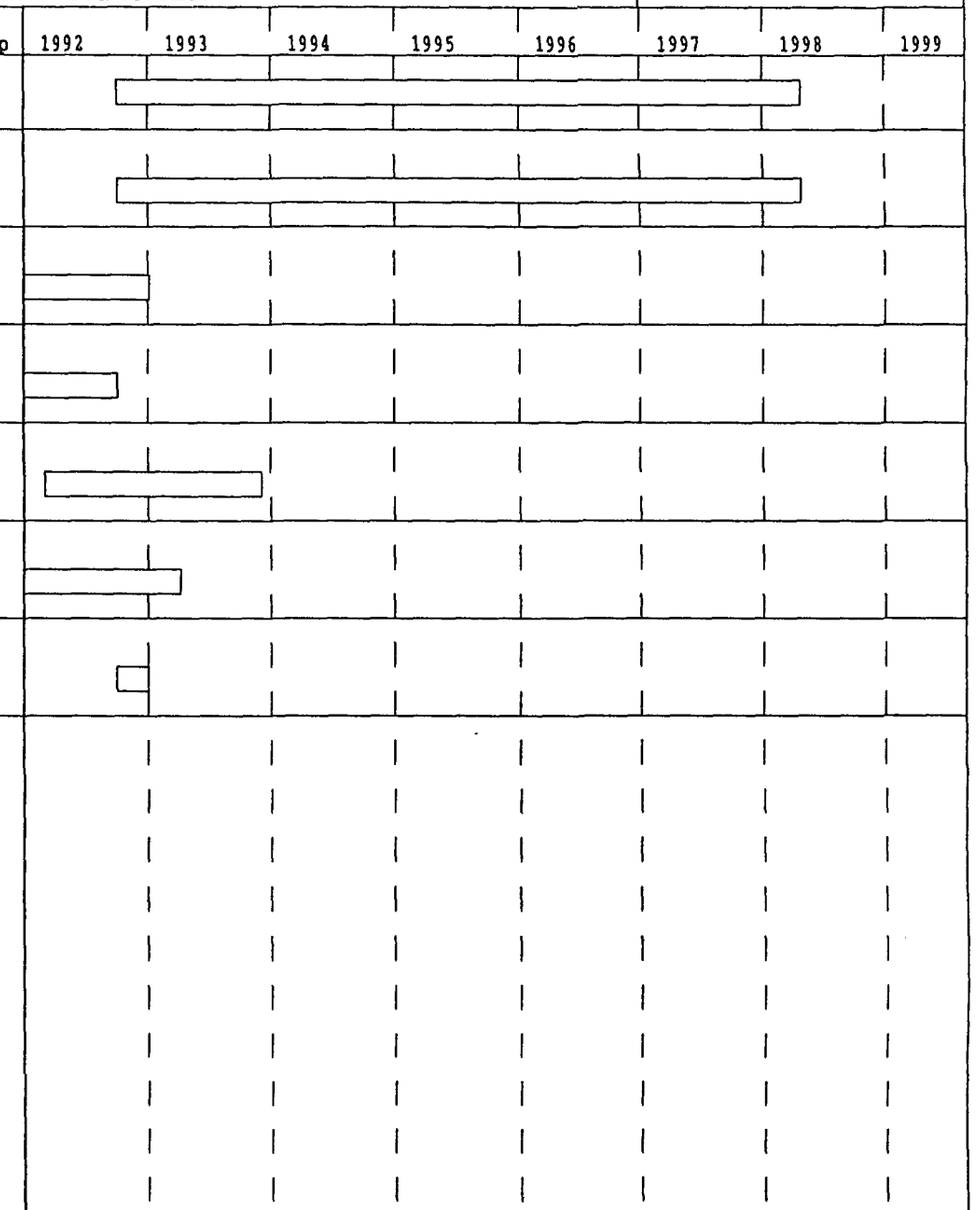
LEVEL III SUMMARY BASELINE SCHEDULE

10 CENTRAL TRACKER

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
LEVEL OF EFFORT (LOE)	01OCT92	22APR98	
WBS:10.08.3 SUBSYSTEM INTEGRATION MANAGEMENT			
LEVEL OF EFFORT (LOE)	01OCT92	22APR98	
WBS:10.09.1 SILICON TRACKER SYSTEM C/PD			
DESIGN	01OCT91	04JAN93	
WBS:10.09.2 IPC TRACKER C/PD			
DESIGN	01OCT91	02OCT92	
WBS:10.09.3 STS ELECTRONICS C/PD			
DESIGN	02MAR92	01DEC93	
WBS:10.09.4 IPC ELECTRONICS C/PD			
DESIGN	01OCT91	06APR93	
WBS:			
DESIGN	01OCT92	31DEC92	



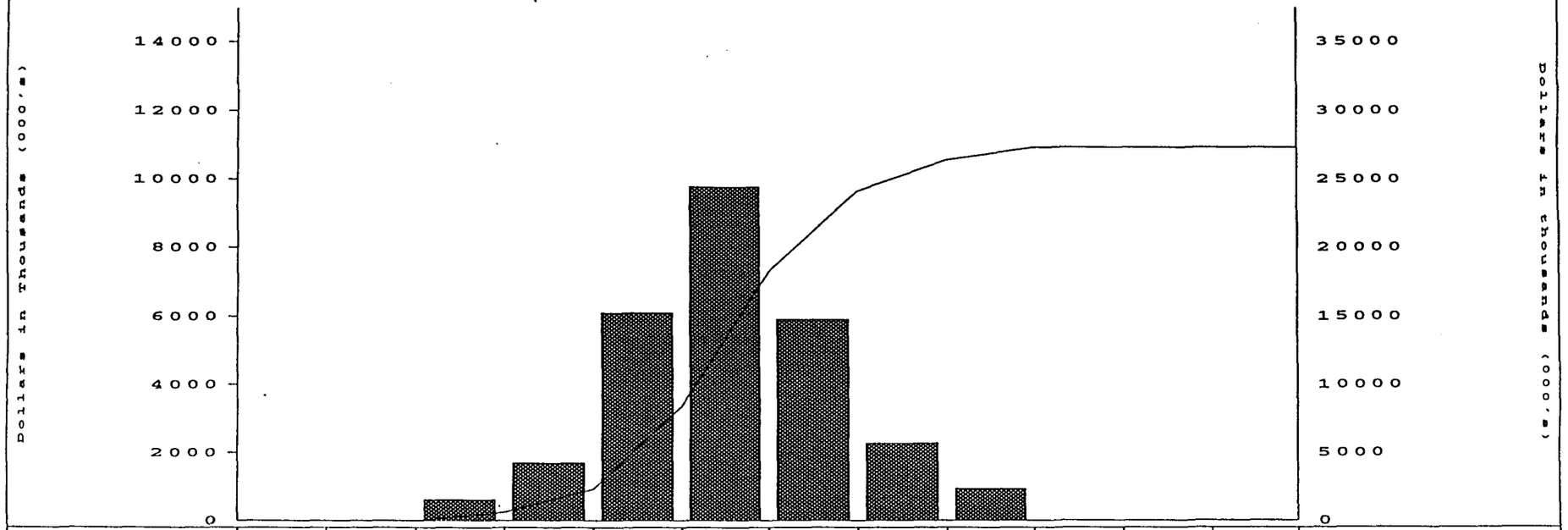
Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

GEM Detector Report: GEM_FY	GEM DETECTOR WBS 10 - CENTRAL TRACKER	Date: 27APR93 Project: TRACKER



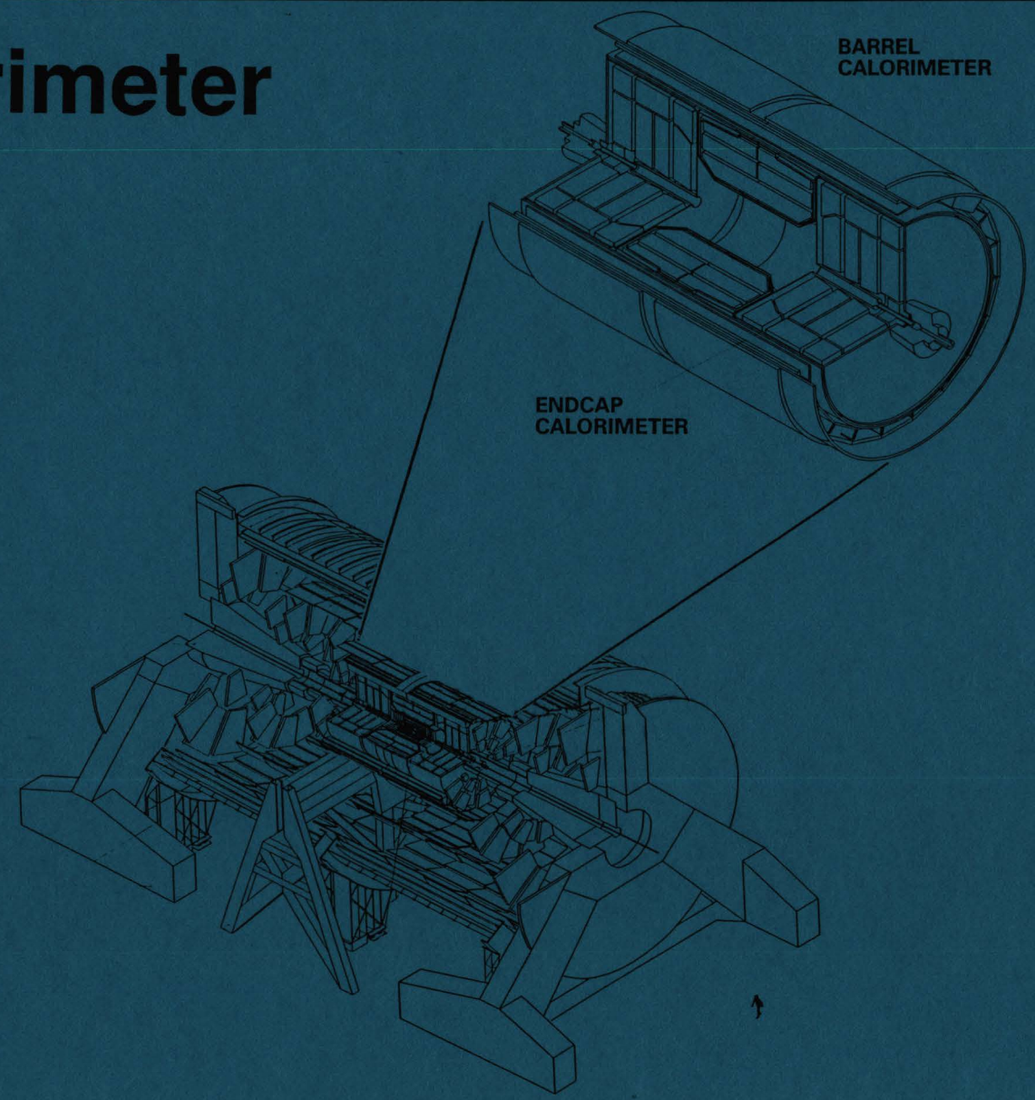
		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
Incr Bud	$k		621	1703	6098	9776	5910	2280	935			
Cum. Bud	$10k		62	232	842	1820	2411	2639	2732	2732	2732	2732

WBS 10.01.1	$1,647,143	SILICON TRACKER SYSTEM R&D
WBS 10.01.2	$1,051,575	IPC TRACKER R&D
WBS 10.01.5	$ 384,208	BEAM TESTS
WBS 10.02.1	$5,281,555	STS SILICON DETECTOR
WBS 10.02.2	$5,633,425	STS MECHANICAL COMPONENTS
WBS 10.02.3	$ 684,642	STS COOLING DISTRIBUTION SYSTEM
WBS 10.02.4	$ 175,884	STS NITROGEN GAS SYSTEM
WBS 10.02.5	$1,541,998	STS ALIGN SYS & INSTRUMENTATION
WBS 10.02.6	$ 145,512	STS SHIPPING
WBS 10.03.1	$3,311,068	IPC SUPERLAYER MODULES
WBS 10.03.2	$1,709,626	STS/IPC SUPPORT STRUCTURE
WBS 10.03.3	$ 489,081	IPC COOLING DISTRIBUTION SYSTEM
WBS 10.03.4	$ 243,558	IPC GAS SYSTEM
WBS 10.03.5	$ 368,872	IPC ALIGNMENT SYSTEMS
WBS 10.03.6	$ 139,465	IPC SHIPPING
WBS 10.06.1	$ 904,795	STS ASSEMBLY AND CHECK

GEM DETECTOR
WBS 10 - CENTRAL TRACKER

		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	
WBS 10.06.2	$ 468,190												IPC ASSEMBLY AND CHECK
WBS 10.06.3	$ 300,983												STS/IPC INTEGRATION
WBS 10.06.4	$ 332,547												CALIBRATION AND BEAM TESTS
WBS 10.07.1	$ 549,063												DETECTOR INSTALLATION
WBS 10.07.2	$ 28,851												SAFETY SYSTEMS TEST & VERIFICATIO
WBS 10.07.3	$ 40,698												FINAL ALIGNMENT CHECK
WBS 10.08.1	$ 523,611												STS TRACKER MANAGEMENT
WBS 10.08.2	$ 453,022												IPC TRACKER MANAGEMENT
WBS 10.08.3	$ 475,360												SUBSYSTEM INTEGRATION MANAGEMENT
WBS 10.09.1													SILICON TRACKER SYSTEM C/PD
WBS 10.09.2													IPC TRACKER C/PD
WBS 10.09.5	$ 42,090												

Calorimeter



gem γeμ

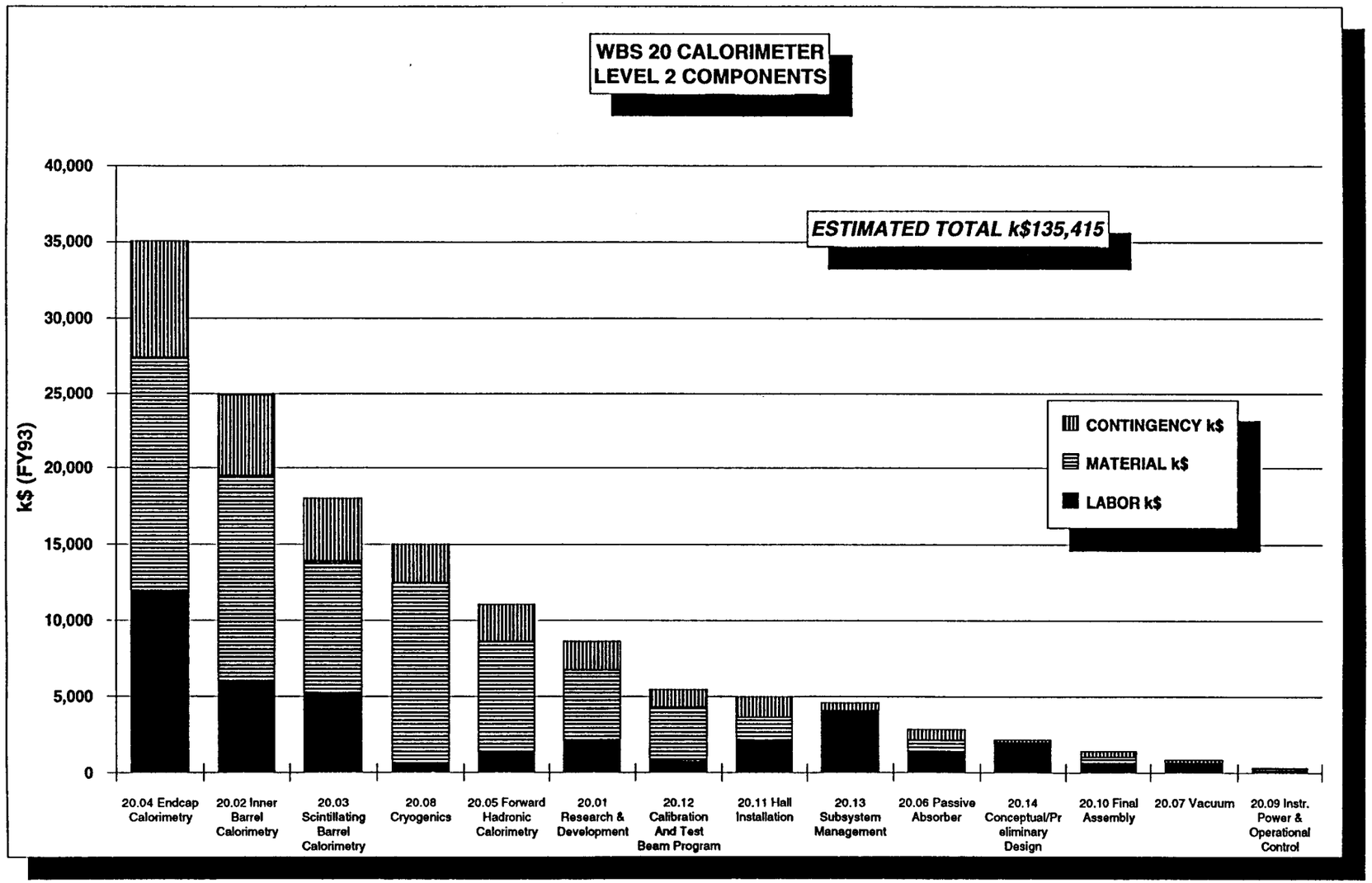
Superconducting ***Super Collider***

Calorimeter Parameters Table

	EM	Hadronic	Hadronic	Total
Absorber Barrel Endcap	 Pb/SS Cu/SS	 Pb Cu	 N/A Cu	
Absorber Plate Thickness (mm)	1.3/.4mmE/C 1mm barrel	9mm	16mm	
Cell Thickness (mm)	6.3mm E/C 6mm barrel	95.04mm	151.04mm	
Segmentation Barrel Endcap	 .026x.026 .026x.026 .052x.052 1.04x.104	 .08x.08 .04x.16 .08x.16 .08x.08	 .04x.16 .08x.16 .08x.08	
No. of Channels	116,081	11,006	2,904	129,991
		Barrel	**Endcaps**	
Weight (Mg)	N/A	433	381 (each)	1,195

Calorimeter Module Parameters Table

	Plates	Quantity	Weight	Module
Barrel EM Accordian	Projective	40	1.58 MT	24
Barrel Fine Hadronic	z	80	2.26 MT	30
Barrel Fine Hadronic	z	80	2.03 MT	24
End EM Accordian	Projective	2	22.00 MT	200
End Fine Hadronic	Vertical	40	1.95 MT	30
End Fine Hadronic	Vertical	40	2.35 MT	36
End Fine Hadronic	Vertical	80	1.95 MT	72
End Fine Hadronic	Vertical	80	1.33 MT	42
End Fine Hadronic	Vertical	40	2.25 MT	36
End Fine Hadronic	Vertical	80	0.85 MT	30


WBS 20 CALORIMETER
LEVEL 2 COMPONENTS
ESTIMATED TOTAL k$135,415
CONTINGENCY k$
MATERIAL k$
LABOR k$
k$ (FY93)
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
20.04 Endcap Calorimetry
20.02 Inner Barrel Calorimetry
20.03 Scintillating Barrel Calorimetry
20.08 Cryogenics
20.05 Forward Hadronic Calorimetry
20.01 Research & Development
20.12 Calibration And Test Beam Program
20.11 Hall Installation
20.13 Subsystem Management
20.06 Passive Absorber
20.14 Conceptual/Preliminary Design
20.10 Final Assembly
20.07 Vacuum
20.09 Instr. Power & Operational Control

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

CALORIMETER SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20	-CALORIMETER	01	68,570	1,012,430	37,976	106,546	28,870	27%	135,415
20.01	-RESEARCH & DEVELOPMENT	02	4,634	69,375	2,092	6,726	1,883	28%	8,609
20.01.1	RESEARCH & DEVELOPMENT	03	4,634	69,375	2,092	6,726	1,883	28%	8,609
20.02	-INNER BARREL CALORIMETRY	02	13,586	168,510	5,890	19,476	5,412	28%	24,888
20.02.1	ASSEMBLY (ON-SITE)	03	1,859	49,945	1,521	3,380	811	24%	4,191
20.02.2	-EM MODULE	03	5,680	42,122	1,465	7,145	2,273	32%	9,418
20.02.2.1	ASSEMBLY	04	1,189	7,714	311	1,500	375	25%	1,875
20.02.2.2	ABSORBER	04	120	12,040	404	524	178	34%	702
20.02.2.3	SIGNAL ELECTRODE	04	3,162	8,528	286	3,448	1,172	34%	4,621
20.02.2.4	MOTHER BOARD	04	659	0	0	659	237	36%	897
20.02.2.5	CONNECTIONS	04	330	0	0	330	119	36%	448
20.02.2.6	STRUCTURE	04	220	13,840	464	684	192	28%	875
20.02.3	-HADRONIC SECTIONS	03	3,870	40,141	1,411	5,281	1,233	23%	6,513
20.02.3.1	ASSEMBLY	04	647	0	0	647	168	26%	815
20.02.3.2	-INNER	04	1,667	24,310	859	2,525	579	23%	3,104
20.02.3.2.1	ASSEMBLY	05	10	6,782	271	281	62	22%	342
20.02.3.2.2	ABSORBER PLATES	05	430	11,384	382	811	179	22%	990
20.02.3.2.3	GROUND PLATES	05	78	1,584	53	132	29	22%	161
20.02.3.2.4	SIGNAL ELECTRODES	05	889	1,912	64	953	210	22%	1,162
20.02.3.2.5	MOTHER BOARD	05	21	0	0	21	8	36%	29
20.02.3.2.6	CONNECTIONS	05	12	0	0	12	4	36%	16
20.02.3.2.7	STRUCTURES	05	227	2,648	89	316	89	28%	405
20.02.3.3	-OUTER	04	1,557	15,831	553	2,109	485	23%	2,594
20.02.3.3.1	ASSEMBLY	05	5	4,575	175	180	40	22%	220
20.02.3.3.2	ABSORBER PLATES	05	461	6,352	213	674	148	22%	822

GEM COST ESTIMATE SUMMARY

4/26/93

CALORIMETER SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.02.3.3.3	GROUND PLATES	05	85	1,192	40	125	27	22%	152
20.02.3.3.4	SIGNAL ELECTRODES	05	775	1,064	36	811	178	22%	989
20.02.3.3.5	MOTHER BOARD	05	17	0	0	17	6	36%	23
20.02.3.3.6	CONNECTIONS	05	9	0	0	9	3	36%	13
20.02.3.3.7	STRUCTURES	05	205	2,648	89	294	82	28%	376
20.02.4	-CRYOSTAT	03	2,177	36,302	1,493	3,670	1,096	30%	4,766
20.02.4.1	ENGINEERING/DESIGN	04	4	1,008	50	53	14	26%	67
20.02.4.2	KRYPTON VESSEL	04	827	17,805	742	1,568	376	24%	1,945
20.02.4.3	VACUUM VESSEL	04	43	8,130	331	373	86	23%	459
20.02.4.4	LKR VESSEL COLD MASS SUPPORTS	04	44	754	37	81	21	26%	101
20.02.4.5	RAIL SUPPORT BEAM	04	40	547	23	63	16	26%	79
20.02.4.6	FEEDTHROUGHS	04	1,221	8,057	311	1,532	582	38%	2,114
20.03	-SCINTILLATING BARREL CALORIMETRY	02	8,731	120,758	5,159	13,889	4,128	30%	18,017
20.03.1	-SUBSYSTEM ASSEMBLY	03	748	12,266	526	1,273	449	35%	1,723
20.03.1.1	-ASSEMBLY LABOR	04	10	8,769	322	332	103	31%	435
20.03.1.1.1	MODULE INSTALLATION	05	3	4,008	139	143	44	31%	187
20.03.1.1.2	READOUT INSTALLATION	05	2	1,647	63	65	20	31%	85
20.03.1.1.3	OUTER BARREL PASSIVE ABSORBER	05	2	2,067	75	77	24	31%	101
20.03.1.1.4	NOBLE LIQUID INSTALL RAILS	05	2	1,047	45	47	15	31%	62
20.03.1.2	-ASSEMBLY EQUIPMENT	04	738	3,498	204	941	346	37%	1,288
20.03.1.2.1	ASSEMBLY STAND	05	271	2,234	137	408	172	42%	580
20.03.1.2.2	PLATE HANDLING FIXTURING	05	10	93	3	13	6	42%	19
20.03.1.2.3	MODULE HANDLING FIXTURING	05	104	93	3	107	26	24%	132
20.03.1.2.4	PERSONNEL PLATFORMS	05	27	270	15	42	10	24%	52
20.03.1.2.5	-GENERAL USE EQUIPMENT	05	325	809	46	371	134	36%	504

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

CALORIMETER SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.03.1.2.5.1	DIMENSIONAL INSPECTION	06	53	270	15	68	25	36%	93
20.03.1.2.5.2	FIBER END FINISHING MACH.	06	12	270	15	27	10	36%	36
20.03.1.2.5.3	TOOLS	06	53	270	15	68	25	36%	93
20.03.1.2.5.4	CLEANING SUPPLIES	06	26	0	0	26	9	36%	35
20.03.1.2.5.5	TEMPORARY USE ITEMS	06	26	0	0	26	9	36%	35
20.03.1.2.5.6	FORK TRUCK RENTAL	06	78	0	0	78	28	36%	106
20.03.1.2.5.7	HAND. CARTS (10-100 T)	06	78	0	0	78	28	36%	106
20.03.2	-SUPPORT TUBES	03	795	26,859	1,109	1,904	543	29%	2,447
20.03.2.1	-SUPPORT TUBE ASSEMBLY	04	3	4,937	167	170	63	37%	233
20.03.2.1.1	CENTER FLANGE/TUBE	05	1	1,614	55	56	21	37%	76
20.03.2.1.2	END FLANGE/TUBE	05	1	1,614	55	56	21	37%	76
20.03.2.1.3	CDS ATTACH/TUBE	05	1	1,710	57	59	22	37%	80
20.03.2.2	-COMPONENTS	04	792	21,922	943	1,734	480	28%	2,214
20.03.2.2.1	-OUTER TUBE	05	547	12,283	538	1,085	297	27%	1,382
20.03.2.2.1.1	ASSEMBLY	06	11	7,413	289	300	111	37%	411
20.03.2.2.1.2	-PLATE	06	535	4,870	250	785	186	24%	971
20.03.2.2.1.2.1	MATERIAL	07	530	1,865	126	655	138	21%	793
20.03.2.2.1.2.2	PLATE MANUFACTURE	07	6	3,006	124	130	48	37%	178
20.03.2.2.2	-END FLANGE	05	53	1,610	72	125	36	29%	161
20.03.2.2.2.1	FABRICATION	06	3	1,433	60	63	23	37%	86
20.03.2.2.2.2	MATERIAL	06	50	177	12	62	13	21%	75
20.03.2.2.3	-CENTER FLANGE	05	55	1,778	77	132	39	29%	171
20.03.2.2.3.1	FABRICATION	06	3	1,601	65	68	25	37%	93
20.03.2.2.3.2	MATERIAL	06	52	177	12	64	14	21%	78
20.03.2.2.4	-CDS ATTACHMENT	05	138	6,250	255	392	108	28%	501

GEM COST ESTIMATE SUMMARY

4/26/93

CALORIMETER SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.03.2.2.4.1	FABRICATION	06	3	4,829	160	162	60	37%	223
20.03.2.2.4.2	MATERIAL	06	135	1,422	95	230	48	21%	278
20.03.3	-MODULES	03	5,182	37,312	1,677	6,859	2,088	31%	8,948
20.03.3.1	-MODULE ASSEMBLY	04	75	11,476	515	591	182	31%	772
20.03.3.1.1	ASSEMBLY LABOR	05	3	6,842	219	221	53	24%	275
20.03.3.1.2	-ASSEMBLY EQUIPMENT	05	72	4,634	297	369	129	35%	498
20.03.3.1.2.1	MODULE ASSEMBLY STAND	06	37	2,234	137	175	73	42%	248
20.03.3.1.2.2	PLATE HANDLING FIXTURING	06	13	536	34	47	20	42%	67
20.03.3.1.2.3	MODULE HANDLING FIXTURING	06	22	1,865	126	148	35	24%	183
20.03.3.2	-COMPONENTS	04	5,107	25,836	1,162	6,269	1,907	30%	8,176
20.03.3.2.1	-ABSORBER PLATES	05	3,472	10,382	430	3,902	874	22%	4,777
20.03.3.2.1.1	FABRICATION	06	11	8,868	332	343	127	37%	470
20.03.3.2.1.2	MATERIAL	06	3,461	1,514	98	3,559	747	21%	4,306
20.03.3.2.2	-SCINTILLATOR	05	1,569	13,043	582	2,151	966	45%	3,117
20.03.3.2.2.1	WLS FIBERS	06	44	447	28	72	26	36%	98
20.03.3.2.2.2	TRANSMISSION FIBERS	06	421	447	28	448	161	36%	610
20.03.3.2.2.3	-TILES	06	1,054	11,255	473	1,527	741	49%	2,268
20.03.3.2.2.3.1	MANUFACTURE	07	11	9,391	347	358	215	60%	573
20.03.3.2.2.3.2	MATERIAL	07	1,043	1,865	126	1,169	526	45%	1,695
20.03.3.2.2.4	ALUMINIZED MYLAR	06	37	447	28	64	23	36%	87
20.03.3.2.2.5	JOINT GLUE	06	13	447	28	40	15	36%	55
20.03.3.2.3	-MODULE COMPONENTS	05	66	2,412	150	215	67	31%	282
20.03.3.2.3.1	FASTENERS	06	7	624	40	47	15	31%	61
20.03.3.2.3.2	BANDING STRAPS	06	7	624	40	47	15	31%	61
20.03.3.2.3.3	SIDE PLATES	06	35	624	40	75	23	31%	98

GEM COST ESTIMATE SUMMARY

4/26/93

CALORIMETER SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.03.3.2.3.4	SPACERS	06	8	270	15	23	7	31%	30
20.03.3.2.3.5	PROTECTIVE FILM	06	9	270	15	24	8	31%	32
20.03.4	-READOUT	03	1,120	37,512	1,551	2,672	756	28%	3,427
20.03.4.1	ASSEMBLY	04	6	16,307	519	524	163	31%	687
20.03.4.2	-COMPONENTS	04	1,115	21,205	1,033	2,147	593	28%	2,740
20.03.4.2.1	-PMT ASSEMBLIES	05	811	7,486	352	1,163	256	22%	1,419
20.03.4.2.1.1	ASSEMBLY	06	6	4,231	160	165	36	22%	202
20.03.4.2.1.2	-COMPONENTS	06	805	3,255	192	998	220	22%	1,217
20.03.4.2.1.2.1	PHOTOMULTIPLIER TUBES	07	753	1,067	54	806	177	22%	984
20.03.4.2.1.2.2	INDIVIDUAL PMT STRUCTURE	07	36	1,094	69	105	23	22%	128
20.03.4.2.1.2.3	PMT GROUP FRAMING	07	17	1,094	69	86	19	22%	105
20.03.4.2.2	-ELECTRONICS	05	86	5,906	308	394	132	34%	526
20.03.4.2.2.1	ASSEMBLY	06	6	2,786	126	131	47	36%	179
20.03.4.2.2.2	-COMPONENTS	06	80	3,120	182	262	85	32%	347
20.03.4.2.2.2.1	LOCAL ELECTRONICS	07	39	1,510	85	124	45	36%	168
20.03.4.2.2.2.2	BASE	07	19	539	30	49	14	29%	64
20.03.4.2.2.2.3	CABLING/CONNECTORS	07	22	1,071	67	90	26	29%	116
20.03.4.2.2.2.4	THERMAL CONTROL (RESERVED)	07	0	0	0	0	0	0%	0
20.03.4.2.3	-CALIBRATION	05	218	7,813	373	591	205	35%	796
20.03.4.2.3.1	ASSEMBLY	06	0	3,899	115	115	36	31%	151
20.03.4.2.3.2	-COMPONENTS	06	218	3,914	258	476	170	36%	645
20.03.4.2.3.2.1	DRIVE ASSEMBLY	07	120	1,957	129	249	97	39%	346
20.03.4.2.3.2.2	ELECTRONICS	07	98	1,957	129	226	72	32%	299
20.03.5	-OUTER BARREL PASSIVE ABSORBER	03	823	4,487	189	1,012	255	25%	1,267
20.03.5.1	MANUFACTURE	04	7	3,948	159	166	51	31%	217

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20.03.5.2	ABSORBER MATERIAL	04	816	539	30	847	203	24%	1,050
20.03.6	-NOBLE LIQUID INSTALL RAILS	03	62	2,323	106	169	37	22%	206
20.03.6.1	MANUFACTURE	04	4	1,783	76	80	25	31%	105
20.03.6.2	MATERIAL	04	59	539	30	89	12	14%	101
20.04	-ENDCAP CALORIMETRY	02	15,447	320,285	11,961	27,408	7,642	28%	35,050
20.04.1	ASSEMBLY (ON-SITE)	03	1,001	140,042	5,110	6,111	1,467	24%	7,578
20.04.2	-EM SECTION	03	4,848	34,752	1,245	6,093	2,401	39%	8,493
20.04.2.1	ASSEMBLY	04	256	8,480	364	620	161	26%	781
20.04.2.2	ABSORBER	04	73	9,304	312	385	162	42%	546
20.04.2.3	SIGNAL ELECTRODE	04	3,952	6,584	221	4,173	1,753	42%	5,925
20.04.2.4	MOTHER BOARD	04	273	0	0	273	109	40%	382
20.04.2.5	CONNECTIONS	04	137	0	0	137	55	40%	191
20.04.2.6	STRUCTURE	04	157	10,384	348	506	162	32%	667
20.04.3	-HADRONIC SECTIONS	03	7,212	74,544	2,651	9,864	2,312	23%	12,175
20.04.3.1	ASSEMBLY	04	1,068	0	0	1,068	278	26%	1,345
20.04.3.2	-INNER A	04	799	11,070	415	1,213	282	23%	1,495
20.04.3.2.1	ASSEMBLY	05	10	3,326	155	164	36	22%	201
20.04.3.2.2	ABSORBER PLATES	05	171	3,952	133	304	67	22%	371
20.04.3.2.3	GROUND PLATES	05	158	1,584	53	212	47	22%	258
20.04.3.2.4	SIGNAL ELECTRODES	05	311	872	29	340	75	22%	415
20.04.3.2.5	MOTHER BOARD	05	28	0	0	28	10	36%	38
20.04.3.2.6	CONNECTIONS	05	16	0	0	16	6	36%	21
20.04.3.2.7	STRUCTURES	05	105	1,336	45	150	42	28%	192
20.04.3.3	-INNER B	04	817	8,983	323	1,140	267	24%	1,407
20.04.3.3.1	ASSEMBLY	05	5	1,927	86	91	20	22%	111

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20.04.3.3.2	ABSORBER PLATES	05	171	3,360	113	284	63	22%	346
20.04.3.3.3	GROUND PLATES	05	158	1,584	53	212	47	22%	258
20.04.3.3.4	SIGNAL ELECTRODES	05	311	776	26	337	74	22%	411
20.04.3.3.5	MOTHER BOARD	05	29	0	0	29	10	36%	39
20.04.3.3.6	CONNECTIONS	05	16	0	0	16	6	36%	22
20.04.3.3.7	STRUCTURES	05	126	1,336	45	171	48	28%	219
20.04.3.4	-INNER C	04	704	9,471	339	1,044	243	23%	1,287
20.04.3.4.1	ASSEMBLY	05	5	1,871	85	89	20	22%	109
20.04.3.4.2	ABSORBER PLATES	05	146	4,016	135	280	62	22%	342
20.04.3.4.3	GROUND PLATES	05	133	1,384	46	179	39	22%	219
20.04.3.4.4	SIGNAL ELECTRODES	05	260	864	29	289	64	22%	353
20.04.3.4.5	MOTHER BOARD	05	11	0	0	11	4	36%	16
20.04.3.4.6	CONNECTIONS	05	6	0	0	6	2	36%	9
20.04.3.4.7	STRUCTURES	05	143	1,336	45	188	53	28%	241
20.04.3.5	-OUTER A	04	1,407	16,247	566	1,974	453	23%	2,427
20.04.3.5.1	ASSEMBLY	05	5	2,735	113	118	26	22%	144
20.04.3.5.2	ABSORBER PLATES	05	295	5,464	183	479	105	22%	584
20.04.3.5.3	GROUND PLATES	05	270	3,952	133	402	89	22%	491
20.04.3.5.4	SIGNAL ELECTRODES	05	624	1,448	49	672	148	22%	820
20.04.3.5.5	MOTHER BOARD	05	9	0	0	9	3	36%	12
20.04.3.5.6	CONNECTIONS	05	5	0	0	5	2	36%	7
20.04.3.5.7	STRUCTURES	05	200	2,648	89	289	81	28%	370
20.04.3.6	-OUTER B	04	1,949	19,023	660	2,608	596	23%	3,204
20.04.3.6.1	ASSEMBLY	05	5	3,655	144	149	33	22%	182
20.04.3.6.2	ABSORBER PLATES	05	458	4,360	146	604	133	22%	737

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20.04.3.6.3	GROUND PLATES	05	415	6,720	225	641	141	22%	782
20.04.3.6.4	SIGNAL ELECTRODES	05	838	1,640	55	893	196	22%	1,089
20.04.3.6.5	MOTHER BOARD	05	22	0	0	22	8	36%	31
20.04.3.6.6	CONNECTIONS	05	12	0	0	12	4	36%	17
20.04.3.6.7	STRUCTURES	05	198	2,648	89	287	80	28%	367
20.04.3.7	-OUTER C	04	469	9,751	349	818	192	24%	1,010
20.04.3.7.1	ASSEMBLY	05	5	2,063	91	96	21	22%	117
20.04.3.7.2	ABSORBER PLATES	05	137	2,392	80	217	48	22%	265
20.04.3.7.3	GROUND PLATES	05	124	1,976	66	190	42	22%	232
20.04.3.7.4	SIGNAL ELECTRODES	05	106	672	23	129	28	22%	157
20.04.3.7.5	MOTHER BOARD	05	8	0	0	8	3	36%	11
20.04.3.7.6	CONNECTIONS	05	4	0	0	4	2	36%	6
20.04.3.7.7	STRUCTURES	05	85	2,648	89	174	49	28%	223
20.04.4	-FORWARD ELECTROMAGNETIC SECTION	03	244	5,440	439	683	198	29%	881
20.04.4.1	-MAIN BODY ASSEMBLY	04	123	921	74	197	57	29%	254
20.04.4.1.1	LABOR	05	0	142	11	11	3	29%	14
20.04.4.1.2	-MATERIAL	05	106	319	26	132	38	29%	171
20.04.4.1.2.1	BRASS ABSORBER PLATES	06	106	319	26	132	38	29%	171
20.04.4.1.3	-ASSEMBLY EQUIPMENT	05	17	461	37	54	16	29%	70
20.04.4.1.3.1	ASSEMBLY STAND	06	7	248	20	28	8	29%	36
20.04.4.1.3.2	CLEANING	06	4	142	11	15	4	29%	20
20.04.4.1.3.3	TOOLS	06	2	35	3	5	2	29%	7
20.04.4.1.3.4	TEMPORARY USE ITEMS	06	3	35	3	6	2	29%	8
20.04.4.2	-TUBE & ROD ASSEMBLY	04	82	1,737	132	214	62	29%	276
20.04.4.2.1	LABOR	05	0	886	63	63	18	29%	81

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20.04.4.2.2	-MATERIAL	05	67	461	38	104	30	29%	134
20.04.4.2.2.1	CONTACT SPRINGS	06	16	106	9	24	7	29%	31
20.04.4.2.2.2	BRASS TUBES	06	11	71	6	17	5	29%	22
20.04.4.2.2.3	QUARTZ FIBER SPACERS	06	5	106	9	14	4	29%	18
20.04.4.2.2.4	BRASS RODS	06	26	71	6	32	9	29%	41
20.04.4.2.2.5	PLUGS	06	8	106	9	17	5	29%	22
20.04.4.2.3	-ASSEMBLY EQUIPMENT	05	16	390	31	47	14	29%	60
20.04.4.2.3.1	ASSEMBLY STAND	06	6	177	15	21	6	29%	27
20.04.4.2.3.2	CLEANING	06	4	142	11	15	4	29%	19
20.04.4.2.3.3	TOOLS	06	2	35	3	5	2	29%	7
20.04.4.2.3.4	TEMPORARY USE ITEMS	06	3	35	3	6	2	29%	8
20.04.4.3	-ELECTRICAL ASSEMBLY	04	15	709	59	74	21	29%	95
20.04.4.3.1	RESERVED	05	0	0	0	0	0	0%	0
20.04.4.3.2	-MATERIAL	05	8	638	53	62	18	29%	80
20.04.4.3.2.1	CABLES	06	6	248	21	27	8	29%	35
20.04.4.3.2.2	INTERCONNECT BOARD	06	2	390	33	35	10	29%	45
20.04.4.3.3	-ASSEMBLY EQUIPMENT	05	6	71	6	12	4	29%	16
20.04.4.3.3.1	CLEANING	06	1	0	0	1	0	29%	1
20.04.4.3.3.2	TOOLS	06	2	35	3	5	2	29%	7
20.04.4.3.3.3	TEMPORARY USE ITEMS	06	3	35	3	6	2	29%	8
20.04.4.4	-ELECTRONICS	04	25	2,073	174	198	58	29%	256
20.04.4.4.1	RESERVED	05	0	0	0	0	0	0%	0
20.04.4.4.2	-MATERIAL	05	19	2,002	168	186	54	29%	240
20.04.4.4.2.1	PREAMPS	06	15	851	71	86	25	29%	111
20.04.4.4.2.2	CARD CAGES	06	1	248	21	22	6	29%	28

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20.04.4.4.2.3	CABLES	06	2	177	15	17	5	29%	22
20.04.4.4.2.4	CALIBRATION SYSTEM	06	1	727	61	62	18	29%	80
20.04.4.4.3	-ASSEMBLY EQUIPMENT	05	6	71	6	12	4	29%	16
20.04.4.4.3.1	CLEANING	06	1	0	0	1	0	29%	1
20.04.4.4.3.2	TOOLS	06	2	35	3	5	2	29%	7
20.04.4.4.3.3	TEMPORARY USE ITEMS	06	3	35	3	6	2	29%	8
20.04.5	-CRYOSTAT	03	2,142	65,506	2,516	4,658	1,265	27%	5,923
20.04.5.1	ENGINEERING/DESIGN	04	1	405	20	21	6	26%	27
20.04.5.2	ARGON VESSEL	04	751	42,723	1,607	2,357	495	21%	2,852
20.04.5.3	VACUUM VESSEL	04	106	13,177	527	633	146	23%	778
20.04.5.4	LAR VESSEL COLD MASS SUPPORTS	04	46	1,344	66	112	29	26%	141
20.04.5.5	RAIL SUPPORT BEAM	04	27	952	43	70	18	26%	88
20.04.5.6	FEEDTHROUGHS	04	1,211	6,905	255	1,465	571	39%	2,037
20.05	-FORWARD HADRONIC CALORIMETRY	02	7,310	32,607	1,266	8,577	2,466	29%	11,042
20.05.1	-HADRONIC FCAL ASSEMBLY	03	115	3,451	139	255	57	22%	312
20.05.1.1	-ASSEMBLY	04	2	2,493	83	85	23	27%	108
20.05.1.1.1	MODULE STRUCTURE ASSEMBLY	05	1	1,816	58	60	18	30%	77
20.05.1.1.2	ASSEMBLY EQUIPMENT	05	1	676	24	25	5	20%	31
20.05.1.2	-ASSEMBLY EQUIPMENT	04	113	958	57	170	34	20%	204
20.05.1.2.1	ASSEMBLY STAND	05	27	183	11	38	8	20%	46
20.05.1.2.2	TUBE ENDPLATE ASSEMBLY FIXTURE	05	22	183	11	33	7	20%	40
20.05.1.2.3	MODULE HANDLING FIXTURE	05	27	183	11	38	8	20%	46
20.05.1.2.4	FIBER ASSEMBLY FIXTURE	05	22	183	11	33	7	20%	40
20.05.1.2.5	PERSONNEL PLATFORMS	05	5	113	6	11	2	20%	14
20.05.1.2.6	FIBER END FINISHING MACHINE	05	10	113	6	17	3	20%	20

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20.05.2	-STRUCTURES	03	238	4,407	217	455	124	27%	578
20.05.2.1	ASSEMBLY	04	1	866	34	35	7	20%	42
20.05.2.2	-COMPONENTS	04	237	3,541	183	420	117	28%	536
20.05.2.2.1	SUPPORT RING&FLANGE	05	113	225	12	126	30	24%	156
20.05.2.2.2	LIQUID HANDLING PIPING	05	21	468	26	47	11	24%	58
20.05.2.2.3	-PASSIVE ABSORBER	05	11	1,175	41	52	13	25%	65
20.05.2.2.3.1	ASSEMBLY	06	0	950	28	28	8	29%	37
20.05.2.2.3.2	MATERIAL	06	11	225	12	24	5	20%	29
20.05.2.2.4	PMT SUPPORT	05	11	263	13	25	5	20%	30
20.05.2.2.5	THERMAL DOME	05	11	263	13	25	5	20%	30
20.05.2.2.6	-CALIBRATION	05	69	1,148	77	146	52	36%	198
20.05.2.2.6.1	ASSEMBLY (RESERVED)	06	0	0	0	0	0	0%	0
20.05.2.2.6.2	-COMPONENTS	06	69	1,148	77	146	52	36%	198
20.05.2.2.6.2.1	DRIVE ASSEMBLY	07	34	539	36	70	25	36%	95
20.05.2.2.6.2.2	ELECTRONICS	07	34	609	42	76	27	36%	103
20.05.3	-FCAL MODULE	03	6,957	24,749	910	7,867	2,285	29%	10,152
20.05.3.1	ASSEMBLY	04	2	1,144	46	48	16	33%	64
20.05.3.2	-SCINTILLATOR SECTION	04	5,633	16,526	586	6,220	1,887	30%	8,106
20.05.3.2.1	ASSEMBLY	05	2	13,031	401	403	149	37%	552
20.05.3.2.2	-MATERIAL/COMPONENTS	05	5,631	3,495	185	5,817	1,738	30%	7,555
20.05.3.2.2.1	TUNGSTEM HEAVYMET ABSORBER	06	4,922	551	29	4,951	1,485	30%	6,437
20.05.3.2.2.2	COPPER CAPILLIARY TUBING	06	305	391	18	323	100	31%	424
20.05.3.2.2.3	GLASS CAPILLIARY TUBING	06	22	391	18	40	12	31%	52
20.05.3.2.2.4	SS END PLATES FOR MANIFOLDS	06	133	693	39	172	38	22%	210
20.05.3.2.2.5	SS JACKET (SHELL)	06	32	391	18	50	10	20%	60

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20.05.3.2.2.6	-OUTLET MANIFOLD FLANGE ASSY	06	217	1,077	63	280	92	33%	372
20.05.3.2.2.6.1	SS HEADS FOR MANIFOLDS	07	100	468	27	126	37	29%	163
20.05.3.2.2.6.2	FUSED QUARTZ WINDOW & FLANGE	07	117	609	36	154	55	36%	209
20.05.3.3	-READOUT SECTION	04	1,322	7,079	278	1,600	383	24%	1,982
20.05.3.3.1	ASSEMBLY	05	2	4,671	151	153	37	24%	190
20.05.3.3.2	-MATERIAL/COMPONENTS	05	1,320	2,408	127	1,447	346	24%	1,792
20.05.3.3.2.1	-READOUT FIBER ASSY	06	653	894	51	704	198	28%	902
20.05.3.3.2.1.1	READOUT FIBERS	07	628	468	26	654	183	28%	838
20.05.3.3.2.1.2	READOUT FIBER COLLECTOR PLATE	07	25	426	25	50	14	29%	64
20.05.3.3.2.2	-PMT ASSEMBLIES	06	667	1,514	76	743	148	20%	891
20.05.3.3.2.2.1	PHOTOMULTIPLIER TUBES	07	574	495	21	595	119	20%	714
20.05.3.3.2.2.2	-PMT ACCESSORY COMPONENTS	07	92	1,019	55	147	29	20%	176
20.05.3.3.2.2.2.1	PMT COMPARTMENTS	08	17	225	13	29	6	20%	35
20.05.3.3.2.2.2.2	LIGHT MIXERS	08	6	190	10	16	3	20%	20
20.05.3.3.2.2.2.3	PMT BASE	08	13	190	10	23	5	20%	27
20.05.3.3.2.2.2.4	PMT HV PS & CABLING	08	40	190	10	50	10	20%	59
20.05.3.3.2.2.2.5	PREAMPS	08	17	190	10	27	5	20%	32
20.05.3.3.2.2.2.6	FASTENERS	08	1	35	3	4	0	9%	4
20.06	-PASSIVE ABSORBER	02	779	32,640	1,331	2,111	752	36%	2,862
20.06.1	-ASSEMBLY	03	137	11,259	445	582	195	34%	777
20.06.1.1	ASSEMBLY NORTH END CAP	04	3	4,257	143	146	47	32%	192
20.06.1.2	ASSEMBLY SOUTH END CAP	04	3	4,257	143	146	47	32%	192
20.06.1.3	-ASSEMBLY EQUIPMENT	04	132	2,746	159	290	102	35%	392
20.06.1.3.1	ASSEMBLY STAND	05	110	1,348	76	185	69	37%	254
20.06.1.3.2	PLATE FIXTURING	05	14	770	46	61	22	37%	83

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20.06.1.3.3	PERSONNEL PLATFORMS	05	8	628	37	45	11	24%	55
20.06.2	-COMPONENTS	03	642	21,381	887	1,529	557	36%	2,085
20.06.2.1	-NORTH END CAP	04	332	12,471	567	899	325	36%	1,225
20.06.2.1.1	-ABSORBER PLATES	05	288	8,356	352	640	237	37%	877
20.06.2.1.1.1	MATERIAL	06	279	1,514	98	377	140	37%	517
20.06.2.1.1.2	MANUFACTURE	06	9	6,843	254	263	97	37%	360
20.06.2.1.2	-CENTER TUBE	05	45	4,115	215	259	89	34%	348
20.06.2.1.2.1	MATERIAL	06	31	770	46	77	29	37%	106
20.06.2.1.2.2	MANUFACTURE	06	9	2,753	134	143	53	37%	196
20.06.2.1.2.3	FASTENERS	06	5	593	34	39	7	18%	46
20.06.2.2	-SOUTH END CAP	04	310	8,910	320	629	231	37%	860
20.06.2.2.1	-ABSORBER PLATES	05	275	6,407	217	492	182	37%	674
20.06.2.2.1.1	MATERIAL	06	273	539	30	303	112	37%	415
20.06.2.2.1.2	MANUFACTURE	06	2	5,868	187	189	70	37%	259
20.06.2.2.2	-CENTER TUBE	05	34	2,503	103	137	49	36%	186
20.06.2.2.2.1	MATERIAL	06	30	539	30	60	22	37%	82
20.06.2.2.2.2	MANUFACTURE	06	2	1,778	67	69	26	37%	95
20.06.2.2.2.3	FASTENERS	06	3	185	6	8	2	18%	10
20.07	-VACUUM	02	76	17,082	583	659	224	34%	883
20.07.1	ASSEMBLY	03	1	5,936	210	211	72	34%	283
20.07.2	-VACUUM EQUIPMENT	03	69	11,146	373	442	150	34%	592
20.07.2.1	ASSEMBLY	04	1	5,316	194	195	66	34%	261
20.07.2.2	ROUGHING PUMPS	04	31	0	0	31	11	34%	42
20.07.2.3	-DIFFUSION PUMPS	04	29	3,172	95	125	42	34%	167
20.07.2.3.1	ASSEMBLY	05	1	2,658	84	85	29	34%	114

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CALORIMETER SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.07.2.3.2	RESERVED	05	0	0	0	0	0	0%	0
20.07.2.3.3	NITROGEN COLD TRAP&DIF PUMPS	05	21	443	10	31	10	34%	41
20.07.2.3.4	PIRARI GAUGE HEADS	05	1	35	1	2	1	34%	3
20.07.2.3.5	PENNING GAUGE HEADS	05	1	35	1	2	1	34%	3
20.07.2.3.6	CONTROLLERS	05	5	0	0	5	2	34%	7
20.07.2.4	VACUUM LINES	04	1	2,658	84	85	29	34%	114
20.07.2.5	-VALVES	04	6	0	0	6	2	34%	8
20.07.2.5.1	BACKING/ROUGHING	05	1	0	0	1	0	34%	1
20.07.2.5.2	MAIN ISOLATION	05	5	0	0	5	2	34%	7
20.07.3	-DECONTAMINATION EQUIPMENT	03	6	0	0	6	2	34%	8
20.07.3.1	RESERVED	04	0	0	0	0	0	0%	0
20.07.3.2	-VACUUM PUMPS	04	5	0	0	5	2	34%	7
20.07.3.2.1	CONTROLLERS	05	5	0	0	5	2	34%	7
20.07.3.3	RESERVED	04	0	0	0	0	0	0%	0
20.07.3.4	VALVES	04	1	0	0	1	0	34%	1
20.08	-CRYOGENICS	02	11,954	19,800	499	12,453	2,565	21%	15,018
20.08.1	CRYOGENICS SYSTEM DESIGN (EFD)	03	0	0	0	0	0	0%	0
20.08.2	-SURFACE STORAGE	03	1,168	5,000	126	1,294	320	25%	1,614
20.08.2.1	ASSEMBLY (EFD)	04	0	5,000	126	126	30	24%	156
20.08.2.2	LIQUID ARGON	04	174	0	0	174	38	22%	212
20.08.2.3	LIQUID KRYPTON (RESERVED)	04	0	0	0	0	0	0%	0
20.08.2.4	NITROGEN (RESERVED)	04	0	0	0	0	0	0%	0
20.08.2.5	KRYPTON PURIFICATION PUMP & PURGE	04	200	0	0	200	64	32%	264
20.08.2.6	TRANSFER SYSTEM	04	381	0	0	381	99	26%	480
20.08.2.7	SURFACE TRANSFER LINES	04	253	0	0	253	66	26%	319

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.08.2.8	SURFACE VALVES	04	160	0	0	160	22	14%	183
20.08.3	-HALL STORAGE	03	1,751	14,800	373	2,124	443	21%	2,567
20.08.3.1	ASSEMBLY (EFD)	04	0	14,800	373	373	90	24%	463
20.08.3.2	LIQUID ARGON	04	200	0	0	200	44	22%	244
20.08.3.3	LIQUID KRYPTON	04	100	0	0	100	22	22%	122
20.08.3.4	NITROGEN (RESERVED)	04	0	0	0	0	0	0%	0
20.08.3.5	HALL TRANSFER LINES	04	704	0	0	704	183	26%	887
20.08.3.6	HALL VALVES	04	747	0	0	747	105	14%	852
20.08.4	-VAPORIZERS	03	98	0	0	98	20	20%	117
20.08.4.1	RESERVED	04	0	0	0	0	0	0%	0
20.08.4.2	NITROGEN	04	39	0	0	39	8	20%	47
20.08.4.3	ARGON	04	58	0	0	58	12	20%	70
20.08.5	-INTERSTAGE COOLING	03	264	0	0	264	67	25%	331
20.08.5.1	RESERVED	04	0	0	0	0	0	0%	0
20.08.5.2	ARGON	04	178	0	0	178	46	26%	224
20.08.5.3	KRYPTON (RESERVED)	04	0	0	0	0	0	0%	0
20.08.5.4	NITROGEN	04	86	0	0	86	21	24%	107
20.08.6	LIQUID KRYPTON	03	8,528	0	0	8,528	1,706	20%	10,234
20.08.7	LIQUID ARGON	03	145	0	0	145	10	7%	156
20.09	-INSTR. POWER & OPERATIONAL CONTROL	02	215	1,735	52	266	73	27%	339
20.09.1	POWER DISTRIBUTION AND UPS SYSTEM (EFD)	03	12	160	5	17	3	18%	20
20.09.2	-CONTROL AND MONITOR SYSTEM	03	203	1,576	47	250	70	28%	320
20.09.2.1	CONTROL SYSTEM HARDWARE(EFD)	04	186	920	27	213	60	28%	273
20.09.2.2	CONTROL SYSTEM SOFTWARE (EFD)	04	6	514	15	21	6	28%	27
20.09.2.3	GLOBAL INTEGRATION (EFD)	04	10	142	5	16	4	28%	20

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FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.10	-FINAL ASSEMBLY	02	509	17,361	511	1,020	429	42%	1,449
20.10.1	ASSEMBLY EQUIPMENT	03	475	1,536	75	550	242	44%	792
20.10.2	-CALORIMETRY	03	34	15,825	436	470	187	40%	657
20.10.2.1	INBARREL & ENDCAP CALORIMETER	04	0	13,656	345	345	152	44%	496
20.10.2.2	-SCINTILLATING HADRON	04	0	950	26	26	11	40%	37
20.10.2.2.1	LABOR	05	0	950	26	26	11	40%	37
20.10.2.3	-EM FCAL	04	7	393	29	36	10	29%	46
20.10.2.3.1	LABOR	05	1	251	18	19	5	29%	24
20.10.2.3.2	LIFTING FIXTURE	05	6	142	11	17	5	29%	22
20.10.2.4	-HADRONIC FCAL	04	27	826	36	63	15	23%	78
20.10.2.4.1	LABOR	05	0	451	16	16	5	29%	21
20.10.2.4.2	-EQUIPMENT	05	27	375	20	47	10	21%	57
20.10.2.4.2.1	TEMPORARY BRACING	06	17	263	14	30	7	22%	37
20.10.2.4.2.2	CRANE RENTAL	06	10	113	6	17	3	20%	20
20.10.3	RESERVED	03	0	0	0	0	0	0%	0
20.10.4	RESERVED	03	0	0	0	0	0	0%	0
20.10.5	RESERVED	03	0	0	0	0	0	0%	0
20.10.6	RESERVED	03	0	0	0	0	0	0%	0
20.11	-HALL INSTALLATION	02	1,532	67,381	2,092	3,624	1,383	38%	5,007
20.11.1	INSTALLATION EQUIPMENT	03	519	0	0	519	229	44%	748
20.11.2	-CALORIMETRY	03	752	60,026	1,841	2,593	971	37%	3,564
20.11.2.1	INNER BARREL & ENDCAP CALORIMETER	04	16	37,992	1,068	1,084	477	44%	1,562
20.11.2.2	-SCINTILLATING HADRON	04	261	13,055	409	670	247	37%	917
20.11.2.2.1	LABOR	05	1	11,577	329	330	132	40%	462
20.11.2.2.2	-EQUIPMENT	05	260	1,478	80	340	115	34%	455

CALORIMETER SUBSYSTEM

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.11.2.2.2.1	TEMPORARY BRACING	06	27	362	18	45	19	41%	64
20.11.2.2.2.2	CRANE RENTAL	06	53	274	12	64	26	41%	91
20.11.2.2.2.3	END CAP OUTRIGGERS	06	159	628	37	195	61	31%	256
20.11.2.2.2.4	ROLLERS	06	22	214	14	35	9	26%	45
20.11.2.3	-EM FCAL	04	3	319	27	30	9	29%	39
20.11.2.3.1	LABOR	05	1	177	14	15	4	29%	20
20.11.2.3.2	MATERIAL	05	2	142	13	15	4	29%	19
20.11.2.4	-SCINTILLATING LIQUID FCAL	04	471	8,660	337	809	239	30%	1,047
20.11.2.4.1	-LIQUID HANDLING SYSTEM	05	463	6,190	258	721	213	30%	934
20.11.2.4.1.1	ASSEMBLY&INSTALLATION	06	2	3,888	131	133	41	31%	174
20.11.2.4.1.2	-COMPONENTS	06	461	2,303	127	588	172	29%	760
20.11.2.4.1.2.1	PIPING & VALVES	07	85	468	26	111	22	20%	133
20.11.2.4.1.2.2	FILTERATION & PURIFICATION	07	81	693	38	119	41	34%	160
20.11.2.4.1.2.3	STORAGE AND MONITORING	07	81	693	38	119	41	34%	160
20.11.2.4.1.2.4	LIQUID CIRCULATING PUMPS	07	7	225	12	20	3	16%	23
20.11.2.4.1.2.5	SCINTILLATING LIQUID	07	207	225	12	219	66	30%	285
20.11.2.4.2	-READOUT THERMAL CONTROL	05	8	2,470	80	88	25	29%	113
20.11.2.4.2.1	ASSEMBLY&INSTALLATION	06	0	2,280	70	70	22	31%	92
20.11.2.4.2.2	AIR DUCT	06	8	190	10	18	4	20%	22
20.11.3	-PASSIVE END CAPS	03	261	7,355	250	512	183	36%	695
20.11.3.1	LABOR	04	1	5,877	171	172	69	40%	240
20.11.3.2	-EQUIPMENT	04	260	1,478	80	340	115	34%	455
20.11.3.2.1	TEMPORARY BRACING	05	27	362	18	45	19	41%	64
20.11.3.2.2	CRANE RENTAL	05	53	274	12	64	26	41%	91
20.11.3.2.3	END CAP OUTRIGGERS	05	159	628	37	195	61	31%	256

GEM COST ESTIMATE SUMMARY

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.11.3.2.4	ROLLERS	05	22	214	14	35	9	26%	45
20.12	-CALIBRATION AND TEST BEAM PROGRAM	02	3,618	25,267	701	4,319	1,143	27%	5,462
20.12.1	-INNER BARREL AND ENDCAP (INCLUDES FERMI LAB)	03	2,917	0	0	2,917	758	26%	3,675
20.12.1.1	CRYOSTAT	04	519	0	0	519	135	26%	654
20.12.1.2	MODULES	04	1,263	0	0	1,263	328	26%	1,591
20.12.1.3	ELECTRONICS	04	408	0	0	408	106	26%	514
20.12.1.4	FIXTURES	04	727	0	0	727	189	26%	916
20.12.1.5	TEST LABOR (INCLUDED IN 20.15.5 / EFD)	04	0	0	0	0	0	0%	0
20.12.2	-SCINTILLATING HADRON	03	0	1,900	64	64	23	36%	87
20.12.2.1	LABOR	04	0	1,900	64	64	23	36%	87
20.12.2.2	RESERVED	04	0	0	0	0	0	0%	0
20.12.3	-EM FCAL	03	265	106	9	274	79	29%	353
20.12.3.1	RESERVED	04	0	0	0	0	0	0%	0
20.12.3.2	EQUIPMENT	04	265	106	9	274	79	29%	353
20.12.4	-SCINTILLATING LIQUID FCAL	03	109	3,594	148	257	73	28%	330
20.12.4.1	LABOR	04	0	1,710	52	52	13	25%	65
20.12.4.2	-EQUIPMENT	04	109	1,884	96	205	60	29%	265
20.12.4.2.1	TEST STANDS	05	54	871	42	96	28	29%	124
20.12.4.2.2	BEAM CALIBRATION SYSTEM	05	55	1,013	54	109	32	29%	141
20.12.5	FERMI LAB	03	327	19,666	480	808	210	26%	1,018
20.13	-SUBSYSTEM MANAGEMENT	02	62	89,947	3,975	4,038	565	14%	4,603
20.13.1	PROJECT MGT & ADMINISTRATION	03	27	37,212	1,746	1,773	248	14%	2,021
20.13.2	RESOURCE MGT & TRAVEL	03	6	12,404	375	380	53	14%	434
20.13.3	ES&H	03	2	3,119	144	146	20	14%	166
20.13.4	QUALITY ASSURANCE	03	9	12,404	571	580	81	14%	661

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20.13.5	SYSTEM ENGINEERING	03	18	24,808	1,141	1,159	162	14%	1,322
20.14	-CONCEPTUAL/PRELIMINARY DESIGN	02	117	29,683	1,864	1,981	205	10%	2,186
20.14.1	LIQUID CALORIMETRY	03	54	19,104	992	1,046	157	15%	1,202
20.14.2	-SCINTILLATING BARREL	03	25	5,511	454	479	0	0%	479
20.14.2.1	-PREPARATION OF LOI	04	9	1,240	102	112	0	0%	112
20.14.2.1.1	CONCEPTUAL DESIGN	05	4	443	37	41	0	0%	41
20.14.2.1.2	COSTING STUDIES	05	4	585	48	52	0	0%	52
20.14.2.1.3	DOCUMENT PREPARATION	05	1	213	18	19	0	0%	19
20.14.2.2	-PREPARATION OF TECH PROP.	04	16	4,271	352	368	0	0%	368
20.14.2.2.1	CONCEPTUAL DESIGN	05	6	1,772	146	152	0	0%	152
20.14.2.2.2	COSTING STUDIES	05	2	585	48	50	0	0%	50
20.14.2.2.3	MANUFACTURING STUDIES	05	3	886	73	76	0	0%	76
20.14.2.2.4	INSTALLATION STUDIES	05	2	443	37	39	0	0%	39
20.14.2.2.5	PREP OF TECH PROP.	05	2	585	48	50	0	0%	50
20.14.3	-EM FORWARD CALORIMETRY	03	14	1,471	121	135	0	0%	135
20.14.3.1	-PREP OF TECHNICAL PROPOSAL	04	14	1,471	121	135	0	0%	135
20.14.3.1.1	CONCEPTUAL DESIGN	05	6	585	48	55	0	0%	55
20.14.3.1.2	COSTING STUDIES	05	2	443	37	39	0	0%	39
20.14.3.1.3	MANUFACTURING STUDIES	05	3	301	25	28	0	0%	28
20.14.3.1.4	INSTALLATION STUDIES	05	2	142	12	14	0	0%	14
20.14.4	-SCINT. LIQUID FORWARD CALORIMETRY	03	25	3,597	297	322	48	15%	370
20.14.4.1	-PREP OF LOI	04	9	1,028	85	94	14	15%	108
20.14.4.1.1	CONCEPTUAL DESIGN	05	4	443	37	41	6	15%	47
20.14.4.1.2	COSTING STUDIES	05	4	443	37	41	6	15%	47
20.14.4.1.3	DOCUMENT PREPARATION	05	1	142	12	13	2	15%	15

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
20.14.4.2	-PREP OF TECHNICAL PROPOSAL	04	16	2,569	212	228	34	15%	**262**
20.14.4.2.1	CONCEPTUAL DESIGN	05	6	886	73	79	12	15%	**91**
20.14.4.2.2	COSTING STUDIES	05	2	585	48	50	8	15%	**58**
20.14.4.2.3	MANUFACTURING STUDIES	05	3	443	37	40	6	15%	**46**
20.14.4.2.4	INSTALLATION STUDIES	05	2	213	18	20	3	15%	**23**
20.14.4.2.5	PREP OF PROPOSAL	05	2	443	37	39	6	15%	**44**

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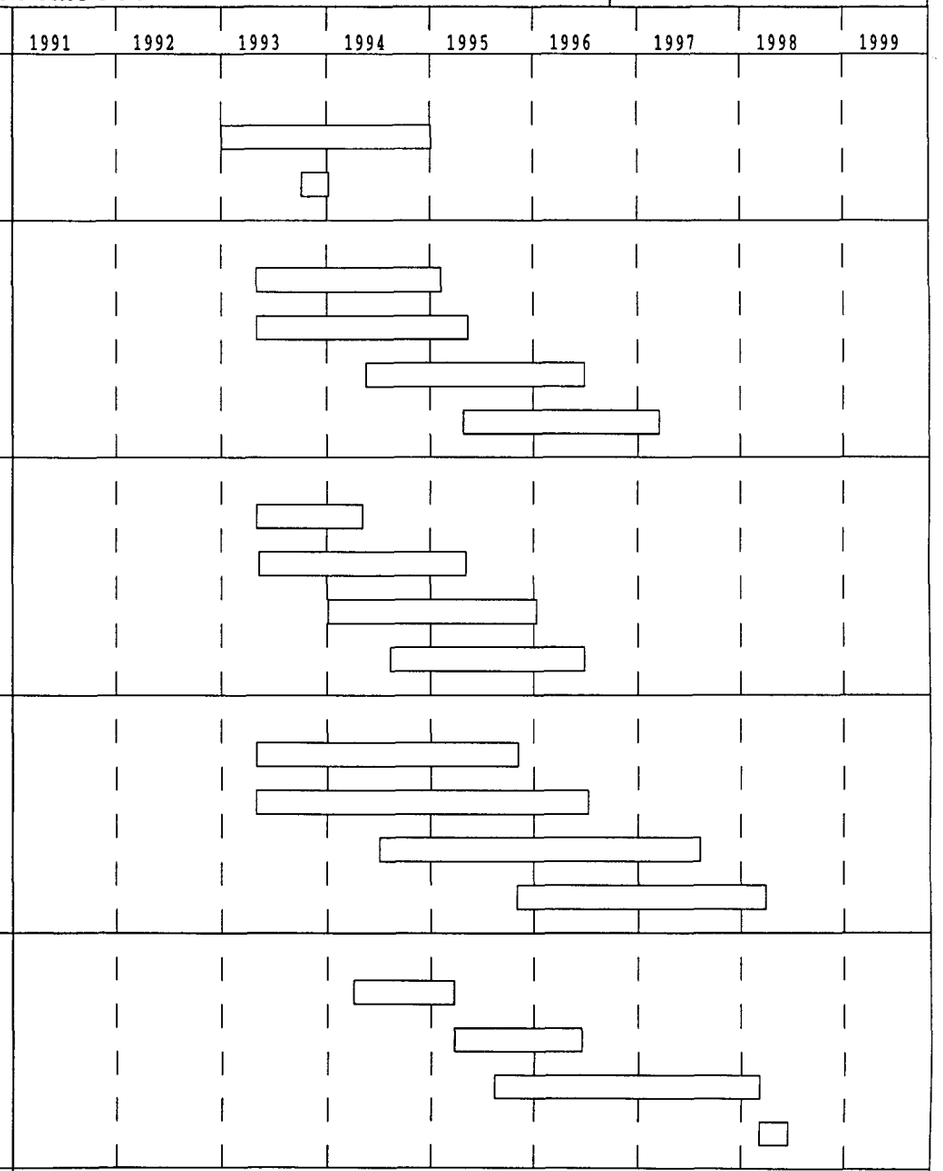
LEVEL II SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
WBS:20.01 Research & Development			
DESIGN	01JAN93	02JAN95	
PROCUREMENT	06OCT93	05JAN94	
WBS:20.02 Inner Barrel Calorimetry			
DESIGN	03MAY93	07FEB95	
PROCUREMENT	03MAY93	10MAY95	
FABRICATION	16MAY94	27JUN96	
ASSEMBLY	26APR95	17MAR97	
WBS:20.03 Scintillating Barrel Calorimetry			
DESIGN	03MAY93	02MAY94	
PROCUREMENT	12MAY93	03MAY95	
FABRICATION	03JAN94	09JAN96	
ASSEMBLY	10AUG94	25JUN96	
WBS:20.04 Endcap Calorimetry			
DESIGN	30APR93	03NOV95	
PROCUREMENT	30APR93	08JUL96	
FABRICATION	01JUL94	05AUG97	
ASSEMBLY	01NOV95	27MAR98	
WBS:20.05 Forward Hadronic Calorimetry			
DESIGN	01APR94	22MAR95	
PROCUREMENT	23MAR95	14JUN96	
FABRICATION	10AUG95	04MAR98	
ASSEMBLY	05MAR98	12JUN98	
WBS:20.06 Passive Absorber			



Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

OPEN PLAN

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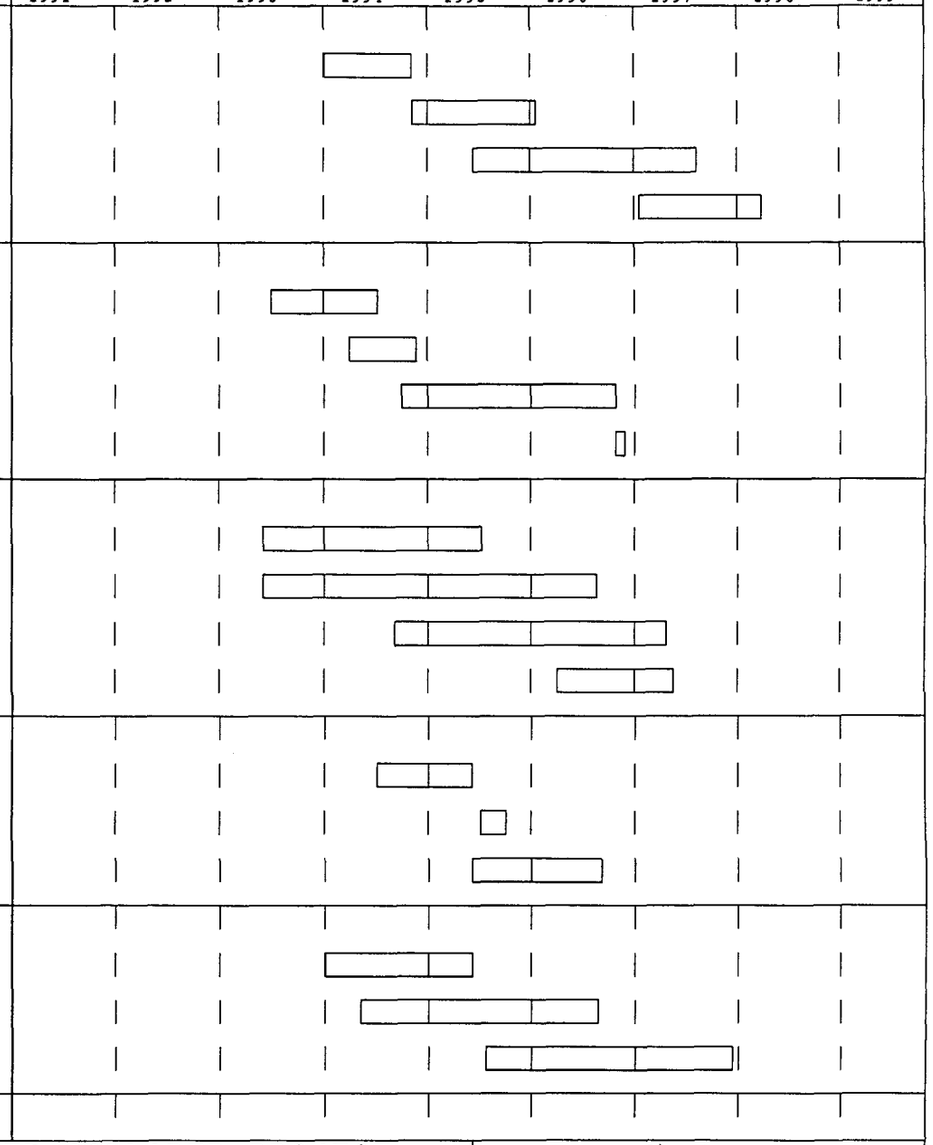
LEVEL II SUMMARY BASELINE SCHEDULE

20 Calorimeter

G E M DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
DESIGN	03JAN94	04NOV94	
PROCUREMENT	07NOV94	18JAN96	
FABRICATION	09JUN95	07AUG97	
ASSEMBLY	17JAN97	25MAR98	
WBS:20.07 Vacuum			
DESIGN	01JUL93	05JUL94	
PROCUREMENT	31MAR94	22NOV94	
FABRICATION	29SEP94	24OCT96	
ASSEMBLY	25OCT96	25NOV96	
WBS:20.08 Cryogenics			
DESIGN	01JUN93	06JUL95	
PROCUREMENT	01JUN93	19AUG96	
FABRICATION	02SEP94	18APR97	
ASSEMBLY	03APR96	14MAY97	
WBS:20.09 Instr.Power&Operational Control			
DESIGN	01JUL94	01JUN95	
PROCUREMENT	03JUL95	02OCT95	
FABRICATION	02JUN95	04SEP96	
WBS:20.10 Final Assembly			
PROCUREMENT	03JAN94	02JUN95	
FABRICATION	05MAY94	23AUG96	
ASSEMBLY	20JUL95	08DEC97	
WBS:20.11 Hall Installation			



Legend: Baseline; Critical; Float; ☆ Baseline; ▽ Projected; ▼ Actual

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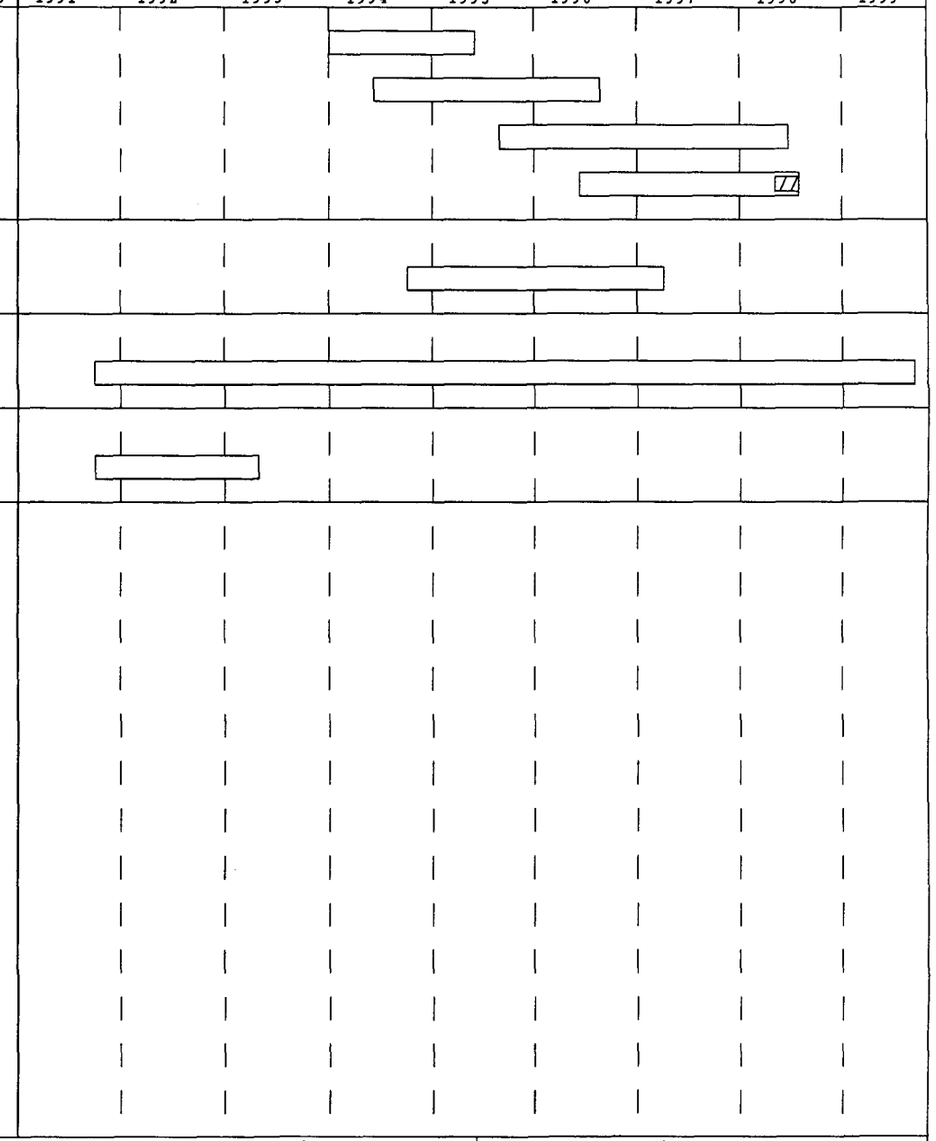
LEVEL II SUMMARY BASELINE SCHEDULE

20 Calorimeter

G E M DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	03JAN94	02JUN95	
FABRICATION	06JUN94	23AUG96	
ASSEMBLY	28AUG95	19JUN98	
INSTALLATION	10JUN96	27JUL98	
WBS:20.12 Calibration and Test Beam Program			
DESIGN	03OCT94	31MAR97	
WBS:20.13 Subsystem Management			
LEVEL OF EFFORT (LOE)	01OCT91	16SEP99	
WBS:20.14 Conceptual/Preliminary Design			
DESIGN	01OCT91	29APR93	



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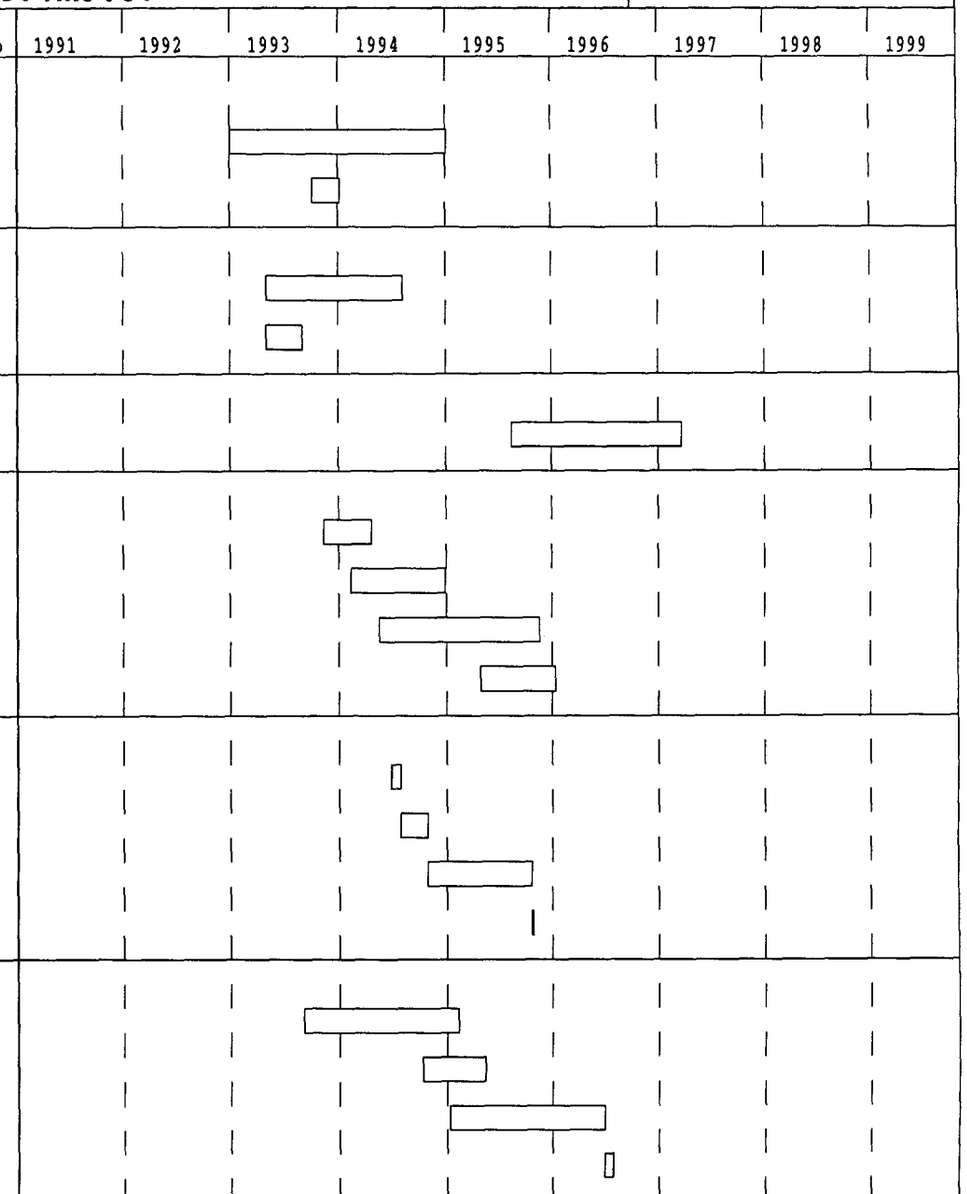
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
WBS:20.01.1 Research & Development			
DESIGN	01JAN93	02JAN95	
PROCUREMENT	06OCT93	05JAN94	
WBS:20.02 Inner Barrel Calorimetry			
DESIGN	03MAY93	05AUG94	
PROCUREMENT	03MAY93	01SEP93	
WBS:20.02.1 Inner Barrel Assembly			
ASSEMBLY	11AUG95	17MAR97	
WBS:20.02.2 EM Module			
DESIGN	11NOV93	20APR94	
PROCUREMENT	11FEB94	27DEC94	
FABRICATION	16MAY94	17NOV95	
ASSEMBLY	26APR95	11JAN96	
WBS:20.02.3 Hadronic Sections			
DESIGN	24JUN94	25JUL94	
PROCUREMENT	26JUL94	25OCT94	
FABRICATION	26OCT94	19OCT95	
ASSEMBLY	20OCT95	24OCT95	
WBS:20.02.4 Cryostat			
DESIGN	02SEP93	07FEB95	
PROCUREMENT	07OCT94	10MAY95	
FABRICATION	09JAN95	27JUN96	
ASSEMBLY	28JUN96	25JUL96	
WBS:20.03 Scintillating Barrel Calorimetry			



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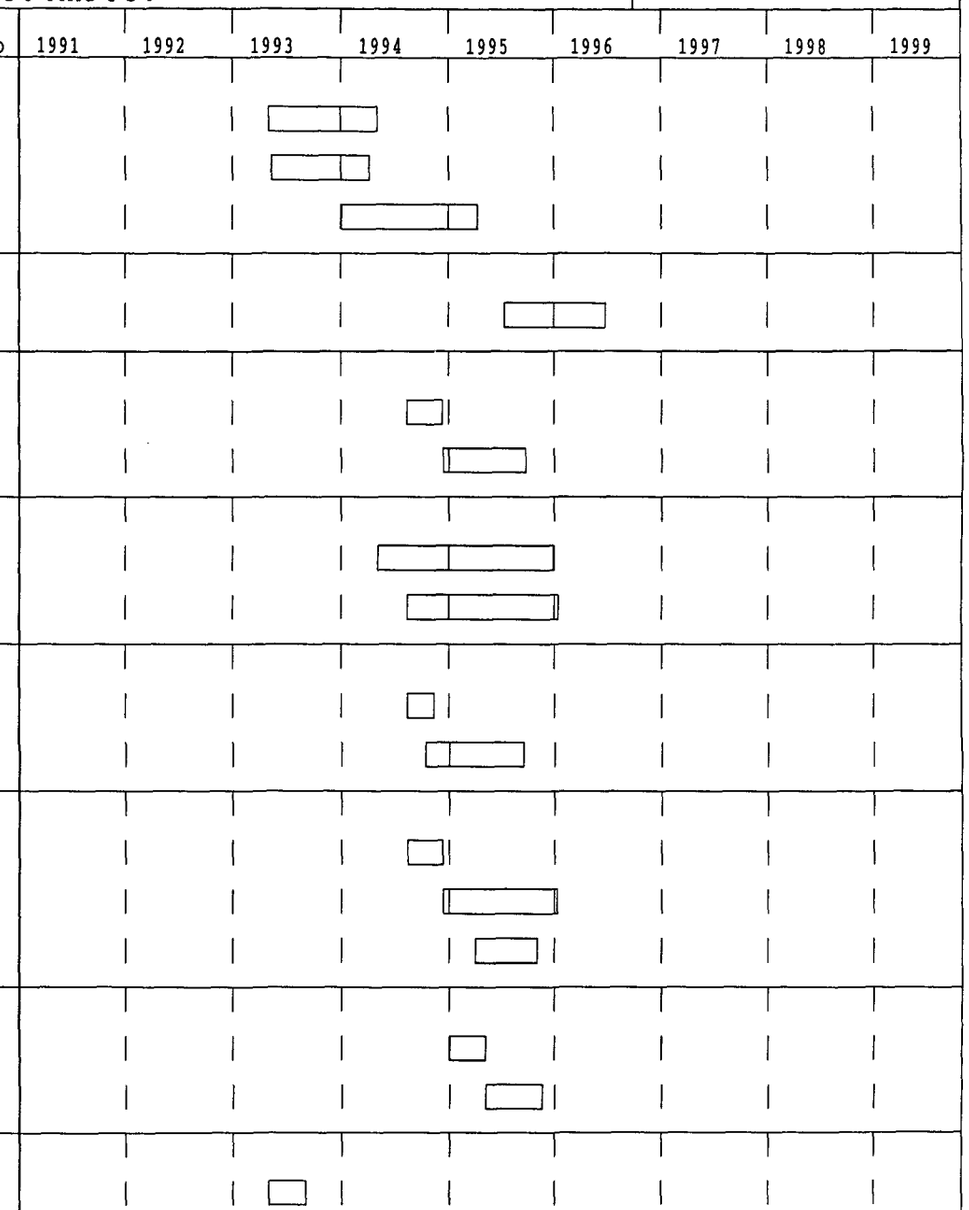
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
DESIGN	03MAY93	02MAY94	
PROCUREMENT	12MAY93	04APR94	
FABRICATION	03JAN94	07APR95	
WBS:20.03.1 Scintillating Barrel Sub-Assembly			
ASSEMBLY	10JUL95	25JUN96	
WBS:20.03.2 Scintillating Barrel Support Tubes			
PROCUREMENT	10AUG94	09DEC94	
FABRICATION	12DEC94	22SEP95	
WBS:20.03.3 Scintillating Barrel Modules			
FABRICATION	03MAY94	26DEC95	
ASSEMBLY	10AUG94	12JAN96	
WBS:20.03.4 Scintillating Barrel Readout			
PROCUREMENT	10AUG94	09NOV94	
FABRICATION	11OCT94	13SEP95	
WBS:20.03.5 Outer Barrel Passive Absorber			
PROCUREMENT	10AUG94	09DEC94	
FABRICATION	12DEC94	09JAN96	
ASSEMBLY	30MAR95	01NOV95	
WBS:20.03.6 Noble Liquid - Install Rails			
PROCUREMENT	02JAN95	03MAY95	
FABRICATION	04MAY95	17NOV95	
WBS:20.04 Endcap Calorimetry			
PROCUREMENT	30APR93	31AUG93	



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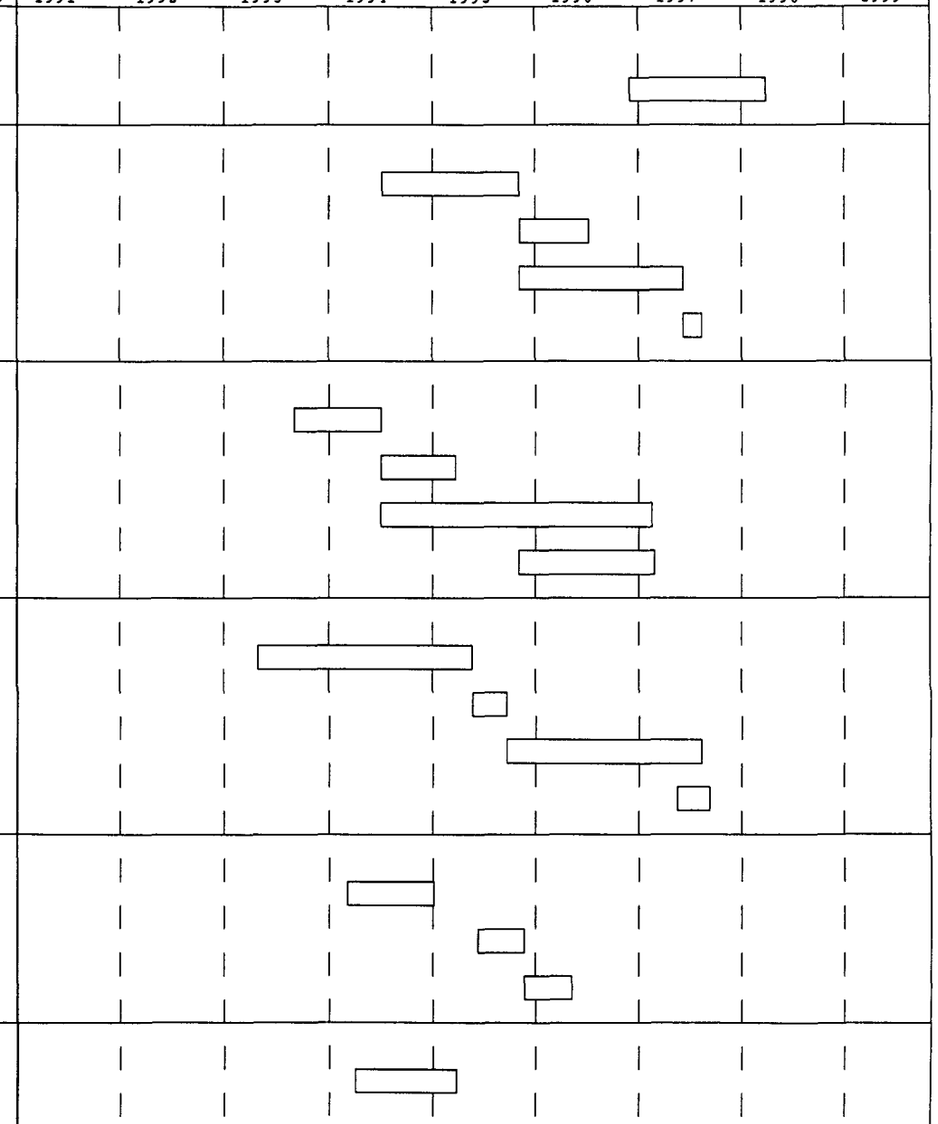
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
WBS:20.04.1 Endcap Assembly (On-Site)			
ASSEMBLY	02DEC96	27MAR98	
WBS:20.04.2 Endcap EM Section			
DESIGN	06JUL94	03NOV95	
PROCUREMENT	06NOV95	08JUL96	
FABRICATION	06NOV95	02JUN97	
ASSEMBLY	03JUN97	08AUG97	
WBS:20.04.3 Endcap Hadronic Sections			
DESIGN	01SEP93	30JUN94	
PROCUREMENT	01JUL94	21MAR95	
FABRICATION	01JUL94	12FEB97	
ASSEMBLY	01NOV95	20FEB97	
WBS:20.04.4 Endcap Forward Electromagnetic Section			
DESIGN	30APR93	16MAY95	
PROCUREMENT	17MAY95	15SEP95	
FABRICATION	18SEP95	05AUG97	
ASSEMBLY	13MAY97	04SEP97	
WBS:20.04.5 Cryostat			
DESIGN	04MAR94	02JAN95	
PROCUREMENT	06JUN95	20NOV95	
FABRICATION	21NOV95	06MAY96	
WBS:20.05 Forward Hadronic Calorimetry			
DESIGN	01APR94	22MAR95	



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Baseline Projected Actual

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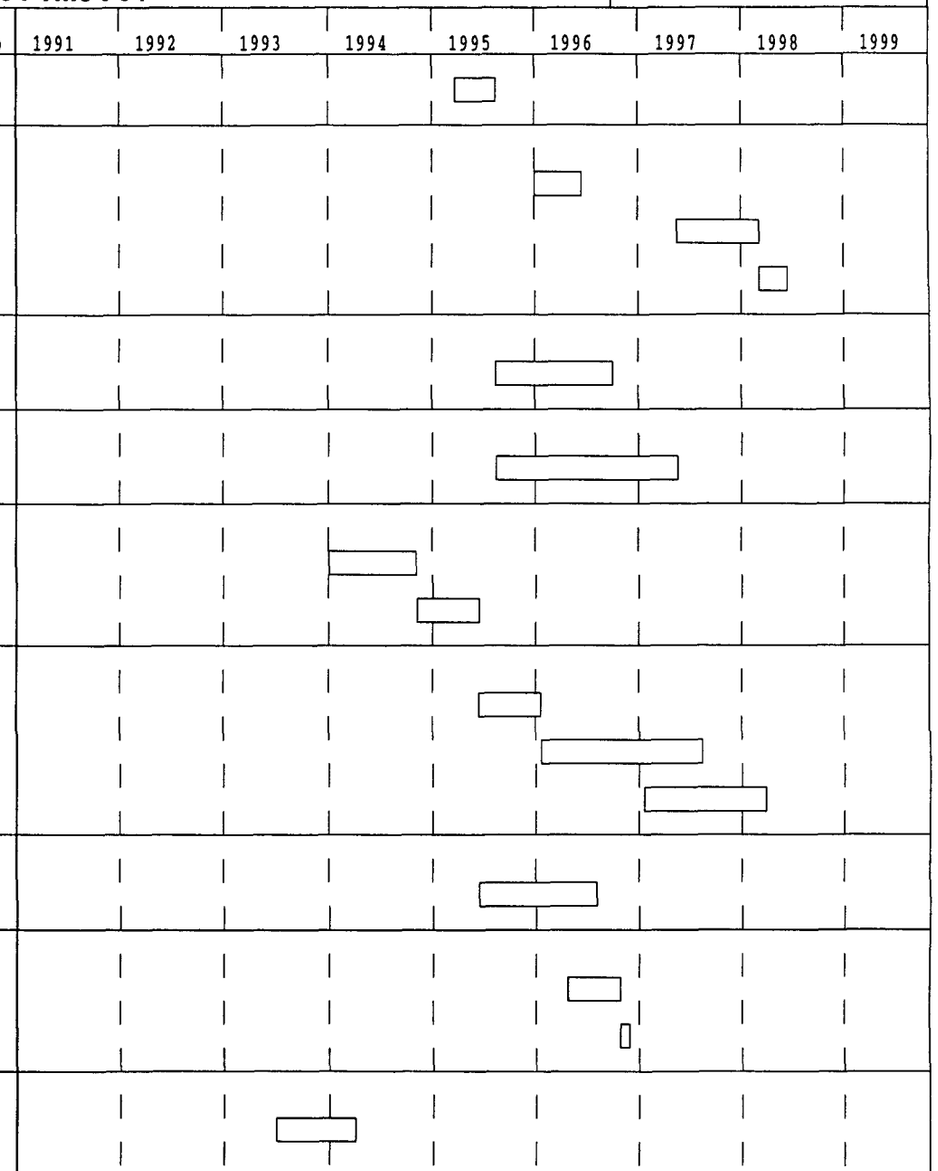
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	23MAR95	09AUG95	
WBS:20.05.1 Hadronic FCAL Assembly			
PROCUREMENT	01JAN96	14JUN96	
FABRICATION	15MAY97	04MAR98	
ASSEMBLY	05MAR98	12JUN98	
WBS:20.05.2 Structures			
FABRICATION	10AUG95	02OCT96	
WBS:20.05.3 Hadronic FCAL Structures			
FABRICATION	10AUG95	14MAY97	
WBS:20.06 Passive Absorber			
DESIGN	03JAN94	04NOV94	
PROCUREMENT	07NOV94	08JUN95	
WBS:20.06.1 Assembly			
PROCUREMENT	09JUN95	18JAN96	
FABRICATION	19JAN96	07AUG97	
ASSEMBLY	17JAN97	25MAR98	
WBS:20.06.2 Components			
FABRICATION	09JUN95	01AUG96	
WBS:20.07.1 Vacuum Assembly			
FABRICATION	24APR96	24OCT96	
ASSEMBLY	25OCT96	25NOV96	
WBS:20.07.2 Vacuum Equipment			
DESIGN	01JUL93	30MAR94	



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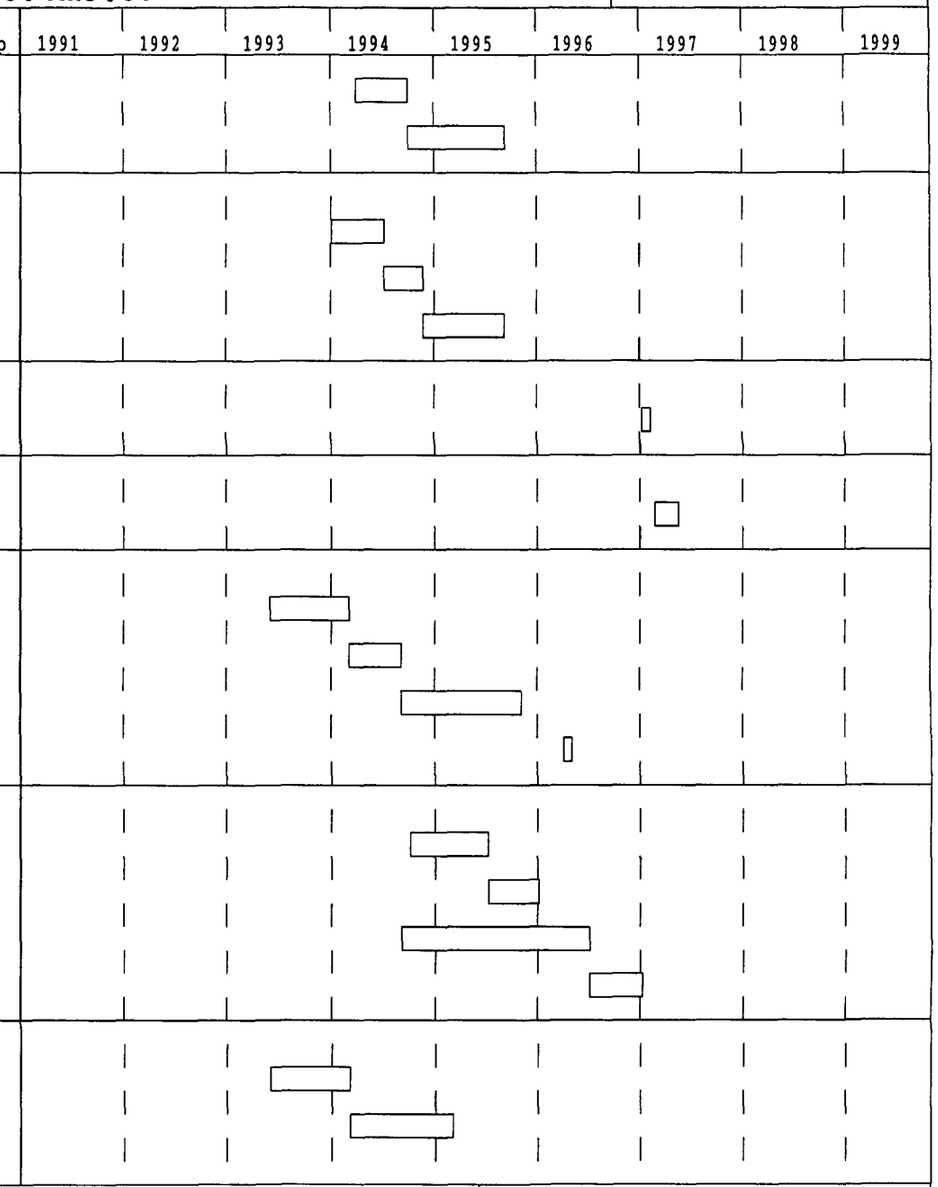
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	31MAR94	28SEP94	
FABRICATION	29SEP94	08SEP95	
WBS:20.07.3 Vacuum Decontamination Equipment			
DESIGN	03JAN94	05JUL94	
PROCUREMENT	06JUL94	22NOV94	
FABRICATION	23NOV94	05SEP95	
WBS:20.08 Cryogenics			
ASSEMBLY	07JAN97	05FEB97	
WBS:20.08.1 Cryogenics Assembly (EFD)			
ASSEMBLY	20FEB97	14MAY97	
WBS:20.08.2 Surface Storage			
DESIGN	01JUN93	03MAR94	
PROCUREMENT	04MAR94	01SEP94	
FABRICATION	02SEP94	03NOV95	
ASSEMBLY	03APR96	02MAY96	
WBS:20.08.3 Hall Storage			
DESIGN	04OCT94	06JUL95	
PROCUREMENT	07JUL95	04JAN96	
FABRICATION	02SEP94	04JUL96	
ASSEMBLY	05JUL96	06JAN97	
WBS:20.08.4 Vaporizers			
DESIGN	01JUN93	03MAR94	
PROCUREMENT	04MAR94	02MAR95	



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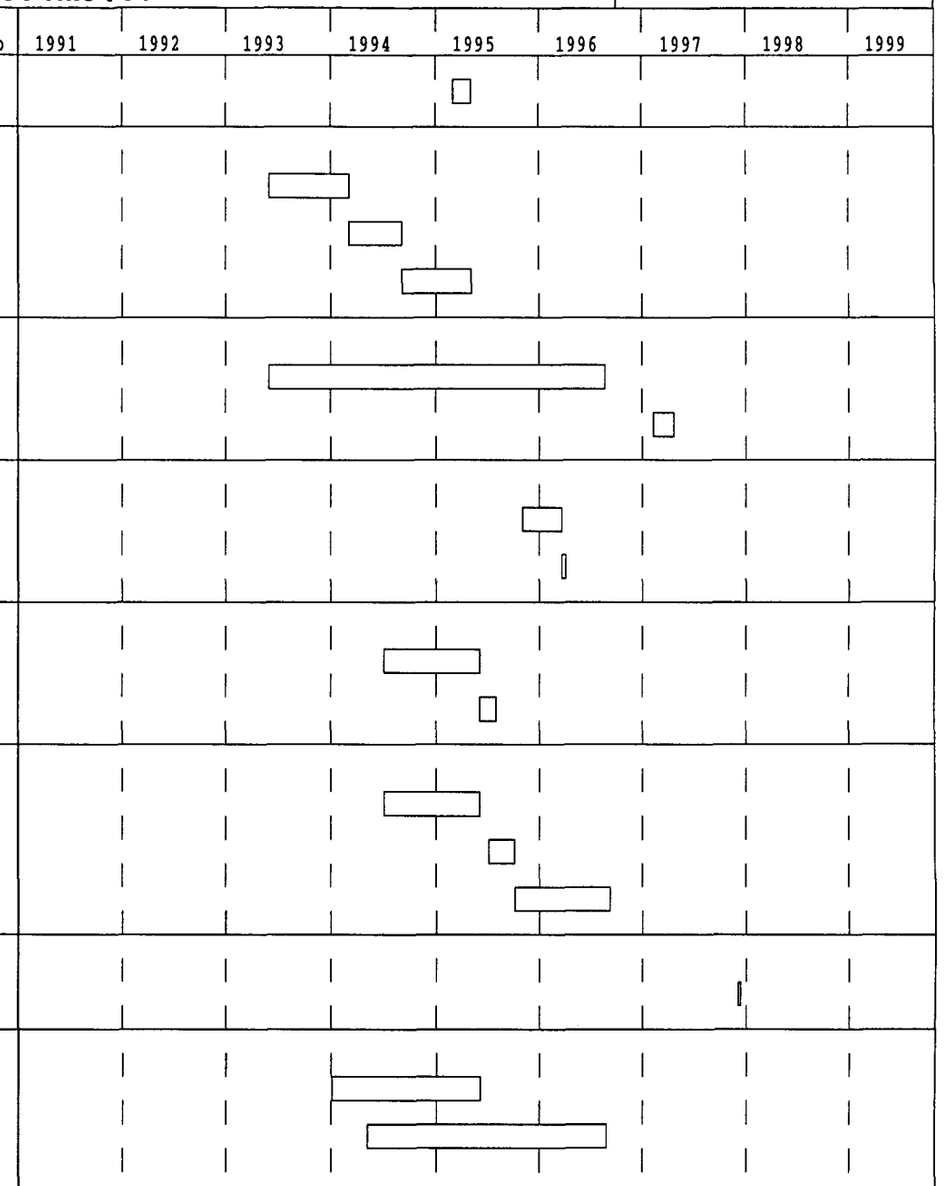
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
FABRICATION	03MAR95	03MAY95	
WBS:20.08.5 Interstage Cooling			
DESIGN	01JUN93	03MAR94	
PROCUREMENT	04MAR94	01SEP94	
FABRICATION	02SEP94	03MAY95	
WBS:20.08.6 Liquid Kr Material			
PROCUREMENT	01JUN93	19AUG96	
FABRICATION	06FEB97	18APR97	
WBS:20.08.7 Liquid Ar Material			
PROCUREMENT	01NOV95	19MAR96	
FABRICATION	20MAR96	02APR96	
WBS:20.09.1 Power Distribution			
DESIGN	01JUL94	01JUN95	
FABRICATION	02JUN95	27JUL95	
WBS:20.09.2 Control and Monitor System			
DESIGN	01JUL94	01JUN95	
PROCUREMENT	03JUL95	02OCT95	
FABRICATION	03OCT95	04SEP96	
WBS:20.10 Final Assembly			
ASSEMBLY	02DEC97	08DEC97	
WBS:20.10.1 Final Assembly Equipment			
PROCUREMENT	03JAN94	02JUN95	
FABRICATION	05MAY94	23AUG96	



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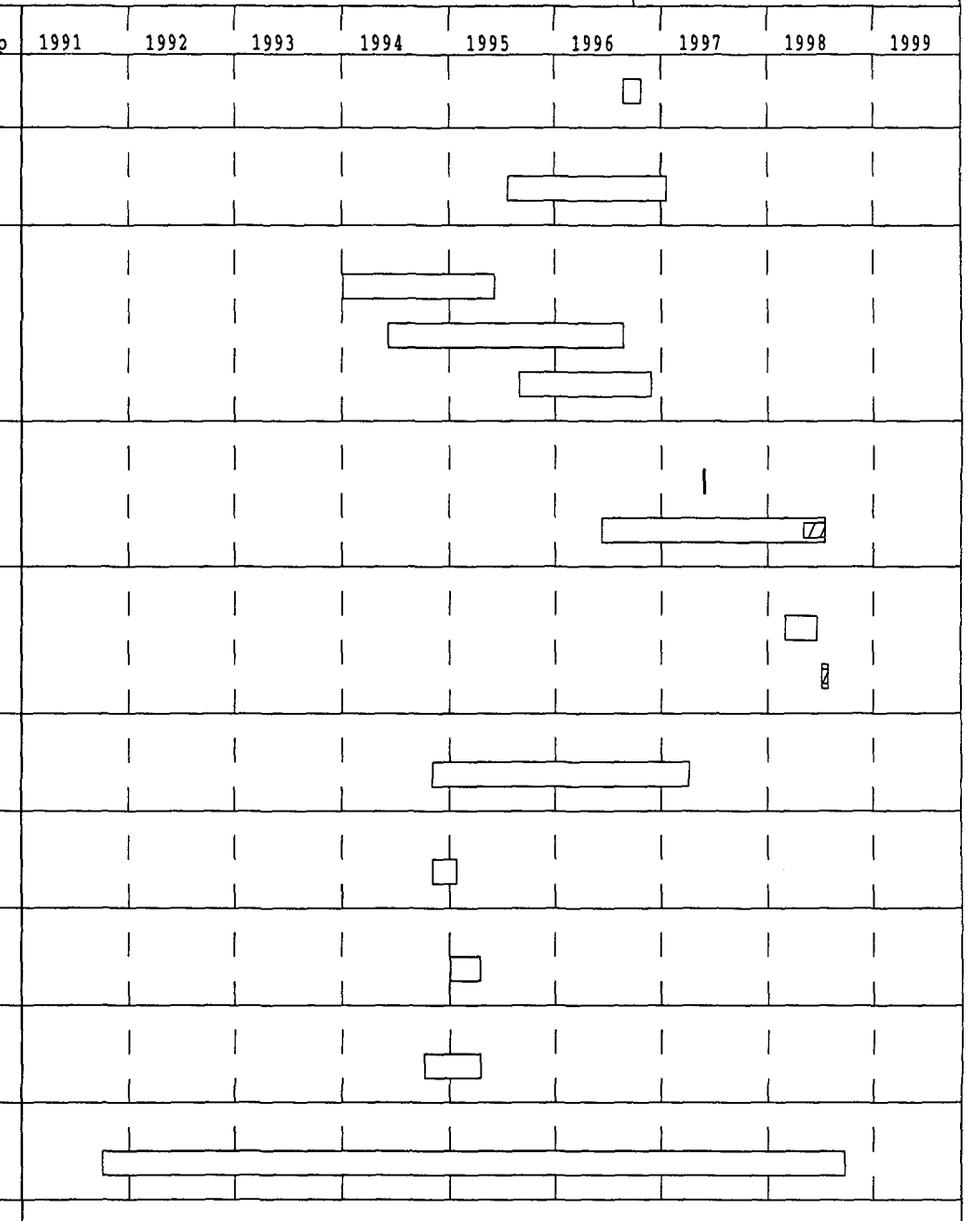
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
ASSEMBLY	26AUG96	24OCT96	
WBS:20.10.2 Final Assembly Calorimetry			
ASSEMBLY	20JUL95	16JAN97	
WBS:20.11.1 Installation Equipment			
PROCUREMENT	03JAN94	02JUN95	
FABRICATION	06JUN94	23AUG96	
ASSEMBLY	28AUG95	25NOV96	
WBS:20.11.2 Hall Installation Calormetry			
ASSEMBLY	23MAY97	27MAY97	
INSTALLATION	10JUN96	16JUL98	
WBS:20.11.3 Hall Installation Passive Endcaps			
ASSEMBLY	02MAR98	19JUN98	
INSTALLATION	06JUL98	27JUL98	
WBS:20.12.1 Inner Barrel & End Cap (Includes Fermi Lab)			
DESIGN	01NOV94	31MAR97	
WBS:20.12.2 Scintillating Hadron			
DESIGN	01NOV94	23JAN95	
WBS:20.12.3 EM Forward Calorimeter			
DESIGN	02JAN95	14APR95	
WBS:20.12.4 Scintillating Liquid Forward Calorimeter			
DESIGN	03OCT94	14APR95	
WBS:20.13.1 Project MGT & Administration			
LEVEL OF EFFORT (LOE)	01OCT91	21SEP98	
WBS:20.13.2 Resourse MGT & Travel			



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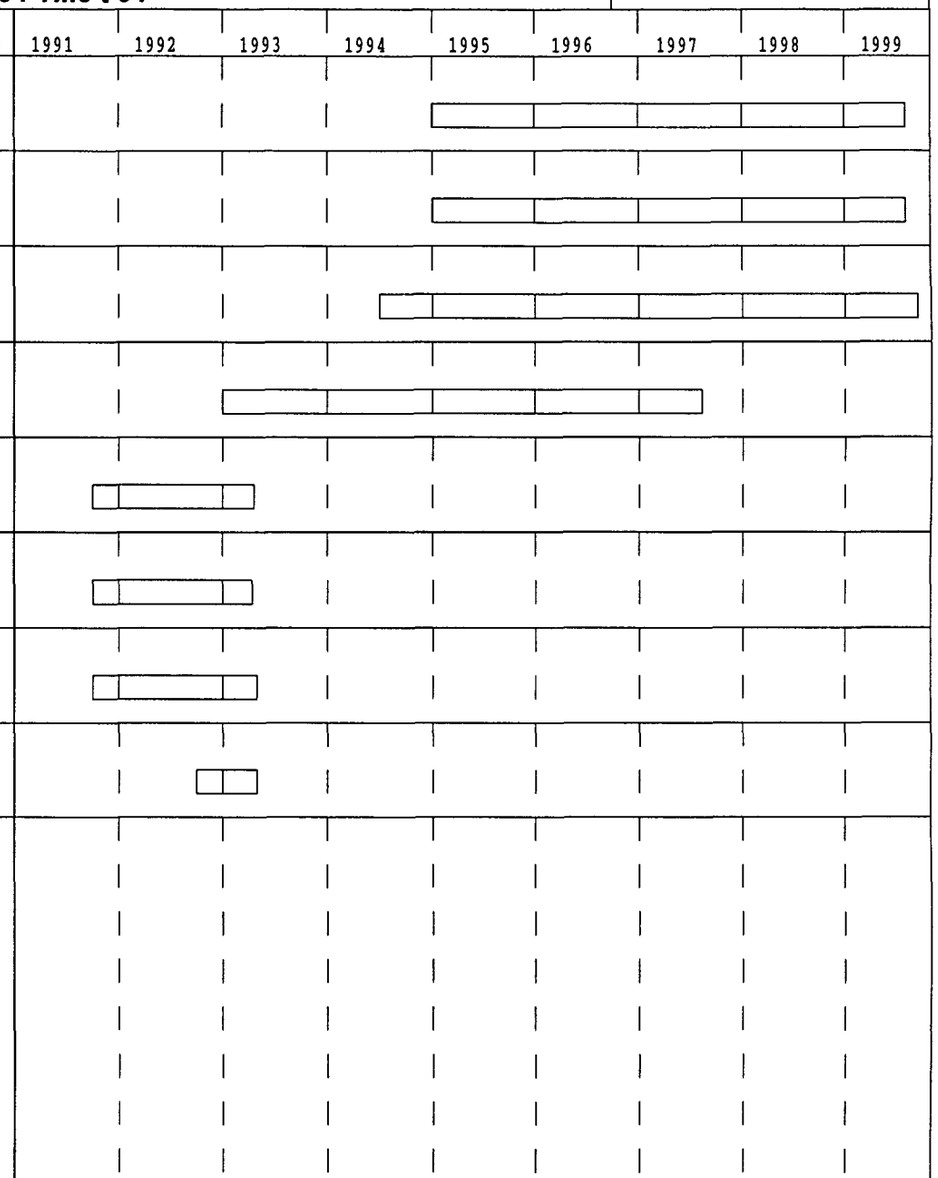
LEVEL III SUMMARY BASELINE SCHEDULE

20 Calorimeter

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
LEVEL OF EFFORT (LOE)	02JAN95	06AUG99	
WBS:20.13.3 ES&H			
LEVEL OF EFFORT (LOE)	02JAN95	06AUG99	
WBS:20.13.4 Quality Assurance			
LEVEL OF EFFORT (LOE)	01JUL94	16SEP99	
WBS:20.13.5 System Engineering			
LEVEL OF EFFORT (LOE)	01JAN93	07AUG97	
WBS:20.14.1 Concept/Prel.Dsn Liquid Calorimetry			
DESIGN	01OCT91	19APR93	
WBS:20.14.2 Concept/Prel.Dsn Scintillating Barrel			
DESIGN	01OCT91	12APR93	
WBS:20.14.3 Concept/Prel.Dsn EM Forward Calorimeter			
DESIGN	01OCT91	29APR93	
WBS:20.14.4 Scintillating Liquid Forward Calorimeter			
DESIGN	01OCT92	29APR93	



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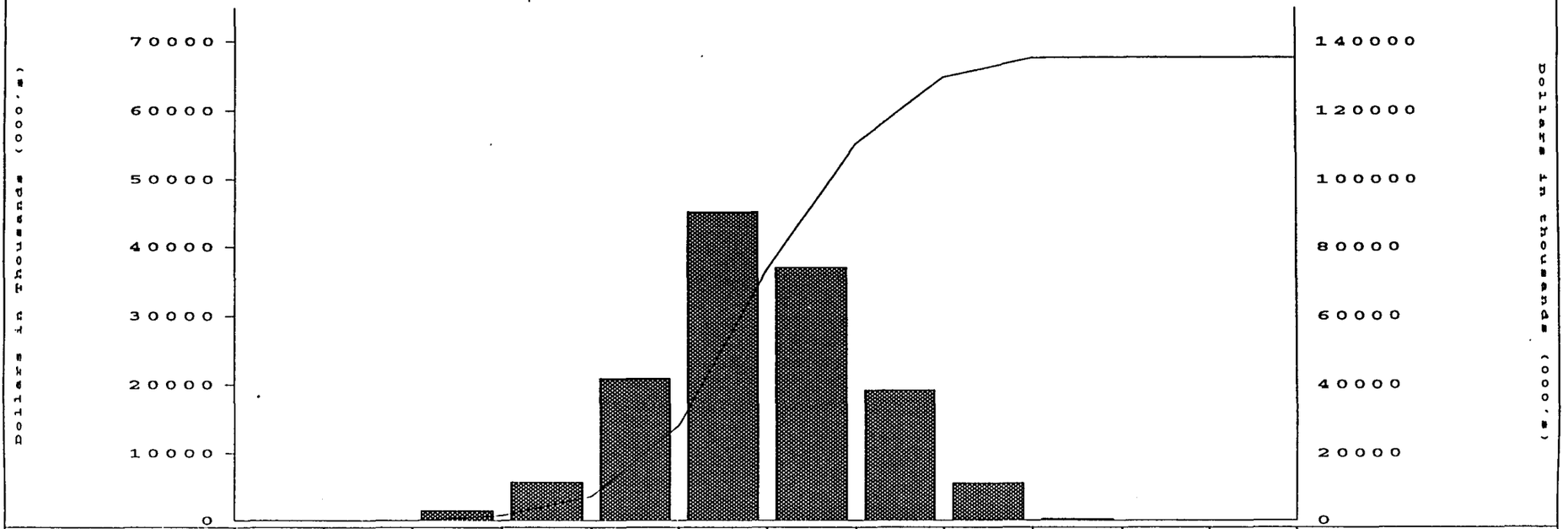
GEM Detector Report: GEM_FY	GEM DETECTOR WBS 20 - Calorimeter	Date: 27APR93 Project: CAL_MPS



		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
Incr Bud	$10k		146	575	2097	4516	3705	1922	557	23		
Cum. Bud	$100k		15	72	282	733	1104	1296	1352	1354	1354	1354

WBS 20.01.1	$8,609,421	Research & Development
WBS 20.02.1	$4,190,808	Inner Barrel Assembly
WBS 20.02.2	$9,417,738	EM Module
WBS 20.02.3	$6,513,395	Hadronic Sections
WBS 20.02.4	$4,765,692	Cryostat
WBS 20.03.1	$1,722,579	Scintillating Barrel Sub-Assembly
WBS 20.03.2	$2,446,617	Scintillating Barrel Support Tubes
WBS 20.03.3	$8,947,736	Scintillating Barrel Modules
WBS 20.03.4	$3,427,265	Scintillating Barrel Readout
WBS 20.03.5	$1,266,537	Outer Barrel Passive Absorber
WBS 20.03.6	$ 205,757	Noble Liquid - Install Rails
WBS 20.04.1	$7,577,592	Endcap Assembly (On-Site)
WBS 20.04.2	$8,493,385	Endcap EM Section
WBS 20.04.3	$12,175,168	Endcap Hadronic Sections
WBS 20.04.4	$ 881,087	Endcap Forward Electromagnetic Sect
WBS 20.04.5	$5,922,458	Cryostat

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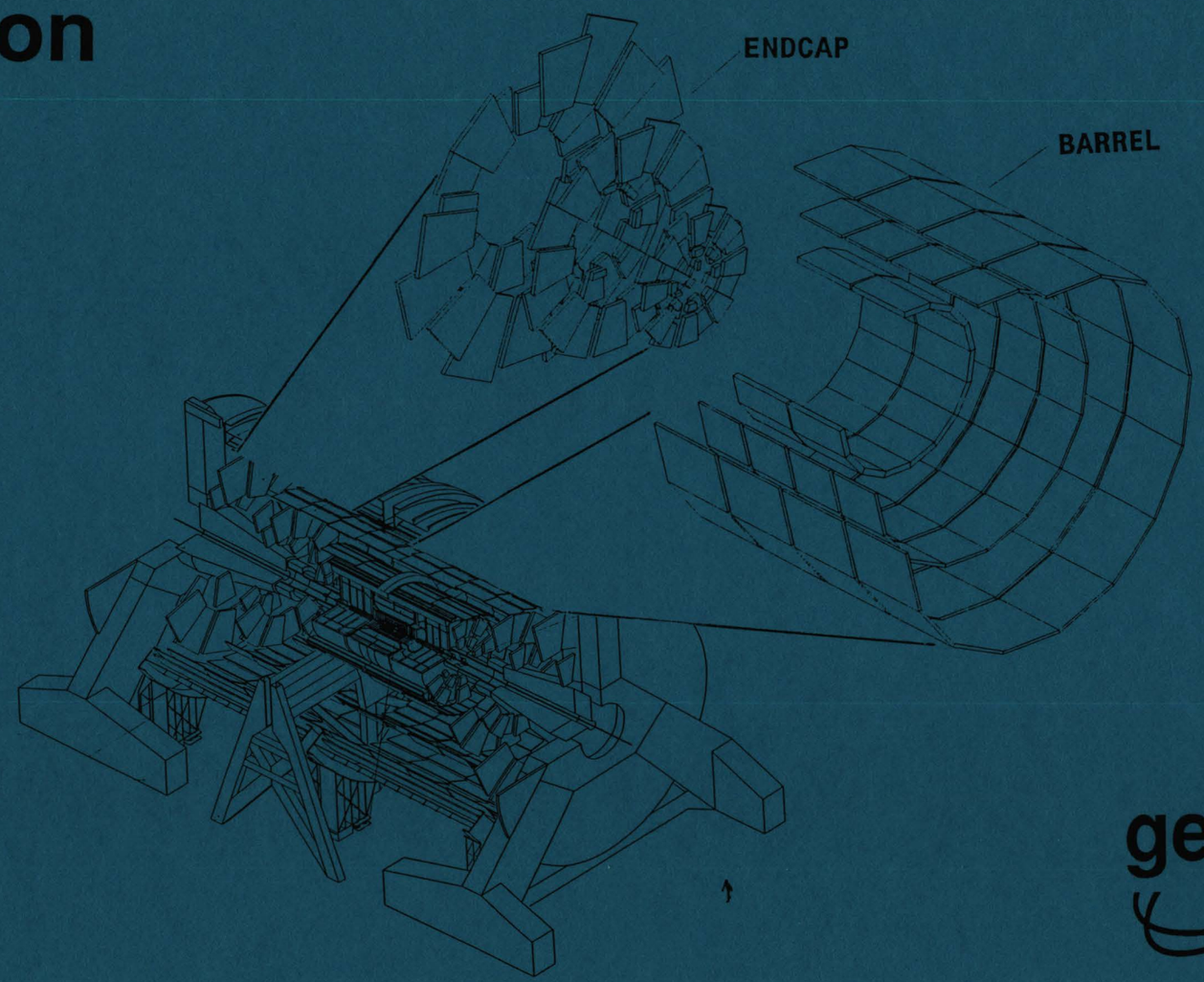
GEM DETECTOR
WBS 20 - Calorimeter

		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	
WBS	20.05.1				$ 311,524								Hadronic FCAL Assembly
WBS	20.05.2				$ 578,419								Structures
WBS	20.05.3				$10,152,346								Hadronic FCAL Structures
WBS	20.06.1				$ 776,814								Assembly
WBS	20.06.2				$2,085,140								Components
WBS	20.07.1					$ 283,002							Vacuum Assembly
WBS	20.07.2			$ 591,818									Vacuum Equipment
WBS	20.07.3				$ 8,348								Vacuum Decontamination Equipment
WBS	20.08.2			$1,613,553									Surface Storage
WBS	20.08.3				$2,567,081								Hall Storage
WBS	20.08.4			$ 117,240									Vaporizers
WBS	20.08.5			$ 330,920									Interstage Cooling
WBS	20.08.6			$10,233,850									Liquid Kr Material
WBS	20.08.7					$ 155,483							Liquid Ar Material
WBS	20.09.1				$ 19,493								Power Distribution
WBS	20.09.2				$ 319,762								Control and Monitor System
WBS	20.10.1			$ 792,262									Final Assembly Equipment
WBS	20.10.2					$ 657,103							Final Assembly Calorimetry
WBS	20.11.1			$ 747,648									Installation Equipment
WBS	20.11.2					$3,564,025							Hall Installation Calormetry
WBS	20.11.3						$ 694,931						Hall Installation Passive Endca
WBS	20.12.1				$3,675,042								Inner Barrel & End Cap (Includes Fermi
WBS	20.12.2				$ 87,123								Scintillating Hadron
WBS	20.12.3				$ 352,891								EM Forward Calorimeter
WBS	20.12.4				$ 329,587								Scintillating Liquid Forward Calorimeter
WBS	20.12.5			$1,017,491									
WBS	20.13.1												Project MGT & Administration
WBS	20.13.2				$ 433,512								Resourse MGT & Travel
WBS	20.13.3				$ 166,152								ES&H
WBS	20.13.4				$ 660,826								Quality Assurance
WBS	20.13.5		$1,321,654										System Engineering
WBS	20.14.1												Concept/Prel.Dsn Liquid Calorimetry
WBS	20.14.2												Concept/Prel.Dsn Scintillating Barrel
WBS	20.14.3												Concept/Prel.Dsn EM Forward Calorimeter
WBS	20.14.4		$ 369,775										Scintillating Liquid Forward Calorimeter

Muon



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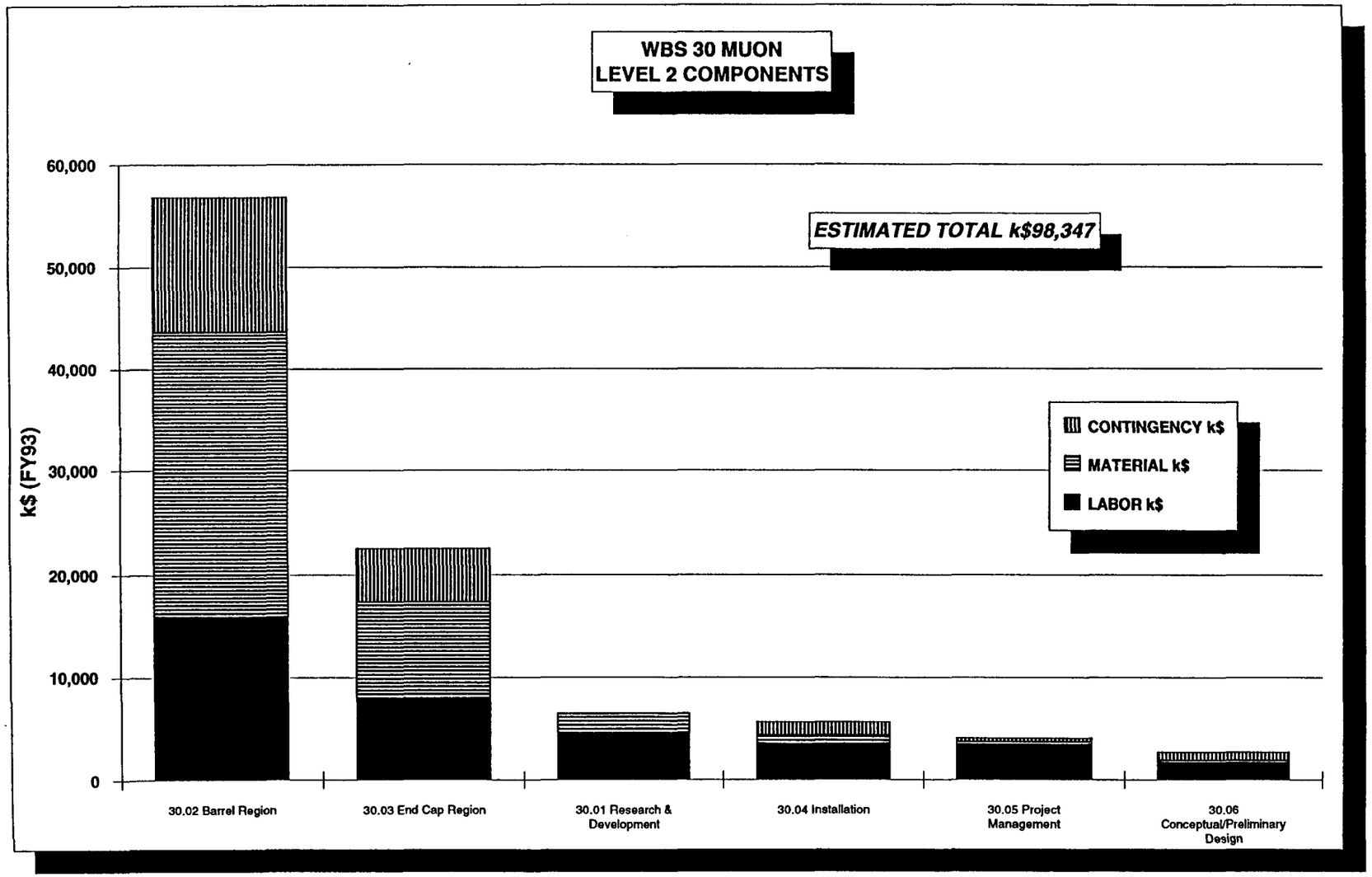
Superconducting ***Super Collider***

MUON Measurement Parameters Table

	Super Layer 1	Super Layer 2	Super Layer 3	Total
End Cap Chambers				
Z Position	7020 mm	11540 mm	16900 mm	
Thickness	910 mm	800 mm	850 mm	
Inner Radius	1095 mm	1845 mm	2756 mm	
Outer Radius	3800 mm	6057 mm	8873 mm	N/A
Number of Channels	105,984	119,808	119,808	345,600
Number of Chambers	96	192	192	480
Barrel Chambers				
Inner Radius	4023 mm	6133 mm	8287 mm	
Depth	316 mm	403 mm	404 mm	
Half Length	6890 mm	10700 mm	14480 mm	N/A
Number of Channels	202,752	331,776	331,776	866,304
Number of Chambers	96	384	384	864


WBS 30 MUON
LEVEL 2 COMPONENTS
ESTIMATED TOTAL k$98,347
CONTINGENCY k$
MATERIAL k$
LABOR k$
k$ (FY93)
60,000
50,000
40,000
30,000
20,000
10,000
0
30.02 Barrel Region
30.03 End Cap Region
30.01 Research & Development
30.04 Installation
30.05 Project Management
30.06 Conceptual/Preliminary Design

GEM COST ESTIMATE SUMMARY

4/25/93

FY93 U.S. Dollars

MUON SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
30	-MUON	01	40,631	891,791	36,819	77,449	20,897	27%	98,347
30.01	-RESEARCH & DEVELOPMENT	02	1,958	62,977	4,550	6,508	0	0%	6,508
30.01.1	DEVELOP CHAMBER TECHNOLOGIES	03	1,177	15,425	1,080	2,257	0	0%	2,257
30.01.2	CHAMBER PERFORMANCE EVALUATION	03	17	4,926	443	460	0	0%	460
30.01.3	MUON TRIGGER	03	7	1,985	164	171	0	0%	171
30.01.4	ALIGNMENT TECHNOLOGY	03	14	4,217	295	309	0	0%	309
30.01.5	ELECTRONICS EVALUATION	03	15	4,430	311	326	0	0%	326
30.01.6	SIMULATIONS	03	3	895	81	84	0	0%	84
30.01.7	INDIVIDUAL CHAMBER DESIGN & FACTORY LAYOUT	03	32	6,539	458	490	0	0%	490
30.01.8	ENGINEERING (structures, costs, etc.)	03	693	24,560	1,720	2,413	0	0%	2,413
30.02	-BARREL REGION	02	27,914	470,928	15,728	43,642	13,174	30%	56,817
30.02.1	-BARREL REGION MODULE ASSEMBLY	03	3,092	27,258	989	4,081	1,224	30%	5,305
30.02.1.1	-ON-SITE	04	3,069	20,305	603	3,672	1,101	30%	4,773
30.02.1.1.1	MODULE STORAGE	05	52	0	0	52	16	30%	68
30.02.1.1.2	TEST	05	1,857	3,216	119	1,976	593	30%	2,569
30.02.1.1.3	ASSEMBLY	05	1,009	16,249	453	1,462	439	30%	1,900
30.02.1.1.4	FACILITY PREP.	05	151	840	31	182	55	30%	236
30.02.1.2	-OFF-SITE	04	23	6,952	386	409	123	30%	532
30.02.1.2.1	ASSY FIXT FNL DESIGN, MACH, ASSY.	05	23	6,952	386	409	123	30%	532
30.02.2	-CATHODE STRIP CHAMBERS	03	16,991	333,174	10,660	27,650	8,295	30%	35,945
30.02.2.1	-OFF-SITE	04	16,991	333,174	10,660	27,650	8,295	30%	35,945
30.02.2.1.1	SHIPPING	05	386	1,900	70	456	137	30%	593
30.02.2.1.2	TEST	05	340	127,661	5,368	5,708	1,713	30%	7,421
30.02.2.1.3	ASSEMBLY	05	1,108	189,084	4,489	5,597	1,679	30%	7,276
30.02.2.1.4	FACILITY PREP.	05	135	8,550	354	489	147	30%	635

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
30.02.2.1.5	MACHINING, INSPECTION	05	15,002	0	0	15,002	4,501	30%	19,503
30.02.2.1.6	FINAL DESIGN, DRWG/SPEC MODS	05	20	5,979	379	399	120	30%	519
30.02.3	-MODULE SUPPORT STRUCTURES	03	3,432	39,197	1,610	5,042	1,709	34%	6,751
30.02.3.1	-OFF-SITE	04	3,432	39,197	1,610	5,042	1,709	34%	6,751
30.02.3.1.1	SHIPPING	05	75	1,384	55	130	39	30%	169
30.02.3.1.2	MACHINING, INSPECTION	05	3,318	27,624	877	4,195	1,426	34%	5,622
30.02.3.1.3	FINAL DESIGN, DRWG/SPEC MODS	05	39	10,189	678	717	244	34%	961
30.02.4	RESERVED	03	0	0	0	0	0	0%	0
30.02.5	-GAS SYSTEMS (REMOVED $580K TO EFD)	03	934	13,528	433	1,367	301	22%	1,668
30.02.5.1	-OFF-SITE	04	2	438	33	35	8	22%	42
30.02.5.1.1	DESIGN AND DEVELOPMENT (EFD)	05	2	438	33	35	8	22%	42
30.02.5.2	-ON-SITE	04	932	13,090	400	1,332	294	22%	1,626
30.02.5.2.1	DESIGN AND DRAWINGS (EFD)	05	0	126	5	6	1	22%	7
30.02.5.2.2	TEST PROCEDURE DEVELOPMENT (EFD)	05	0	37	3	3	1	27%	4
30.02.5.2.3	SAFETY PROCEDURE DEVELOPMENT (EFD)	05	0	50	4	4	1	27%	5
30.02.5.2.4	MAINTENANCE PROCEDURE DEVELOPMENT (EFD)	05	0	50	4	4	1	27%	5
30.02.5.2.5	ASSEMBLY AND TEST (EFD)	05	602	12,906	381	983	216	22%	1,200
30.02.5.2.6	PROCUREMENT - SURFACE SYSTEM (EFD)	05	52	-205	-2	50	11	22%	61
30.02.5.2.7	PROCUREMENT - HALL SYSTEM (EFD)	05	277	126	5	282	62	22%	344
30.02.6	-COOLING SYSTEM	03	1,180	9,008	444	1,624	487	30%	2,112
30.02.6.1	-OFF-SITE	04	1,180	9,008	444	1,624	487	30%	2,112
30.02.6.1.1	SHIPPING	05	55	285	12	67	20	30%	87
30.02.6.1.2	SUBASSEMBLY, TEST	05	15	2,327	66	81	24	30%	106
30.02.6.1.3	MACHINING, INSPECTION	05	1,041	2,147	87	1,128	338	30%	1,466
30.02.6.1.4	PROCUREMENT	05	54	475	20	74	22	30%	96

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30.02.6.1.5	FINAL DESIGN, DRWG/SPEC. MODS.	05	15	3,774	260	275	83	30%	358
30.02.7	-LOCAL ALIGNMENT	03	2,286	48,763	1,592	3,878	1,158	30%	5,035
30.02.7.1	-OFF-SITE	04	2,286	48,763	1,592	3,878	1,158	30%	5,035
30.02.7.1.1	SHIPPING	05	78	1,348	55	133	40	30%	173
30.02.7.1.2	TEST	05	316	23,808	706	1,022	307	30%	1,328
30.02.7.1.3	ASSEMBLY	05	13	19,049	565	578	173	30%	751
30.02.7.1.4	FACILITY PREP.	05	28	879	56	84	19	23%	104
30.02.7.1.5	MACHINING, INSPECTION	05	1,840	570	23	1,863	559	30%	2,422
30.02.7.1.6	FINAL DESIGN, DRWG/SPEC. MODS.	05	11	3,109	187	198	59	30%	257
30.03	-END CAP REGION	02	9,336	225,218	7,975	17,312	5,216	30%	22,528
30.03.1	-END CAP REGION MODULE ASSEMBLY	03	514	25,346	922	1,436	431	30%	1,867
30.03.1.1	-ON-SITE	04	491	18,393	536	1,027	308	30%	1,335
30.03.1.1.1	SECTOR STORAGE	05	52	0	0	52	16	30%	68
30.03.1.1.2	TEST	05	159	3,225	120	279	84	30%	362
30.03.1.1.3	ASSEMBLY	05	269	13,839	373	642	193	30%	834
30.03.1.1.4	FACILITY PREP.	05	11	1,329	44	55	16	30%	71
30.03.1.2	-OFF-SITE	04	23	6,952	386	409	123	30%	532
30.03.1.2.1	ASSY FIXT FINAL DSGN, MACH, ASSY	05	23	6,952	386	409	123	30%	532
30.03.2	-CATHODE STRIP CHAMBERS	03	5,794	126,419	4,203	9,996	2,999	30%	12,995
30.03.2.1	-OFF-SITE	04	5,794	126,419	4,203	9,996	2,999	30%	12,995
30.03.2.1.1	SHIPPING	05	162	1,900	70	232	69	30%	301
30.03.2.1.2	TEST	05	179	43,035	1,810	1,989	597	30%	2,586
30.03.2.1.3	ASSEMBLY	05	607	66,939	1,589	2,196	659	30%	2,855
30.03.2.1.4	FACILITY PREP.	05	135	8,550	354	489	147	30%	635
30.03.2.1.5	MACHINING, INSPECTION	05	4,691	0	0	4,691	1,407	30%	6,098

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30.03.2.1.6	FINAL DESIGN, DRWG/SPEC MODS	05	20	5,995	381	401	120	30%	521
30.03.3	-MODULE SUPPORT STRUCTURES	03	1,151	33,598	1,433	2,583	873	34%	3,457
30.03.3.1	-OFF-SITE	04	1,151	33,598	1,433	2,583	873	34%	3,457
30.03.3.1.1	SHIPPING	05	75	1,393	55	130	39	30%	169
30.03.3.1.2	MACHINING, INSPECTION	05	1,037	22,016	699	1,736	590	34%	2,326
30.03.3.1.3	FINAL DESIGN, DRWG/SPEC MODS	05	39	10,189	678	717	244	34%	961
30.03.4	RESERVED	03	0	0	0	0	0	0%	0
30.03.5	-GAS SYSTEM	03	196	10,558	369	565	124	22%	690
30.03.5.1	-OFF-SITE	04	0	0	0	0	0	0%	0
30.03.5.1.1	RESERVED	05	0	0	0	0	0	0%	0
30.03.5.2	-ON-SITE	04	196	10,558	369	565	124	22%	690
30.03.5.2.1	RESERVED	05	0	0	0	0	0	0%	0
30.03.5.2.2	RESERVED	05	0	0	0	0	0	0%	0
30.03.5.2.3	RESERVED	05	0	0	0	0	0	0%	0
30.03.5.2.4	RESERVED	05	0	0	0	0	0	0%	0
30.03.5.2.5	ASSEMBLY AND TEST	05	196	10,558	369	565	124	22%	690
30.03.5.2.6	RESERVED	05	0	0	0	0	0	0%	0
30.03.5.2.7	RESERVED	05	0	0	0	0	0	0%	0
30.03.6	-COOLING SYSTEM	03	601	4,740	164	765	230	30%	995
30.03.6.1	-OFF-SITE	04	601	4,740	164	765	230	30%	995
30.03.6.1.1	SHIPPING	05	34	285	12	46	14	30%	60
30.03.6.1.2	SUBASSEMBLY, TEST	05	15	2,318	66	81	24	30%	105
30.03.6.1.3	MACHINING, INSPECTION	05	552	2,138	86	639	192	30%	830
30.03.6.1.4	RESERVED	05	0	0	0	0	0	0%	0
30.03.6.1.5	RESERVED	05	0	0	0	0	0	0%	0

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30.03.7	-LOCAL ALIGNMENT	03	1,081	24,558	885	1,966	560	29%	2,525
30.03.7.1	-OFF-SITE	04	1,081	24,558	885	1,966	560	29%	2,525
30.03.7.1.1	SHIPPING	05	47	798	32	79	24	30%	103
30.03.7.1.2	TEST	05	208	10,593	321	529	159	30%	687
30.03.7.1.3	ASSEMBLY	05	7	8,576	265	272	82	30%	354
30.03.7.1.4	FACILITY PREP.	05	28	918	58	86	20	23%	105
30.03.7.1.5	MACHINING, INSPECTION	05	780	572	24	804	217	27%	1,021
30.03.7.1.6	FINAL DESIGN, DRWG/SPEC MODS	05	11	3,101	186	197	59	30%	256
30.04	-INSTALLATION	02	779	70,223	3,557	4,336	1,308	30%	5,644
30.04.1	- BARREL REGION	03	424	33,745	1,607	2,031	616	30%	2,648
30.04.1.1	-ON-SITE	04	375	19,268	596	971	299	31%	1,270
30.04.1.1.1	TEST	05	93	4,833	142	235	78	33%	313
30.04.1.1.2	MECHANICAL ASSEMBLY	05	271	1,262	44	315	95	30%	410
30.04.1.1.3	FACILITY PREP.	05	11	13,172	410	421	126	30%	548
30.04.1.2	-OFF-SITE	04	49	14,477	1,011	1,060	318	30%	1,378
30.04.1.2.1	INSTALL. TOOL FNL DESIGN, MACH, ASSY.	05	49	14,477	1,011	1,060	318	30%	1,378
30.04.2	-END CAP REGION	03	232	24,063	1,148	1,379	414	30%	1,793
30.04.2.1	-ON-SITE	04	198	13,962	431	629	189	30%	817
30.04.2.1.1	TEST	05	92	3,952	116	207	62	30%	270
30.04.2.1.2	MECHANICAL ASSEMBLY	05	99	878	31	130	39	30%	168
30.04.2.1.3	FACILITY PREP.	05	7	9,133	285	292	88	30%	379
30.04.2.2	-OFF-SITE	04	34	10,100	717	751	225	30%	976
30.04.2.2.1	INSTALL TOOL FINAL DSGN, MACH, ASSY	05	34	10,100	717	751	225	30%	976
30.04.3	-GLOBAL ALIGNMENT	03	124	12,416	802	926	278	30%	1,203
30.04.3.1	-OFF-SITE	04	124	12,416	802	926	278	30%	1,203

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30.04.3.1.1	SHIPPING	05	104	1,330	54	158	47	30%	**205**
30.04.3.1.2	TEST	05	5	4,430	310	315	95	30%	**410**
30.04.3.1.3	ASSEMBLY	05	4	3,551	251	255	77	30%	**331**
30.04.3.1.4	FINAL DESIGN, DRWG/SPEC MODS	05	11	3,105	187	198	59	30%	**257**
30.05	-PROJECT MANAGEMENT	02	435	37,921	3,297	3,732	373	10%	**4,105**
30.05.1	ADMINISTRATION/OVERSIGHT	03	150	16,834	1,463	1,613	161	10%	**1,774**
30.05.2	RESOURCE MANAGEMENT	03	45	2,109	183	228	23	10%	**251**
30.05.3	ES&H ASSURANCE	03	90	4,217	367	457	46	10%	**503**
30.05.4	QUALITY ASSURANCE PROGRAM	03	90	6,326	550	640	64	10%	**704**
30.05.5	SYSTEMS INTEGRATION	03	30	4,217	367	397	40	10%	**437**
30.05.6	SUBSYSTEM COST/SCHEDULE MONITOR	03	30	4,217	367	397	40	10%	**437**
30.06	CONCEPTUAL/PRELIMINARY DESIGN	02	208	24,525	1,712	1,920	826	43%	**2,746**

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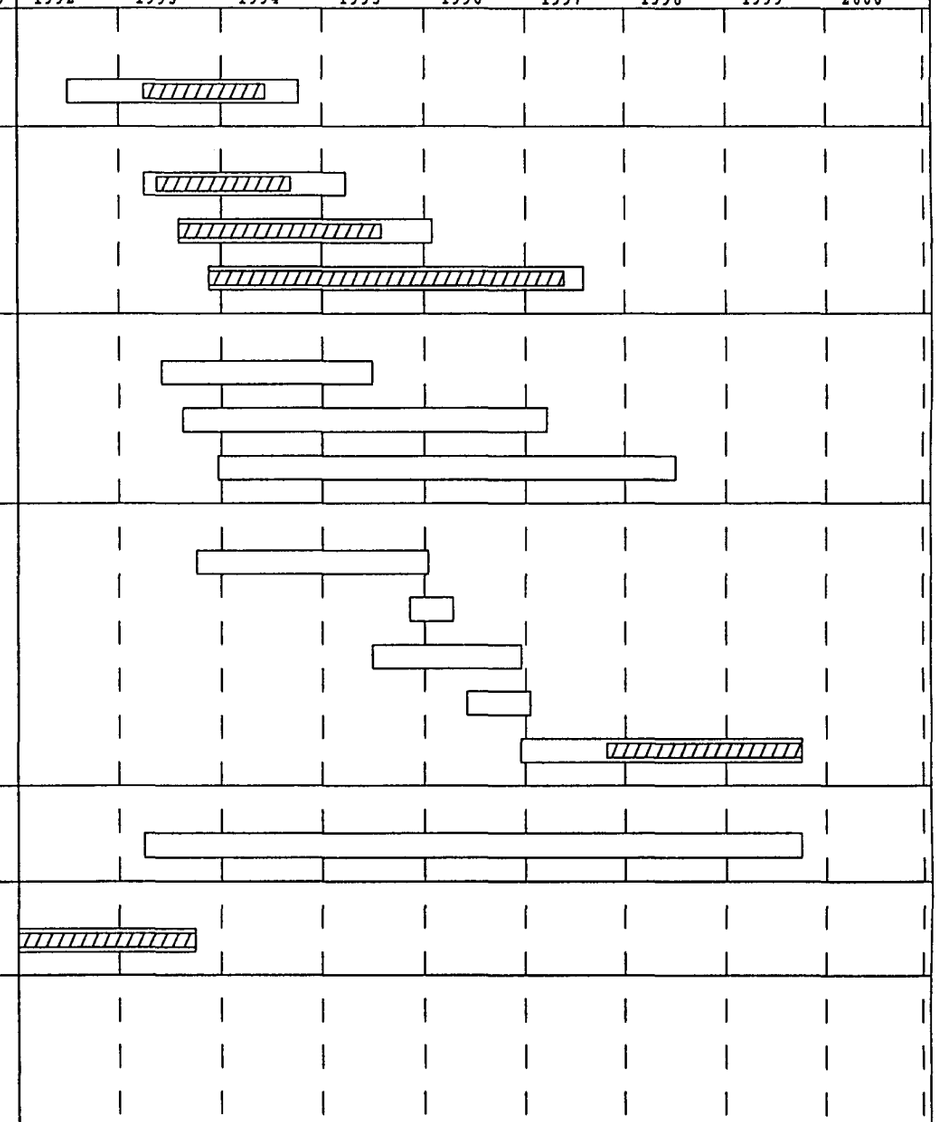
LEVEL II SUMMARY BASELINE SCHEDULE

30 MUON SUBSYSTEM

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
WBS:30.01 RESEARCH & DEVELOPMENT			
DESIGN	01JUL92	06OCT94	
WBS:30.02 BARREL REGION			
DESIGN	01APR93	24MAR95	
FABRICATION	03AUG93	26JAN96	
ASSEMBLY	18NOV93	29JUL97	
WBS:30.03 END CAP REGION			
DESIGN	02JUN93	26JUN95	
FABRICATION	18AUG93	18MAR97	
ASSEMBLY	20DEC93	29JUN98	
WBS:30.04 INSTALLATION			
DESIGN	04OCT93	11JAN96	
PROCUREMENT	09NOV95	10APR96	
FABRICATION	27JUN95	12DEC96	
ASSEMBLY	30MAY96	15JAN97	
INSTALLATION	13DEC96	30SEP99	
WBS:30.05 PROJECT MANAGEMENT			
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
WBS:30.06.0 CONCEPTUAL/PRELIMINARY DESIGN			
DESIGN	01AUG91	29SEP93	



Legend
Baseline
Critical
Float
Baseline Projected Actual

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LEVEL III SUMMARY BASELINE SCHEDULE

30 MUON SUBSYSTEM

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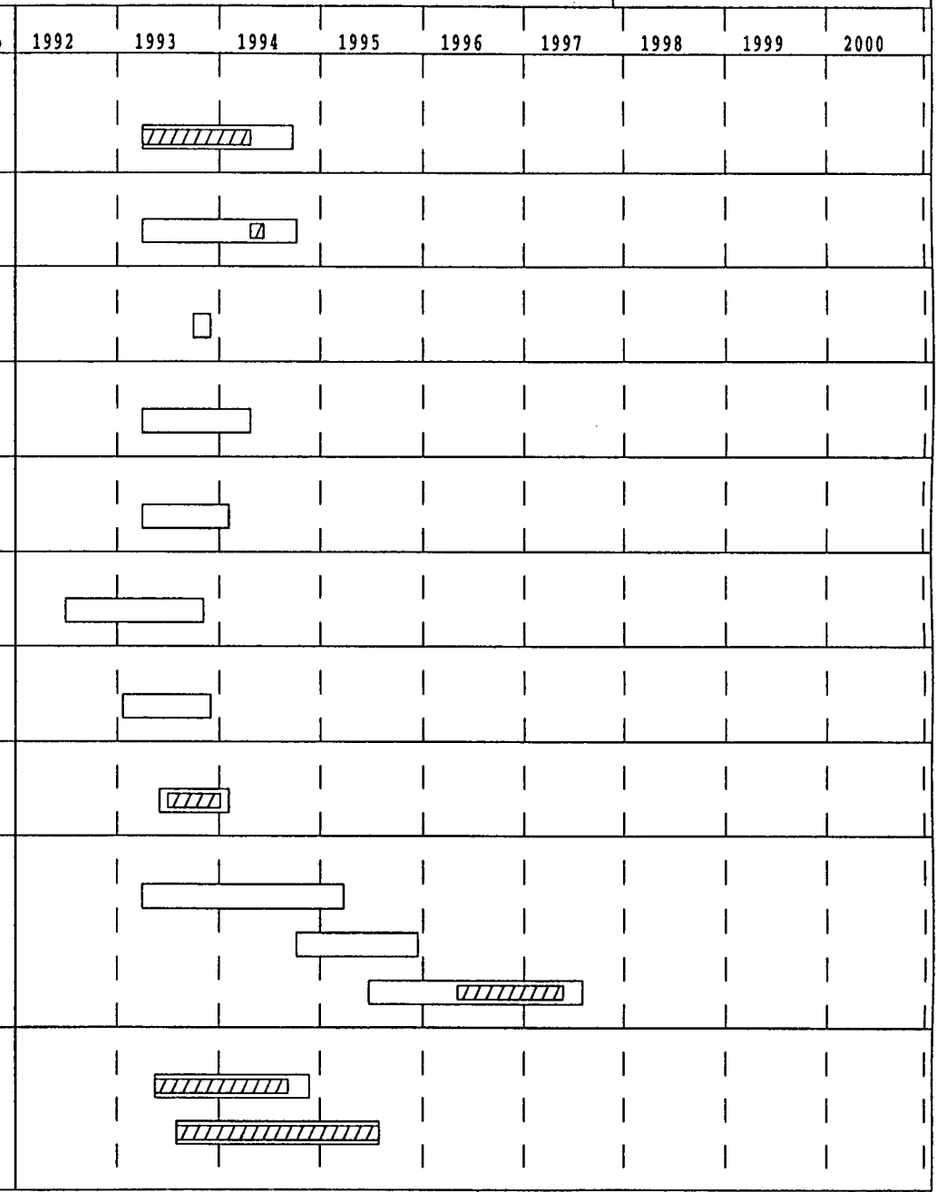
Summary Description	Baseline	Start/Finish	%Comp
WBS:30.01.1 DEVELOP CHAMBER TECHNOLOGIES			
DESIGN	01APR93	21SEP94	
WBS:30.01.2 CHAMBER PERFORMANCE EVALUATION			
DESIGN	01APR93	06OCT94	
WBS:30.01.3 MUON TRIGGER			
DESIGN	30SEP93	30NOV93	
WBS:30.01.4 ALIGNMENT TECHNOLOGY			
DESIGN	01APR93	20APR94	
WBS:30.01.5 ELECTRONICS EVALUATION			
DESIGN	01APR93	02FEB94	
WBS:30.01.6 SIMULATIONS			
DESIGN	01JUL92	04NOV93	
WBS:30.01.7 RESERVED			
DESIGN	20JAN93	30NOV93	
WBS:30.01.8 ENGINEERING (STRUCTURES, COSTS, ETC.)			
DESIGN	02JUN93	02FEB94	
WBS:30.02.1 BARREL REGION MODULE ASSEMBLY			
DESIGN	01APR93	24MAR95	
FABRICATION	07OCT94	12DEC95	
ASSEMBLY	23JUN95	29JUL97	
WBS:30.02.2 CATHODE STRIP CHAMBERS			
DESIGN	18MAY93	22NOV94	
FABRICATION	03AUG93	28JUL95	



Legend: Baseline, Critical, Float, ☆ Baseline, ▽ Projected, ▼ Actual

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30 MUON SUBSYSTEM

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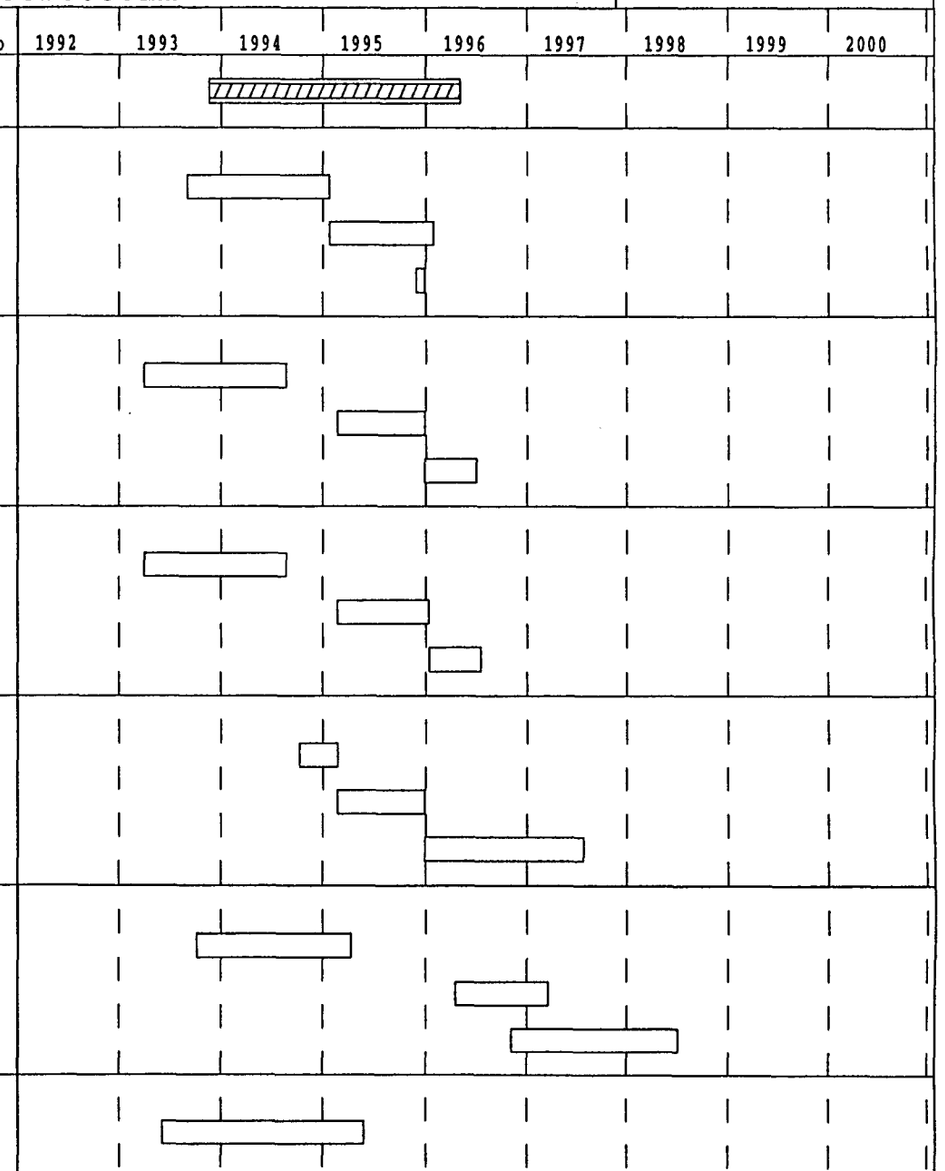
Summary Description	Baseline	Start/Finish	%Comp
ASSEMBLY	18NOV93	01MAY96	
WBS:30.02.3 MODULE SUPPORT STRUCTURES			
DESIGN	02SEP93	23JAN95	
FABRICATION	24JAN95	26JAN96	
ASSEMBLY	28NOV95	27DEC95	
WBS:30.02.5 GAS SYSTEMS			
DESIGN	01APR93	19AUG94	
FABRICATION	22FEB95	26DEC95	
ASSEMBLY	27DEC95	27JUN96	
WBS:30.02.6 COOLING SYSTEM			
DESIGN	01APR93	19AUG94	
FABRICATION	22FEB95	10JAN96	
ASSEMBLY	11JAN96	12JUL96	
WBS:30.02.7 LOCAL ALIGNMENT			
DESIGN	07OCT94	21FEB95	
FABRICATION	22FEB95	26DEC95	
ASSEMBLY	27DEC95	22JUL97	
WBS:30.03.1 END CAP REGION MODULE ASSEMBLY			
DESIGN	04OCT93	10APR95	
FABRICATION	15APR96	18MAR97	
ASSEMBLY	31OCT96	29JUN98	
WBS:30.03.2 CATHODE STRIP CHAMBERS			
DESIGN	02JUN93	25MAY95	



Legend
Baseline
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Baseline Projected Actual

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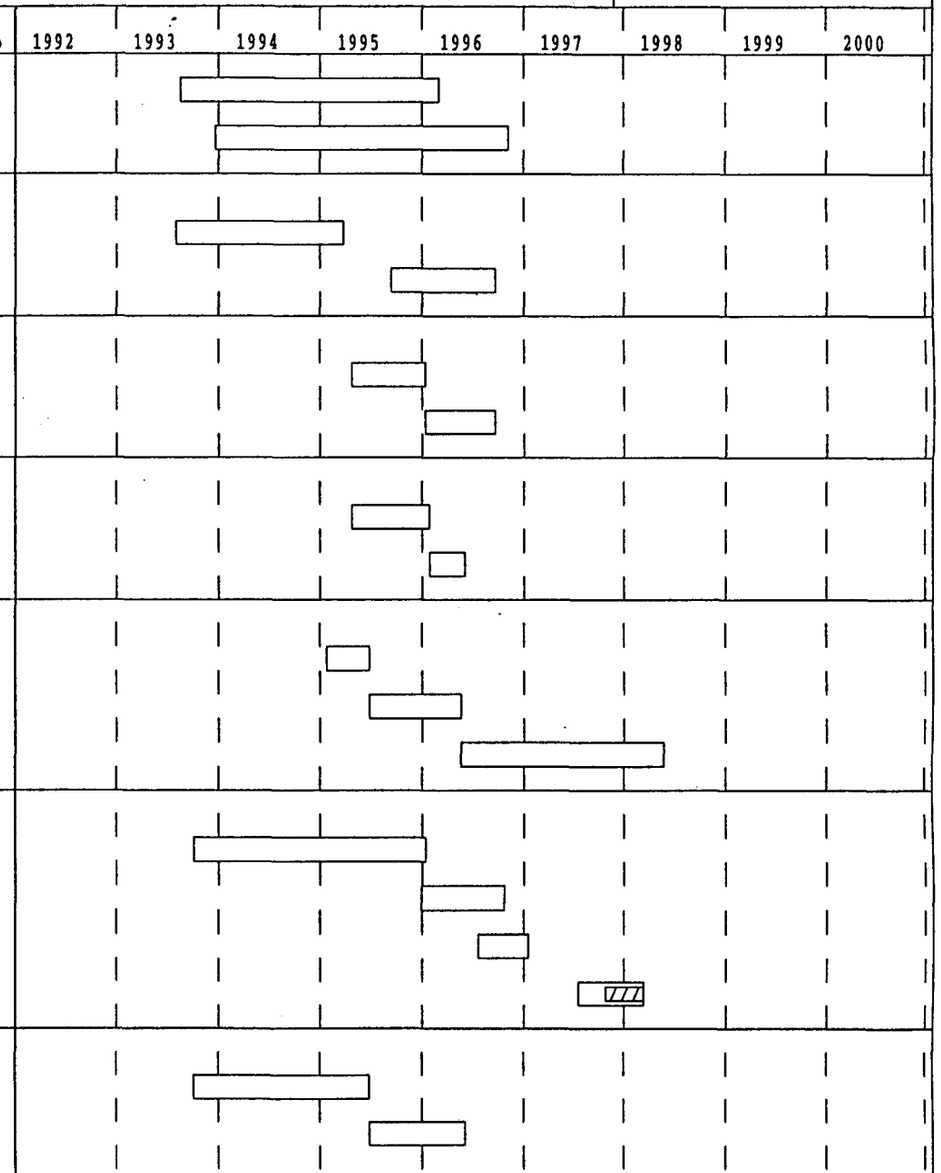
LEVEL III SUMMARY BASELINE SCHEDULE

30 MUON SUBSYSTEM

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
FABRICATION	18AUG93	27FEB96	
ASSEMBLY	20DEC93	30OCT96	
WBS:30.03.3 MODULE SUPPORT STRUCTURES			
DESIGN	03AUG93	24MAR95	
FABRICATION	12SEP95	13SEP96	
WBS:30.03.5 GAS SYSTEM			
FABRICATION	25APR95	10JAN96	
ASSEMBLY	11JAN96	12SEP96	
WBS:30.03.6 COOLING SYSTEM			
FABRICATION	25APR95	25JAN96	
ASSEMBLY	26JAN96	28MAY96	
WBS:30.03.7 LOCAL ALIGNMENT			
DESIGN	24JAN95	26JUN95	
FABRICATION	27JUN95	14MAY96	
ASSEMBLY	15MAY96	21MAY98	
WBS:30.04.1 BARREL REGION			
DESIGN	04OCT93	11JAN96	
FABRICATION	28DEC95	15OCT96	
ASSEMBLY	16JUL96	15JAN97	
INSTALLATION	15JUL97	10MAR98	
WBS:30.04.2 END CAP REGION			
DESIGN	04OCT93	26JUN95	
FABRICATION	27JUN95	29MAY96	



Legend: Baseline, Critical, Float, Baseline, Projected, Actual

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30 MUON SUBSYSTEM

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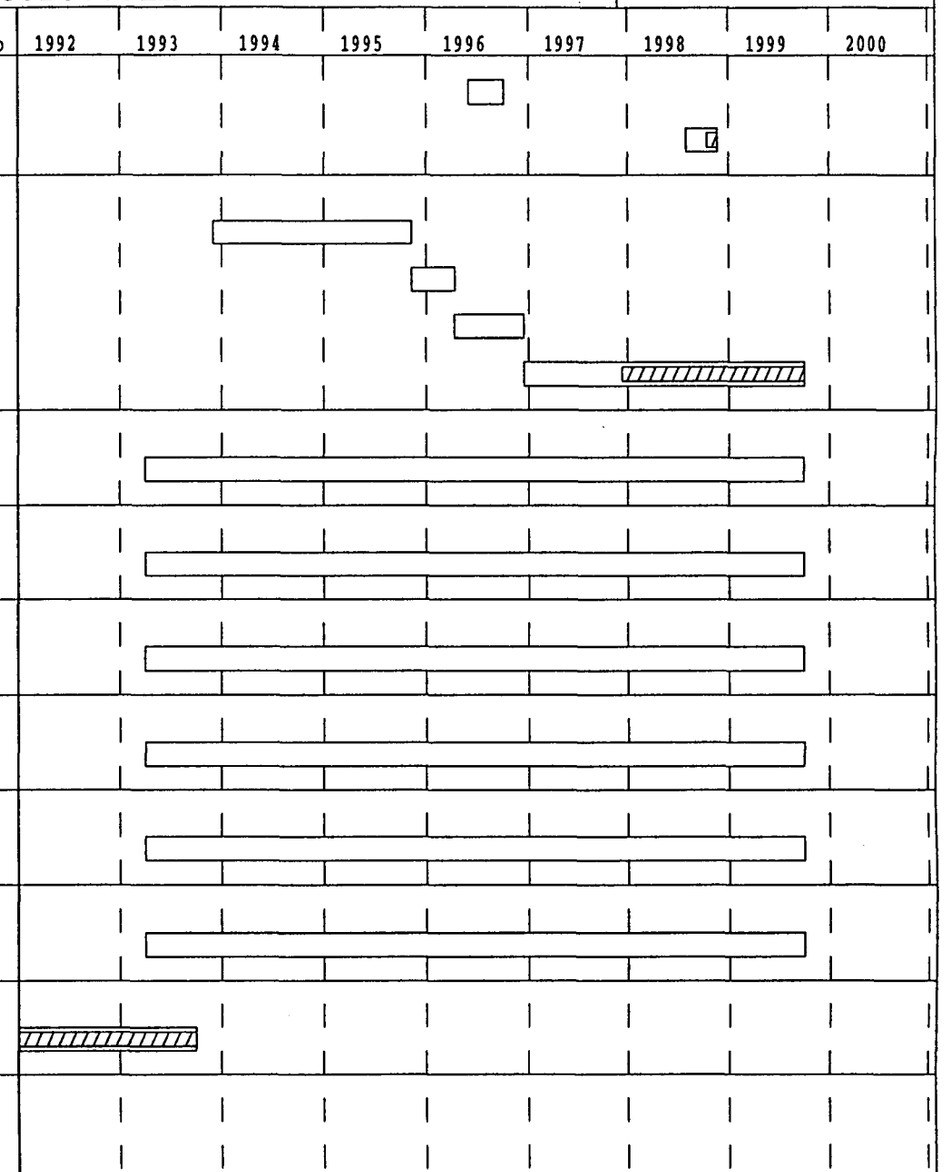
Summary Description	Baseline	Start/Finish	%Comp
ASSEMBLY	30MAY96	30SEP96	
INSTALLATION	30JUL98	19NOV98	
WBS:30.04.3 GLOBAL ALIGNMENT			
DESIGN	01DEC93	08NOV95	
PROCUREMENT	09NOV95	10APR96	
FABRICATION	11APR96	12DEC96	
INSTALLATION	13DEC96	30SEP99	
WBS:30.05.1 ADMINISTRATION/OVERSIGHT			
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
WBS:30.05.2 RESOURCE MANAGEMENT			
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
WBS:30.05.3 ES&H ASSURANCE			
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
WBS:30.05.4 QUALITY ASSURANCE PROGRAM			
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
WBS:30.05.5 SYSTEMS INTEGRATION			
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
WBS:30.05.6 SUBSYSTEM COST/SCHEDULE MONITOR			
LEVEL OF EFFORT (LOE)	01APR93	28SEP99	
WBS:30.06.0 CONCEPTUAL/PRELIMINARY DESIGN			
DESIGN	01AUG91	29SEP93	



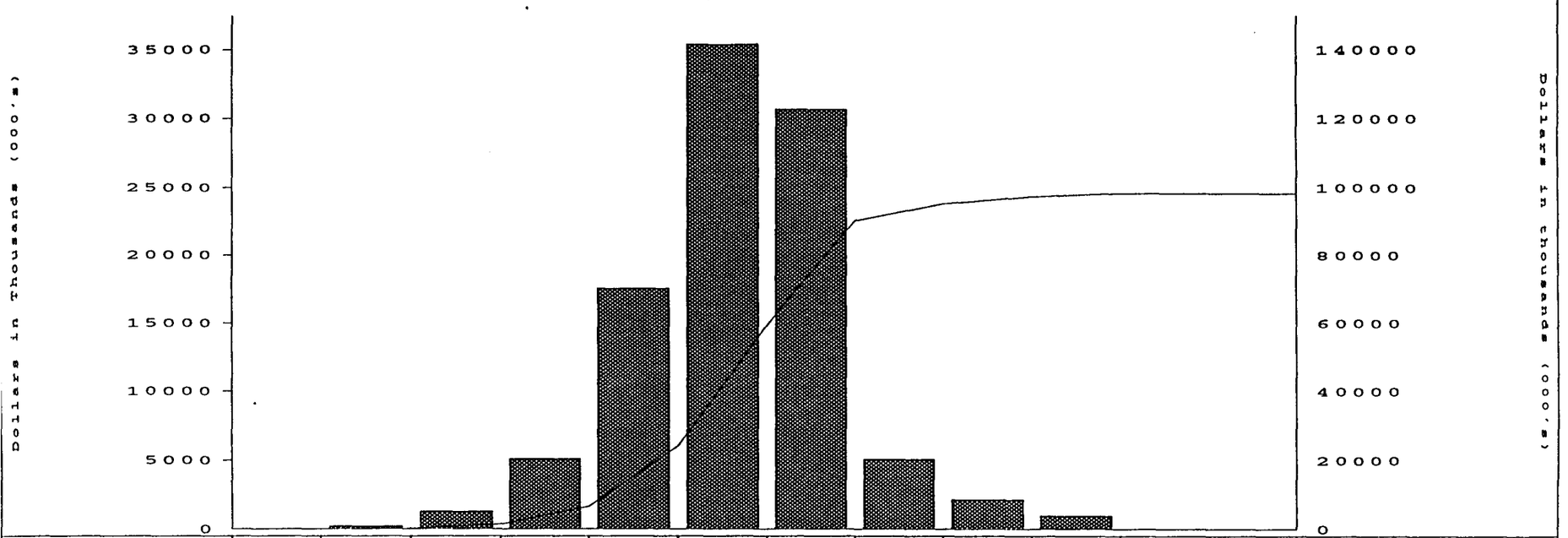
Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

GEM Detector Report: GEM_FY	GEM DETECTOR WBS 30 - MUON SUBSYSTEM	Date: 27APR93 Project: MUON



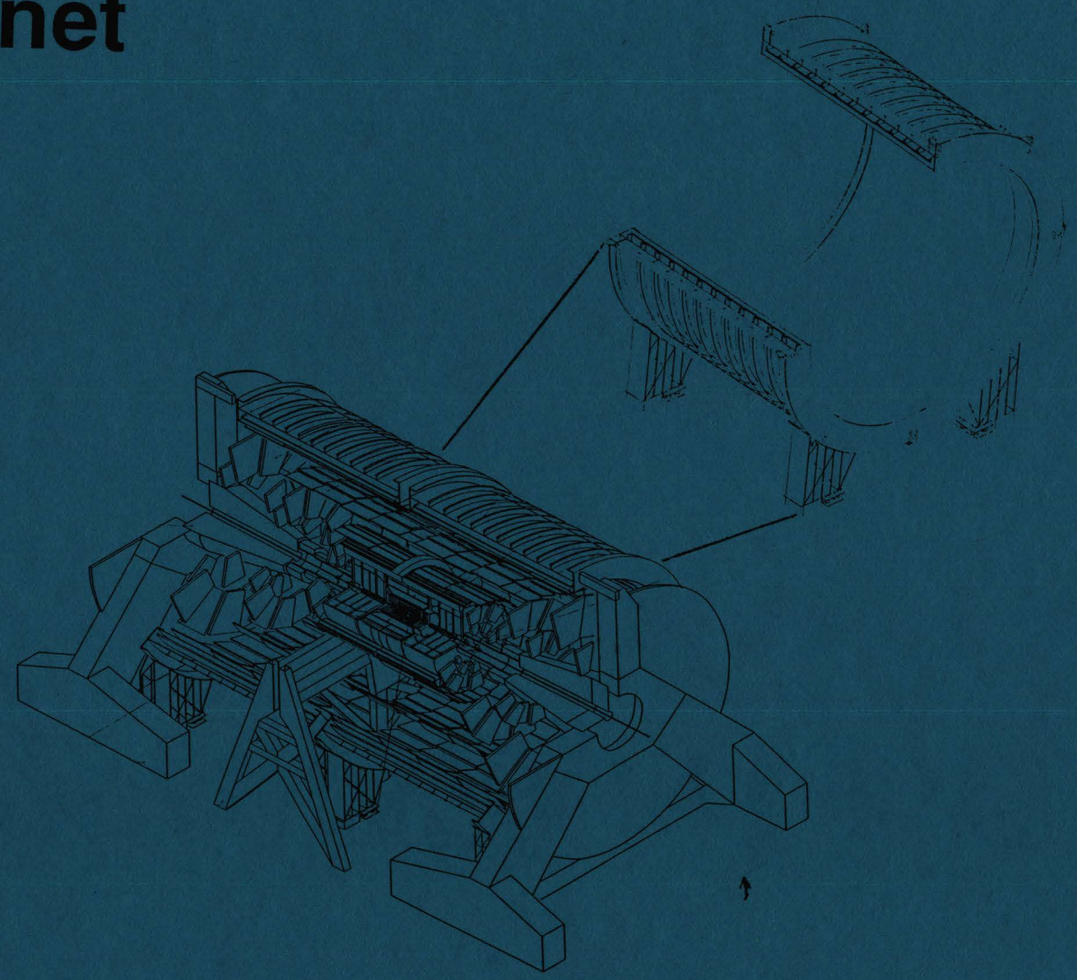
		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
Incr Bud	$10k	21	128	512	1755	3531	3064	508	216	98		
Cum. Bud	$10k	21	149	662	2417	5948	9012	9521	9737	9834	9835	9835

WBS 30.01.1	$2,257,151	DEVELOP CHAMBER TECHNOLOGIES
WBS 30.01.2	$ 460,354	CHAMBER PERFORMANCE EVALUATION
WBS 30.01.3	$ 170,653	MUON TRIGGER
WBS 30.01.4	$ 308,563	ALIGNMENT TECHNOLOGY
WBS 30.01.5	$ 325,513	ELECTRONICS EVALUATION
WBS 30.01.6	$ 83,537	SIMULATIONS
WBS 30.01.7	$ 489,795	RESERVED
WBS 30.01.8	$2,412,522	ENGINEERING (STRUCTURES, COSTS, ETC.)
WBS 30.02.1	$5,304,672	BARREL REGION MODULE ASSEMBLY
WBS 30.02.2	$35,945,432	CATHODE STRIP CHAMBERS
WBS 30.02.3	$6,751,350	MODULE SUPPORT STRUCTURES
WBS 30.02.5	$1,668,086	GAS SYSTEMS
WBS 30.02.6	$2,111,533	COOLING SYSTEM
WBS 30.02.7	$5,035,403	LOCAL ALIGNMENT
WBS 30.03.1	$1,866,627	END CAP REGION MODULE ASSEMBLY
WBS 30.03.2	$12,995,277	CATHODE STRIP CHAMBERS

GEM DETECTOR
WBS 30 - MUON SUBSYSTEM

		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	
WBS 30.03.3	$3,456,543												MODULE SUPPORT STRUCTURES
WBS 30.03.5	$ 689,488												GAS SYSTEM
WBS 30.03.6	$ 994,541												COOLING SYSTEM
WBS 30.03.7	$2,525,334												LOCAL ALIGNMENT
WBS 30.04.1	$2,647,750												BARREL REGION
WBS 30.04.2	$1,793,004												END CAP REGION
WBS 30.04.3	$1,203,381												GLOBAL ALIGNMENT
WBS 30.05.1	$1,774,343												ADMINISTRATION/OVERSIGHT
WBS 30.05.2	$ 251,061												RESOURCE MANAGEMENT
WBS 30.05.3	$ 502,490												ES&H ASSURANCE
WBS 30.05.4	$ 703,866												QUALITY ASSURANCE PROGRAM
WBS 30.05.5	$ 436,490												SYSTEMS INTEGRATION
WBS 30.05.6	$ 436,490												SUBSYSTEM COST/SCHEDULE M
WBS 30.06.0													CONCEPTUAL/PRELIMINARY DESIGN

Magnet



gem

γeμ

Superconducting ***Super Collider***

gem DETECTOR PROJECT

Magnet General Physical Parameters Table

Central Induction	0.80 T
Inner Radius, Magnet Subsystem	9.00 m
Overall Outer Radius (Outside Ribs)	10.9 m
Number of Coil/Cryostat Assemblies	2
Central Membrane Maximum Z	300 mm
Cryostat Inner End Minimum Z	400 mm
Cryostat Outer End Maximum Z	15.5 m
Magnet Axis Height Above Hall Floor	13.0 m
Operating Current	50.2 kA
Maximum Allowed Operating Current	51.0 kA
Stored Energy	2.5 GJ
Inductance	1.98 H
Number of Turns	456

Magnet Cold Mass Parameters Table

Mean Radius of Windings	9.50 m
Length, End to End (per Half)	14.25 m
Axial Force on Conductor (each Half)	52 MN
Inner Radius of Inner Ground Warp	9.456 m
Inner Radius of Conductor	9.466 m
Mean Radius of Conductor	9.5 m
Outer Radius of Conductor	9.534 m
Bobbin Inner Radius	9.544 m
Bobbin Outer Radius	9.620 m
Bobbin Minimum Z	750 mm
Winding Minimum Z	804 mm
Winding Maximum Z	14.946 m
Bobbin Maximum Z	15.000 m
Conductor Length (total)	27,219 m
Total Mass of Coil Windings (per Half)	159 Mg
Total Mass Cold 4.5 degree K Structure (per Half)	526 Mg

SENSITIVE

gem DETECTOR PROJECT

Magnet Vacuum Vessel and Internal Component Parameters Table

Cryostat Vessel Length (each Half)	15.1 m
Inner Radius, Magnet Subsystem	9.00 m
(excluding muon attachments)	
Overall Radius (Outside Longerons)	10.9 m
(excluding lift eyes and utility connections)	
Inner Radius of Inner Cryostat Vessel	9.10 m
Outer Radius of Inner Cryostat Vessel	9.1255 m
Inner Radius of Inner LN Shield (Avg.)	9.230 m
Outer Radius of Inner LN Shield (Avg.)	9.993 m
Inner Radius of Outer LN Shield (Avg.)	9.998 m
Outer Radius of Outer LN Shield (Avg.)	9.803 m
Inner Radius of Outer Cryostat Vessel	10.1 m
Outer Radius of Outer Cryostat Vessel	10.125 m
Overall Outer Radius (Outside Longerons)	10.9 m
Cryostat Inner End Minimum Z	400 mm
Cryostat Inner End Maximum Z	476.2 mm
Cryostat Outer End Minimum Z	15.424 m
Cryostat Outer End Maximum Z	15.5 m

Thickness of Inner Vessel	25.5 mm
Thickness of Outer Vessel	25.5 mm
Thickness of Inner Thermal Shield	3.2 mm
Thickness of Outer Thermal Shield	3.2 mm
Height of Outer Circumferential Ribs	406.2 mm
Number of Circumferential Ribs per Coil Assembly	10
Width of Flange on Circumferential Ribs	254 mm
Thickness of Web on Circumferential Ribs	9.52 mm
Height of Longerons	825.2 mm
Number of Longerons	8
Thickness of Longeron Web	76.2 mm
Width of Longeron Flanges	254 mm
Thickness of Longeron Flanges	25.4 mm
Thickness of Vessel Ends	76.2 mm
LN Shield Minimum Z	527 mm
LN Shield Maximum Z	15.343 m
Total Mass of Cryostat Vessel (each Half)	818 Mg

SENSITIVE

gem DETECTOR PROJECT

Magnet Forward Field Shaper (FFS) Parameters Table

Minimum Z	10 m
Minimum Z, Overall	18 m
Outer Radius at Minimum Z	1,402 mm
Included Angle (Tapered Section)	18.8 deg
Tapered Section Maximum Z	16.5 m
Outer Radius, Cylindrical Section	2,478 mm
Axial (Z) Location to Which Cone is Projective	1,531 mm
Inner Radius (Clear Bore)	0.6 m
Axial Force on Forward Field Shaper	12.2 MN
Forward Field Shaper Mass	899 Mg
Forward Field Shaper Support Mass	985 Mg
Total Mass of FFS and Support (each Half)	1,884 Mg

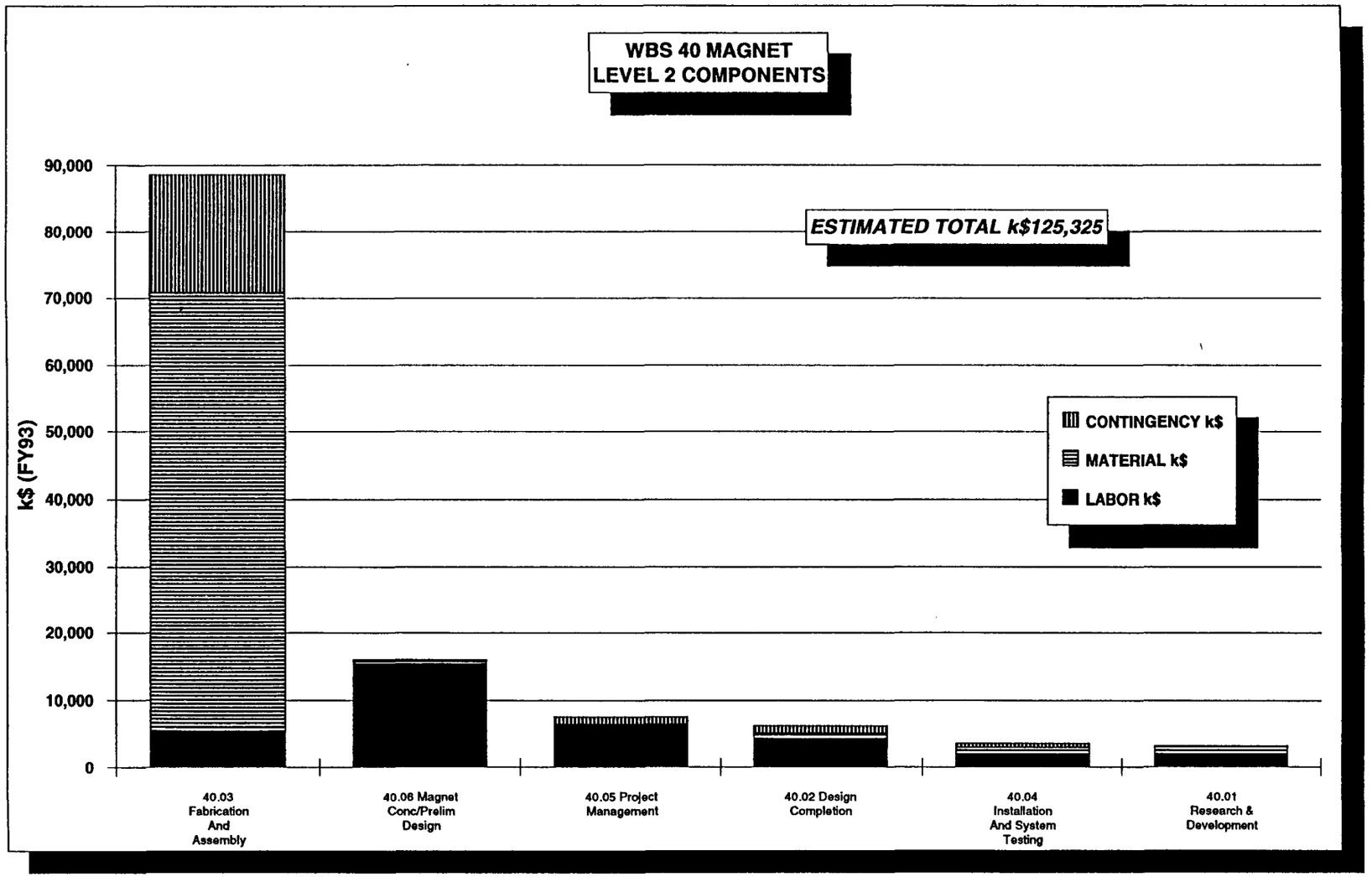
Magnet Component Parameters Table

Total Mass of Magnet Assembly (each Half)		1,378 Mg
Cold Mass (Total)		1,052 Mg
Cold Mass (Total, each Half)		560 Mg
	Per Module	**Total**
Coil Component Masses		
Bobbin	14,882 kg	357,159 kg
Compression Flanges	13,875 kg	333,012 kg
Conductor Aluminum Sheath	7,986 kg	191,671 kg
Conductor Conduit	1,607 kg	38,576 kg
Conductor Cable	1,814 kg	43,528 kg
Turn Insulation	1,846 kg	44,300 kg
Ground Warp	1,819 kg	43,650 kg
Number of Turns per Module	19	456
Total Coil Module Mass	43,829 kg	
Number of Coil Modules per Magnet Half	12	
Total Mass of Coil Windings (per Half)	159 Mg	
Total Mass of Cryostat Vessel (each Half)	818 Mg	
Total Mass of FFS and Support (each Half)	1,884 Mg	

SENSITIVE

SENSITIVE

4/26/93



GEM DETECTOR PROJECT

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

IAGNET SUBSYSTEM

'BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
)	-MAGNET	01	64,787	348,234	33,232	98,019	6,029	6%	21,277	21%	125,325
).01	-RESEARCH & DEVELOPMENT	02	1,563	0	1,641	3,204	0	0%	64	2%	3,268
).01.1	CONDUCTOR DEVELOPMENT	03	771	0	807	1,578	0	0%	32	2%	1,609
).01.2	JOINT DEVELOPMENT	03	221	0	526	747	0	0%	15	2%	762
).01.3	WINDING DEVELOPMENT	03	571	0	309	880	0	0%	18	2%	897
).01.4	COMPONENT DEVELOPMENT (RESERVED)	03	0	0	0	0	0	0%	0	0%	0
).02	-DESIGN COMPLETION	02	922	58,575	3,796	4,718	374	8%	1,136	22%	6,227
).02.1	-COIL ASSEMBLIES DESIGN	03	524	28,105	1,822	2,346	186	8%	648	26%	3,180
).02.1.1	-COLD MASS SUBASSEMBLIES DESIGN	04	162	10,467	678	840	67	8%	257	28%	1,164
).02.1.1.1	COIL FORM DESIGN	05	33	1,359	88	121	10	8%	33	25%	163
).02.1.1.2	CONDUCTOR DESIGN	05	54	1,453	92	146	12	8%	40	25%	197
).02.1.1.3	DIAGNOSTICS DESIGN	05	4	254	16	20	2	8%	7	30%	29
).02.1.1.4	WINDING TOOLING DESIGN	05	25	2,614	170	195	15	8%	59	28%	269
).02.1.1.5	WINDING/TESTING DESIGN	05	0	147	9	9	1	8%	3	31%	13
).02.1.1.6	COLD MASS ASSEMBLY/TOOLING DESIGN	05	23	2,840	185	208	17	8%	70	31%	294
).02.1.1.7	COLD MASS ASSEMBLY/TESTING DESIGN	05	23	1,800	118	141	11	8%	47	31%	199
.02.1.2	-VACUUM VESSEL SUBASSEMBLIES DESIGN	04	150	7,593	493	643	51	8%	158	23%	851
.02.1.2.1	VESSEL SHELLS DESIGN	05	37	2,282	145	182	14	8%	45	23%	242
.02.1.2.2	VESSEL STIFFENERS DESIGN	05	37	1,600	105	142	11	8%	35	23%	189
.02.1.2.3	VESSEL SUPPORT STRUCTURES DESIGN	05	37	1,631	107	144	11	8%	36	23%	192
.02.1.2.4	VESSEL ASSEMBLY/TESTING DESIGN	05	37	2,080	136	174	14	8%	41	22%	229
.02.1.3	-CRYOSTAT SUBASSEMBLY DESIGN	04	137	4,471	287	424	34	8%	84	18%	542
.02.1.3.1	-THERMAL RADIATION SHIELDS DESIGN	05	67	1,555	99	166	13	8%	39	22%	218
.02.1.3.1.1	LN THERMAL RADIATION SHIELDS D	06	46	774	49	95	8	8%	23	22%	125
.02.1.3.1.2	SUPERINSULATION DESIGN	06	8	234	15	23	2	8%	3	12%	28

FY93 U.S. Dollars

IAGNET SUBSYSTEM

'BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
).02.1.3.1.3	SHIELD SUPPORTS/THERMAL INTERC	06	13	547	35	48	4	8%	13	26%	65
).02.1.3.2	-COLD MASS SUPPORTS DESIGN	05	42	1,094	70	112	9	8%	21	17%	141
).02.1.3.2.1	RADIAL RODS DESIGN	06	21	547	35	56	4	8%	10	17%	71
).02.1.3.2.2	AXIAL RODS DESIGN	06	21	547	35	56	4	8%	10	17%	71
).02.1.3.3	-INTERNAL CRYOGENIC SYSTEMS DESIGN	05	25	1,261	82	106	8	8%	18	16%	133
).02.1.3.3.1	LN PIPING AND DISTRIBUTION DES	06	8	394	25	34	3	8%	6	16%	42
).02.1.3.3.2	LHe THERMOSYPHON PIPING/DIST D	06	8	474	31	39	3	8%	7	16%	49
).02.1.3.3.3	LHe FORCED FLOW PIPING/DIST DE	06	8	394	25	34	3	8%	6	16%	42
).02.1.3.4	CRYOGENIC CURRENT LEADS DESIGN	05	4	562	36	40	3	8%	6	14%	50
).02.1.4	-COIL ASSEMBLY/TESTING DESIGN	04	76	5,574	364	440	35	8%	149	31%	623
).02.1.4.1	COIL ASSEMBLY TESTING AND EQUIPME	05	26	2,200	144	170	14	8%	51	28%	235
).02.1.4.2	COIL ASSEMBLY DESIGN	05	42	2,427	158	200	16	8%	73	34%	289
).02.1.4.3	COIL TESTING DESIGN	05	8	947	61	70	6	8%	24	32%	99
).02.2	-FOR FIELD SHAPERS/SPPTS DESIGN	03	87	9,323	604	691	55	8%	121	16%	867
).02.2.1	FORWARD FIELD SHAPERS DESIGN	04	25	2,441	158	183	15	8%	32	16%	229
).02.2.2	FFS SUPPORT STRUCTURE DESIGN	04	62	6,415	417	479	38	8%	83	16%	600
).02.2.3	-ASSEMBLY DESIGN	04	0	467	30	30	2	8%	7	22%	39
).02.2.3.1	OFF-SITE ASSEMBLY DESIGN (RESERVE	05	0	0	0	0	0	0%	0	0%	0
).02.2.3.2	ON-SITE ASSEMBLY DESIGN	05	0	467	30	30	2	8%	7	22%	39
).02.3	RESERVED	03	0	0	0	0	0	0%	0	0%	0
).02.4	-POWER/PROTECTION SYSTEM DESIGN	03	17	1,729	112	128	10	8%	22	16%	160
).02.4.1	POWER SUPPLY DESIGN	04	8	441	29	37	3	8%	5	12%	45
).02.4.2	BUSWORK DESIGN (EFD)	04	0	0	0	0	0	0%	0	0%	0
).02.4.3	BREAKERS/DUMP RESISTORS DESIGN	04	4	682	44	48	4	8%	9	18%	61
).02.4.4	DISCHARGE RESISTOR & SWITCH DESIGN	04	4	606	39	44	3	8%	8	16%	54

GEM COST ESTIMATE SUMMARY

FY93 U.S. Dollars

IAGNET SUBSYSTEM

/BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
).02.5	-CRYOGENICS DESIGN (EFD)	03	0	0	0	0	0	0%	0	0%	0
).02.5.1	-LIQUID NITROGEN SYSTEM DESIGN (EFD)	04	0	0	0	0	0	0%	0	0%	0
).02.5.1.1	LN STORAGE DEWAR DESIGN (EFD)	05	0	0	0	0	0	0%	0	0%	0
).02.5.1.2	SUBCOOLER DESIGN (EFD)	05	0	0	0	0	0	0%	0	0%	0
).02.5.1.3	LN PIPING AND DISTRIBUTION DESIGN	05	0	0	0	0	0	0%	0	0%	0
).02.5.2	-LIQUID HELIUM SYSTEM DESIGN (EFD)	04	0	0	0	0	0	0%	0	0%	0
).02.5.2.1	-LIQUID HELIUM SUPPLY DESIGN (EFD)	05	0	0	0	0	0	0%	0	0%	0
).02.5.2.1.1	HELIUM REFRIGERATION DESIGN (E	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.1.2	LHe SUPPLY PIPING/DISTRIBUTION	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.1.3	-HELIUM RECOVERY SYSTEM DESIGN	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.1.3.1	GAS BAG & ASSOC COMP (EFD)	07	0	0	0	0	0	0%	0	0%	0
).02.5.2.1.3.2	RECOVERY COMPRESSOR (EFD)	07	0	0	0	0	0	0%	0	0%	0
).02.5.2.1.4	HELIUM PURIFICATION DESIGN (EF	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.1.5	GAS STORAGE DESIGN (EFD)	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.2	-THERMOSYPHON SYSTEM DESIGN (EFD)	05	0	0	0	0	0	0%	0	0%	0
).02.5.2.2.1	MAGNET STORAGE AND SUPPLY DEWA	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.2.2	LHe THERMOSYPHON DISTRIBUTION	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.3	-FORCED FLOW SYSTEM DESIGN (EFD)	05	0	0	0	0	0	0%	0	0%	0
).02.5.2.3.1	SUB-COOLER DESIGN (EFD)	06	0	0	0	0	0	0%	0	0%	0
).02.5.2.3.2	FORCED FLOW DISTRIBUTION DESIG	06	0	0	0	0	0	0%	0	0%	0
).02.6	-MAGNET VACUUM SYSTEM DESIGN	03	21	3,393	219	240	19	8%	30	11%	289
).02.6.1	VACUUM PUMPS DESIGN	04	5	1,033	68	73	6	8%	8	10%	87
).02.6.2	VACUUM PIPING DESIGN	04	16	2,360	152	167	13	8%	22	12%	202
).02.7	-MAGNET CONTROL SYSTEMS DESIGN	03	13	1,223	79	92	7	8%	17	17%	116
).02.7.1	POWER CONTROLS DESIGN	04	8	374	24	32	3	8%	6	16%	41

FY93 U.S. Dollars

IAGNET SUBSYSTEM

BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
.02.7.2	PROTECTION CONTROLS DESIGN	04	4	409	26	31	2	8%	5	16%	38
.02.7.3	CYROGENICS CONTROLS DESIGN (EFD)	04	0	0	0	0	0	0%	0	0%	0
.02.7.4	VACUUM CONTROLS DESIGN (EFD)	04	0	0	0	0	0	0%	0	0%	0
.02.7.5	QUENCH DET AND DIAG DESIGN (EFD)	04	0	441	29	29	2	8%	6	20%	37
.02.8	RETURN FIELD MITIGATION DESIGN	03	31	547	35	66	5	8%	11	16%	83
.02.9	-INSTALLATION TESTING/TOOLING DESIGN	03	230	14,255	924	1,154	91	8%	287	23%	1,533
.02.9.1	-INSTALLATION TOOLING DESIGN	04	121	10,123	657	777	62	8%	185	22%	1,023
.02.9.1.1	COIL ASSEMBLIES TOOLING DESIGN	05	57	4,128	268	325	26	8%	77	22%	427
.02.9.1.2	RESERVED	05	0	0	0	0	0	0%	0	0%	0
.02.9.1.3	FORWARD FIELD SHAPERS TOOLING DES	05	47	4,128	268	314	25	8%	75	22%	414
.02.9.1.4	TESTING EQUIPMENT DESIGN	05	17	1,867	122	138	11	8%	33	22%	182
.02.9.2	-INSTALLATION DESIGN	04	109	4,132	268	377	30	8%	103	25%	509
.02.9.2.1	SOLENOID MAGNET INSTALLATION DESI	05	94	2,952	192	285	23	8%	80	26%	388
.02.9.2.2	PPS INSTALLATION DESIGN (RESERVED	05	0	0	0	0	0	0%	0	0%	0
.02.9.2.3	-CYROGENICS SYSTEM INSTALLATION DE	05	0	0	0	0	0	0%	0	0%	0
.02.9.2.3.1	LN SYSTEM INSTALLATION DESIGN	06	0	0	0	0	0	0%	0	0%	0
.02.9.2.3.2	LHe SYSTEM INSTALLATION DESIGN	06	0	0	0	0	0	0%	0	0%	0
.02.9.2.4	VACUUM SYSTEM INSTALLATION DESIGN	05	16	1,180	76	91	7	8%	23	23%	121
.02.9.2.5	CONTROL SYSTEM INSTALLATION DESIG	05	0	0	0	0	0	0%	0	0%	0
.02.9.3	TESTING DESIGN (RESERVED)	04	0	0	0	0	0	0%	0	0%	0
.03	-FABRICATION AND ASSEMBLY	02	60,749	159,177	4,883	65,632	5,059	8%	17,940	25%	88,631
.03.1	-COIL ASSEMBLIES FAB/ASSY	03	38,935	144,339	4,304	43,239	3,333	8%	11,885	26%	58,457
.03.1.1	-COLD MASS SUBASSEMBLIES FAB/ASSY	04	19,380	98,663	2,850	22,230	1,713	8%	6,453	27%	30,396
.03.1.1.1	COIL FORM FAB/ASSY	05	9,084	1,136	69	9,153	706	8%	2,465	25%	12,323
.03.1.1.2	CONDUCTOR FAB/ASSY	05	7,663	3,964	150	7,813	602	8%	2,104	25%	10,519

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

MAGNET SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
0.03.1.1.3	DIAGNOSTICS FAB/ASSY	05	27	0	0	27	2	8%	9	30%	38
0.03.1.1.4	WINDING TOOLING FAB/ASSY	05	1,184	13,142	349	1,533	118	8%	578	35%	2,229
0.03.1.1.5	WINDING/TESTING	05	987	47,940	1,299	2,285	176	8%	763	31%	3,224
0.03.1.1.6	COLD MASS ASSEMBLY/TOOLING FAB/AS	05	156	0	0	156	12	8%	59	35%	227
0.03.1.1.7	COLD MASS ASSEMBLY/TESTING	05	279	32,480	984	1,264	97	8%	476	35%	1,837
0.03.1.2	-VACUUM VESSEL SUBASSEMBLIES FAB/ASSY	04	11,567	5,145	310	11,877	916	8%	2,917	23%	15,710
0.03.1.2.1	VESSEL SHELLS FAB/ASSY	05	4,542	1,617	98	4,639	358	8%	1,149	23%	6,146
0.03.1.2.2	VESSEL STIFFENERS FAB/ASSY	05	3,282	1,029	62	3,344	258	8%	828	23%	4,430
0.03.1.2.3	VESSEL SUPPORT STRUCTURES FAB/ASS	05	2,296	735	44	2,340	180	8%	555	22%	3,075
0.03.1.2.4	ASSEMBLY/TESTING	05	1,448	1,764	106	1,554	120	8%	385	23%	2,059
0.03.1.3	-CRYOSTAT SUBASSEMBLY FAB/ASSY	04	3,854	2,051	124	3,977	307	8%	800	19%	5,084
0.03.1.3.1	-THERMAL RADIATION SHIELDS FAB/ASS	05	1,203	985	59	1,263	97	8%	305	23%	1,665
0.03.1.3.1.1	LN THERMAL RAD SHIELDS FAB/ASS	06	882	735	44	926	71	8%	219	22%	1,217
0.03.1.3.1.2	SUPERINSULATION FAB/ASSY	06	56	0	0	56	4	8%	7	12%	68
0.03.1.3.1.3	SHIELD SUP'TS/THERM. INTERCEPT	06	266	250	15	281	22	8%	79	26%	381
0.03.1.3.2	-COLD MASS SUPPORTS	05	2,464	934	56	2,520	194	8%	462	17%	3,176
0.03.1.3.2.1	RADIAL RODS FAB/ASSY	06	914	659	40	954	74	8%	175	17%	1,202
0.03.1.3.2.2	AXIAL RODS FAB/ASSY	06	1,550	275	17	1,567	121	8%	287	17%	1,975
0.03.1.3.3	-INTERNAL CRYOGENIC SYSTEMS FAB/AS	05	24	132	8	32	3	8%	6	16%	40
0.03.1.3.3.1	LN PIPING AND DISTRIBUTION FAB	06	8	44	3	10	1	8%	2	16%	13
0.03.1.3.3.2	LHE THERMOSYPHON PIPING/DIST F	06	8	44	3	11	1	8%	2	16%	14
0.03.1.3.3.3	LHe FORCED FLOW PIPING/DIST FA	06	8	44	3	11	1	8%	2	16%	14
0.03.1.3.4	CRYOGENIC CURRENT LEADS FAB/ASSY	05	162	0	0	162	13	8%	28	16%	202
0.03.1.4	-COIL ASSEMBLY/TESTING	04	4,135	38,480	1,020	5,155	397	8%	1,715	31%	7,267
0.03.1.4.1	ASSY AND TEST EQUIPMENT FAB/ASSY	05	363	882	53	417	32	8%	126	28%	574

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MAGNET SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
0.03.1.4.2	ASSEMBLY	05	3,323	31,267	791	4,114	317	8%	1,374	31%	5,805
0.03.1.4.3	TESTING	05	449	6,331	176	624	48	8%	215	32%	888
0.03.2	-FOR FIELD SHAPERS/SPPTS FAB/ASSY	03	9,498	9,684	389	9,887	762	8%	3,156	30%	13,805
0.03.2.1	FORWARD FIELD SHAPERS FAB/ASSY	04	7,843	3,557	126	7,969	614	8%	1,373	16%	9,956
0.03.2.2	FFS SUPPORT STRUCTURE FAB/ASSY	04	1,645	2,352	142	1,787	138	8%	1,752	91%	3,677
0.03.2.3	-ASSEMBLY	04	10	3,775	121	132	10	8%	31	22%	173
0.03.2.3.1	OFF-SITE ASSEMBLY (RESERVED)	05	0	0	0	0	0	0%	0	0%	0
0.03.2.3.2	ON-SITE ASSEMBLY	05	10	3,775	121	132	10	8%	31	22%	173
0.03.3	RESERVED	03	0	0	0	0	0	0%	0	0%	0
0.03.4	-POWER/PROTECTION SYSTEM FAB/ASSY	03	1,046	0	0	1,046	81	8%	206	18%	1,332
0.03.4.1	POWER SUPPLY FAB/ASSY (EFD)	04	270	0	0	270	21	8%	35	12%	326
0.03.4.2	BUSWORK FAB/ASSY (EFD)	04	194	0	0	194	15	8%	63	30%	272
0.03.4.3	BREAKERS/DUMP RESISTORS FAB/ASSY	04	374	0	0	374	29	8%	73	18%	475
0.03.4.4	DISCHARGE RESISTOR & SWITCH FAB/ASSY	04	208	0	0	208	16	8%	36	16%	260
0.03.5	-CRYOGENICS FAB/ASSY	03	9,448	0	0	9,448	728	8%	2,305	23%	12,481
0.03.5.1	-LIQUID NITROGEN SYSTEM FAB/ASSY	04	624	0	0	624	48	8%	126	19%	798
0.03.5.1.1	LN STORAGE DEWAR FAB/ASSY	05	415	0	0	415	32	8%	72	16%	519
0.03.5.1.2	RESERVED	05	0	0	0	0	0	0%	0	0%	0
0.03.5.1.3	LN PIPING AND DISTRIBUTION FAB/AS	05	209	0	0	209	16	8%	54	24%	279
0.03.5.2	-LIQUID HELIUM SYSTEM FAB/ASSY	04	8,824	0	0	8,824	680	8%	2,179	23%	11,683
0.03.5.2.1	-LIQUID HELIUM SUPPLY FAB/ASSY	05	7,644	0	0	7,644	589	8%	1,909	23%	10,142
0.03.5.2.1.1	HELIUM REFRIGERATOR FAB/ASSY	06	6,230	0	0	6,230	480	8%	1,544	23%	8,254
0.03.5.2.1.2	LIQUID He SUPPLY PIPING FAB/AS	06	168	0	0	168	13	8%	43	24%	224
0.03.5.2.1.3	RESERVED	06	0	0	0	0	0	0%	0	0%	0
0.03.5.2.1.4	HELIUM PURIFICATION FAB/ASSY (	06	208	0	0	208	16	8%	54	24%	277

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
).03.5.2.1.5	GAS STORAGE FAB/ASSY (EFD)	06	1,038	0	0	1,038	80	8%	268	24%	1,387
).03.5.2.2	-THERMOSYPHON SYSTEM FAB/ASSY	05	948	0	0	948	73	8%	210	21%	1,231
).03.5.2.2.1	MAGNET STOR. AND SUP. DEWAR FA	06	540	0	0	540	42	8%	105	18%	686
).03.5.2.2.2	LHE THERMOSYPHON DISTRIBUTION	06	408	0	0	408	32	8%	106	24%	545
).03.5.2.3	-FORCED-FLOW SYSTEM FAB/ASSY	05	232	0	0	232	18	8%	60	24%	309
).03.5.2.3.1	LHe SUBCOOLER FAB/ASSY (EFD)	06	26	0	0	26	2	8%	7	24%	35
).03.5.2.3.2	FORCED-FLOW DISTRIBUTION FAB/A	06	206	0	0	206	16	8%	53	24%	275
).03.6	-MAGNET VACUUM SYSTEM FAB/ASSY	03	572	1,029	64	636	49	8%	78	11%	763
).03.6.1	VACUUM PUMPS FAB/ASSY	04	187	294	19	206	16	8%	22	10%	244
).03.6.2	VACUUM PIPING FAB/ASSY	04	385	735	44	430	33	8%	56	12%	518
).03.7	-MAGNET CONTROL SYSTEMS FAB/ASSY	03	263	0	0	263	20	8%	51	18%	334
).03.7.1	POWER CONTROLS FAB/ASSY	04	42	0	0	42	3	8%	7	16%	52
).03.7.2	PROTECTION CONTROLS FAB/ASSY	04	36	0	0	36	3	8%	6	16%	45
).03.7.3	CRYOGENICS CONTROLS FAB/ASSY	04	36	0	0	36	3	8%	9	22%	48
).03.7.4	VACUUM CONTROLS FAB/ASSY	04	71	0	0	71	6	8%	12	16%	89
).03.7.5	QENCH DET AND DIAG FAB/ASSY	04	78	0	0	78	6	8%	17	20%	101
).03.8	RETURN FIELD MITIGATION FAB/ASSY	03	52	0	0	52	4	8%	9	16%	65
).03.9	-INSTALLATION TESTING/TOOLING FAB/ASSY	03	935	4,126	126	1,061	82	8%	251	22%	1,394
).03.9.1	COIL ASSEMBLIES TOOLING FAB/ASSY	04	312	3,743	103	415	32	8%	98	22%	545
).03.9.2	RESERVED	04	0	0	0	0	0	0%	0	0%	0
).03.9.3	FORWARD FIELD SHAPERS TOOLING FAB/AS	04	260	294	18	277	21	8%	66	22%	364
).03.9.4	TESTING EQUIPMENT FAB/ASSY	04	363	88	5	369	28	8%	87	22%	485
).04	-INSTALLATION AND SYSTEM TESTING FAB/ASSY	02	987	58,302	1,784	2,770	214	8%	673	23%	3,656
).04.1	-INSTALLATION	03	961	47,767	1,316	2,277	176	8%	566	23%	3,018
).04.1.1	-SOLENOID MAGNET INSTALLATION	04	561	19,860	542	1,103	85	8%	309	26%	1,497

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WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
0.04.1.1.1	COIL ASSY	05	229	9,930	271	500	39	8%	140	26%	678
0.04.1.1.2	RESERVED	05	0	0	0	0	0	0%	0	0%	0
0.04.1.1.3	FFS	05	332	9,930	271	603	47	8%	169	26%	819
0.04.1.2	POWER/PROT SYS INST (EFD)	04	73	3,924	96	169	13	8%	26	14%	207
0.04.1.3	-CRYOGENIC SYSTEM INSTALLATION	04	156	8,820	216	372	29	8%	76	19%	476
0.04.1.3.1	LN SYSTEM INSTALLATION (EFD)	05	78	4,410	108	186	14	8%	38	19%	238
0.04.1.3.2	LHE SYSTEMS INSTALLATION (EFD)	05	78	4,410	108	186	14	8%	38	19%	238
0.04.1.4	VACUUM SYSTEM INSTALLATION	04	156	12,793	404	560	43	8%	139	23%	741
0.04.1.5	CONTROL SYSTEM INSTALLATION (EFD)	04	16	2,370	58	74	6	8%	17	22%	97
0.04.2	TESTING	03	26	10,534	468	494	38	8%	106	20%	638
0.04.3	OPERATION & MAINTENANCE PROCEDURE (RESE	03	0	0	0	0	0	0%	0	0%	0
0.05	-PROJECT MANAGEMENT	02	121	72,180	5,877	5,997	383	6%	1,160	18%	7,540
0.05.1	-PROJECT MGMT AND ADMIN	03	0	45,600	3,813	3,813	244	6%	811	20%	4,868
0.05.1.1	TECHNOLOGY TRANSFER (RESERVED)	04	0	0	0	0	0	0%	0	0%	0
0.05.1.2	ENGINEERING & MGMNT OVERSIGHT	04	0	45,600	3,813	3,813	244	6%	811	20%	4,868
0.05.2	PROJECT CONTROL	03	21	14,176	1,027	1,047	67	6%	167	15%	1,281
0.05.3	ES&H	03	25	3,544	296	321	21	6%	51	15%	393
0.05.4	QUALITY ASSURANCE	03	25	4,430	370	395	25	6%	63	15%	484
0.05.5	-SYSTEM ENGINEERING	03	50	4,430	370	420	27	6%	67	15%	514
0.05.5.1	REQUIREMENTS AND ANALYSIS	04	50	4,430	370	420	27	6%	67	15%	514
0.05.5.2	CONFIGURATION MANAGEMENT (RESERVED)	04	0	0	0	0	0	0%	0	0%	0
0.05.5.3	INTERFACE MANAGEMENT (RESERVED)	04	0	0	0	0	0	0%	0	0%	0
0.06	-MAGNET CONC/PRELIM DESIGN	02	446	0	15,252	15,698	0	0%	305	2%	16,002
0.06.1	PRE LOI ENGINEERING/DESIGN	03	0	0	475	475	0	0%	0	0%	475
0.06.2	-LOI TO TECH DESIGN REPORT (TDR)	03	446	0	14,777	15,223	0	0%	305	2%	15,527

GEM COST ESTIMATE SUMMARY

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MAGNET SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
0.06.2.1	-PRELIMINARY DESIGN	04	357	0	10,706	11,063	0	0%	221	2%	11,284
0.06.2.1.1	-SOLENOID MAGNET	05	311	0	10,166	10,477	0	0%	210	2%	10,687
0.06.2.1.1.1	-COIL ASSEMBLIES	06	302	0	9,861	10,163	0	0%	203	2%	10,366
0.06.2.1.1.1.1	-COIL SUBASSEMBLIES	07	219	0	8,634	8,853	0	0%	177	2%	9,030
0.06.2.1.1.1.1.1	COIL FORM	08	133	0	1,767	1,900	0	0%	38	2%	1,938
0.06.2.1.1.1.1.2	CONDUCTOR	08	47	0	3,646	3,693	0	0%	74	2%	3,767
0.06.2.1.1.1.1.3	RESERVED	08	0	0	0	0	0	0%	0	0%	0
0.06.2.1.1.1.1.4	WINDING TOOLING	08	39	0	3,222	3,261	0	0%	65	2%	3,326
0.06.2.1.1.1.2	THERMAL RADIATION SHIELDS	07	12	0	197	209	0	0%	4	2%	213
0.06.2.1.1.1.3	VACUUM VESSEL SUBASSEMBLIES	07	20	0	279	299	0	0%	6	2%	305
0.06.2.1.1.1.4	COLD MASS SUPPORTS	07	18	0	272	290	0	0%	6	2%	295
0.06.2.1.1.1.5	INTERNAL CRYOGENIC SYSTEMS	07	18	0	125	143	0	0%	3	2%	146
0.06.2.1.1.1.6	CRYOGENIC CURRENT LEADS	07	11	0	95	106	0	0%	2	2%	108
0.06.2.1.1.1.7	ASSY/TESTING EQUIPMENT	07	4	0	260	264	0	0%	5	2%	269
0.06.2.1.1.2	END POLES/SUPPORTS	06	9	0	281	290	0	0%	6	2%	296
0.06.2.1.1.3	DETECTOR SUPPORTS	06	0	0	24	24	0	0%	1	2%	25
0.06.2.1.2	POWER/PROTECTION SYSTEM	05	8	0	106	114	0	0%	2	2%	117
0.06.2.1.3	CRYOGENICS	05	18	0	176	194	0	0%	4	2%	198
0.06.2.1.4	VACUUM SYSTEM	05	3	0	36	39	0	0%	1	2%	40
0.06.2.1.5	MAGNET CONTROL SYSTEMS	05	12	0	100	112	0	0%	2	2%	114
0.06.2.1.7	INSTALLATION TOOLING	05	5	0	49	54	0	0%	1	2%	55
0.06.2.1.8	CONV/TECHNICAL FACILITIES	05	0	0	72	72	0	0%	2	2%	74
0.06.2.2	-ANALYSIS	04	89	0	559	648	0	0%	13	2%	661
0.06.2.2.1	MAGNETIC FIELD/FORCE ANAL	05	30	0	156	186	0	0%	4	2%	189
0.06.2.2.2	SYSTEM THERMAL ANAL	05	17	0	146	163	0	0%	3	2%	167

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IAGNET SUBSYSTEM

'BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Markup, k$	%	Contingency, k$	%	TOTAL, k$
).06.2.2.3	SYSTEM STRUCTURAL ANAL	05	42	0	209	251	0	0%	5	2%	256
).06.2.2.4	MAGNETIC SHIELDING ANAL	05	0	0	48	48	0	0%	1	2%	49
).06.2.2.5	RESERVED	05	0	0	0	0	0	0%	0	0%	0
).06.2.3	TDR PREPARATION	04	0	0	145	145	0	0%	3	2%	147
).06.2.4	MAGNET SUBSYS MGMT/INT	04	0	0	3,367	3,367	0	0%	67	2%	3,435

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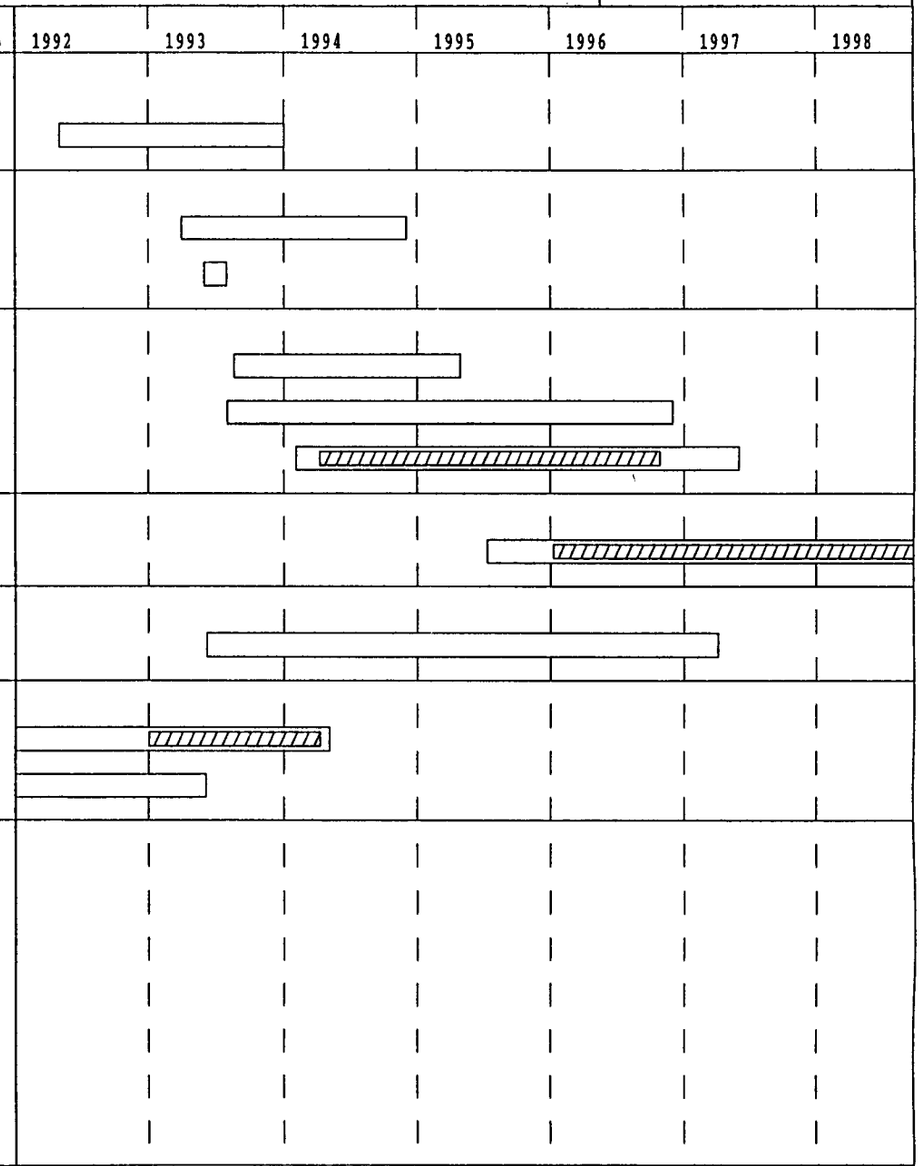
LEVEL II SUMMARY BASELINE SCHEDULE

40 GEM MAGNET

G E M DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
BS:40.01 RESEARCH & DEVELOPMENT			
DESIGN	01MAY92	31DEC93	
BS:40.02 DESIGN COMPLETION			
DESIGN	31MAR93	01DEC94	
PROCUREMENT	01JUN93	30JUL93	
BS:40.03 FABRICATION AND ASSEMBLY			
PROCUREMENT	20AUG93	26APR95	
FABRICATION	02AUG93	27NOV96	
ASSEMBLY	02FEB94	30MAY97	
BS:40.04 INSTALLATION AND SYSTEM TESTING			
INSTALLATION	07JUL95	30OCT98	
BS:40.05 PROJECT MANAGEMENT			
LEVEL OF EFFORT (LOE)	07JUN93	03APR97	
BS:40.06 MAGNET CONC/PRELIM DESIGN			
DESIGN	15AUG91	02MAY94	
LEVEL OF EFFORT (LOE)	02DEC91	04JUN93	



Legend: Baseline; Critical; Float; Baseline; Projected; Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

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Approved by

SENSITIVE

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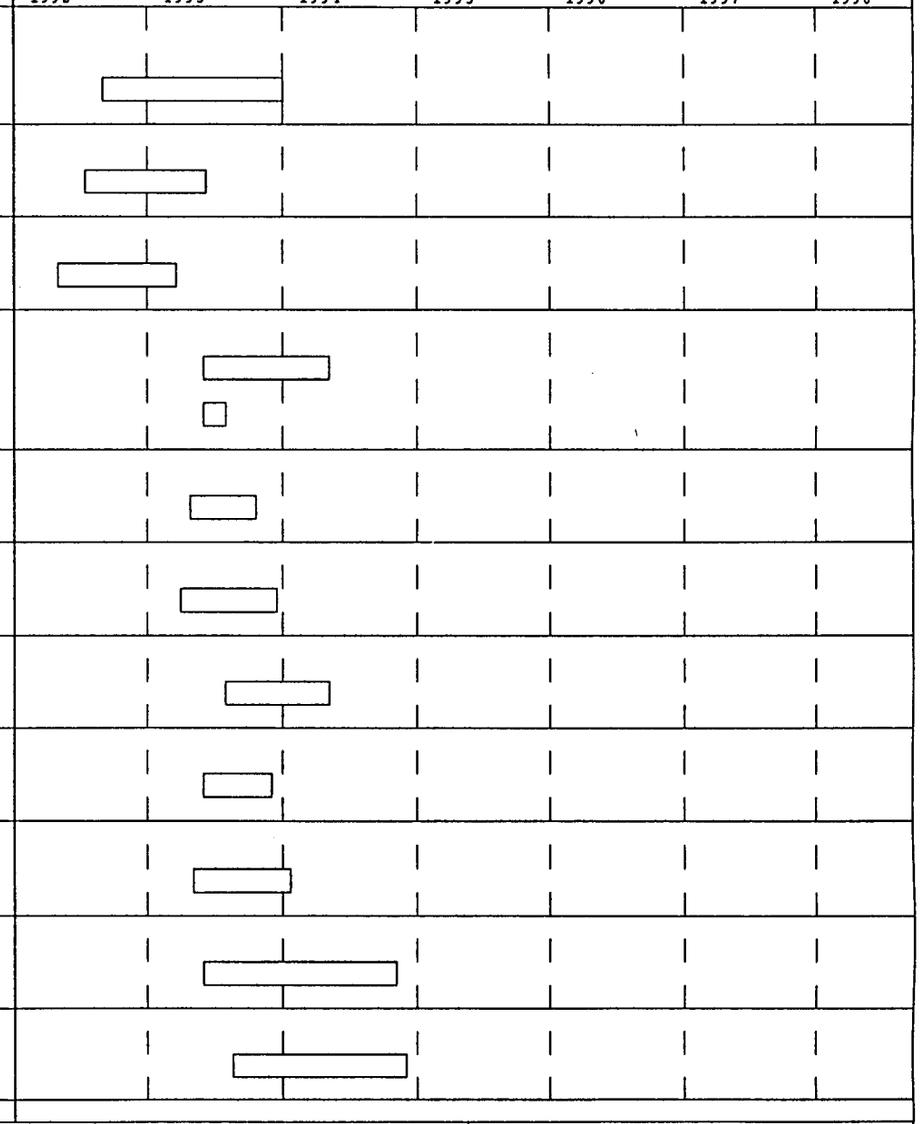
LEVEL III SUMMARY BASELINE SCHEDULE

40 GEM MAGNET

GEM DETECTOR

Summary Description	Baseline Start	Baseline Finish	%Comp
BS:40.01.1 CONDUCTOR DEVELOPMENT R&D			
DESIGN	01SEP92	31DEC93	
BS:40.01.2 JOINT DEVELOPMENT R&D			
DESIGN	15JUL92	07JUN93	
BS:40.01.3 WINDING DEVELOPMENT R&D			
DESIGN	01MAY92	19MAR93	
BS:40.02.1 COIL ASSEMBLIES DESIGN			
DESIGN	01JUN93	04MAY94	
PROCUREMENT	01JUN93	30JUL93	
BS:40.02.2 FORWARD FIELD SHAPER ASSEMBLY DESIGN			
DESIGN	26APR93	20OCT93	
BS:40.02.4 POWER PROTECTION SYSTEM DESIGN			
DESIGN	31MAR93	15DEC93	
BS:40.02.5 CRYOGENICS DESIGN			
DESIGN	30JUL93	05MAY94	
BS:40.02.6 MAGNET VACUUM SYSTEM DESIGN			
DESIGN	01JUN93	01DEC93	
BS:40.02.7 MAGNET CONTROL SYSTEM DESIGN			
DESIGN	04MAY93	21JAN94	
BS:40.02.8 RETURN FIELD MITIGATION DESIGN			
DESIGN	01JUN93	04NOV94	
BS:40.02.9 INSTALLATION AND TESTING DESIGN			
DESIGN	19AUG93	01DEC94	
BS:40.03.1 COIL ASSEMBLIES			



Legend: Baseline, Critical, Float
Baseline ▽ Projected ▼ Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures
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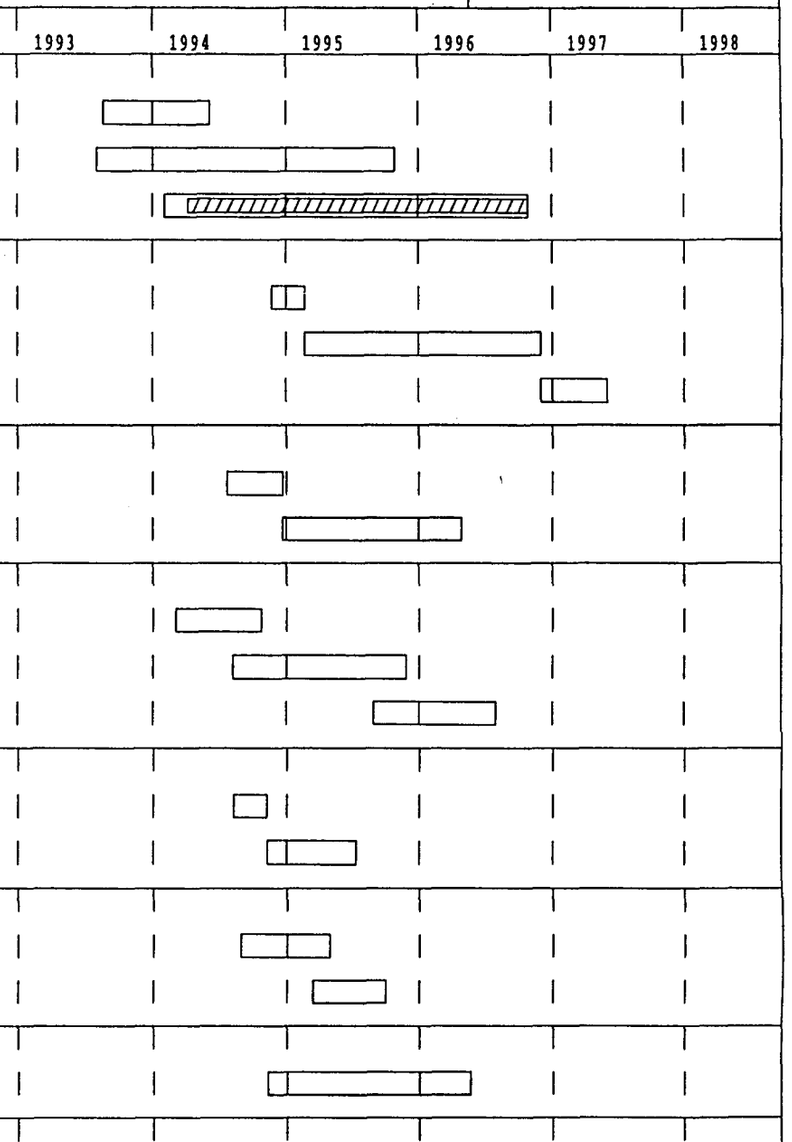
LEVEL III SUMMARY BASELINE SCHEDULE

40 GEM MAGNET

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	20AUG93	03JUN94	
FABRICATION	02AUG93	25OCT95	
ASSEMBLY	02FEB94	24OCT96	
BS:40.03.2 FORWARD FIELD SHAPERS/SPPTS			
PROCUREMENT	21NOV94	20FEB95	
FABRICATION	21FEB95	27NOV96	
ASSEMBLY	28NOV96	30MAY97	
BS:40.03.4 POWER/PROTECTION SYSTEM			
PROCUREMENT	20JUL94	20DEC94	
FABRICATION	21DEC94	25APR96	
BS:40.03.5 CRYOGENICS			
PROCUREMENT	03MAR94	20OCT94	
FABRICATION	04AUG94	24NOV95	
ASSEMBLY	25AUG95	26JUL96	
BS:40.03.6 MAGNET VACUUM SYSTEM			
PROCUREMENT	05AUG94	04NOV94	
FABRICATION	07NOV94	06JUL95	
BS:40.03.7 MAGNET CONTROL SYSTEMS			
PROCUREMENT	24AUG94	26APR95	
FABRICATION	13MAR95	27SEP95	
BS:40.03.8 RETURN FIELD MITIGATION			
FABRICATION	07NOV94	17MAY96	
BS:40.03.9 INSTALLATION TOOLING & TEST EQUIPMENT			



Legend: Baseline, Critical, Float; Baseline, Projected, Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by:

SENSITIVE

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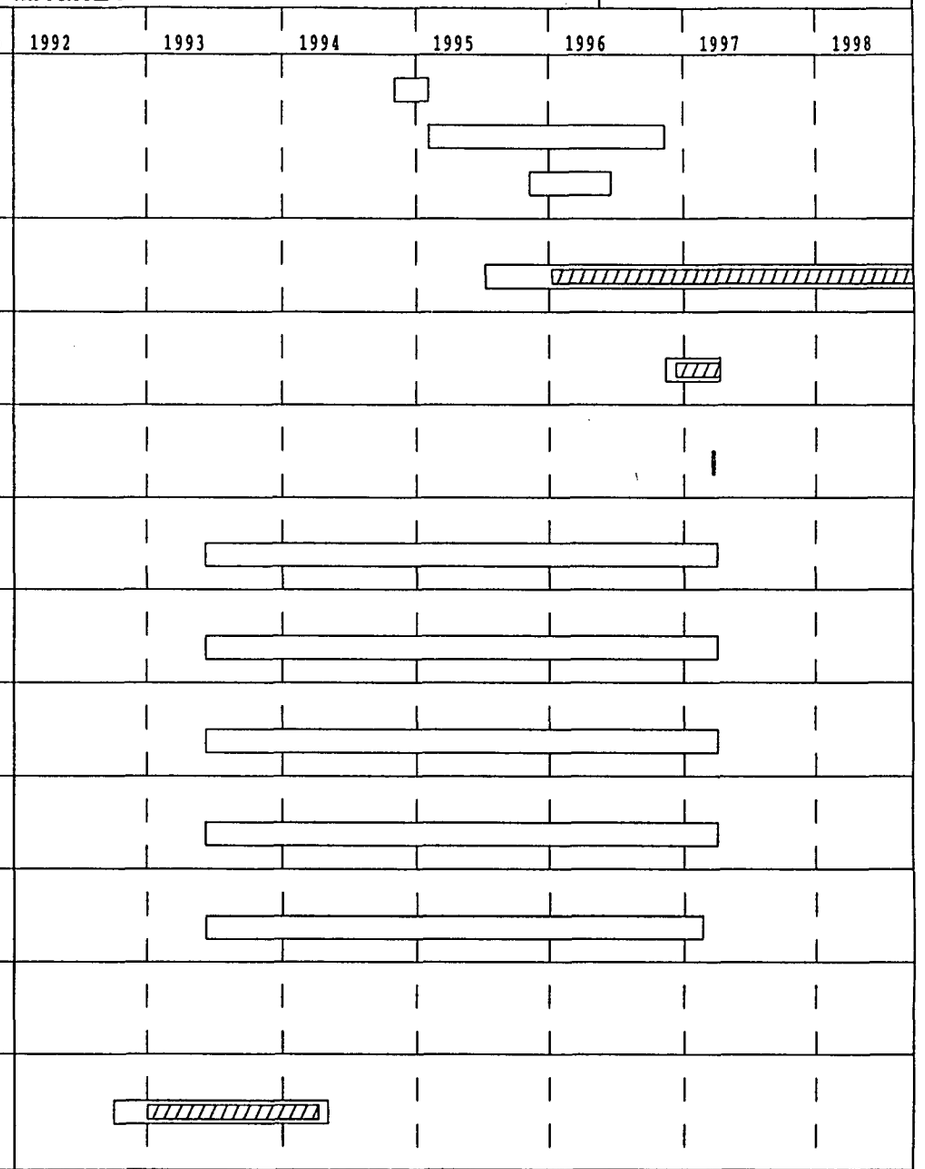
Project: MAGNET
Report: TDR_SUM1
Status as of: 15AUG91
Current Date: 27APR93
Page: 3

LEVEL III SUMMARY BASELINE SCHEDULE

40 GEM MAGNET

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	03NOV94	02FEB95	
FABRICATION	03FEB95	08NOV96	
ASSEMBLY	08NOV95	17JUN96	
WBS:40.04.1 INSTALLATION			
INSTALLATION	07JUL95	30OCT98	
WBS:40.04.2 TESTING			
INSTALLATION	11NOV96	10APR97	
WBS:40.04.3 OPERATION AND MAINTENANCE PROCEDURES			
INSTALLATION	20MAR97	26MAR97	
WBS:40.05.1 PROJECT MGMT AND ADMIN			
LEVEL OF EFFORT (LOE)	07JUN93	03APR97	
WBS:40.05.2 PROJECT CONTROL			
LEVEL OF EFFORT (LOE)	07JUN93	03APR97	
WBS:40.05.3 ES&H			
LEVEL OF EFFORT (LOE)	07JUN93	03APR97	
WBS:40.05.4 QUALITY ASSURANCE			
LEVEL OF EFFORT (LOE)	07JUN93	03APR97	
WBS:40.05.5 SYSTEM ENGINEERING			
LEVEL OF EFFORT (LOE)	07JUN93	19FEB97	
WBS:40.06.1 PRE LOI ENGINEERING/DESIGN			
DESIGN	15AUG91	29NOV91	
WBS:40.06.2 LOI TO TECHNICAL DESIGN REPORT (TDR)			
DESIGN	01OCT92	02MAY94	



Legend: Baseline, Critical, Float
Baseline ▽ Projected ▼ Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
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Project: MAGNET
Report: TDR_SUM1
Status as of: 15AUG91
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Page: 4

LEVEL III SUMMARY BASELINE SCHEDULE

40 GEM MAGNET

G E M DETECTOR

Summary Description	Baseline Start/Finish		%Comp	1992	1993	1994	1995	1996	1997	1998
LEVEL OF EFFORT (LOE)	02DEC91	04JUN93								

Legend: Baseline, Critical, Float; Baseline, Projected, Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
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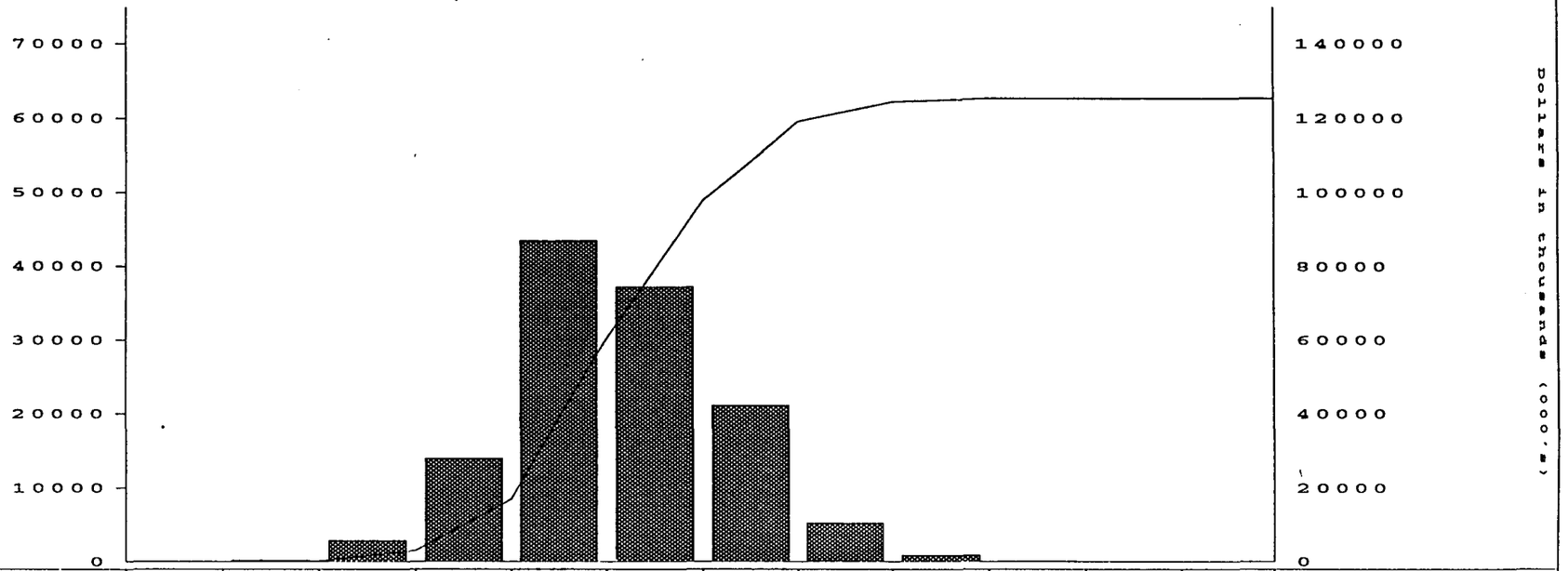
GEM Detector Report: GEM_FY	GEM DETECTOR WBS 40 - GEM MAGNET	Date: 27APR93 Project: MAG_TDR



		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
cr Bud	$10k	21	290	1397	4352	3726	2119	530	91	8		
m Bud	$100k	2	31	171	606	979	1190	1243	1252	1253	1253	1253

WBS 40.01.1	$1,609,310	CONDUCTOR DEVELOPMENT R&D
WBS 40.01.2	$ 761,690	JOINT DEVELOPMENT R&D
WBS 40.01.3	$ 897,350	WINDING DEVELOPMENT R&D
WBS 40.02.1	$3,179,660	COIL ASSEMBLIES DESIGN
WBS 40.02.2	$ 867,444	FORWARD FIELD SHAPER ASSEMBLY DESIGN
WBS 40.02.4	$ 160,133	POWER PROTECTION SYSTEM DESIGN
WBS 40.02.6	$ 288,609	MAGNET VACUUM SYSTEM DESIGN
WBS 40.02.7	$ 116,146	MAGNET CONTROL SYSTEM DESIGN
WBS 40.02.8	$ 82,912	RETURN FIELD MITIGATION DESIGN
WBS 40.02.9	$1,532,462	INSTALLATION AND TESTING DESIGN
WBS 40.03.1	$58,456,663	COIL ASSEMBLIES
WBS 40.03.2	$13,805,326	FORWARD FIELD SHAPERS/SPPTS
WBS 40.03.4	$1,331,975	POWER/PROTECTION SYSTEM
WBS 40.03.5	$12,481,003	CRYOGENICS
WBS 40.03.6	$ 762,455	MAGNET VACUUM SYSTEM
WBS 40.03.7	$ 334,268	MAGNET CONTROL SYSTEMS

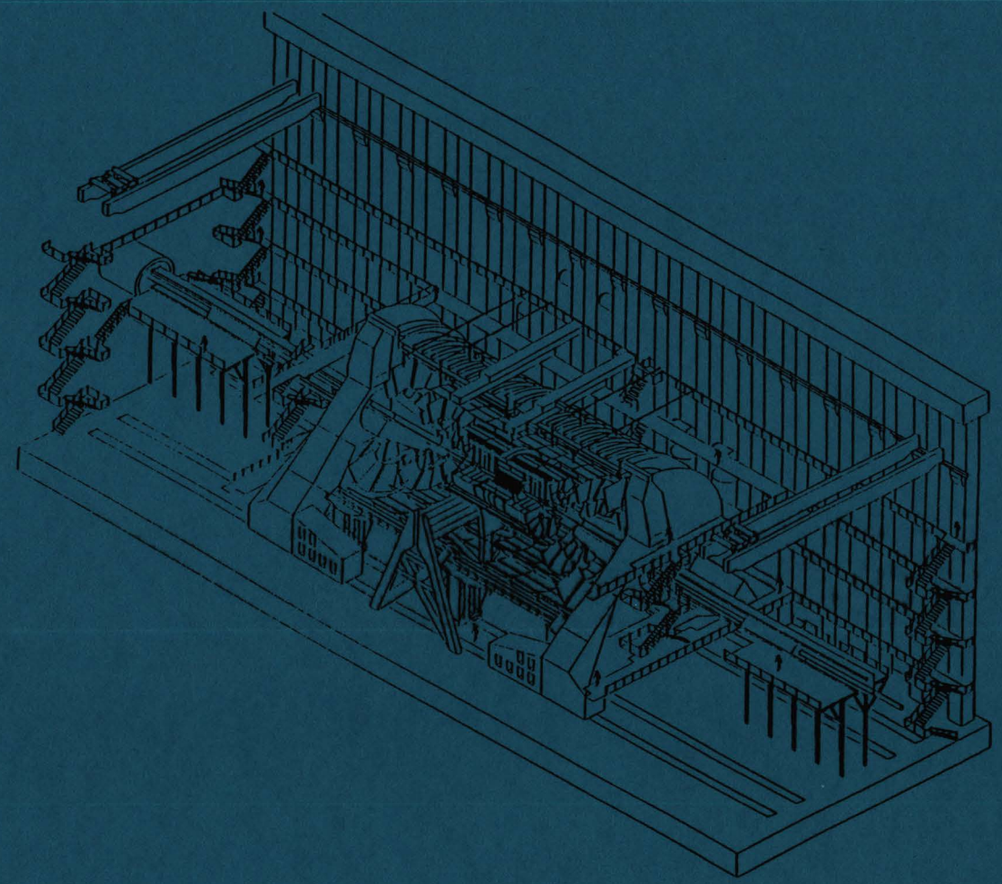
SENSITIVE

GEM DETECTOR
WBS 40 - GEM MAGNET

		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	
WBS 40.03.8	$ 64,870												RETURN FIELD MITIGATION
WBS 40.03.9	$1,393,955												INSTALLATION TOOLING & TEST EQUIPMENT
WBS 40.04.1	$3,018,395												INSTALLATION
WBS 40.04.2	$ 637,850												TESTING
WBS 40.05.1	$4,868,046												PROJECT MGMT AND ADMIN
WBS 40.05.2	$1,281,377												PROJECT CONTROL
WBS 40.05.3	$ 393,068												ES&H
WBS 40.05.4	$ 483,713												QUALITY ASSURANCE
WBS 40.05.5	$ 514,204												SYSTEM ENGINEERING
WBS 40.06.1													PRE LOI ENGINEERING/DESIGN
WBS 40.06.2													LOI TO TECHNICAL DESIGN REPORT (TDR)

SENSITIVE

Electronics



gem

Superconducting ***Super Collider***

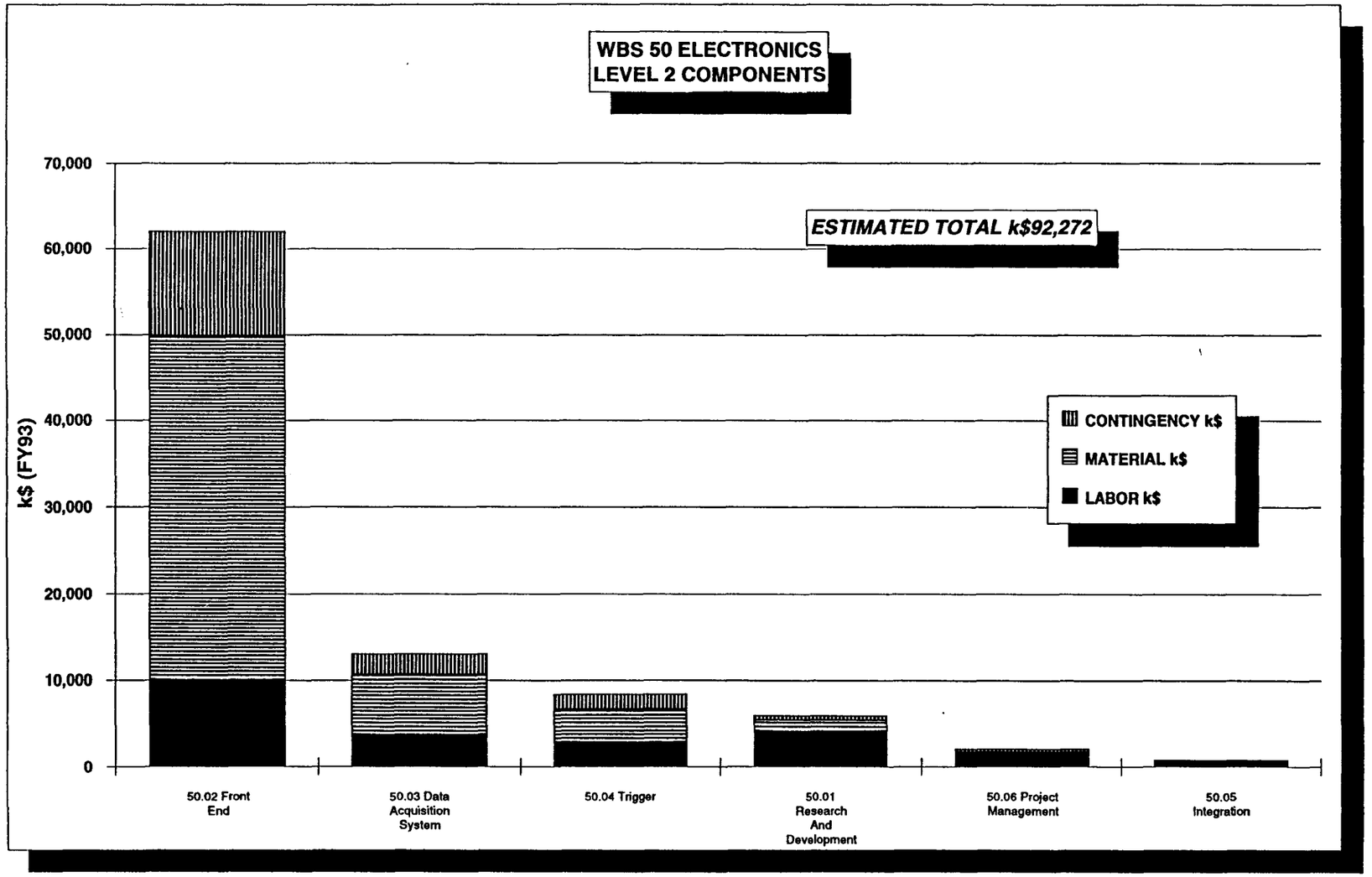
gem DETECTOR PROJECT

Electronic Parameters Table

	Si Strip	IPC	LK	CSC Wire	CSC PAD
No. of Channels (K)	2500	400	120	210	1000
Power dissipation/ch (In-detector, mW) (On-detector,mW)	2	60	275 5000	100 45	100 45
Resolution	1-bit	8-bit	10-bit	<16ns	8-bit
Dynamic Range	1-bit	10-bit	16-bit	4us	10-bit
Occupancy/channel (%)	.06-.22	1.8	5	<10	<10
Number of Samples	1	2	5	1	5
Channels/Link	640	128	496		864
Link Bandwidth (Mbit/s)	30	30	400		20
Radiation	0.44M	20K	ID HIGH	<1K	<1K

Electronic Fiber Optic Link Parameters Table

	SI Strip	IPC	LK	CSC
No. of Channels (K)	2500	400	120	1210
Channels/Link	640	128	496	864
No. of Data Links	3892	3125	242	1440
Data Link (Mbits/s)	30	30	400	20
No. of Trigger Links			322	1440
T-Link (Mbits/s)			1200	1000


WBS 50 ELECTRONICS
LEVEL 2 COMPONENTS
ESTIMATED TOTAL k$92,272
CONTINGENCY k$
MATERIAL k$
LABOR k$
k$ (FY93)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
50.02 Front End
50.03 Data Acquisition System
50.04 Trigger
50.01 Research And Development
50.06 Project Management
50.05 Integration

GEM COST ESTIMATE SUMMARY

4/25/93

LECTRONICS SUBSYSTEM

FY93 U.S. Dollars

BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
	-ELECTRONICS	01	52,619	465,971	22,552	75,171	17,100	23%	92,272
.01	-RESEARCH AND DEVELOPMENT	02	1,433	57,809	4,051	5,484	462	8%	5,946
.01.1	-SILICON TRACKER	03	476	19,049	1,471	1,947	0	0%	1,947
.01.1.1	BIPOLAR	04	125	3,101	246	370	0	0%	370
.01.1.2	CMOS I	04	160	6,645	523	683	0	0%	683
.01.1.3	CMOS II	04	16	2,437	186	201	0	0%	201
.01.1.4	MCM	04	97	2,880	209	305	0	0%	305
.01.1.5	FIBER OPTICS	04	25	1,108	87	112	0	0%	112
.01.1.6	CLOCK DISTRIBUTION	04	5	1,108	83	88	0	0%	88
.01.1.7	CABLE	04	45	1,551	119	163	0	0%	163
.01.1.8	TEST STATION	04	4	222	20	24	0	0%	24
.01.2	-IPC	03	363	10,992	852	1,215	218	18%	1,433
.01.2.1	PREAMP IC	04	156	5,476	424	580	104	18%	684
.01.2.2	SCA IC	04	156	5,476	424	580	104	18%	684
.01.2.3	SCA TEST STATION	04	52	40	3	55	9	16%	64
.01.3	-CALORIMETER FRONT-END	03	324	11,607	786	1,110	244	22%	1,355
.01.3.1	-READOUT ELECTRONICS	04	324	11,607	786	1,110	244	22%	1,355
.01.3.1.1	PREAMPLIFIER R&D	05	41	1,595	124	165	36	22%	202
.01.3.1.2	CALIBRATION CIRCUIT R&D	05	57	975	76	133	29	22%	162
.01.3.1.3	SHAPER AMPLIFIER R&D	05	64	2,304	180	243	54	22%	297
.01.3.1.4	CABLE DRIVER R&D	05	104	5,316	296	400	88	22%	488
.01.3.1.5	SCAIC DRIVER R&D	05	59	1,418	111	169	37	22%	206
.01.4	-MUON FRONT-END	03	130	5,636	321	450	0	0%	450
.01.4.1	CSC SYSTEM R&D	04	73	2,850	144	217	0	0%	217
.01.4.2	CSC PREAMP R&D	04	26	886	80	106	0	0%	106

GEM COST ESTIMATE SUMMARY

4/25/93

LECTRONICS SUBSYSTEM

FY93 U.S. Dollars

BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
.01.4.3	CSC ANODE R&D	04	31	1,900	96	127	0	0%	127
.01.5	-LEVEL 1 - TRIGGER	03	88	3,672	256	344	0	0%	344
.01.5.1	-CAL LEVEL 1 R&D	04	31	1,836	128	159	0	0%	159
.01.5.1.1	CAL LEVEL 1 R&D (ANALOG)	05	26	950	48	74	0	0%	74
.01.5.1.2	CAL LEVEL 1 R&D (DIGITAL)	05	5	886	80	85	0	0%	85
.01.5.2	-MUON LEVEL 1 TRIGGER R&D	04	57	1,836	128	185	0	0%	185
.01.5.2.1	MUON LEVEL 1 TRIGGER R&D (COMBO)	05	42	950	48	90	0	0%	90
.01.5.2.2	MUON LEVEL 1 TRIGGER R&D (CAM)	05	16	886	80	95	0	0%	95
.01.6	DAQ	03	52	5,316	245	297	0	0%	297
.01.7	FY 92 EXPENDITURE	03	0	1,537	122	122	0	0%	122
.02	-FRONT END	02	39,856	219,208	9,991	49,846	12,155	24%	62,002
.02.1	-MUON	03	8,126	102,004	3,926	12,052	3,008	25%	15,060
.02.1.1	-CSC 2nd COORDINATE READOUT	04	2,367	27,562	946	3,314	770	23%	4,083
.02.1.1.1	DESIGN DOCUMENTATION	05	42	6,734	194	236	83	35%	319
.02.1.1.2	-PROTOTYPE CSC ANODE ELECTRONICS	05	173	9,024	357	529	160	30%	689
.02.1.1.2.1	-HIGH VOLTAGE	06	10	1,617	48	58	21	36%	79
.02.1.1.2.1.1	POWER SUPPLY	07	6	0	0	6	0	5%	7
.02.1.1.2.1.2	DISTRIBUTION	07	4	1,617	48	52	21	40%	73
.02.1.1.2.2	-LOW VOLTAGE	06	0	64	2	3	0	10%	3
.02.1.1.2.2.1	POWER SUPPLY	07	0	0	0	0	0	5%	0
.02.1.1.2.2.2	DISTRIBUTION	07	0	64	2	2	0	10%	3
.02.1.1.2.3	-SIGNAL CABLES	06	1	50	1	2	0	8%	2
.02.1.1.2.3.1	SIGNAL FEED (PCB1 TO PCB2)	07	1	40	1	2	0	8%	2
.02.1.1.2.3.2	SIGNAL FEED (PCTIMING STROBE SIGNA	07	0	10	0	0	0	8%	0
.02.1.1.2.4	-ACTIVE COMPONENTS	06	143	4,267	209	352	115	33%	467

GEM COST ESTIMATE SUMMARY

4/25/93

FY93 U.S. Dollars

:LECTRONICS SUBSYSTEM

/BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
).02.1.1.2.4.1	INTEGRATED PREAMP/DRIVER	07	57	1,410	111	168	67	40%	235
).02.1.1.2.4.2	INTEGRATED 24-CHANNEL MULTI-FUNCTI	07	44	1,409	49	93	22	24%	115
).02.1.1.2.4.3	CONTROL ASIC (ALP/DCC)	07	42	1,449	50	92	26	28%	117
).02.1.1.2.5	-PRINTED CIRCUIT BOARD	06	17	2,898	91	108	23	21%	131
).02.1.1.2.5.1	6-PLANE INTERFACE BOARD (PCB1)	07	14	1,489	47	61	10	16%	71
).02.1.1.2.5.2	SIGNAL PROCESSING BOARD (PCB2)	07	3	1,409	45	47	13	28%	61
).02.1.1.2.6	CRATE AND RACK	06	0	0	0	0	0	0%	0
).02.1.1.2.7	-CONTROL AND DATA LINKS	06	1	128	6	6	1	12%	7
).02.1.1.2.7.1	CONTROL BUS	07	0	64	3	3	0	12%	4
).02.1.1.2.7.2	DATA BUS	07	0	64	3	3	0	12%	4
).02.1.1.3	-PRODUCTION	05	2,101	7,375	293	2,394	503	21%	2,897
).02.1.1.3.1	-HIGH VOLTAGE	06	410	1,870	47	456	111	24%	567
).02.1.1.3.1.1	POWER SUPPLY	07	206	0	0	206	10	5%	216
).02.1.1.3.1.2	DISTRIBUTION	07	204	1,870	47	251	100	40%	351
).02.1.1.3.2	-SIGNAL CABLES	06	67	607	14	80	13	16%	93
).02.1.1.3.2.1	SIGNAL FEED (PCB1 TO PCB2)	07	43	164	4	46	4	8%	50
).02.1.1.3.2.2	TIMING STROBE SIGNAL CABLES	07	24	443	10	34	9	26%	43
).02.1.1.3.3	-ACTIVE COMPONENTS	06	712	3,010	166	878	176	20%	1,054
).02.1.1.3.3.1	INTEGRATED PREAMP/DRIVER	07	355	1,624	122	477	95	20%	572
).02.1.1.3.3.2	INTEGRATED FUNCTION I.C. (DISC/AND	07	243	841	27	269	54	20%	323
).02.1.1.3.3.3	CONTROL ASIC (ALP/DDC)	07	115	544	17	132	26	20%	159
).02.1.1.3.4	-PRINTED CIRCUIT BOARD	06	836	1,762	60	896	196	22%	1,092
).02.1.1.3.4.1	6-PLANE, 4 LAYER INTERFACE BOARD (	07	589	952	36	625	125	20%	750
).02.1.1.3.4.2	96-CHANNEL SIGNAL PROCESSING BOARD	07	247	810	24	271	71	26%	342
).02.1.1.3.5	-CONTROL AND DATA LINKS	06	77	128	6	83	8	10%	92

GEM COST ESTIMATE SUMMARY

4/25/93

:LECTRONICS SUBSYSTEM

FY93 U.S. Dollars

/BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
).02.1.1.3.5.1	CONTROL BUS	07	30	64	3	33	3	10%	36
).02.1.1.3.5.2	DATA BUS	07	48	64	3	51	5	10%	56
).02.1.1.4	INSTALLATION & TEST	05	52	4,430	102	154	25	16%	179
).02.1.2	-CSC PAD (925K CHANNELS)	04	5,759	74,442	2,980	8,739	2,238	26%	10,977
).02.1.2.1	DESIGN/DOCUMENTATION	05	54	2,215	138	192	38	20%	230
).02.1.2.2	-PROTOTYPE	05	375	20,942	1,327	1,702	487	29%	2,189
).02.1.2.2.1	PROTO HVPS	06	0	0	0	0	0	0%	0
).02.1.2.2.2	PROTO. LVPS	06	4	1,948	94	98	24	24%	121
).02.1.2.2.3	PROTO. CATH CABLES	06	3	1,569	81	84	24	28%	107
).02.1.2.2.4	-ACTIVE COMPONENTS	06	239	9,020	661	900	250	28%	1,150
).02.1.2.2.4.1	PROTO. PASA IC	07	99	2,658	222	321	64	20%	385
).02.1.2.2.4.2	PROTO. SCA IC	07	99	4,430	308	407	138	34%	545
).02.1.2.2.4.3	PROTO. ALP IC	07	38	1,772	122	160	45	28%	205
).02.1.2.2.4.4	PROTO. ADC	07	3	160	9	12	2	18%	14
).02.1.2.2.5	-PRINTED CIRCUIT BOARD	06	83	7,925	469	552	177	32%	728
).02.1.2.2.5.1	96 PROTO. CH FE PCB	07	43	4,504	263	306	98	32%	404
).02.1.2.2.5.2	PROTO. READOUT PCB	07	40	3,421	206	245	79	32%	324
).02.1.2.2.6	SYSTEM TEST OF PILOT ELECT	06	46	480	23	69	14	20%	82
).02.1.2.3	-PRODUCTION	05	5,282	32,199	1,040	6,322	1,548	25%	7,870
).02.1.2.3.1	PROD. LVPS	06	727	0	0	727	175	24%	901
).02.1.2.3.2	-SIGNAL CABLES	06	248	9,568	216	464	76	16%	540
).02.1.2.3.2.1	PROD. DATA CABLE	07	42	1,976	45	87	14	16%	101
).02.1.2.3.2.2	PROD. TRIGGER CABLE	07	21	1,976	45	66	12	18%	78
).02.1.2.3.2.3	PROD. CATH. SIG. CAB	07	185	5,616	126	311	50	16%	360
).02.1.2.3.3	-ACTIVE COMPONENTS	06	2,531	13,364	492	3,023	794	26%	3,817

LECTRONICS SUBSYSTEM

FY93 U.S. Dollars

BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
.02.1.2.3.3.1	PROD. PASA IC	07	815	4,660	170	985	276	28%	1,261
.02.1.2.3.3.2	PROD. SCA IC	07	833	6,294	227	1,060	297	28%	1,357
.02.1.2.3.3.3	PROD. ALP IC	07	379	2,310	87	466	159	34%	625
.02.1.2.3.3.4	PROD. ADC IC	07	428	80	6	434	52	12%	486
.02.1.2.3.3.5	PROD. ANALOG MUX	07	77	20	2	78	11	14%	89
02.1.2.3.4	-PRINTED CIRCUIT BOARD	06	1,544	9,227	330	1,874	481	26%	2,355
02.1.2.3.4.1	PROD. 96 CH FE PCB	07	792	8,507	305	1,096	263	24%	1,359
02.1.2.3.4.2	PROD. READOUT PC	07	753	720	25	778	218	28%	996
02.1.2.3.5	FIBER LINK	06	232	40	2	234	23	10%	257
02.1.2.4	-INSTALLATION & TEST	05	49	19,086	474	523	165	31%	688
.02.1.2.4.1	INSTALL BOARDS ON CSC	06	23	7,896	202	225	81	36%	306
.02.1.2.4.2	INSTALL CSC's IN DETECTOR	06	26	11,190	272	298	84	28%	382
02.2	-CENTRAL TRACKER	03	13,596	77,123	4,263	17,859	4,927	28%	22,786
02.2.1	-SILICON TRACKER	04	5,709	35,803	2,696	8,405	2,347	28%	10,752
02.2.1.0	BIPOLAR	05	1,342	4,873	384	1,725	552	32%	2,278
02.2.1.1	CMOS-1	05	1,331	6,202	483	1,815	690	38%	2,504
02.2.1.2	-CMOS-2	05	372	6,167	482	854	218	26%	1,072
02.2.1.2.1	CMOS-2D	06	209	3,544	277	487	112	23%	598
02.2.1.2.2	CMOS-2A	06	163	2,623	204	367	106	29%	473
02.2.1.3	MULTI-CHIP MODULE	05	912	3,544	261	1,173	340	29%	1,513
02.2.1.4	FIBER OPTICS	05	730	3,296	224	954	210	22%	1,164
02.2.1.5	POWER SUPPLIES	05	75	1,134	77	151	21	14%	173
02.2.1.6	CABLES	05	635	3,057	203	839	168	20%	1,006
02.2.1.7	TEST STATION	05	96	2,835	224	319	45	14%	364
02.2.1.8	CLOCK DISTRIBUTION	05	160	2,171	160	320	70	22%	390

GEM COST ESTIMATE SUMMARY

4/25/93

FY93 U.S. Dollars

LECTRONICS SUBSYSTEM

BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
.02.2.1.9	COMMAND CONTROL	05	57	2,525	199	256	33	13%	289
.02.2.2	-IPC (400K CHANNELS)	04	7,887	41,320	1,567	9,454	2,580	27%	12,033
.02.2.2.1	-PROTOTYPE	05	206	11,654	498	704	177	25%	880
.02.2.2.1.1	-ACTIVE COMPONENTS	06	105	3,544	155	260	39	15%	299
.02.2.2.1.1.1	READOUT CONTROLLER	07	105	3,544	155	260	39	15%	299
.02.2.2.1.2	-PRINTED CIRCUIT BOARD	06	96	6,190	260	356	121	34%	476
.02.2.2.1.2.1	MCM	07	75	2,658	114	190	87	46%	277
.02.2.2.1.2.2	R/O BOARD	07	13	1,766	73	86	17	20%	103
.02.2.2.1.2.3	CONTROLLER BOARD	07	8	1,766	73	81	16	20%	97
.02.2.2.1.3	-CONTROL/DATA LINKS	06	5	1,920	83	87	18	20%	105
.02.2.2.1.3.1	RECEIVER	07	3	1,040	46	49	10	20%	59
.02.2.2.1.3.2	DATA LINK	07	2	880	37	38	8	20%	46
.02.2.2.2	-PRODUCTION	05	7,681	29,666	1,069	8,750	2,403	28%	11,153
.02.2.2.2.1	-HIGH VOLTAGE	06	79	2,960	85	164	11	7%	175
.02.2.2.2.1.1	POWER SUPPLY	07	54	640	14	68	3	5%	72
.02.2.2.2.1.2	DISTRIBUTION	07	25	2,320	71	96	8	8%	103
.02.2.2.2.2	-LOW VOLTAGE IN-DETECTOR	06	243	2,240	69	312	18	6%	331
.02.2.2.2.2.1	POWER SUPPLY	07	173	240	5	179	9	5%	188
.02.2.2.2.2.2	DISTRIBUTION	07	70	2,000	64	134	9	7%	143
.02.2.2.2.3	SIGNAL CABLES	06	0	0	0	0	0	0%	0
.02.2.2.2.4	-ACTIVE COMPONENTS	06	4,206	4,344	271	4,476	1,646	37%	6,123
.02.2.2.2.4.1	PREAMP/SHAPER	07	794	1,126	88	883	344	39%	1,227
.02.2.2.2.4.2	SWITCHED CAP ARRAY	07	1,693	1,126	88	1,781	695	39%	2,476
.02.2.2.2.4.3	FADC	07	1,381	240	17	1,398	545	39%	1,943
.02.2.2.2.4.4	R/O CONTROLLER	07	338	1,852	77	414	62	15%	477

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3S Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
02.2.2.2.5	-PRINTED CIRCUIT BOARD	06	2,114	7,600	297	2,411	482	20%	2,893
02.2.2.2.5.1	R/O BOARD	07	273	3,200	100	373	52	14%	426
02.2.2.2.5.2	CONTROLLER BOARD	07	132	3,200	100	232	33	14%	264
02.2.2.2.5.3	MCM's	07	1,709	1,200	97	1,806	397	22%	2,203
02.2.2.2.6	-CONTROL/DATA SETS	06	1,040	12,522	347	1,387	245	18%	1,632
02.2.2.2.6.1	RECEIVER BOARD	07	291	1,200	27	318	45	14%	362
02.2.2.2.6.2	FIBER DATA LINKS	07	535	7,402	184	720	137	19%	857
02.2.2.2.6.3	RECEIVER CRATES	07	47	240	6	53	7	14%	60
02.2.2.2.6.4	CLOCK/TRIGGER LINKS	07	133	1,760	62	196	37	19%	233
02.2.2.2.6.5	SLOW CONTROL	07	33	1,920	68	101	19	19%	120
02.3	-CALORIMETER	03	18,134	40,081	1,802	19,936	4,221	21%	24,156
02.3.1	DESIGN/DOCUMENTATION	04	0	1,063	71	71	7	10%	78
02.3.2	-PROTOTYPE	04	794	9,099	588	1,382	330	24%	1,711
02.3.2.1	HIGH VOLTAGE	05	10	0	0	10	3	28%	13
02.3.2.2	LOW VOLTAGE (ON-DETECTOR)	05	10	0	0	10	3	28%	13
02.3.2.3	-SIGNAL AND CONTROL CABLES	05	112	0	0	112	30	27%	141
02.3.2.3.1	SIGNAL CABLES TO JUNCTION BOX	06	78	0	0	78	22	28%	100
.02.3.2.3.2	SIGNAL CABLES FROM JUNCTION BOX	06	33	0	0	33	8	24%	41
.02.3.2.4	-ACTIVE COMPONENTS	05	556	4,046	276	832	185	22%	1,017
.02.3.2.4.1	PREAMPLIFIER	06	47	177	14	61	13	22%	75
.02.3.2.4.2	CALIBRATION CIRCUIT	06	112	1,063	73	185	41	22%	226
.02.3.2.4.3	BIPOLAR SHAPER AMPLIFIER	06	90	1,240	90	180	40	22%	220
.02.3.2.4.4	CABLE DRIVER	06	105	532	41	146	32	22%	179
.02.3.2.4.5	SCA IC	06	52	443	25	77	17	22%	93
.02.3.2.4.6	SCA TEST STATION	06	52	148	8	60	22	36%	82

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.02.3.2.4.7	SCA CONTROL GA	06	52	443	25	77	16	21%	93
.02.3.2.4.8	DSP	06	45	0	0	45	5	10%	50
.02.3.2.5	-PRINTED CIRCUIT BOARD	05	107	5,053	311	418	109	26%	527
.02.3.2.5.1	JUNCTION BOX DRIVER BOARD	06	10	443	28	37	10	26%	47
.02.3.2.5.2	CALORIMETER READOUT BOARD	06	59	1,026	53	112	29	26%	142
.02.3.2.5.3	CALORIMETER OUTPUT BOARD	06	8	926	50	59	15	26%	74
.02.3.2.5.4	CALIBRATION ELECTRONICS BOARD	06	26	2,215	152	178	46	26%	225
.02.3.2.5.5	JUNCTION BOX CALIBRATION BOARD	06	3	443	28	31	8	26%	39
.02.3.3	-PRODUCTION	04	17,339	29,919	1,143	18,483	3,884	21%	22,367
.02.3.3.1	-HIGH VOLTAGE	05	28	1,104	97	125	20	16%	145
.02.3.3.1.1	POWER SUPPLY	06	20	144	53	73	13	18%	86
.02.3.3.1.2	DISTRIBUTION	06	8	960	44	52	7	14%	59
.02.3.3.2	-LOW VOLTAGE IN-DETECTOR	05	171	0	0	171	38	22%	209
.02.3.3.2.1	POWER SUPPLY AND DISTRIBUTION	06	171	0	0	171	38	22%	209
02.3.3.3	-SIGNAL AND CONTROL CABLES	05	3,335	5,670	127	3,462	485	14%	3,947
02.3.3.3.1	SIGNAL CABLES TO JUNCTION BOX	06	620	1,772	40	660	92	14%	752
02.3.3.3.2	SIGNAL CABLES FROM JUNCTION BOX	06	2,452	3,544	79	2,531	354	14%	2,886
02.3.3.3.3	CONTROL CABLES	06	263	354	8	271	38	14%	309
02.3.3.4	-ACTIVE COMPONENTS	05	7,098	12,345	566	7,664	1,828	24%	9,492
02.3.3.4.1	PREAMPLIFIER IC	06	729	443	35	764	199	26%	962
02.3.3.4.2	CALIBRATION CIRCUIT	06	1,192	4,253	184	1,375	358	26%	1,733
02.3.3.4.3	SHAPER AMPLIFIER HYBRID	06	2,267	3,987	198	2,464	641	26%	3,105
02.3.3.4.4	CABLE DRIVER	06	602	443	35	637	166	26%	802
02.3.3.4.5	SCA IC	06	336	2,776	92	428	111	26%	539
02.3.3.4.6	SCA CONTROL GATE ARRAY	06	96	443	25	121	17	14%	137

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.02.3.3.4.7	DSP	06	1,876	0	0	1,876	338	18%	2,214
.02.3.3.5	-PRINTED CIRCUIT BOARD	05	4,376	9,914	330	4,706	1,180	25%	5,886
.02.3.3.5.1	CABLE DRIVER BOARD	06	484	266	17	500	110	22%	611
.02.3.3.5.2	CAL READOUT BOARD	06	3,512	7,600	235	3,747	974	26%	4,721
.02.3.3.5.3	CAL OUTPUT BOARD	06	207	699	34	241	53	22%	294
.02.3.3.5.4	CALIBRATION ELECTRONICS BOARD	06	62	443	28	90	20	22%	110
02.3.3.5.5	JUNCTION BOX CALIBRATION BOARD	06	111	906	17	127	23	18%	150
02.3.3.6	-CRATES	05	2,197	886	23	2,221	312	14%	2,532
02.3.3.6.1	JUNCTION BOX	06	83	0	0	83	18	22%	101
.02.3.3.6.2	READOUT ELECTRONICS	06	1,875	0	0	1,875	225	12%	2,100
.02.3.3.6.3	PATCH PANEL	06	239	886	23	262	68	26%	331
.02.3.3.7	-CONTROL AND DATA LINKS	05	134	0	0	134	21	16%	155
.02.3.3.7.1	CONTROL AND DATA LINKS	06	134	0	0	134	21	16%	155
.03	-DATA ACQUISITION SYSTEM	02	6,940	83,096	3,717	10,657	2,317	22%	12,974
03.1	-DESIGN AND DOCUMENT	03	328	31,960	1,470	1,798	361	20%	2,160
03.1.1	-SYSTEM DESIGN & SIMULATION	04	58	4,000	184	242	44	18%	286
03.1.1.1	PROJECT COORDINATION	05	37	0	0	37	2	5%	39
03.1.1.2	FUNCTIONAL SPECS AND DESIGN DOCUMENT	05	0	2,160	99	99	22	22%	121
.03.1.1.3	BEHAVIORAL SIMULATION	05	21	1,840	85	105	20	19%	125
.03.1.2	-EVENT DATA COLLECTION MODULES	04	73	4,400	202	275	53	19%	328
03.1.2.1	FUNCTIONAL SPECS DOCUMENT	05	0	560	26	26	6	22%	31
03.1.2.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	52	3,120	144	195	37	19%	233
03.1.2.3	SIMULATION & LAYOUT	05	10	400	18	29	6	20%	35
03.1.2.4	EMBEDDED SOFTWARE	05	10	240	11	21	4	18%	25
.03.1.2.5	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5

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).03.1.3	SLOW LINKS	04	0	1,600	74	74	16	22%	90
).03.1.4	FAST LINKS	04	0	920	42	42	9	22%	52
).03.1.5	-EVENT BUILDER	04	62	2,480	114	176	35	20%	211
).03.1.5.1	FUNCTIONAL SPECS DOCUMENT	05	0	320	15	15	3	22%	18
).03.1.5.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	62	1,680	77	140	27	19%	166
).03.1.5.3	SIMULATION & LAYOUT	05	0	240	11	11	2	22%	14
).03.1.5.4	EMBEDDED SOFTWARE	05	0	160	7	7	2	22%	9
).03.1.5.5	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
).03.1.6	-EVENT DATA DISTRIBUTION MODULES	04	62	4,400	202	265	52	20%	316
).03.1.6.1	FUNCTIONAL SPECS DOCUMENT	05	0	560	26	26	6	22%	31
).03.1.6.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	52	3,120	144	195	37	19%	233
).03.1.6.3	SIMULATION & LAYOUT	05	0	400	18	18	4	22%	23
).03.1.6.4	EMBEDDED SOFTWARE	05	10	240	11	21	4	18%	25
).03.1.6.5	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.1.7	-CONTROL NETWORK	04	62	3,520	162	224	44	20%	268
.03.1.7.1	FUNCTIONAL SPECS DOCUMENT	05	0	400	18	18	4	22%	23
.03.1.7.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	52	1,440	66	118	21	18%	139
.03.1.7.3	SIMULATION & LAYOUT	05	0	240	11	11	2	22%	14
.03.1.7.4	EMBEDDED SOFTWARE	05	10	160	7	18	3	17%	21
.03.1.7.5	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.1.7.6	SYSTEM SUPERVISOR	05	0	640	29	29	7	22%	36
.03.1.7.7	TRIGGER SUPERVISOR	05	0	560	26	26	6	22%	31
.03.1.8.	-CLOCK DISTRIBUTION, AND FAST CONTROL	04	10	1,360	63	73	15	21%	88
.03.1.8.1	FUNCTIONAL SPECS DOCUMENT	05	0	240	11	11	2	22%	14
.03.1.8.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	720	33	33	7	22%	40

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!S Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
)3.1.8.3	SIMULATION & LAYOUT	05	0	160	7	7	2	22%	9
)3.1.8.4	EMBEDDED SOFTWARE	05	10	160	7	18	3	17%	21
)3.1.8.5	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
)3.1.9	-GATING LOGIC	04	0	2,320	107	107	24	22%	130
)3.1.9.1	FUNCTIONAL SPECS DOCUMENT	05	0	240	11	11	2	22%	14
)3.1.9.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	880	41	41	9	22%	49
)3.1.9.3	SIMULATION & LAYOUT	05	0	160	7	7	2	22%	9
)3.1.9.4	EMBEDDED SOFTWARE	05	0	800	37	37	8	22%	45
)3.1.9.5	TESTS & COMMISSIONING	05	0	240	11	11	2	22%	14
)3.1.10	-CONTROL AND MONITORING SOFTWARE	04	0	1,200	55	55	12	22%	67
)3.1.10.1	FUNCTIONAL SPECS DOCUMENT	05	0	320	15	15	3	22%	18
)3.1.10.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	480	22	22	5	22%	27
)3.1.10.3	IMPLEMENTATION & CODING	05	0	400	18	18	4	22%	23
)3.1.11	REAL-TIME OPERATING SYSTEM	04	0	800	37	37	8	22%	45
)3.1.12	STANDARD CPUs	04	0	720	33	33	7	22%	40
)3.1.13	INTERFACE WITH FRONT-END ELECTRONICS	04	0	720	33	33	7	22%	40
)3.1.14	INTERFACE WITH FAST CONTROL AND TRIGGER	04	0	1,280	59	59	13	22%	72
)3.1.15	INTERFACE WITH ON-LINE COMPUTING	04	0	1,040	48	48	11	22%	58
)3.1.16	ANCILLARY CONTROLS & HUMAN INTERFACE	04	0	1,200	55	55	12	22%	67
)3.2	-PROTOTYPE SYSTEM	03	352	28,920	1,311	1,662	347	21%	2,009
)3.2.1	-SYSTEM DESIGN & SIMULATION	04	36	2,960	136	173	33	19%	206
)3.2.1.1	PROJECT COORDINATION	05	31	0	0	31	2	6%	33
)3.2.1.2	FUNCTIONAL SPECS AND DESIGN DOCUMENT	05	0	1,920	88	88	19	22%	108
)3.2.1.3	BEHAVIORAL SIMULATION	05	5	1,040	48	53	12	22%	65
)3.2.2	-EVENT DATA COLLECTION MODULES	04	33	3,472	158	191	43	22%	234

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03.2.2.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
03.2.2.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	1,120	52	52	11	22%	63
03.2.2.3	SIMULATION & LAYOUT	05	0	400	18	18	4	22%	23
03.2.2.4	BID PACKAGE & PROCUREMENT	05	29	80	2	31	8	24%	39
03.2.2.5	PRODUCTION & ASSEMBLY	05	4	32	1	5	1	24%	6
03.2.2.6	EMBEDDED SOFTWARE	05	0	1,200	55	55	12	22%	67
03.2.2.7	TESTS & COMMISSIONING	05	0	480	22	22	5	22%	27
03.2.3	-SLOW LINKS	04	49	1,064	47	96	22	23%	118
03.2.3.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
03.2.3.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	200	9	9	2	22%	11
03.2.3.3	SIMULATION & LAYOUT	05	0	160	7	7	2	22%	9
03.2.3.4	BID PACKAGE & PROCUREMENT	05	20	80	2	22	6	25%	28
03.2.3.5	PRODUCTION & ASSEMBLY	05	19	64	2	21	6	28%	26
03.2.3.6	EMBEDDED SOFTWARE	05	10	240	11	21	4	18%	25
03.2.3.7	TESTS & COMMISSIONING	05	0	160	7	7	2	22%	9
03.2.4	FAST LINKS	04	0	880	39	39	8	20%	47
03.2.5	-EVENT BUILDER	04	33	1,512	67	99	21	21%	120
03.2.5.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
03.2.5.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	280	13	13	3	22%	16
03.2.5.3	SIMULATION & LAYOUT	05	0	240	11	11	2	22%	14
03.2.5.4	BID PACKAGE & PROCUREMENT	05	18	160	5	23	5	20%	27
03.2.5.5	PRODUCTION & ASSEMBLY	05	4	32	1	5	1	24%	6
03.2.5.6	EMBEDDED SOFTWARE	05	10	400	18	29	6	20%	35
03.2.5.7	TESTS & COMMISSIONING	05	0	240	11	11	2	22%	14
03.2.6	-EVENT DATA DISTRIBUTION MODULES	04	53	2,912	131	184	38	21%	222

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BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
.03.2.6.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
.03.2.6.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	480	22	22	5	22%	27
.03.2.6.3	SIMULATION & LAYOUT	05	0	240	11	11	2	22%	14
.03.2.6.4	BID PACKAGE & PROCUREMENT	05	28	160	5	33	7	22%	40
.03.2.6.5	PRODUCTION & ASSEMBLY	05	15	32	1	16	2	15%	18
.03.2.6.6	EMBEDDED SOFTWARE	05	10	1,200	55	66	13	20%	79
.03.2.6.7	TESTS & COMMISSIONING	05	0	640	29	29	7	22%	36
.03.2.7	-CONTROL NETWORK	04	24	3,160	145	169	36	21%	205
.03.2.7.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
.03.2.7.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	280	13	13	3	22%	16
.03.2.7.3	SIMULATION & LAYOUT	05	0	80	4	4	1	22%	5
.03.2.7.4	BID PACKAGE & PROCUREMENT	05	13	0	0	13	3	19%	16
.03.2.7.5	EMBEDDED SOFTWARE	05	10	400	18	29	6	20%	35
.03.2.7.6	TESTS & COMMISSIONING	05	0	240	11	11	2	22%	14
.03.2.7.7	SYSTEM SUPERVISOR	05	0	1,160	53	53	12	22%	65
.03.2.7.8	TRIGGER SUPERVISOR	05	0	840	39	39	9	22%	47
.03.2.8	-CLOCK DISTRIBUTION, AND FAST CONTROL	04	32	1,152	50	81	16	20%	98
.03.2.8.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
.03.2.8.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	240	11	11	2	22%	14
.03.2.8.3	SIMULATION & LAYOUT	05	0	240	11	11	2	22%	14
.03.2.8.4	BID PACKAGE & PROCUREMENT	05	17	160	5	22	4	19%	26
.03.2.8.5	PRODUCTION & ASSEMBLY	05	4	32	1	5	1	24%	6
.03.2.8.6	EMBEDDED SOFTWARE	05	10	80	4	14	2	14%	16
.03.2.8.7	TESTS & COMMISSIONING	05	0	240	11	11	2	22%	14
.03.2.9	-GATING LOGIC	04	6	1,128	49	55	12	21%	67

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.03.2.9.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
.03.2.9.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	240	11	11	2	22%	14
.03.2.9.3	SIMULATION & LAYOUT	05	0	240	11	11	2	22%	14
.03.2.9.4	BID PACKAGE & PROCUREMENT	05	5	160	5	10	2	17%	12
.03.2.9.5	PRODUCTION & ASSEMBLY	05	1	8	0	1	0	24%	2
.03.2.9.6	EMBEDDED SOFTWARE	05	0	160	7	7	2	22%	9
.03.2.9.7	TESTS & COMMISSIONING	05	0	160	7	7	2	22%	9
.03.2.10	-CONTROL AND MONITORING SOFTWARE	04	10	2,000	92	102	22	21%	124
.03.2.10.1	FUNCTIONAL SPECS DOCUMENT	05	0	120	6	6	1	22%	7
.03.2.10.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	360	17	17	4	22%	20
.03.2.10.3	IMPLEMENTATION & CODING	05	10	1,280	59	69	15	21%	84
.03.2.10.4	TESTS & COMMISSIONING	05	0	240	11	11	2	22%	14
.03.2.11	REAL-TIME OPERATING SYSTEM	04	21	1,520	70	91	17	19%	108
.03.2.12	STANDARD CPUs	04	14	640	28	41	8	20%	50
.03.2.13	INTERFACE WITH FRONT-END ELECTRONICS	04	10	1,120	52	62	12	20%	74
.03.2.14	INTERFACE WITH FAST CONTROL AND TRIGGER	04	10	1,600	74	84	18	21%	102
.03.2.15	INTERFACE WITH ON-LINE COMPUTING	04	10	1,480	68	79	17	21%	95
.03.2.16	ANCILLARY CONTROLS & HUMAN INTERFACE	04	10	2,320	107	117	25	21%	142
.03.3	-PRODUCTION SYSTEM	03	6,231	14,760	636	6,867	1,542	23%	8,409
.03.3.1	-SYSTEM DESIGN & SIMULATION	04	25	1,360	63	88	15	17%	103
.03.3.1.1	PROJECT COORDINATION	05	25	0	0	25	2	6%	26
.03.3.1.2	FUNCTIONAL SPECS AND DESIGN DOCUMENT	05	0	800	37	37	8	22%	45
.03.3.1.3	BEHAVIORAL SIMULATION	05	0	560	26	26	6	22%	31
.03.3.2	-EVENT DATA COLLECTION MODULES	04	3,151	1,632	60	3,212	769	24%	3,981
.03.3.2.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9

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BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
.03.3.2.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	480	22	22	5	22%	27
.03.3.2.3	SIMULATION & LAYOUT	05	36	160	7	44	7	15%	50
.03.3.2.4	BID PACKAGE & PROCUREMENT	05	2,977	160	5	2,982	716	24%	3,698
.03.3.2.5	PRODUCTION & ASSEMBLY	05	138	512	11	149	39	26%	188
.03.3.2.6	EMBEDDED SOFTWARE	05	0	80	4	4	1	22%	5
.03.3.2.7	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.3.3	SLOW LINKS	04	0	520	24	24	5	22%	29
.03.3.4	FAST LINKS	04	0	480	22	22	5	22%	27
.03.3.5	-EVENT BUILDER	04	391	936	38	429	93	22%	521
.03.3.5.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
.03.3.5.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	200	9	9	2	22%	11
.03.3.5.3	SIMULATION & LAYOUT	05	36	160	7	44	7	15%	50
.03.3.5.4	BID PACKAGE & PROCUREMENT	05	303	160	5	308	68	22%	376
.03.3.5.5	PRODUCTION & ASSEMBLY	05	41	96	2	43	12	28%	55
.03.3.5.6	EMBEDDED SOFTWARE	05	10	80	4	14	2	14%	16
.03.3.5.7	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.3.6	-EVENT DATA DISTRIBUTION MODULES	04	1,049	1,248	52	1,101	246	22%	1,347
.03.3.6.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
.03.3.6.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	480	22	22	5	22%	27
.03.3.6.3	SIMULATION & LAYOUT	05	36	160	7	44	7	15%	50
.03.3.6.4	BID PACKAGE & PROCUREMENT	05	934	160	5	939	216	23%	1,155
.03.3.6.5	PRODUCTION & ASSEMBLY	05	47	128	3	50	14	28%	64
.03.3.6.6	EMBEDDED SOFTWARE	05	0	80	4	4	1	22%	5
.03.3.6.7	TESTS & COMMISSIONING	05	31	80	4	35	2	5%	37
.03.3.7	-CONTROL NETWORK	04	276	1,240	57	333	56	17%	389

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'BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
).03.3.7.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
).03.3.7.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	200	9	9	2	22%	11
).03.3.7.3	SIMULATION & LAYOUT	05	0	80	4	4	1	22%	5
).03.3.7.4	BID PACKAGE & PROCUREMENT	05	234	0	0	234	38	16%	272
).03.3.7.5	EMBEDDED SOFTWARE	05	0	80	4	4	1	22%	5
).03.3.7.6	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.3.7.7	SYSTEM SUPERVISOR	05	21	320	15	36	6	17%	42
.03.3.7.8	TRIGGER SUPERVISOR	05	21	320	15	36	6	17%	42
.03.3.8	-CLOCK DISTRIBUTION, AND FAST CONTROL	04	1,317	1,352	48	1,364	290	21%	1,654
).03.3.8.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
).03.3.8.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	200	9	9	2	22%	11
).03.3.8.3	SIMULATION & LAYOUT	05	0	160	7	7	2	22%	9
.03.3.8.4	BID PACKAGE & PROCUREMENT	05	1,253	160	5	1,258	264	21%	1,522
.03.3.8.5	PRODUCTION & ASSEMBLY	05	64	512	11	75	19	25%	94
.03.3.8.6	EMBEDDED SOFTWARE	05	0	80	4	4	1	22%	5
.03.3.8.7	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.3.9	-GATING LOGIC	04	13	952	41	53	11	21%	64
.03.3.9.1	FUNCTIONAL SPECS DOCUMENT	05	0	160	7	7	2	22%	9
.03.3.9.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	200	9	9	2	22%	11
.03.3.9.3	SIMULATION & LAYOUT	05	0	160	7	7	2	22%	9
.03.3.9.4	BID PACKAGE & PROCUREMENT	05	12	160	5	17	3	19%	20
.03.3.9.5	PRODUCTION & ASSEMBLY	05	0	32	1	1	0	21%	1
.03.3.9.6	EMBEDDED SOFTWARE	05	0	160	7	7	2	22%	9
.03.3.9.7	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.3.10	-CONTROL AND MONITORING SOFTWARE	04	10	680	31	42	8	20%	50

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BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
03.3.10.1	FUNCTIONAL SPECS DOCUMENT	05	0	80	4	4	1	22%	5
03.3.10.2	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	200	9	9	2	22%	11
03.3.10.3	IMPLEMENTATION & CODING	05	10	240	11	21	4	18%	25
03.3.10.4	TESTS & COMMISSIONING	05	0	160	7	7	2	22%	9
03.3.11	REAL-TIME OPERATING SYSTEM	04	0	600	28	28	6	22%	34
03.3.12	STANDARD CPUs	04	0	80	4	4	1	22%	5
03.3.13	INTERFACE WITH FRONT-END ELECTRONICS	04	0	1,000	46	46	10	22%	56
03.3.14	INTERFACE WITH FAST CONTROL AND TRIGGER	04	0	1,040	48	48	11	22%	58
03.3.15	INTERFACE WITH ON-LINE COMPUTING	04	0	880	41	41	9	22%	49
03.3.16	ANCILLARY CONTROLS & HUMAN INTERFACE	04	0	760	35	35	8	22%	43
03.4	-INSTALLATION AND TEST	03	29	7,456	300	329	67	20%	396
03.4.1	-SYSTEM DESIGN & SIMULATION	04	19	880	41	59	10	17%	69
03.4.1.1	PROJECT COORDINATION	05	19	0	0	19	1	5%	20
03.4.1.2	FUNCTIONAL SPECS AND DESIGN DOCUMENT	05	0	560	26	26	6	22%	31
03.4.1.3	BEHAVIORAL SIMULATION	05	0	320	15	15	3	22%	18
03.4.2	-EVENT DATA COLLECTION MODULES	04	0	1,104	37	37	8	21%	45
03.4.2.1	BID PACKAGE & PROCUREMENT	05	0	80	2	2	0	8%	3
03.4.2.2	TESTS & COMMISSIONING	05	0	1,024	35	35	8	22%	43
03.4.3	SLOW LINKS	04	10	360	17	27	5	19%	32
03.4.4	FAST LINKS	04	0	240	11	11	2	22%	14
03.4.5	-EVENT BUILDER	04	0	672	27	27	6	21%	33
03.4.5.1	BID PACKAGE & PROCUREMENT	05	0	80	2	2	0	8%	3
03.4.5.2	EMBEDDED SOFTWARE	05	0	400	18	18	4	22%	23
03.4.5.3	TESTS & COMMISSIONING	05	0	192	7	7	1	22%	8
03.4.6	-EVENT DATA DISTRIBUTION MODULES	04	0	376	13	13	3	19%	16

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BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
03.4.6.1	BID PACKAGE & PROCUREMENT	05	0	80	2	2	0	8%	3
.03.4.6.2	EMBEDDED SOFTWARE	05	0	40	2	2	0	22%	2
.03.4.6.3	TESTS & COMMISSIONING	05	0	256	9	9	2	22%	11
.03.4.7	-CONTROL NETWORK	04	0	960	40	40	9	22%	49
.03.4.7.1	TESTS & COMMISSIONING	05	0	160	7	7	2	22%	9
.03.4.7.2	SYSTEM SUPERVISOR	05	0	400	17	17	4	22%	20
03.4.7.3	TRIGGER SUPERVISOR	05	0	400	17	17	4	22%	20
03.4.8	-CLOCK DISTRIBUTION, AND FAST CONTROL	04	0	1,344	48	48	10	21%	59
.03.4.8.1	BID PACKAGE & PROCUREMENT	05	0	80	2	2	0	8%	3
.03.4.8.2	TESTS & COMMISSIONING	05	0	1,264	46	46	10	22%	56
.03.4.9	-GATING LOGIC	04	0	120	5	5	1	22%	6
.03.4.9.1	TESTS & COMMISSIONING	05	0	120	5	5	1	22%	6
.03.4.10	-CONTROL AND MONITORING SOFTWARE	04	0	120	6	6	1	22%	7
.03.4.10.1	DESIGN, DOCUMENTATION & TEST PROCEDURE	05	0	40	2	2	0	22%	2
.03.4.10.2	TESTS & COMMISSIONING	05	0	80	4	4	1	22%	5
.03.4.11	REAL-TIME OPERATING SYSTEM	04	0	120	6	6	1	22%	7
.03.4.12	STANDARD CPUs	04	0	240	9	9	2	22%	11
.03.4.13	INTERFACE WITH FRONT-END ELECTRONICS	04	0	280	13	13	3	22%	16
.03.4.14	INTERFACE WITH FAST CONTROL AND TRIGGER	04	0	200	9	9	2	22%	11
.03.4.15	INTERFACE WITH ON-LINE COMPUTING	04	0	320	13	13	3	22%	16
.03.4.16	ANCILLARY CONTROLS & HUMAN INTERFACE	04	0	120	6	6	1	22%	7
.04	-TRIGGER	02	3,996	65,724	2,698	6,694	1,740	26%	8,434
.04.1	-LEVEL 1 CALORIMETER (ANALOG OPTION)	03	2,110	21,850	924	3,034	718	24%	3,751
.04.1.1	DESIGN/DOCUMENTATION	04	0	380	18	18	4	22%	22
.04.1.2	-PROTOTYPE	04	240	17,670	767	1,006	253	25%	1,259

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BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
04.1.2.1	-ACTIVE COMPONENTS	05	46	1,900	91	137	32	24%	170
04.1.2.1.1	FPGA FOR L1 SUM BOARD	06	12	950	46	57	14	24%	71
04.1.2.1.2	FPGA FOR COUNT LOGIC BOARD	06	7	950	46	53	13	24%	66
04.1.2.1.3	IDT 7210 MAC IC FOR JET SUM/FILTER BO	06	3	0	0	3	1	22%	4
04.1.2.1.4	AD9020 FADC IC FOR JET SUM/FILTER BOA	06	1	0	0	1	0	22%	2
04.1.2.1.5	VARIABLE GAIN SHAPING AMPLIFIER FOR L	06	18	0	0	18	4	22%	21
04.1.2.1.6	SUMMING AMPLIFIER	06	5	0	0	5	1	22%	6
04.1.2.2	-PRINTED CIRCUIT BOARD	05	182	15,675	673	855	218	26%	1,072
04.1.2.2.1	L1 SUM BOARD	06	80	3,610	157	237	66	28%	303
04.1.2.2.2	COUNT LOGIC BOARD	06	30	2,280	102	132	32	24%	164
04.1.2.2.3	JET SUM/FILTER BOARD	06	38	3,610	157	196	47	24%	243
04.1.2.2.4	ADDER BOARD	06	16	3,610	157	173	42	24%	215
04.1.2.2.5	GLOBAL SUM BOARD	06	9	1,710	66	75	21	28%	96
04.1.2.2.6	TIMING DISRIMINATION SMT BOARD	06	9	855	33	42	10	24%	52
04.1.2.3	-CONTROL/DATA LINKS	05	12	95	3	14	3	22%	17
04.1.2.3.1	1 G BIT/S FIBER OPTIC TRANSMITTER-GLO	06	12	95	3	14	3	22%	17
04.1.3	-PRODUCTION	04	1,870	1,900	70	1,940	447	23%	2,386
04.1.3.1	SIGNAL CABLES	05	52	0	0	52	10	20%	62
04.1.3.2	-ACTIVE COMPONENTS	05	452	0	0	452	103	23%	554
04.1.3.2.1	FPGA FOR L1 SUM BOARD	06	108	0	0	108	26	24%	134
04.1.3.2.2	FPGA FOR COUNT LOGIC BOARD	06	71	0	0	71	17	24%	88
04.1.3.2.3	IDT 7210 MAC IC FOR JET SUM/FILTER BO	06	30	0	0	30	7	22%	37
04.1.3.2.4	AD 9020 FADC IIC FOR JET SUM/FILTER B	06	14	0	0	14	3	22%	17
04.1.3.2.5	VARIABLE GAIN SHAPING AMPLIFIER FOR L	06	176	0	0	176	39	22%	215
04.1.3.2.6	SUMMING AMPLIFIER	06	53	0	0	53	12	22%	64

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3S Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
04.1.3.3	-PRINTED CIRCUIT BOARD	05	1,070	0	0	1,070	257	24%	1,327
04.1.3.3.1	L1 SUM BOARD	06	480	0	0	480	115	24%	595
04.1.3.3.2	COUNT LOGIC BOARD	06	212	0	0	212	51	24%	263
04.1.3.3.3	JET SUM/FILTER BOARD	06	159	0	0	159	38	24%	197
04.1.3.3.4	ADDER BOARD	06	79	0	0	79	19	24%	98
04.1.3.3.5	GLOBAL SUM BOARD	06	52	0	0	52	13	24%	64
04.1.3.3.6	TIMING DISRCIMINATOR SMT BOARD	06	88	0	0	88	21	24%	109
04.1.3.4	-CONTROL/DATA LINKS	05	297	1,900	70	366	76	21%	443
04.1.3.4.1	1 G BIT/S FIBER OPTIC TRANSMITTER-GLO	06	84	1,900	70	153	34	22%	187
04.1.3.4.2	RACK SLOT	06	213	0	0	213	43	20%	256
04.1.4	INSTALLATION & TEST OF 489 BOARDS	04	0	1,900	70	70	14	20%	83
04.2	-LEVEL 1 MUON	03	1,850	42,722	1,699	3,549	985	28%	4,534
04.2.1	DESIGN/DOCUMENTATION	04	171	29,452	1,209	1,380	414	30%	1,794
04.2.2	BARREL PRODUCTION	04	932	2,215	67	1,000	300	30%	1,299
04.2.3	END CAP PRODUCTION	04	704	2,215	67	772	232	30%	1,003
04.2.4	INSTALLATION & TEST	04	42	8,840	356	398	40	10%	438
04.3	LEVEL 1 GLOBAL TRIGGER	03	37	1,152	74	111	38	34%	149
05	-INTEGRATION	02	31	17,098	732	763	63	8%	826
05.1	-RACK DEVELOPMENT	03	21	2,922	132	153	20	13%	173
05.1.1	RACK SYSTEMS DESIGN AND ENGINEERING	04	0	2,812	129	129	19	15%	149
05.1.2	VME RACK PARTS AND MATERIALS (PROTO)	04	21	0	0	21	0	2%	21
05.1.3	STANDARD RACK ASSBLY (PROTO)	04	0	83	2	2	0	0%	2
05.1.4	STANDARD RACK INSTALLATION (PROTO)	04	0	27	1	1	0	0%	1
05.2	FIBER LINK DEVELOPMENT	03	10	3,544	319	329	26	8%	356
05.3	FACILITY INTERFACE	03	0	5,316	140	140	8	6%	149

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BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
.05.4	FACILITY DEVELOPMENT	03	0	5,316	140	140	8	6%	149
.06	-PROJECT MANAGEMENT	02	363	23,036	1,364	1,727	363	21%	2,090
.06.1	PROJECT MANAGEMENT- FY 93	03	52	886	41	93	20	21%	112
.06.2	PROJECT MANAGEMENT- FY 94	03	52	1,772	112	164	34	21%	198
.06.3	PROJECT MANAGEMENT- FY 95	03	52	1,772	112	164	34	21%	198
.06.4	PROJECT MANAGEMENT- FY 96	03	52	3,544	224	276	58	21%	334
.06.5	PROJECT MANAGEMENT- FY 97	03	52	4,430	265	317	67	21%	383
.06.6	PROJECT MANAGEMENT- FY 98	03	52	5,316	305	357	75	21%	432
.06.7	PROJECT MANAGEMENT- FY 99	03	52	5,316	305	357	75	21%	432

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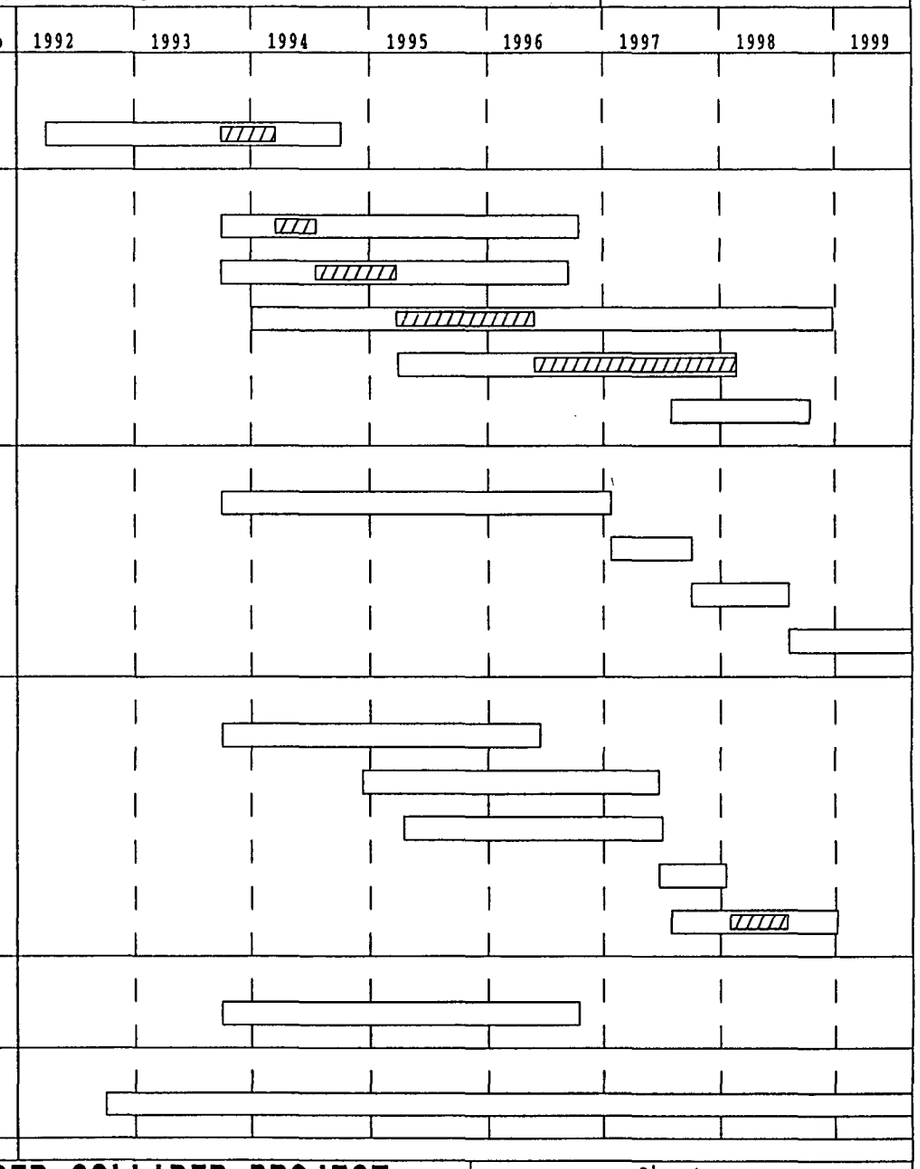
LEVEL II SUMMARY BASELINE SCHEDULE

50 ELECTRONICS

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
WBS:50.01 Research and development			
DESIGN	01APR92	05OCT94	
WBS:50.02 Front-End			
DESIGN	01OCT93	14OCT96	
PROCUREMENT	01OCT93	12SEP96	
FABRICATION	03JAN94	21DEC98	
ASSEMBLY	27MAR95	16FEB98	
INSTALLATION	28JUL97	09OCT98	
WBS:50.03 DATA ACQUISITION SYSTEM			
DESIGN	01OCT93	22JAN97	
PROCUREMENT	23JAN97	01OCT97	
FABRICATION	02OCT97	05AUG98	
INSTALLATION	06AUG98	06SEP99	
WBS:50.04 Trigger			
DESIGN	01OCT93	12JUN96	
PROCUREMENT	09DEC94	19JUN97	
FABRICATION	12APR95	30JUN97	
ASSEMBLY	20JUN97	15JAN98	
INSTALLATION	30JUL97	05JAN99	
WBS:50.05 Integration			
DESIGN	01OCT93	14OCT96	
WBS:50.06 Project Management			
LEVEL OF EFFORT (LOE)	01OCT92	28SEP99	



Legend: Baseline, Critical, Float
☆ Baseline ▽ Projected ▼ Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

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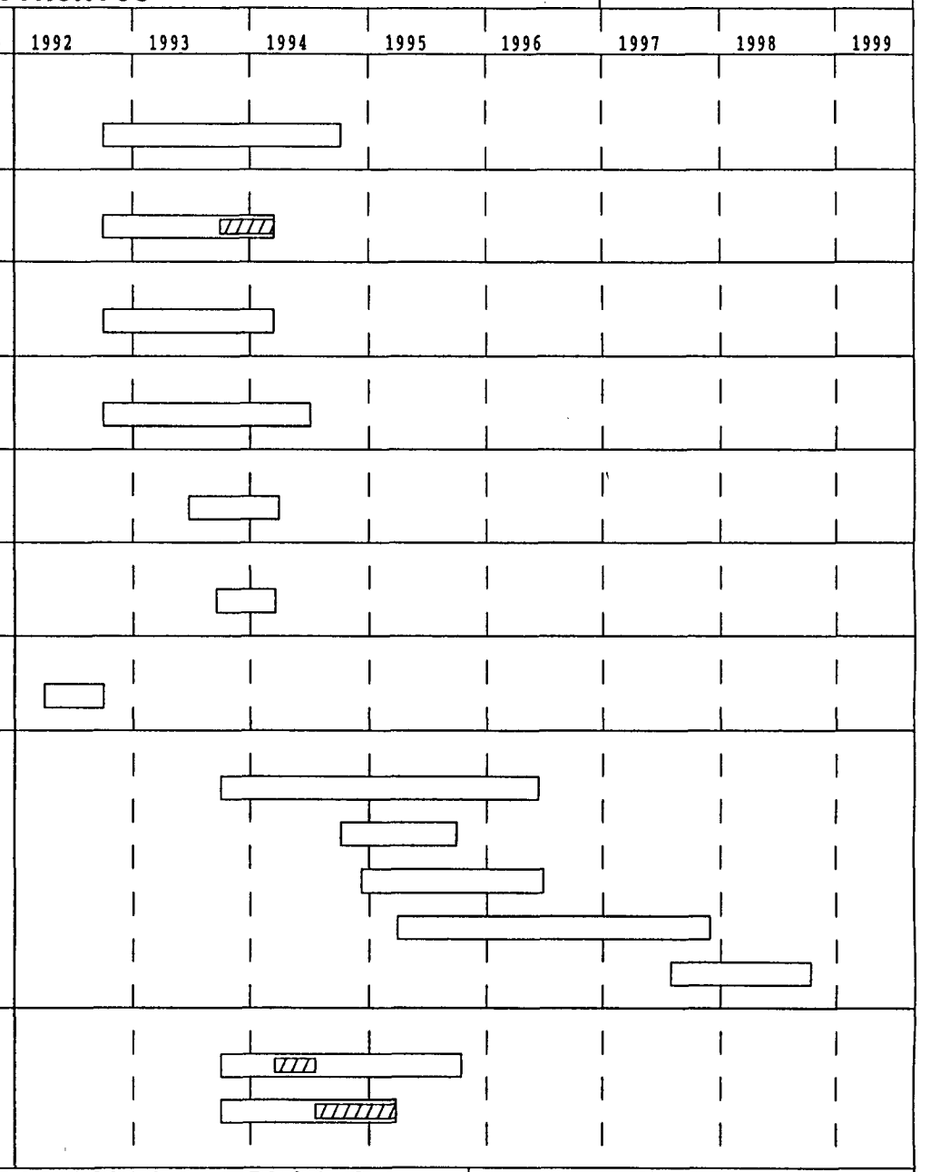
LEVEL III SUMMARY BASELINE SCHEDULE

50 ELECTRONICS

G E M DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
WBS:50.01.1 Silicon Tracker			
DESIGN	01OCT92	05OCT94	
WBS:50.01.2 IPC			
DESIGN	01OCT92	17MAR94	
WBS:50.01.3 Calorimeter front-end			
DESIGN	01OCT92	14MAR94	
WBS:50.01.4 Muon front-end			
DESIGN	01OCT92	05JUL94	
WBS:50.01.5 Level 1 - trigger			
DESIGN	24JUN93	30MAR94	
WBS:50.01.6 DAQ			
DESIGN	16SEP93	18MAR94	
WBS:50.01.7 FY 92 Expenditure			
DESIGN	01APR92	29SEP92	
WBS:50.02.1 Muon			
DESIGN	01OCT93	12JUN96	
PROCUREMENT	06OCT94	25SEP95	
FABRICATION	07DEC94	27JUN96	
ASSEMBLY	27MAR95	25NOV97	
INSTALLATION	28JUL97	09OCT98	
WBS:50.02.2 Central Tracker			
DESIGN	01OCT93	10OCT95	
PROCUREMENT	01OCT93	22MAR95	



Legend
Baseline
Critical
Float
☆ Baseline ▽ Projected ▼ Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

OPEN PLAN 0

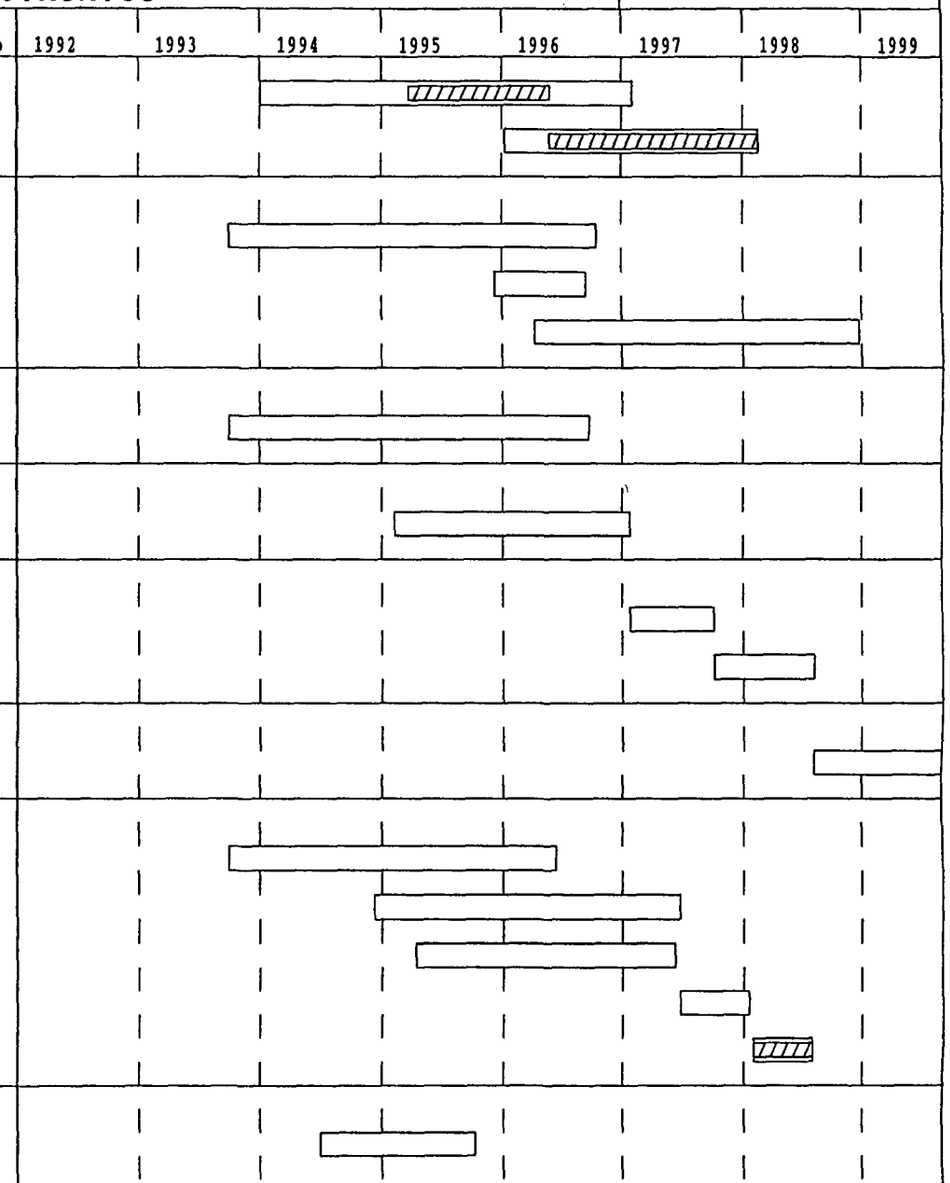
Project: ELEC_MPS
Report: TDR_SUM1
Status as of: 01OCT91
Current Date: 27APR93
Page: 2

LEVEL III SUMMARY BASELINE SCHEDULE

50 ELECTRONICS

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
FABRICATION	03JAN94	30JAN97	
ASSEMBLY	11JAN96	16FEB98	
WBS:50.02.3 Calorimeter			
DESIGN	01OCT93	14OCT96	
PROCUREMENT	08DEC95	12SEP96	
FABRICATION	10APR96	21DEC98	
WBS:50.03.1 Design and Document			
DESIGN	01OCT93	20SEP96	
WBS:50.03.2 Prototype System			
DESIGN	08FEB95	22JAN97	
WBS:50.03.3 Production System			
PROCUREMENT	23JAN97	01OCT97	
FABRICATION	02OCT97	05AUG98	
WBS:50.03.4 Installation and Test			
INSTALLATION	06AUG98	06SEP99	
WBS:50.04.1 Level 1 Calorimeter			
DESIGN	01OCT93	12JUN96	
PROCUREMENT	09DEC94	19JUN97	
FABRICATION	12APR95	03JUN97	
ASSEMBLY	20JUN97	15JAN98	
INSTALLATION	30JAN98	30JUL98	
WBS:50.04.2 Level 1 Muon			
DESIGN	01JUL94	05OCT95	



Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

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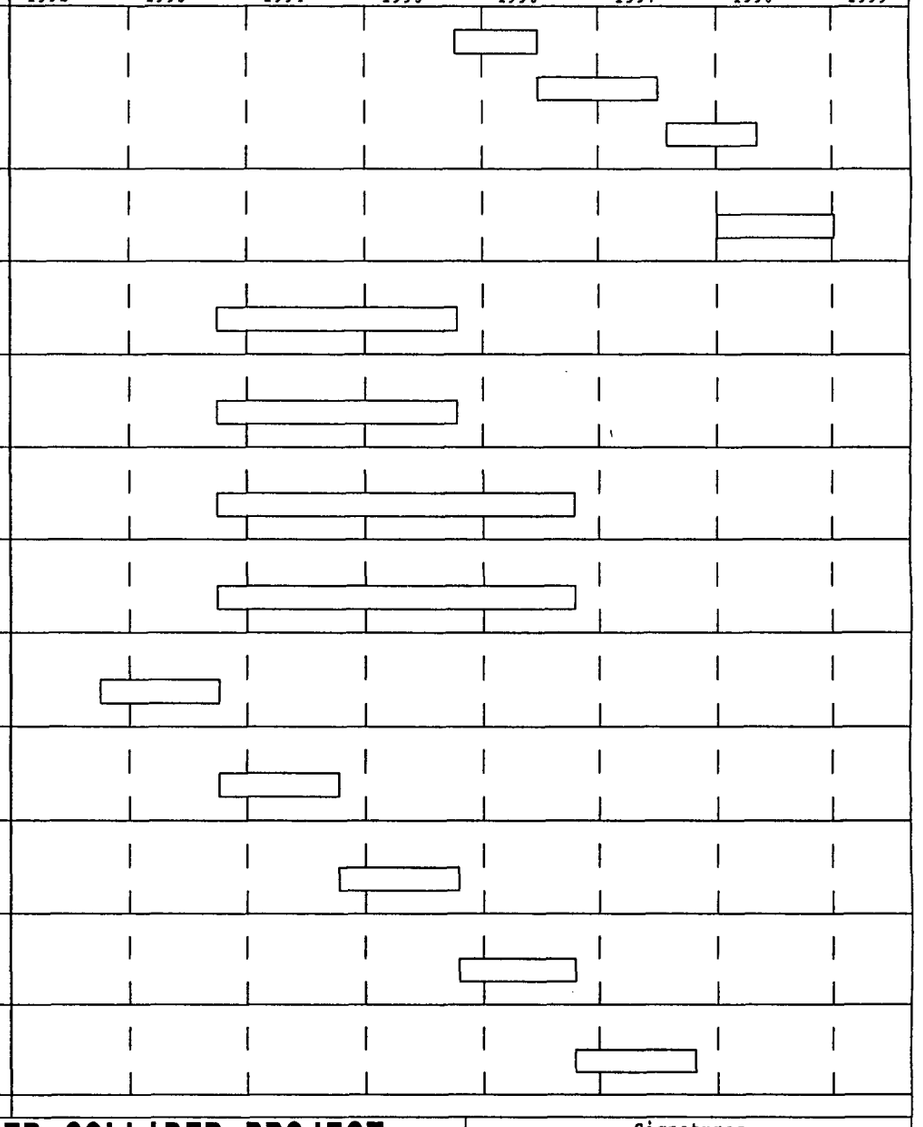
LEVEL III SUMMARY BASELINE SCHEDULE

50 ELECTRONICS

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
PROCUREMENT	06OCT95	25JUN96	
FABRICATION	26JUN96	30JUN97	
INSTALLATION	30JUL97	05MAY98	
WBS:50.04.3 Level 1 Global			
INSTALLATION	01JAN98	05JAN99	
WBS:50.05.1 Rack Development			
DESIGN	01OCT93	10OCT95	
WBS:50.05.2 Fiber Link Development			
DESIGN	01OCT93	10OCT95	
WBS:50.05.3 Facility Interface			
DESIGN	01OCT93	14OCT96	
WBS:50.05.4 Facility Development			
DESIGN	01OCT93	14OCT96	
WBS:50.06.1 Project Management -FY 93			
LEVEL OF EFFORT (LOE)	01OCT92	05OCT93	
WBS:50.06.2 Project Management -FY 94			
LEVEL OF EFFORT (LOE)	06OCT93	10OCT94	
WBS:50.06.3 Project Management -FY 95			
LEVEL OF EFFORT (LOE)	11OCT94	13OCT95	
WBS:50.06.4 Project Management -FY 96			
LEVEL OF EFFORT (LOE)	16OCT95	17OCT96	
WBS:50.06.5 Project Management -FY 97			
LEVEL OF EFFORT (LOE)	18OCT96	22OCT97	
WBS:50.06.6 Project Management -FY 98			



Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

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Project: ELEC_MPS
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Current Date: 27APR93
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LEVEL III SUMMARY BASELINE SCHEDULE

50 ELECTRONICS

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
LEVEL OF EFFORT (LOE)	23OCT97	27OCT98	
WBS:50.06.7 Project Management -FY 99			
LEVEL OF EFFORT (LOE)	28OCT98	28SEP99	

1992 1993 1994 1995 1996 1997 1998 1999

Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

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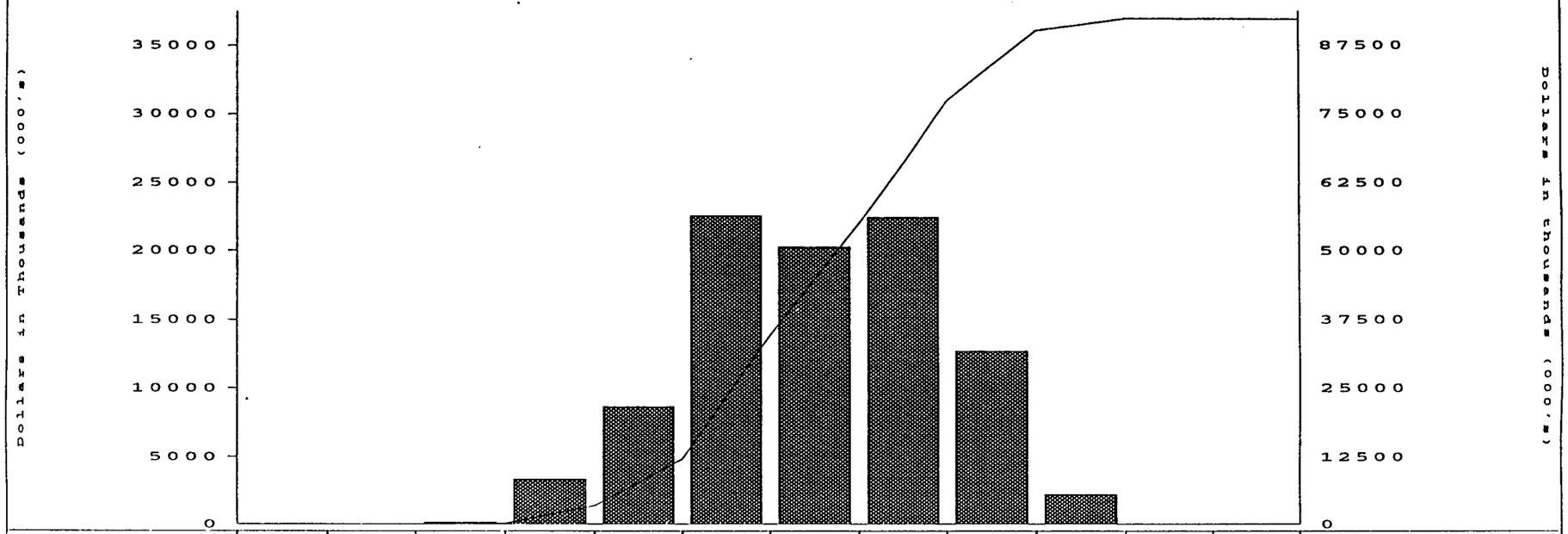
GEM Detector Report: GEM_FY	GEM DETECTOR WBS 50 - ELECTRONICS	Date: 27APR93 Project: ELEC_MPS



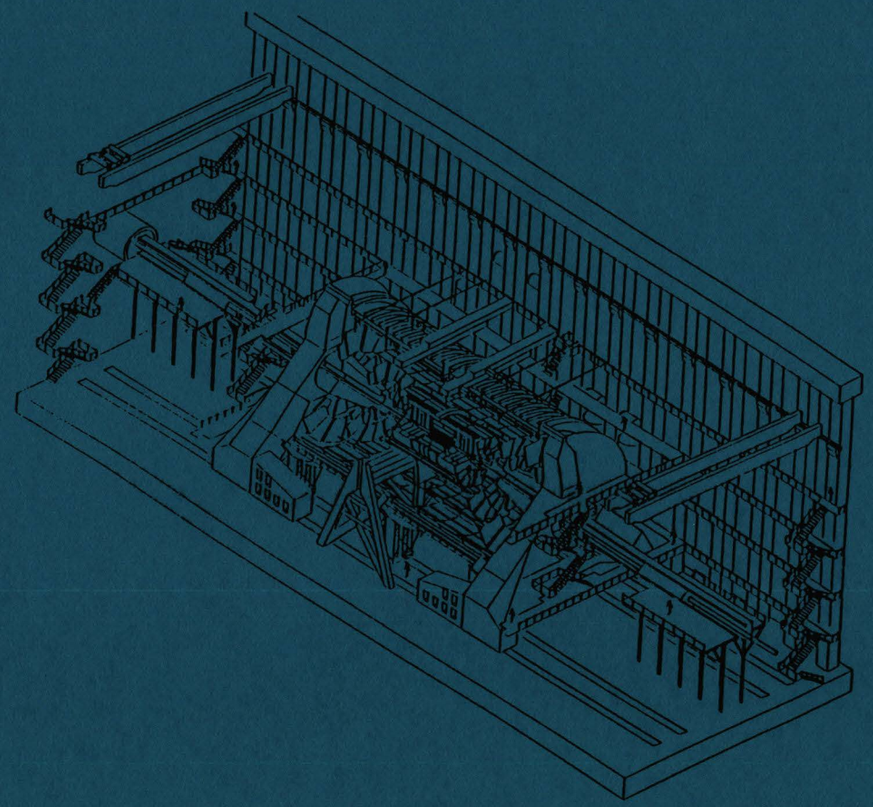
		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
Incr Bud	$10k		12	335	865	2254	2025	2244	1271	222		
Cum Bud	$10k		12	347	1213	3466	5491	7735	9005	9227	9227	9227

WBS 50.01.1	$1,946,675	Silicon Tracker
WBS 50.01.2	$1,432,673	IPC
WBS 50.01.3	$1,354,459	Calorimeter front-end
WBS 50.01.4	$ 450,270	Muon front-end
WBS 50.01.5	$ 344,036	Level 1 - trigger
WBS 50.01.6	$ 296,456	DAQ
WBS 50.01.7	$ 121,610	FY 92 Expenditure
WBS 50.02.1	$15,060,023	Muon
WBS 50.02.2	$22,785,452	Central Tracker
WBS 50.02.3	$24,156,012	Calorimeter
WBS 50.03.1	$2,159,698	Design and Document
WBS 50.03.2	$2,009,218	Prototype System
WBS 50.03.3	$8,408,957	Production System
WBS 50.03.4	$ 395,957	Installation and Test
WBS 50.04.1	$3,751,159	Level 1 Calorimeter
WBS 50.04.2	$4,534,142	Level 1 Muon

GEM DETECTOR
WBS 50 - ELECTRONICS

	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
WBS 50.04.3						$ 148,885		Level 1 Global			
WBS 50.05.1		$ 172,572			Rack Development						
WBS 50.05.2		$ 355,692			Fiber Link Development						
WBS 50.05.3		$ 148,763					Facility Interface				
WBS 50.05.4		$ 148,763					Facility Development				
WBS 50.06.1	$ 112,138			Project Management -FY 93							
WBS 50.06.2		$ 198,267			Project Management -FY 94						
WBS 50.06.3			$ 198,267			Project Management -FY 95					
WBS 50.06.4				$ 333,711			Project Management -FY 96				
WBS 50.06.5					$ 383,025			Project Management -FY 97			
WBS 50.06.6						$ 432,340			Project Management -FY 98		
WBS 50.06.7							$ 432,340			Project Management -FY 99	

Computing



gem

Superconducting ***Super Collider***

Computing Parameters Table

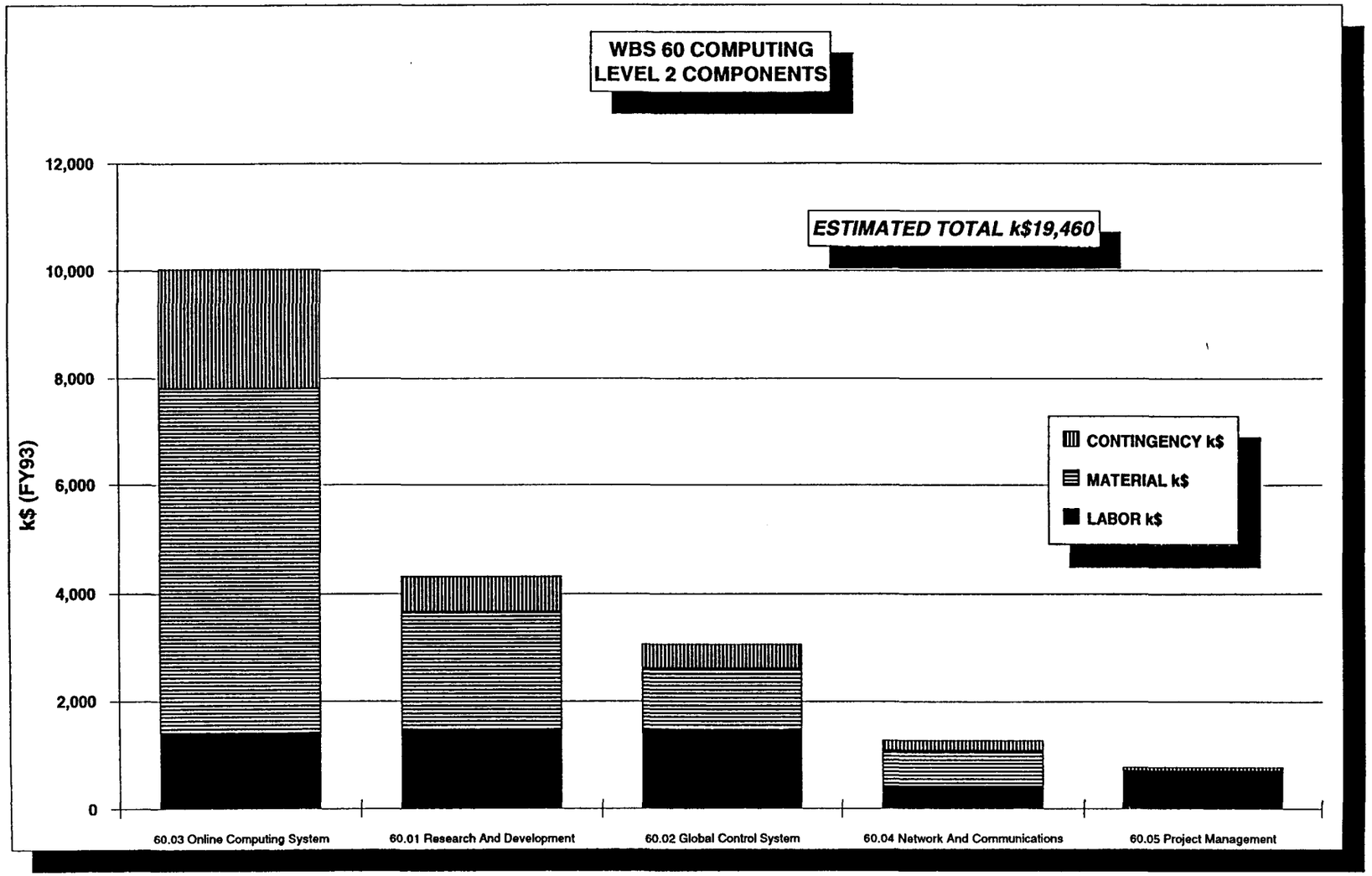
	FY 1999	FY2000	FY2001	FY2002
Peak Luminosity (cm-2s-1)	10^30	10^31	10^32	10^32
Total Collision Time(s)	10^6	10^7	10^7	10^7
Level 1 Trigger level	100 microb	40 microb	40 microb	20 microb
Level 1 Trigger Rate (Peak)	100 Hz	400 Hz	4 kHz	20 kHz
Event Size	1 MB	0.5 MB	0.2 MB	0.2 MB
Data Rate (Peak)	100 MB/s	200MB/s	800 MB/s	4 GB/s
Event Filter (Level 2/3) Factor	1	2 (Note 1)	8	40
Filter Level	100 microb	20 microb	5 microb	500 nb
Event Rate Stored	100 Hz	200 Hz	500 Hz	500 Hz
Rate to Storage (Peak)	100 MB/s	100 MB/s	100 MB/s	100 MB/s
Stored Event Data for Year	100 TB	.05 PB	1 PB	1 PB
Integrated Luminosity (pb-1)	1	100	1,000	10,000
PASS 1 Occupational Load, SSCUPs (Note 2)	2x10^4	2x10^5	2x10^5	2x10^5

NOTES

1. If the event size is reduced to 0.2 MB, no event filter is needed.

2. Typical processes that are included in the data sent to storage are:

   Singe Z->ll (2 nb)
   Single W (10 nb), pre-scaled in FY 2002
   Tbar production (10 nb)
   Missing E_T (50 GeV/c - 100 GeV/c, ...


WBS 60 COMPUTING
LEVEL 2 COMPONENTS
ESTIMATED TOTAL k$19,460
CONTINGENCY k$
MATERIAL k$
LABOR k$
k$ (FY93)
12,000
10,000
8,000
6,000
4,000
2,000
0
60.03 Online Computing System
60.01 Research And Development
60.02 Global Control System
60.04 Network And Communications
60.05 Project Management

GEM COST ESTIMATE SUMMARY

4/26/93

COMPUTER & CONTROLS SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
50	-COMPUTER & CONTROLS	01	10,390	168,299	5,478	15,869	3,591	23%	19,460
50.01	-RESEARCH AND DEVELOPMENT	02	2,176	47,640	1,487	3,662	666	18%	4,328
50.01.1	-GLOBAL CONTROL SYSTEM (GCS)	03	356	23,683	739	1,095	209	19%	1,303
50.01.1.1	-PROJECT PLAN	04	5	3,588	112	117	18	15%	134
50.01.1.1.1	REQUIREMENTS, SPECIFICATIONS	05	1	718	22	23	4	15%	27
50.01.1.1.2	STANDARDS RECOMMENDATIONS	05	1	718	22	23	4	15%	27
50.01.1.1.3	HARDWARE RECOMMENDATIONS	05	1	718	22	23	4	15%	27
50.01.1.1.4	INTERFACE TO CCD	05	1	718	22	23	4	15%	27
50.01.1.1.5	DEVELOPMENT PLAN	05	1	718	22	23	4	15%	27
50.01.1.2	-TEST SYSTEMS	04	70	5,741	179	249	50	20%	299
50.01.1.2.1	HARDWARE	05	30	2,871	90	119	24	20%	143
50.01.1.2.2	SOFTWARE	05	41	2,871	90	130	26	20%	156
50.01.1.3	-DESIGN	04	8	5,981	187	194	39	20%	233
50.01.1.3.1	DATA SPECIFICATIONS	05	2	1,196	37	39	8	20%	47
50.01.1.3.2	PROCESS SPECIFICATIONS	05	2	1,196	37	39	8	20%	47
50.01.1.3.3	HARDWARE SPECIFICATIONS	05	2	1,196	37	39	8	20%	47
50.01.1.3.4	PROCUREMENT PLAN	05	2	1,196	37	39	8	20%	47
50.01.1.3.5	INSTALLATION PLAN	05	2	1,196	37	39	8	20%	47
50.01.1.4	-PROTOTYPE SYSTEMS	04	262	5,981	187	448	90	20%	538
50.01.1.4.1	SOFTWARE DEVELOPMENT	05	3	2,392	75	78	16	20%	93
50.01.1.4.2	ACQUIRED SOFTWARE	05	212	1,196	37	249	50	20%	299
50.01.1.4.3	HARDWARE	05	47	2,392	75	122	24	20%	146
50.01.1.5	TEST BEAM SUPPORT	04	12	2,392	75	87	13	15%	100
50.01.2	-ON-LINE COMPUTING	03	1,448	10,933	341	1,789	315	18%	2,103
50.01.2.1	PROJECT PLAN	04	2	1,276	40	41	6	15%	48

GEM COST ESTIMATE SUMMARY

4/26/93

COMPUTER & CONTROLS SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
30.01.2.2	TEST SYSTEMS	04	287	2,002	63	349	70	20%	419
30.01.2.3	-DESIGN	04	5	4,253	133	138	21	15%	159
30.01.2.3.1	DATA SPECIFICATIONS	05	1	851	27	28	4	15%	32
30.01.2.3.2	PROCESS SPECIFICATIONS	05	1	851	27	28	4	15%	32
30.01.2.3.3	HARDWARE SPECIFICATIONS	05	1	851	27	28	4	15%	32
30.01.2.3.4	PROCUREMENT PLAN	05	1	851	27	28	4	15%	32
30.01.2.3.5	INSTALLATION PLAN	05	1	851	27	28	4	15%	32
30.01.2.4	-PROTOTYPE SYSTEMS	04	1,053	2,552	80	1,133	199	18%	1,332
30.01.2.4.1	SOFTWARE DEVELOPMENT	05	902	1,276	40	941	141	15%	1,083
30.01.2.4.2	HARDWARE	05	152	1,276	40	191	57	30%	249
30.01.2.5	TEST BEAM SUPPORT	04	101	851	27	128	19	15%	147
30.01.3	-NETWORK AND COMMUNICATIONS	03	372	13,024	406	779	143	18%	921
30.01.3.1	-DIGITAL COMMUNICATIONS	04	142	6,135	191	333	61	18%	394
30.01.3.1.1	-PROJECT PLAN	05	2	1,435	45	47	8	17%	55
30.01.3.1.1.1	REQUIREMENTS, SPECIFICATIONS	06	0	160	5	5	1	15%	6
30.01.3.1.1.2	STANDARDS RECOMMENDATIONS	06	0	319	10	10	2	15%	12
30.01.3.1.1.3	HARDWARE RECOMMENDATIONS	06	0	319	10	10	2	15%	12
30.01.3.1.1.4	INTERFACE TO CCD	06	0	319	10	10	2	20%	12
30.01.3.1.1.5	DEVELOPMENT PLAN	06	0	319	10	10	2	20%	12
30.01.3.1.2	TEST SYSTEMS	05	108	1,382	43	151	30	20%	181
30.01.3.1.3	-DESIGN	05	2	1,403	44	46	7	15%	52
30.01.3.1.3.1	PROTOCOL SPECIFICATIONS	06	0	351	11	11	2	15%	13
30.01.3.1.3.2	HARDWARE SPECIFICATIONS	06	0	351	11	11	2	15%	13
30.01.3.1.3.3	PROCUREMENT PLAN	06	0	351	11	11	2	15%	13
30.01.3.1.3.4	INSTALLATION PLAN	06	0	351	11	11	2	15%	13

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

COMPUTER & CONTROLS SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
60.01.3.1.4	-PROTOTYPE SYSTEMS	05	2	1,382	43	45	9	20%	54
60.01.3.1.4.1	SOFTWARE DEVELOPMENT	06	1	691	22	22	5	20%	27
60.01.3.1.4.2	HARDWARE	06	1	691	22	22	5	20%	27
60.01.3.1.5	TEST BEAM SUPPORT	05	29	532	17	45	7	15%	52
60.01.3.2	-HUMAN COMMUNICATIONS	04	219	5,614	175	394	73	19%	467
60.01.3.2.1	-VIDEOCONFERENCE	05	2	1,382	43	45	6	13%	51
60.01.3.2.1.1	PROJECT PLAN	06	1	681	21	22	2	10%	24
60.01.3.2.1.2	DESIGN	06	1	702	22	23	3	15%	26
60.01.3.2.2	-MULTIMEDIA COMPUTING SYSTEMS	05	217	4,232	132	349	67	19%	417
60.01.3.2.2.1	PROJECT PLAN	06	1	617	19	20	3	15%	23
60.01.3.2.2.2	DESIGN	06	1	1,063	33	35	5	15%	40
60.01.3.2.2.3	TEST SYSTEMS	06	108	1,276	40	147	30	20%	177
60.01.3.2.2.4	PROTOTYPES	06	108	1,276	40	147	30	20%	177
60.01.3.3	-TEST BEAM SUPPORT	04	12	1,276	40	51	9	18%	60
60.01.3.3.1	PROJECT PLAN	05	6	638	20	26	4	15%	30
60.01.3.3.2	PROJECT DESIGN	05	6	638	20	26	5	20%	31
60.02	-GLOBAL CONTROL SYSTEM	02	1,150	48,702	1,454	2,603	444	17%	3,047
60.02.1	-SOFTWARE	03	458	14,909	465	923	183	20%	1,106
60.02.1.1	USER INTERFACE	04	37	1,187	37	74	15	20%	88
60.02.1.2	DATABASE	04	42	1,187	37	79	16	20%	94
60.02.1.3	ALARM HANDLER	04	32	1,187	37	69	14	20%	82
60.02.1.4	ARCHIVE	04	37	1,187	37	74	15	20%	88
60.02.1.5	CHANNEL ACCESS	04	42	1,187	37	79	16	20%	94
60.02.1.6	MONITORING PROCESSES	04	42	1,187	37	79	16	20%	94
60.02.1.7	ADAPTIVE CONTROL	04	42	1,187	37	79	16	20%	94

GEM COST ESTIMATE SUMMARY

4/26/93

COMPUTER & CONTROLS SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
0.02.1.8	-COMMERCIAL SOFTWARE	04	135	3,562	111	246	49	20%	295
0.02.1.8.1	RT OS	05	31	890	28	59	12	20%	71
0.02.1.8.2	DRIVERS	05	31	890	28	59	12	20%	71
0.02.1.8.3	EXPERT SYSTEM	05	41	890	28	69	14	20%	83
0.02.1.8.4	ANALYSIS	05	31	890	28	59	12	20%	71
0.02.1.9	INTERFACE TO OTHER COMP. SYSTEMS	04	23	1,012	32	55	11	20%	66
0.02.1.10	INTERFACE TO WAN	04	23	1,012	32	55	11	20%	66
0.02.1.11	ELECTRONIC LOGBOOK SUPPORT	04	6	1,012	32	38	6	15%	44
0.02.2	-HARDWARE	03	453	11,134	348	800	120	15%	920
0.02.2.1	CONSOLES AND DISPLAYS	04	45	1,012	32	77	12	15%	88
0.02.2.2	PROCESSORS	04	51	1,012	32	83	12	15%	95
0.02.2.3	STORAGE SYSTEM	04	51	1,012	32	83	12	15%	95
0.02.2.4	NETWORKS	04	51	1,012	32	83	12	15%	95
0.02.2.5	I/O CRATES	04	26	1,012	32	58	9	15%	67
0.02.2.6	RACKS	04	26	1,012	32	58	9	15%	67
0.02.2.7	SIGNAL CONDITIONING	04	51	1,012	32	83	12	15%	95
0.02.2.8	INTERFACE TO ACCELERATOR	04	51	1,012	32	83	12	15%	95
0.02.2.9	INTERFACES TO OTHER GEM COMP. SYSTEMS	04	51	1,012	32	83	12	15%	95
0.02.2.10	ELECTRONIC LOGBOOK SUPPORT	04	11	1,012	32	43	6	15%	49
0.02.2.11	UPS	04	36	1,012	32	68	10	15%	78
0.02.3	-DOCUMENTATION	03	5	3,622	113	118	18	15%	135
0.02.3.1	USERS GUIDE	04	1	906	28	29	4	15%	34
0.02.3.2	MANUALS	04	1	906	28	29	4	15%	34
0.02.3.3	STANDARDS	04	1	906	28	29	4	15%	34
0.02.3.4	SPECIFICATIONS	04	1	906	28	29	4	15%	34

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

:OMPUTER & CONTROLS SUBSYSTEM

/BS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
0.02.4	PROCUREMENT	03	1	1,098	34	36	4	10%	39
0.02.5	-INSTALLATION	03	61	10,948	286	347	49	14%	396
0.02.5.1	OPERATIONS ROOM PREP	04	7	1,932	54	60	6	10%	66
0.02.5.2	HARDWARE INSTALLATION	04	27	4,515	116	144	22	15%	165
0.02.5.3	SOFTWARE INSTALLATION	04	27	4,501	116	143	22	15%	165
0.02.6	TESTING	03	57	2,237	66	123	25	20%	148
0.02.7	-TEST BEAM SUPPORT	03	115	4,754	142	257	47	18%	304
0.02.7.1	SOFTWARE	04	43	1,530	48	91	18	20%	109
0.02.7.2	HARDWARE	04	43	1,530	48	91	18	20%	109
0.02.7.3	PROCUREMENT	04	1	475	15	15	2	10%	17
0.02.7.4	INSTALLATION	04	29	1,219	31	60	9	15%	69
0.03	-ONLINE COMPUTING SYSTEM	02	6,381	47,944	1,424	7,804	2,222	29%	10,026
0.03.1	-SOFTWARE	03	493	10,278	312	804	152	19%	956
0.03.1.1	PROCESS CONTROL	04	71	1,063	32	104	16	15%	119
0.03.1.2	SYSTEM MANAGEMENT	04	1	1,063	32	34	3	10%	37
0.03.1.3	DATABASED	04	71	1,063	32	104	21	20%	124
0.03.1.4	-COMMERCIAL SOFTWARE	04	162	1,772	54	216	43	20%	259
0.03.1.4.1	OS	05	81	886	27	108	22	20%	130
0.03.1.4.2	QUEING SYSTEM	05	81	886	27	108	22	20%	130
0.03.1.5	INTERFACE TO GCS	04	62	1,772	54	116	23	20%	139
0.03.1.6	INTERFACE TO DAQ	04	62	1,772	54	116	23	20%	139
0.03.1.7	INTERFACE TO OFFLINE SYSTEMS	04	62	1,772	54	116	23	20%	139
0.03.2	-HARDWARE	03	5,292	11,341	346	5,638	1,828	32%	7,466
0.03.2.1	SYSTEM MANAGEMENT	04	2	1,418	43	45	5	10%	49
0.03.2.2	PROCESSORS	04	4,657	1,418	43	4,700	1,645	35%	6,345

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

COMPUTER & CONTROLS SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
0.03.2.3	NETWORKS	04	106	1,418	43	149	30	20%	178
0.03.2.4	RACKS	04	105	1,418	45	150	30	20%	180
0.03.2.5	INTERFACE TO GCS	04	106	1,418	43	149	30	20%	178
0.03.2.6	INTERFACE TO DAQ	04	106	1,418	43	149	30	20%	178
0.03.2.7	INTERFACE TO OFFLINE SYSTEMS	04	106	1,418	43	149	30	20%	178
0.03.2.8	UPS	04	106	1,418	43	149	30	20%	178
0.03.3	-DOCUMENTATION	03	5	4,253	133	138	21	15%	159
0.03.3.1	USERS GUIDE	04	1	1,063	33	35	5	15%	40
0.03.3.2	MANUALS	04	1	1,063	33	35	5	15%	40
0.03.3.3	STANDARDS	04	1	1,063	33	35	5	15%	40
0.03.3.4	SPECIFICATIONS	04	1	1,063	33	35	5	15%	40
0.03.4	PROCUREMENT	03	2	1,418	44	46	7	15%	53
0.03.5	-INSTALLATION	03	163	14,017	388	550	105	19%	655
0.03.5.1	OPERATIONS ROOM PREP	04	33	833	23	55	6	10%	61
0.03.5.2	HARDWARE INSTALLATION	04	61	3,677	90	151	30	20%	181
0.03.5.3	SOFTWARE INSTALLATION	04	69	9,507	275	344	69	20%	413
0.03.6	TESTING	03	140	1,660	50	189	28	15%	218
0.03.7	-TEST BEAM SUPPORT	03	287	4,979	152	439	81	19%	520
0.03.7.1	SOFTWARE	04	105	1,772	55	161	32	20%	193
0.03.7.2	HARDWARE	04	105	1,772	55	161	32	20%	193
0.03.7.3	PROCUREMENT	04	1	532	17	17	2	10%	19
0.03.7.4	INSTALLATION	04	76	904	25	101	15	15%	116
0.04	-NETWORK AND COMMUNICATIONS	02	658	15,476	429	1,086	188	17%	1,274
0.04.1	-DIGITAL COMMUNICATIONS	03	451	11,958	327	778	139	18%	917
0.04.1.1	-SOFTWARE	04	43	1,980	62	104	16	15%	120

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

COMPUTER & CONTROLS SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
0.04.1.1.1	PROTOCOL DEVELOPMENT	05	21	990	31	52	8	15%	60
0.04.1.1.2	DRIVER DEVELOPMENT	05	21	990	31	52	8	15%	60
0.04.1.2	-HARDWARE	04	405	2,106	66	471	94	20%	565
0.04.1.2.1	DATA LINKS	05	322	702	22	344	69	20%	413
0.04.1.2.2	LAN AT IR	05	42	702	22	64	13	20%	76
0.04.1.2.3	UPS	05	42	702	22	64	13	20%	76
0.04.1.3	-DOCUMENTATION	04	1	709	22	23	4	15%	27
0.04.1.3.1	USERS GUIDE	05	0	177	6	6	1	15%	7
0.04.1.3.2	MANUALS	05	0	177	6	6	1	15%	7
0.04.1.3.3	STANDARDS	05	0	177	6	6	1	15%	7
0.04.1.3.4	SPECIFICATIONS	05	0	177	6	6	1	15%	7
0.04.1.4	PROCUREMENT	04	1	532	17	17	2	10%	19
0.04.1.5	INSTALLATION	04	1	5,741	133	134	20	15%	154
0.04.1.6	TESTING	04	1	890	28	29	4	15%	33
0.04.2	-HUMAN COMMUNICATIONS	03	166	1,980	62	228	34	15%	262
0.04.2.1	VIDEOCONFERENCE FACILITIES	04	83	990	31	114	17	15%	131
0.04.2.2	MULTIMEDIA SYSTEMS	04	83	990	31	114	17	15%	131
0.04.3	-TEST BEAM SUPPORT	03	41	1,538	40	81	14	18%	95
0.04.3.1	SOFTWARE	04	16	217	7	23	5	20%	28
0.04.3.2	HARDWARE	04	16	217	7	23	5	20%	28
0.04.3.3	PROCUREMENT	04	0	87	3	3	0	10%	3
0.04.3.4	INSTALLATION	04	8	1,017	24	32	5	15%	36
0.05	PROJECT MANAGEMENT	02	27	8,537	686	713	71	10%	785

OPEN PLAN

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Report: TDR_SUM1
Status as of: 01OCT91
Current Date: 27APR93
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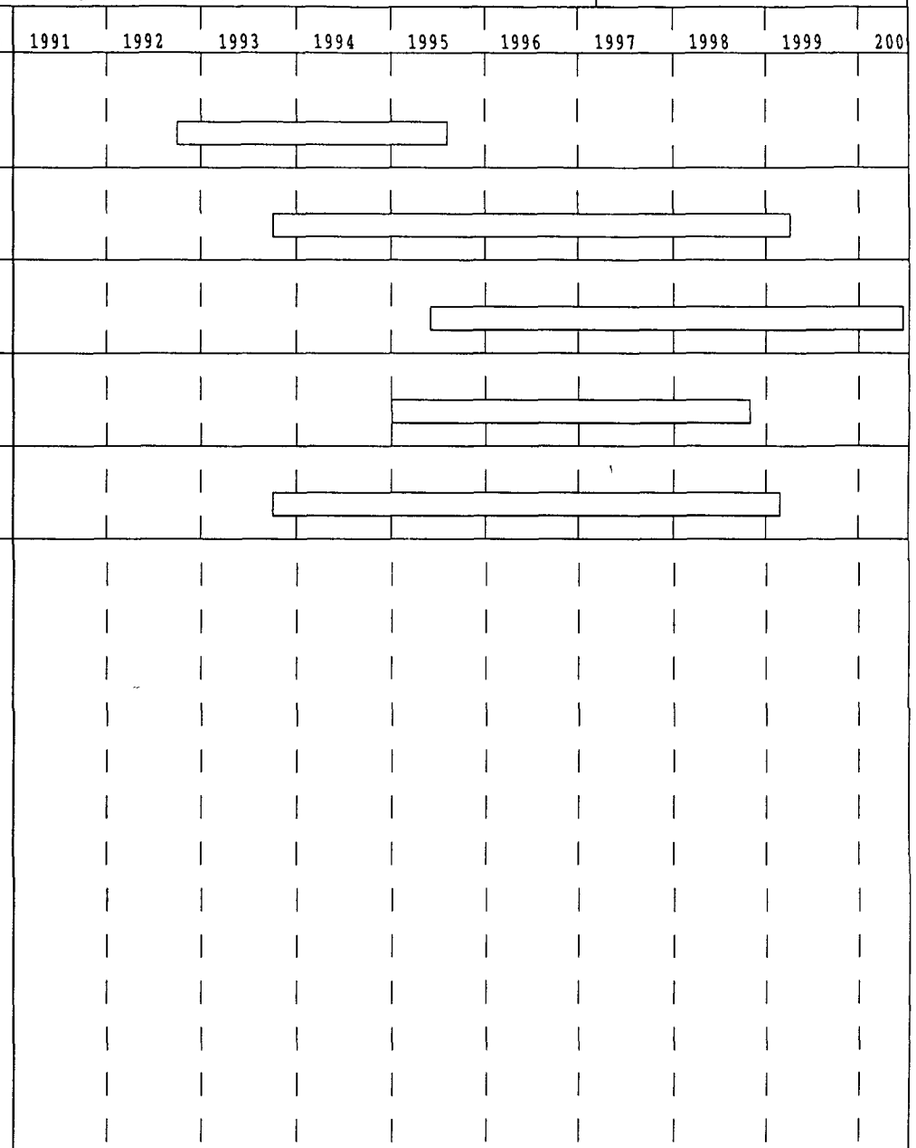
LEVEL II SUMMARY BASELINE SCHEDULE

60 COMPUTER & CONTROLS

GEM DETECTOR

Summary Description	Baseline Start	Baseline Finish	%Comp
WBS:60.01 RESEARCH & DEVELOPMENT	01OCT92	03AUG95	
WBS:60.02 GLOBAL CONTROL SYSTEM	01OCT93	02APR99	
WBS:60.03 ON LINE COMPUTING SYSTEM	01JUN95	21JUN00	
WBS:60.04 NETWORK & COMMUNICATIONS	02JAN95	26OCT98	
WBS:60.05 PROJECT MANAGEMENT	01OCT93	23FEB99	



Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

OPEN PLAN

Project: COMPUTER
Report: TDR_SUM1
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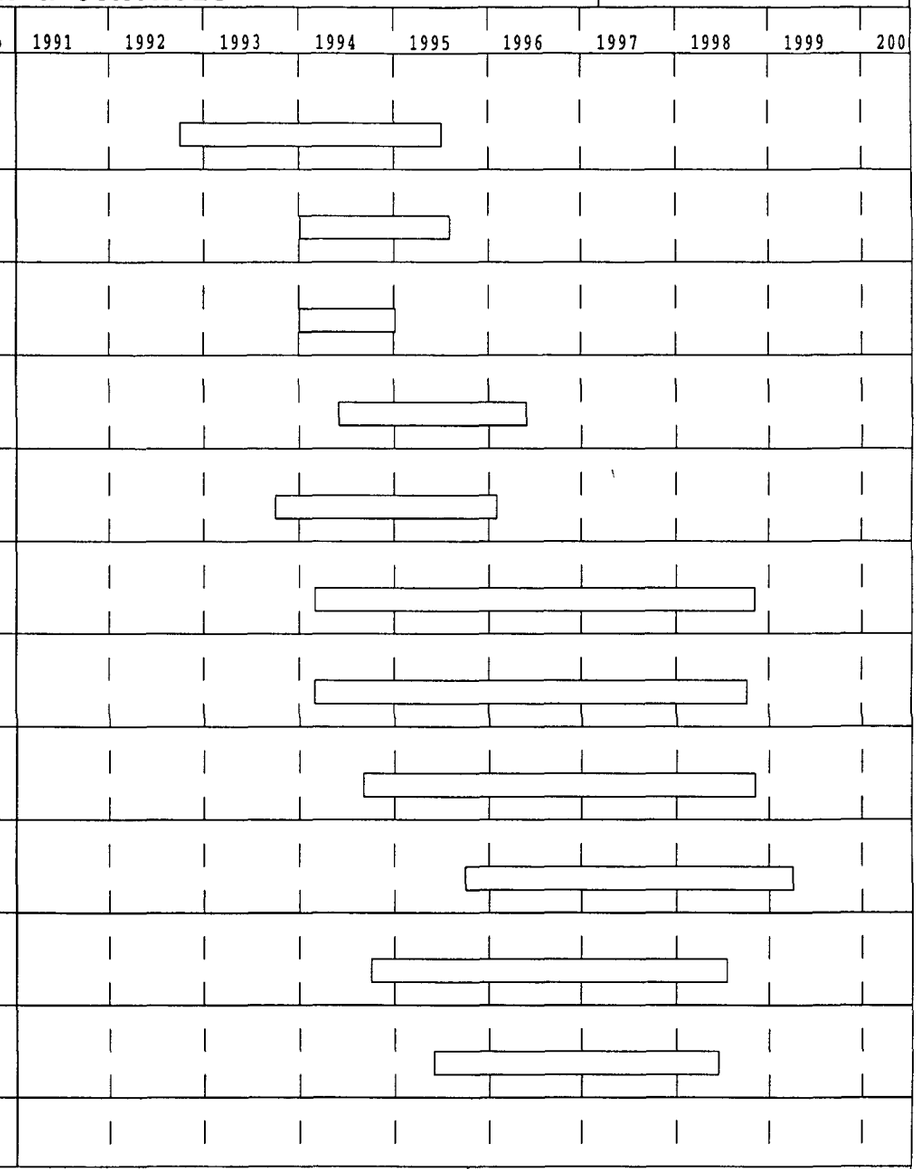
LEVEL III SUMMARY BASELINE SCHEDULE

60 COMPUTER & CONTROLS

GEM DETECTOR

Summary Description	Baseline Start	Baseline Finish	%Comp
WBS:60.01.1 GLOBAL CONTROL SYSYTEM	01OCT92	03JUL95	
WBS:60.01.2 ON-LINE COMPUTING	04JAN94	03AUG95	
WBS:60.01.3 NETWORK & COMMUNICATIONS	03JAN94	05JAN95	
WBS:60.02.1 SOFTWARE	01JUN94	30MAY96	
WBS:60.02.2 HARDWARE	01OCT93	01FEB96	
WBS:60.02.3 DOCUMENTATION	01MAR94	04NOV98	
WBS:60.02.4 PROCUREMENT	01MAR94	05OCT98	
WBS:60.02.5 INSTALLATION	01SEP94	04NOV98	
WBS:60.02.6 TESTING	02OCT95	02APR99	
WBS:60.02.7 TEST BEAM SUPPORT	03OCT94	17JUL98	
WBS:60.03.1 SOFTWARE	01JUN95	12JUN98	
WBS:60.03.2 HARDWARE			



Legend: Baseline, Critical, Float, Baseline, Projected, Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

OPEN PLAN

Project: COMPUTER
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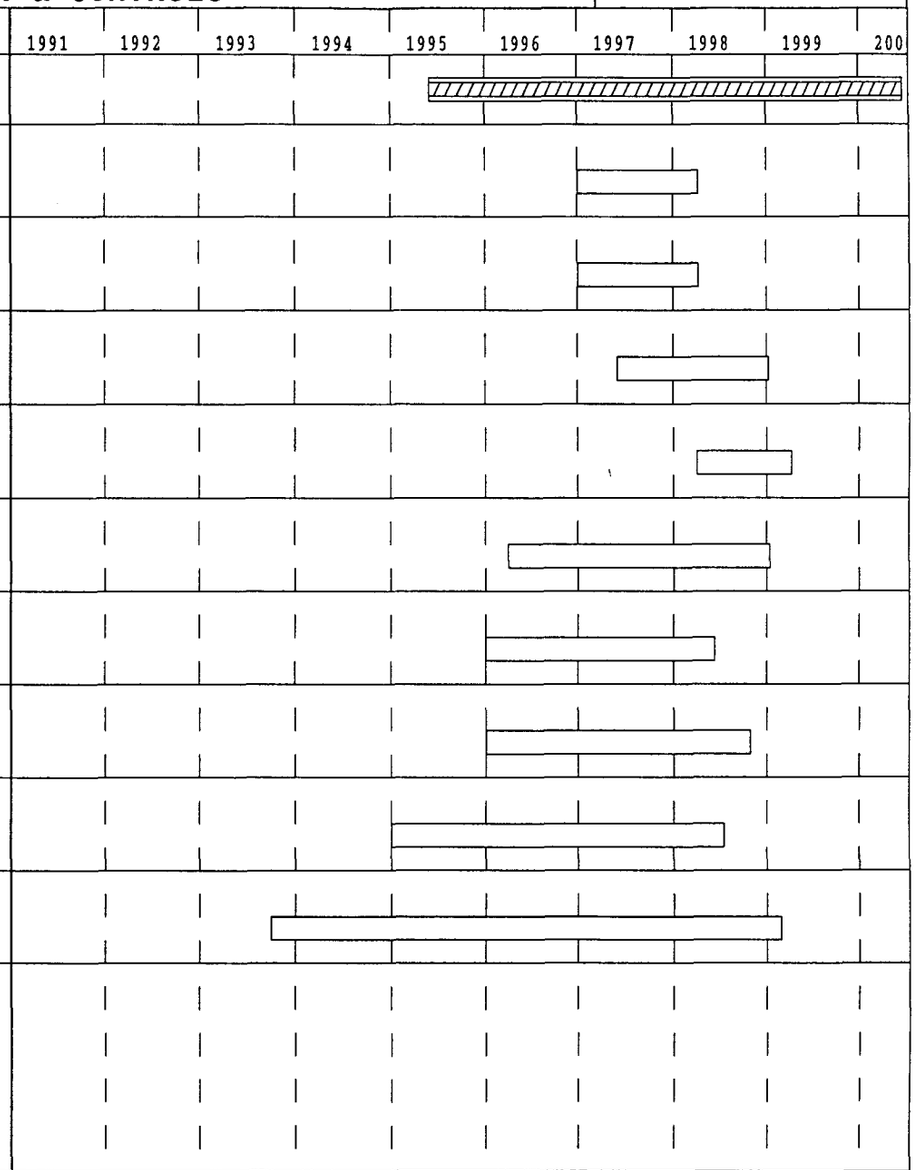
LEVEL III SUMMARY BASELINE SCHEDULE

60 COMPUTER & CONTROLS

GEM DETECTOR

Summary Description	Baseline Start	Baseline Finish	%Comp
	01JUN95	21JUN00	
WBS:60.03.3 DOCUMENTATION	01JAN97	07APR98	
WBS:60.03.4 PROCUREMENT	01JAN97	07APR98	
WBS:60.03.5 INSTALLATION	02JUN97	06JAN99	
WBS:60.03.6 TESTING	01APR98	05APR99	
WBS:60.03.7 TEST BEAM SUPPORT	01APR96	11JAN99	
WBS:60.04.1 DIGITAL COMMUNICATIONS	01JAN96	10JUN98	
WBS:60.04.2 HUMAN COMMUNICATIONS	01JAN96	26OCT98	
WBS:60.04.3 TEST BEAM SUPPORT	02JAN95	16JUL98	
WBS:60.05 PROJECT MANAGEMENT	01OCT93	23FEB99	



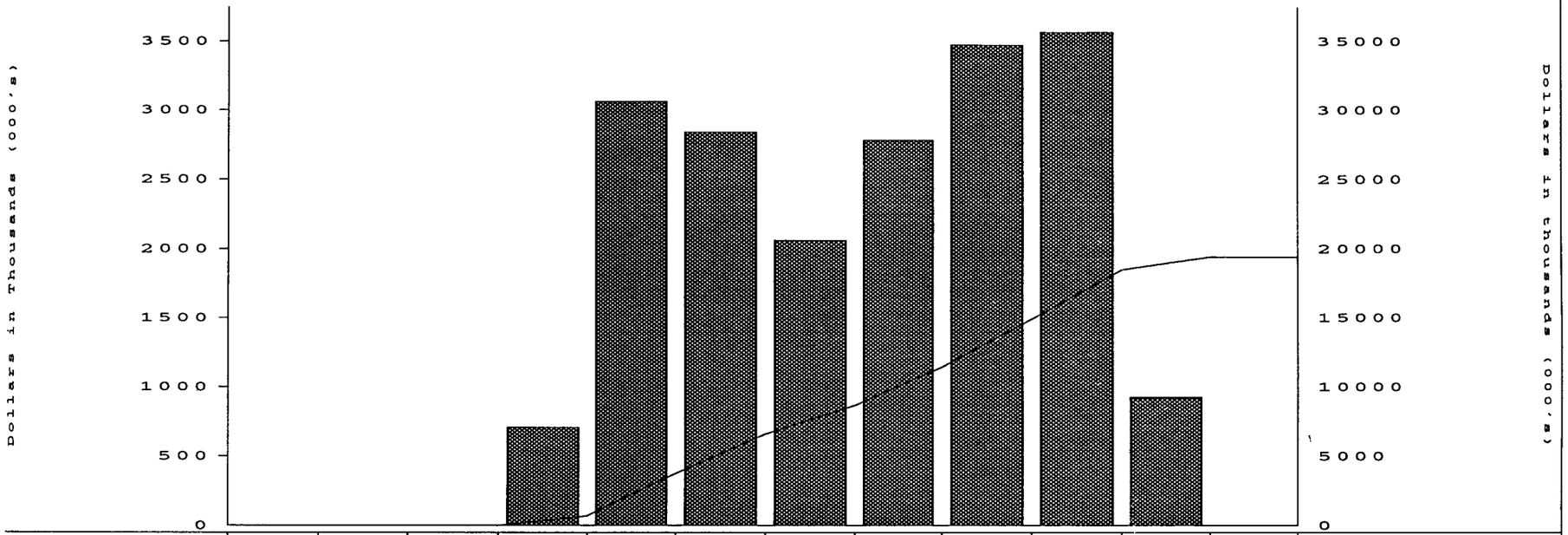
Legend
Baseline
Critical
Float
Baseline Projected Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
GEM - PROJECT OFFICE

Signatures

Approved by: _____

GEM Detector Report: GEM_FY	GEM DETECTOR WBS 60 - COMPUTER & CONTROLS	Date: 27APR93 Project: COMPUTER



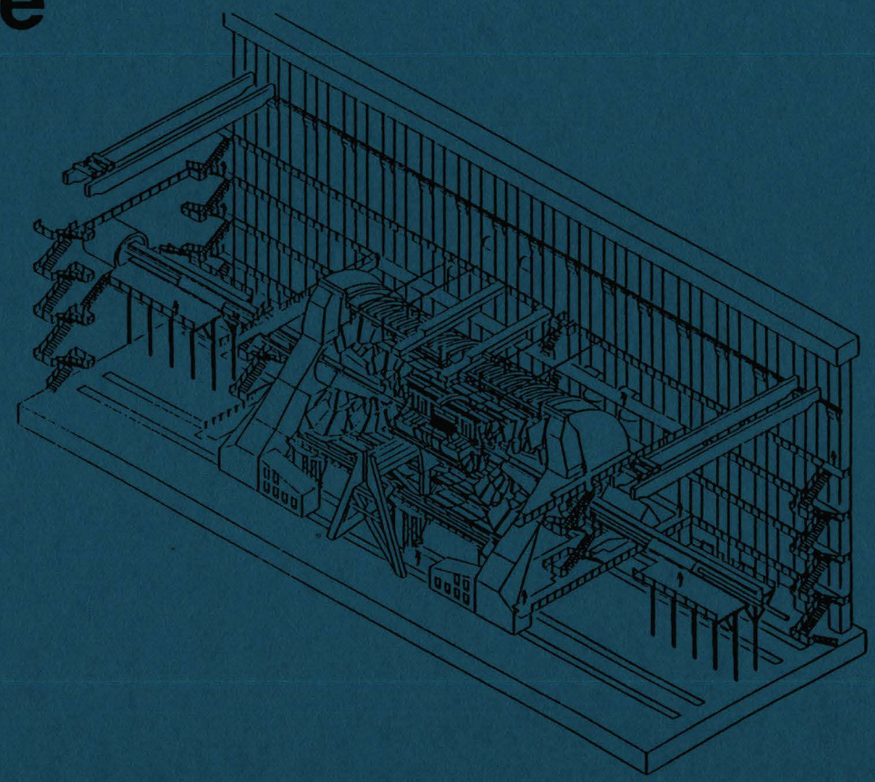
		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
ncr Bud	$k			708	3059	2838	2062	2780	3475	3570	924	
um Bud	$10k			71	377	660	867	1145	1492	1849	1942	1942

WBS 60.01.1	$1,303,381	GLOBAL CONTROL SYSYTEM
WBS 60.01.2	$2,103,318	ON-LINE COMPUTING
WBS 60.01.3	$ 921,241	NETWORK & COMMUNICATIONS
WBS 60.02.1	$1,105,545	SOFTWARE
WBS 60.02.2	$ 920,410	HARDWARE
WBS 60.02.3.1	$ 81,111	DOCUMENTATION PHASE I
WBS 60.02.3.2	$ 54,074	DOCUMENTATION PHASE II
WBS 60.02.4.1	$ 27,432	PROCUREMENT PHASE I
WBS 60.02.4.2	$ 11,757	PROCUREMENT PHASE II
WBS 60.02.5.1	$ 277,246	INSTALLATION PHASE I
WBS 60.02.5.2	$ 118,821	INSTALLATION PHASE II
WBS 60.02.6.1	$ 103,233	TESTING PHASE I
WBS 60.02.7	$ 303,562	TEST BEAM SUPPORT
WBS 60.03.1	$ 956,370	SOFTWARE
WBS 60.03.2	$7,465,446	HARDWARE
WBS 60.03.3	$ 158,725	DOCUMENTATION

GEM DETECTOR
WBS 60 - COMPUTER & CONTROLS

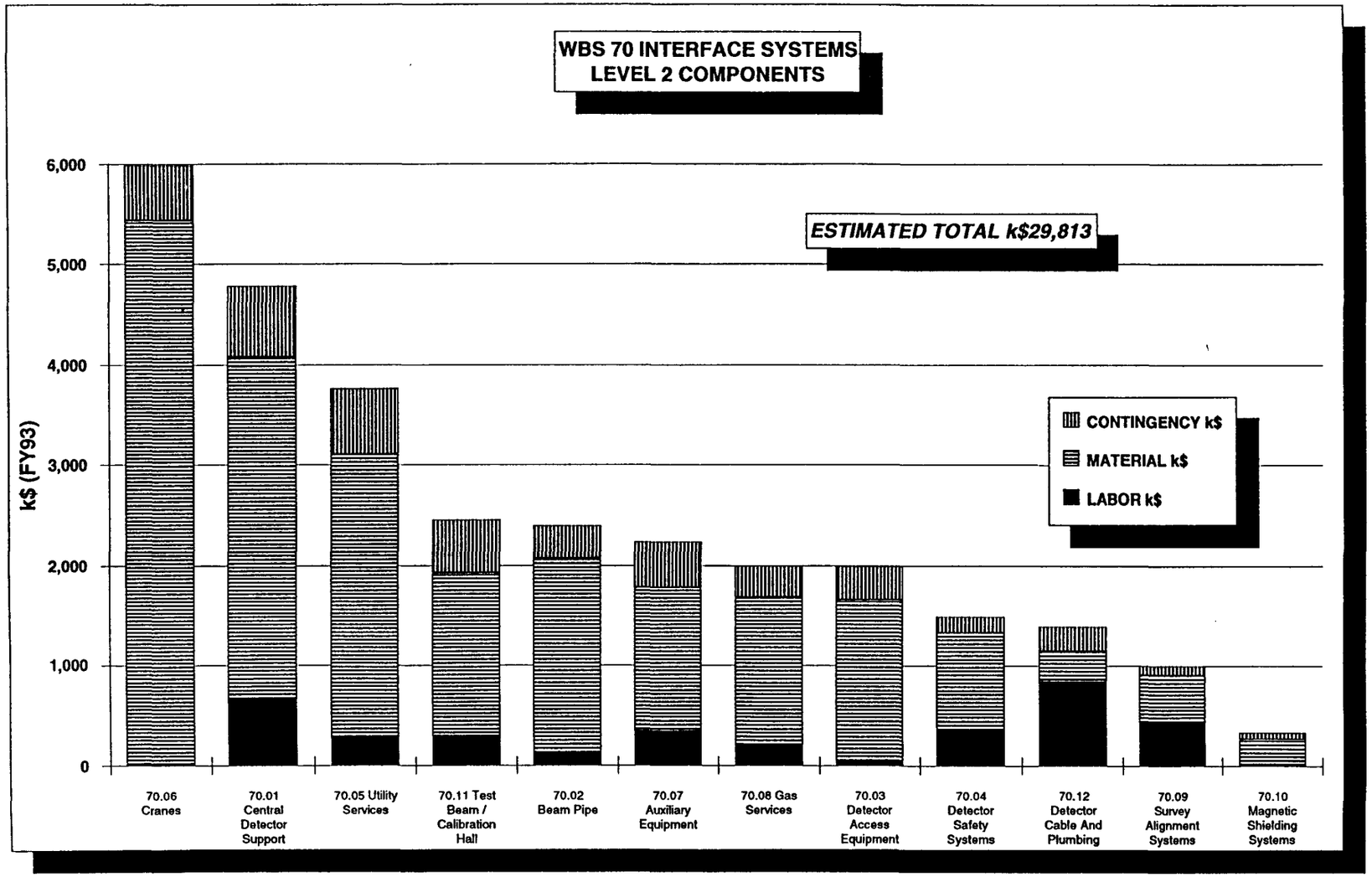
		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	
WBS 60.03.4	$ 52,909												PROCUREMENT
WBS 60.03.5	$ 654,938												INSTALLATION
WBS 60.03.6	$ 217,820												TESTING
WBS 60.03.7	$ 519,848												TEST BEAM SUPPORT
WBS 60.04.1	$ 917,316												DIGITAL COMMUNICATIONS
WBS 60.04.2	$ 261,579												HUMAN COMMUNICATIONS
WBS 60.04.3	$ 94,738												TEST BEAM SUPPORT
WBS 60.05	$ 784,603												PROJECT MANAGEMENT

Interface



gem

Superconducting ***Super Collider***


WBS 70 INTERFACE SYSTEMS
LEVEL 2 COMPONENTS
ESTIMATED TOTAL k$29,813
CONTINGENCY k$
MATERIAL k$
LABOR k$
k$ (FY93)
6,000
5,000
4,000
3,000
2,000
1,000
0
70.06 Cranes
70.01 Central Detector Support
70.05 Utility Services
70.11 Test Beam / Calibration Hall
70.02 Beam Pipe
70.07 Auxiliary Equipment
70.08 Gas Services
70.03 Detector Access Equipment
70.04 Detector Safety Systems
70.12 Detector Cable And Plumbing
70.09 Survey Alignment Systems
70.10 Magnetic Shielding Systems

GEM COST ESTIMATE SUMMARY

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INTERFACE SUBSYSTEM

FY93 U.S. Dollars

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
70	-INTERFACE SYSTEMS	01	21,814	122,305	3,567	25,381	4,433	18%	29,813
70.01	-CENTRAL DETECTOR SUPPORT (CDS)	02	3,414	14,500	665	4,079	701	17%	4,780
70.01.1	CENTRAL DETECTOR SUPPORT DESIGN	03	0	5,631	369	369	59	16%	428
70.01.2	CENTRAL DETECTOR SUPPORT TOOLING DESIGN	03	8	907	60	67	15	22%	82
70.01.3	CENTRAL DETECTOR SUPPORT FAB/ASSY	03	3,096	74	5	3,101	496	16%	3,597
70.01.4	CENTRAL DETECTOR SUPPORT TOOLING FAB/ASSY	03	200	738	45	245	54	22%	298
70.01.5	CDS INSTALLATION	03	110	7,151	188	298	78	26%	376
70.02	-BEAM PIPE	02	1,958	3,101	114	2,072	331	16%	2,403
70.02.1	BEAM PIPE DESIGN (EFD)	03	0	0	0	0	0	0%	0
70.02.2	BEAM PIPE DOCUMENTATION (EFD)	03	0	0	0	0	0	0%	0
70.02.3	BEAM PIPE PROCUREMENT (EFD)	03	0	0	0	0	0	0%	0
70.02.4	-BEAM PIPE MANUFACTURE	03	1,145	0	0	1,145	192	17%	1,337
70.02.4.1	BERYLLIUM SECTION (EFD)	04	260	0	0	260	52	20%	312
70.02.4.2	Al/SS SECTION (EFD)	04	140	0	0	140	28	20%	168
70.02.4.3	VAC PUMPS, VALVES, BELLOW ASSY'S (EFD)	04	745	0	0	745	112	15%	857
70.02.5	VAC PUMP & MONITOR CONTR SYS (EFD)	03	180	0	0	180	27	15%	207
70.02.6	BEAM PIPE ASSEMBLY (SURFACE) (EFD)	03	483	886	23	506	76	15%	582
70.02.7	BEAM PIPE INSTALLATION (TUNNEL) (EFD)	03	0	886	23	23	4	15%	27
70.02.8	IN-HALL PUMP & PIPE SUPT STRUC (EFD)	03	100	443	23	123	18	15%	141
70.02.9	SPECIAL HANDL & SUPT FIXTURES (EFD)	03	50	886	45	95	14	15%	109
70.03	-DETECTOR ACCESS EQUIPMENT	02	1,622	2,578	39	1,661	332	20%	1,993
70.03.1	ACCESS EQUIPMENT DESIGN (EFD)	03	0	0	0	0	0	0%	0
70.03.2	ACCESS EQUIPMENT DOCUMENTATION (EFD)	03	0	0	0	0	0	0%	0
70.03.3	ACCESS EQUIPMENT PROCUREMENT	03	1,622	0	0	1,622	324	20%	1,946
70.03.4	ACCESS EQUIPMENT INSTAL & DISMANTLE	03	0	2,578	39	39	8	20%	47

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

INTERFACE SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
70.04	-DETECTOR SAFETY SYSTEMS	02	968	11,784	358	1,325	159	12%	1,484
70.04.1	SAFETY SYSTEM DESIGN (EFD)	03	0	0	0	0	0	0%	0
70.04.2	-SAFETY SYSTEM DOCUMENTATION	03	0	0	0	0	0	0%	0
70.04.2.1	PREP OF SPECS, ETC. (EFD)	04	0	0	0	0	0	0%	0
70.04.2.2	PREP WORKSTATION DRAWING PACKAGE (EFD)	04	0	0	0	0	0	0%	0
70.04.3	SAFETY SYSTEM PROCUREMENT (EFD)	03	0	0	0	0	0	0%	0
70.04.4	-SAFETY SYSTEM MANUFACTURE, ASSY, TEST	03	51	6,177	223	274	33	12%	307
70.04.4.1	SAFETY CONSOLE (EFD)	04	40	1,968	45	85	10	12%	95
70.04.4.2	OTHER INTERFACE ITEMS (EFD)	04	11	640	14	25	3	12%	28
70.04.4.3	SAFETY COMPUTER (EFD)	04	0	3,569	164	164	20	12%	184
70.04.5	-SAFETY SYSTEM INSTALLATION	03	917	5,607	134	1,051	126	12%	1,177
70.04.5.1	ABOVE GROUND SAFETY SYS INSTALL (EFD)	04	100	924	21	121	15	12%	135
70.04.5.2	BELOW GROUND SAFETY SYS INSTALL (EFD)	04	817	4,084	91	908	109	12%	1,017
70.04.5.3	SAFETY COMPUTER SYSTEM (EFD)	04	0	599	23	23	3	12%	25
70.04.6	SAFETY SYSTEMS VERIFICATION & READINESS REVIEW	03	0	0	0	0	0	0%	0
70.05	-UTILITY SERVICES	02	2,833	7,749	271	3,104	661	21%	3,765
70.05.1	HEATING, VENTILATION AND AIR CONDITIONING (EFD	03	347	6,420	232	580	145	25%	725
70.05.2	COOLING WATER (EFD)	03	653	0	0	653	163	25%	816
70.05.3	COMPRESSED AIR (EFD)	03	0	0	0	0	0	0%	0
70.05.4	-ELECTRICAL POWER SYSTEM	03	1,713	0	0	1,713	308	18%	2,021
70.05.4.1	-HALL/ELECTRONICS SHAFT	04	1,571	0	0	1,571	283	18%	1,854
70.05.4.1.1	60 HZ PWR DISTRIB/GROUNDING (EFD)	05	229	0	0	229	41	18%	270
70.05.4.1.2	IR REGION COMMUNICATION (EFD)	05	552	0	0	552	99	18%	651
70.05.4.1.3	CABLE TRAYS (EFD)	05	790	0	0	790	142	18%	932
70.05.4.2	-UTILITY BUILDING	04	142	0	0	142	26	18%	168

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

INTERFACE SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
'0.05.4.2.1	RESERVED	05	0	0	0	0	0	0%	0
'0.05.4.2.2	COMMUNICATION (EFD)	05	142	0	0	142	26	18%	168
'0.05.5	MECHANICAL CONTROLS (EFD)	03	120	1,329	39	159	44	28%	203
'0.06	-CRANES	02	5,439	0	0	5,439	544	10%	5,983
'0.06.1	-SURFACE CRANES	03	5,439	0	0	5,439	544	10%	5,983
'0.06.1.1	SURFACE CRANE SYSTEM DESIGN (EFD)	04	0	0	0	0	0	0%	0
'0.06.1.2	SURFACE CRANE SYSTEM DOCUMENTATION (EFD)	04	0	0	0	0	0	0%	0
'0.06.1.3	SURFACE CRANE SYSTEM PROCUREMENT	04	5,439	0	0	5,439	544	10%	5,983
'0.06.2	RESERVED	03	0	0	0	0	0	0%	0
'0.07	-AUXILIARY EQUIPMENT	02	1,437	9,480	340	1,777	462	26%	2,239
'0.07.1	EXPERIMENTAL HALL SYSTEM	03	1,437	9,480	340	1,777	462	26%	2,239
'0.08	-GAS SERVICES	02	1,478	7,726	205	1,683	311	19%	1,995
'0.08.1	-ASSEMBLY BUILDING	03	1,132	2,038	54	1,186	214	18%	1,399
'0.08.1.1	GAS SYSTEM ASSY EQUIPMENT (EFD)	04	96	0	0	96	17	18%	113
'0.08.1.2	CONSUMABLES - ASSY BLDG (EFD)	04	1,036	0	0	1,036	187	18%	1,223
'0.08.1.3	GAS SERVICES MFG, ASSY, TEST - ASSY BLDG (E	04	0	2,038	54	54	10	18%	64
'0.08.2	-DETECTOR HALL	03	283	5,015	132	415	75	18%	490
'0.08.2.1	GAS SYSTEM HALL EQUIPMENT (EFD)	04	160	0	0	160	29	18%	189
'0.08.2.2	CONSUMABLES - HALL (EFD)	04	123	0	0	123	22	18%	145
'0.08.2.3	GAS SERVICES MFG, ASSY, TEST - HALL (EFD)	04	0	5,015	132	132	24	18%	156
'0.08.3	GAS CONTROL & MONITOR SYSTEM (EFD)	03	63	673	19	82	23	28%	105
0.09	-SURVEY ALIGNMENT SYSTEMS	02	467	17,392	438	906	91	10%	996
0.09.1	SURVEY ALIGNMENT SYSTEM DESIGN (EFD)	03	0	0	0	0	0	0%	0
0.09.2	SURVEY ALIGNMENT SYSTEM DOCUMENTATION (EFD)	03	0	0	0	0	0	0%	0
0.09.3	SURVEY ALIGNMENT SYSTEM PROCUREMENT (EFD)	03	418	277	8	426	43	10%	469

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

INTERFACE SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
70.09.4	SURVEY ALIGNMENT SYSTEM MANF, ASSY & TEST (EFD	03	14	8,539	215	228	23	10%	251
70.09.5	SURVEY ALIGNMENT SYSTEM INSTALLATION & MONITOR	03	36	8,577	216	251	25	10%	276
70.10	-MAGNETIC SHIELDING SYSTEMS	02	268	0	0	268	64	24%	332
70.10.1	MAGNETIC SHIELDING SYSTEM PROCUREMENT	03	268	0	0	268	64	24%	332
70.11	-TEST BEAM / CALIBRATION HALL	02	1,632	16,831	294	1,927	531	28%	2,457
70.11.1	-CALIBRATION HALL	03	1,632	16,831	294	1,927	531	28%	2,457
70.11.1.1	MECHANICAL SYSTEMS (EFD)	04	100	0	0	100	25	25%	125
70.11.1.2	DAQ	04	200	0	0	200	60	30%	260
70.11.1.3	-EQUIPMENT & SUPPLIES	04	1,332	16,831	294	1,626	446	27%	2,072
70.11.1.3.1	SHIELDING BLOCKS/PLATFORMS (EFD)	05	240	41	2	242	73	30%	315
70.11.1.3.2	RIGGING (EFD)	05	287	0	0	287	86	30%	373
70.11.1.3.3	TOOLS & FIXTURES (EFD)	05	350	488	10	360	108	30%	468
70.11.1.3.4	ACCESS EQUIPMENT (EFD)	05	305	0	0	305	92	30%	397
70.11.1.3.5	ELECTRONICS SUPPORT (EFD)	05	100	0	0	100	30	30%	130
70.11.1.3.6	TECHNICAL LABOR SUPPORT (EFD)	05	0	16,302	283	283	42	15%	325
70.11.1.3.7	CONSUMABLES (EFD)	05	50	0	0	50	15	30%	65
70.12	-DETECTOR CABLE AND PLUMBING ROUTING, DESIGN AND V	02	299	31,163	841	1,141	246	22%	1,387
70.12.1	-DETECTOR CABLE AND PLUMBING (C&P) INSTALLATION	03	156	26,048	691	846	194	23%	1,040
70.12.1.1	DETECTOR C&P DESIGN	04	26	5,848	150	176	32	18%	208
70.12.1.2	DETECTOR C&P DESIGN DOCUMENTATION	04	7	3,898	110	117	15	13%	133
70.12.1.3	DETECTOR C&P PROCUREMENT AND FABRICATION	04	114	354	11	125	40	32%	165
70.12.1.4	DETECTOR C&P INSTALLATION	04	9	15,948	420	428	107	25%	535
70.12.2	-CABLE AND PLUMBING ROUTING (C&PR) AND INSTALLA	03	144	5,114	151	294	52	18%	347
70.12.2.1	C&PR AND FIT TEST FIXTURE DESIGN	04	6	532	21	27	10	38%	38
70.12.2.2	C&PR AND FIT TEST FIXTURE DOCUMENTATION	04	2	1,418	38	40	4	10%	44

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

INTERFACE SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
70.12.2.3	C&PR AND FIT TEST FIXTURE PROCUREMENT	04	130	177	5	135	15	11%	150
70.12.2.4	C&PR AND FIT TEST FIXTURE MANF, ASSY, TEST	04	5	2,988	87	92	23	25%	115
70.13	RESERVED	02	0	0	0	0	0	0%	0

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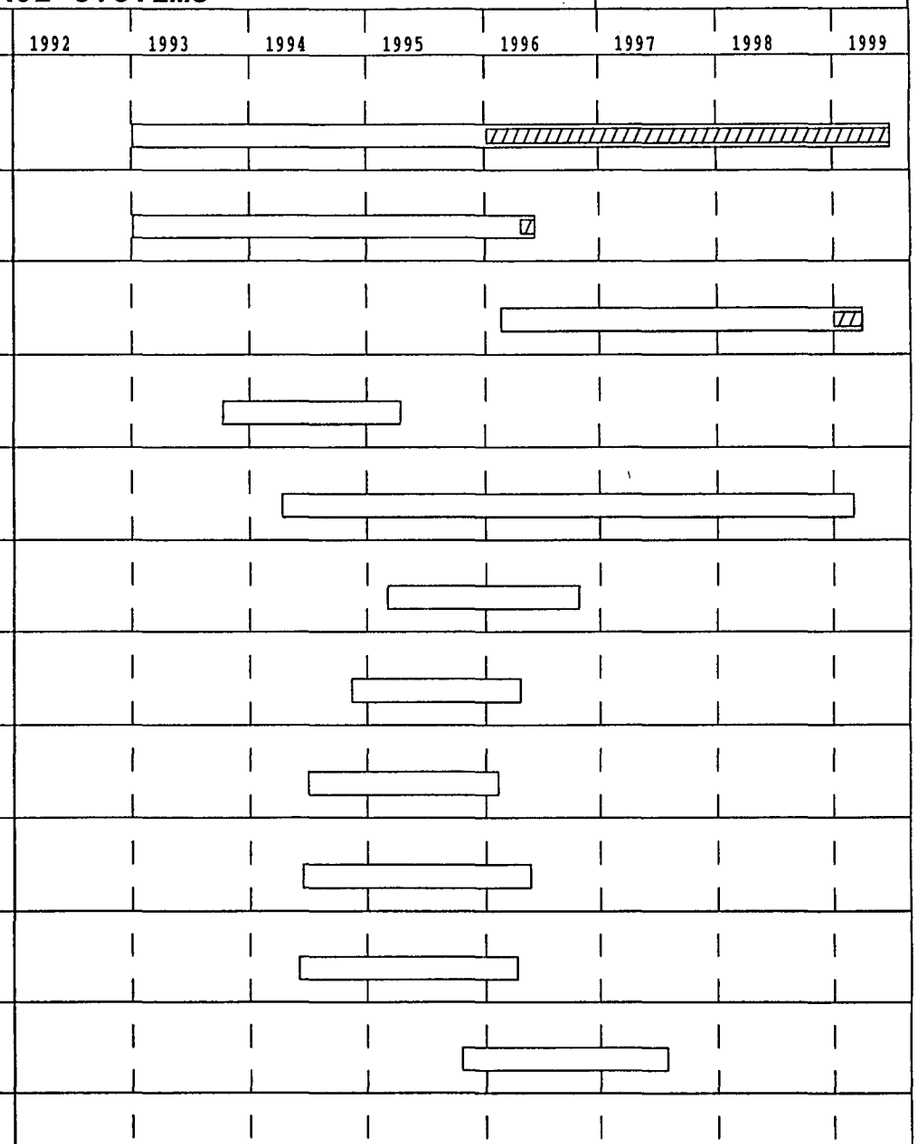
LEVEL II SUMMARY BASELINE SCHEDULE

70 INTERFACE SYSTEMS

GEM DETECTOR

Summary Description	Baseline	Start/Finish	%Comp
BS:70 INTERFACE SYSTEMS	05JAN93	05JUL99	
BS:70.01 Central Detector Support (CDS)	05JAN93	07JUN96	
BS:70.02 Beam Pipe	19FEB96	02APR99	
BS:70.03 Detector Access Equipment	08OCT93	14APR95	
BS:70.04 Detector Safety Systems	12APR94	05MAR99	
BS:70.05 Utility Services	06MAR95	24OCT96	
BS:70.06 Cranes	14NOV94	18APR96	
BS:70.07 Auxiliary Equipment	01JUL94	06FEB96	
BS:70.08 Gas Services	13JUN94	20MAY96	
BS:70.09 Survey	03JUN94	08APR96	
BS:70.10 Magnetic Shielding	18OCT95	24JUL97	
BS:70.11 Test Beam/Calibration Hall			



Legend: Baseline, Critical, Float; Baseline, Projected, Actual

SUPERCONDUCTING SUPER COLLIDER PROJECT
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LEVEL II SUMMARY BASELINE SCHEDULE

70 INTERFACE SYSTEMS

GEM DETECTOR

Summary Description	Baseline	Start/Finish		%Comp	1992	1993	1994	1995	1996	1997	1998	1999
	31MAR94	07MAR96										
BS:70.12 Cable & Plumbing Routing	03MAY93	10MAR97										

Legend
- Baseline
- Critical
- Float
- Baseline ▽ Projected ▼ Actual

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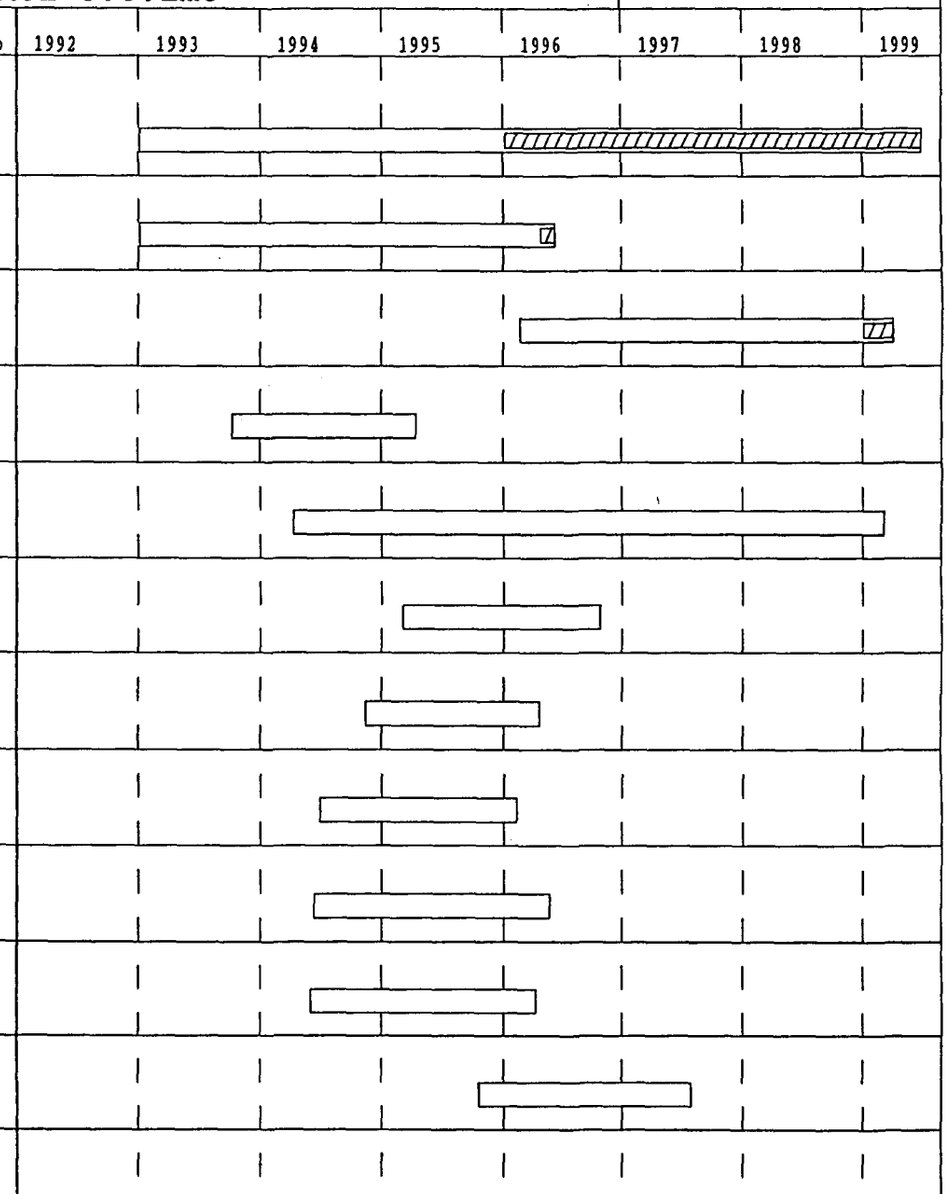
LEVEL III SUMMARY BASELINE SCHEDULE

70 INTERFACE SYSTEMS

GEM DETECTOR

Summary Description	Baseline Start	Baseline Finish	%Comp
3S:70 INTERFACE SYSTEMS	05JAN93	05JUL99	
3S:70.01 Central Detector Support (CDS)	05JAN93	07JUN96	
3S:70.02 Beam Pipe	19FEB96	02APR99	
3S:70.03 Detector Access Equipment	08OCT93	14APR95	
3S:70.04 Detector Safety Systems	12APR94	05MAR99	
3S:70.05 Utility Services	06MAR95	24OCT96	
3S:70.06 Cranes	14NOV94	18APR96	
3S:70.07 Auxiliary Equipment	01JUL94	06FEB96	
3S:70.08 Gas Services	13JUN94	20MAY96	
3S:70.09 Survey	03JUN94	08APR96	
3S:70.10 Magnetic Shielding	18OCT95	24JUL97	
3S:70.11 Test Beam/Calibration Hall			



Legend: Baseline, Critical, Float; Baseline, Projected, Actual

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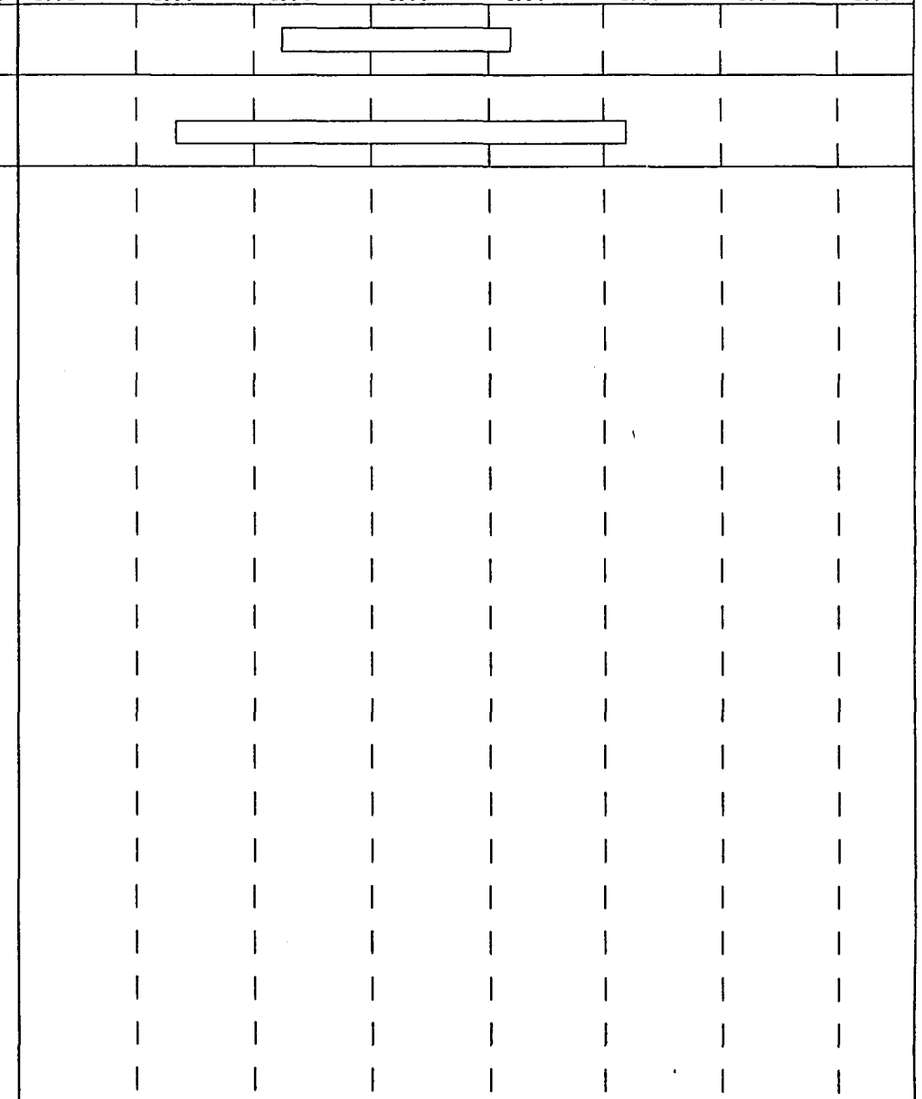
LEVEL III SUMMARY BASELINE SCHEDULE

70 INTERFACE SYSTEMS

GEM DETECTOR

Summary Description	Baseline	Start/Finish		%Comp
	31MAR94	07MAR96		
BS:70.12 Cable & Plumbing Routing	03MAY93	10MAR97		



Legend: Baseline, Critical, Float, Baseline, Projected, Actual

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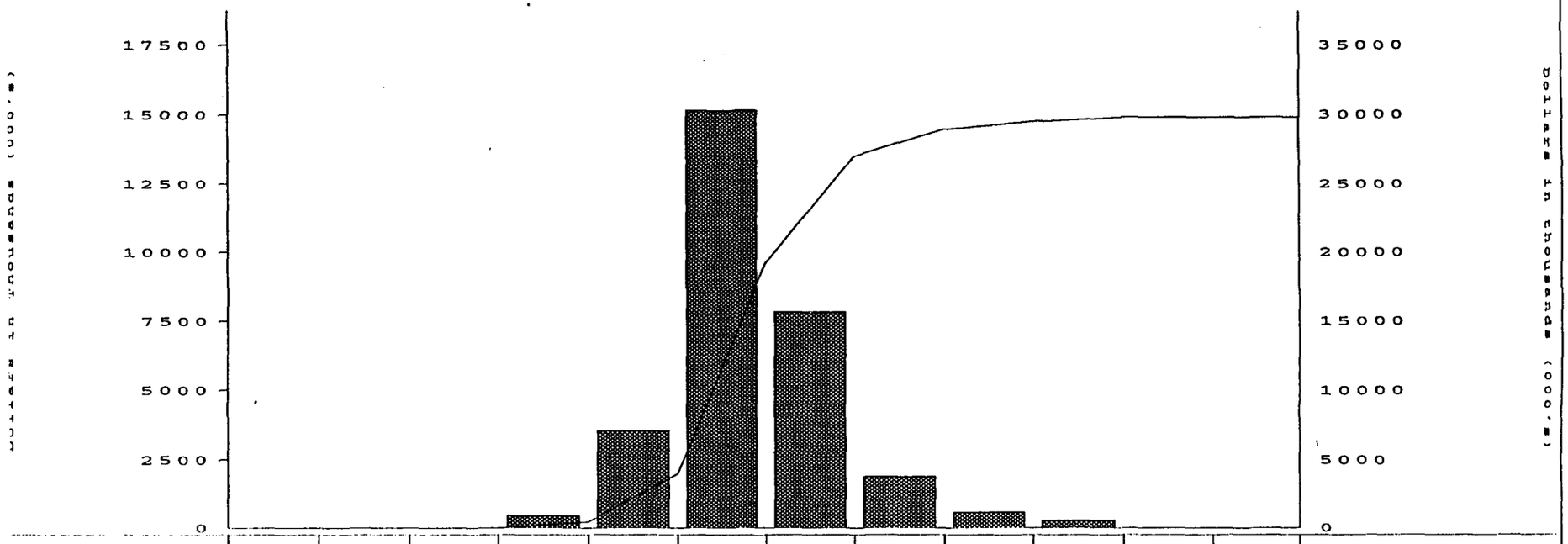
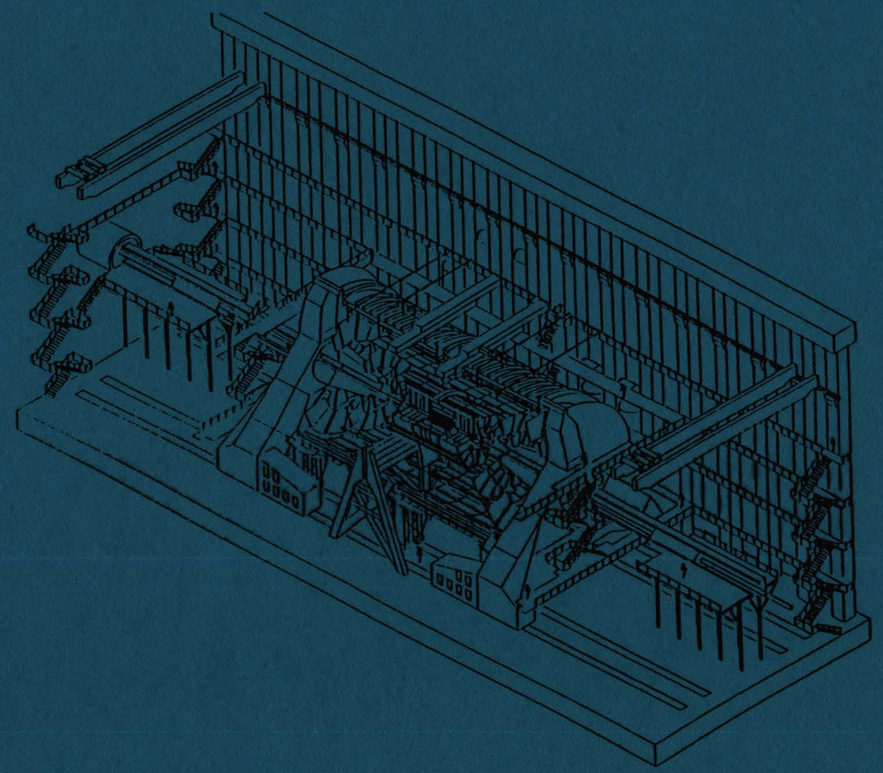
GEM Detector Report: GEM_FY	GEM DETECTOR WBS 70 - INTERFACE SYSTEMS	Date: 27APR93 Project: INTER



		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
ncr Bud	$10k			47	356	1515	785	190	59	29		
um Bud	$10k			47	403	1919	2703	2894	2953	2981	2981	2981

WBS 70.01	$4,779,929	Central Detector Support (CDS)
WBS 70.02	$2,402,705	Beam Pipe
WBS 70.03	$1,993,301	Detector Access Equipment
WBS 70.04	$1,484,335	Detector Safety Systems
WBS 70.05	$3,765,077	Utility Services
WBS 70.06	$5,982,680	Cranes
WBS 70.07	$2,238,463	Auxiliary Equipment
WBS 70.08	$1,994,523	Gas Services
WBS 70.09	$ 996,029	Survey
WBS 70.10	$ 332,320	Magnetic Shielding
WBS 70.11	$2,457,138	Test Beam/Calibration Hall
WBS 70.12	$1,386,584	Cable & Plumbing Routing

Project Management



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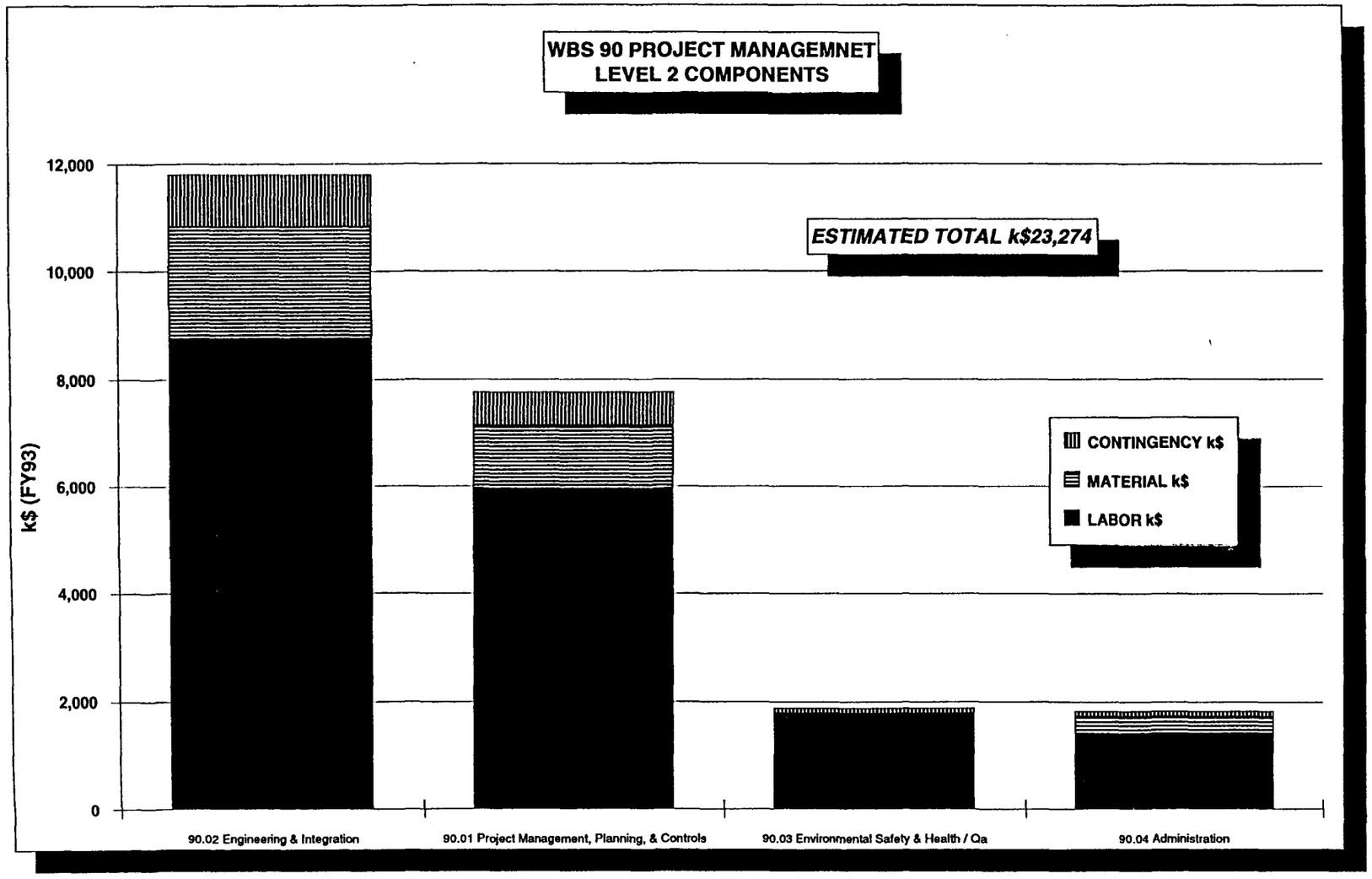
Superconducting ***Super Collider***



GEM DETECTOR PROJECT

GEM COST ESTIMATE SUMMARY

4/26/93

FY93 U.S. Dollars

PROJECT MANAGEMENT SUBSYSTEM

WBS Code	Description	WBS Level	Material, k$	ManHours	Labor, k$	M + L, k$	Contingency, k$	%	TOTAL, k$
90	-PROJECT MANAGEMENT	01	3,551	458,239	17,897	21,448	1,825	9%	**23,274**
90.01	PROJECT MANAGEMENT, PLANNING, & CONTROLS	02	1,163	152,392	5,956	7,119	641	9%	**7,760**
90.02	ENGINEERING & INTEGRATION	02	2,077	185,706	8,751	10,828	975	9%	**11,803**
90.03	ENVIRONMENTAL SAFETY & HEALTH / QA	02	0	38,630	1,777	1,777	107	6%	**1,884**
90.04	ADMINISTRATION	02	312	81,512	1,413	1,724	104	6%	**1,828**

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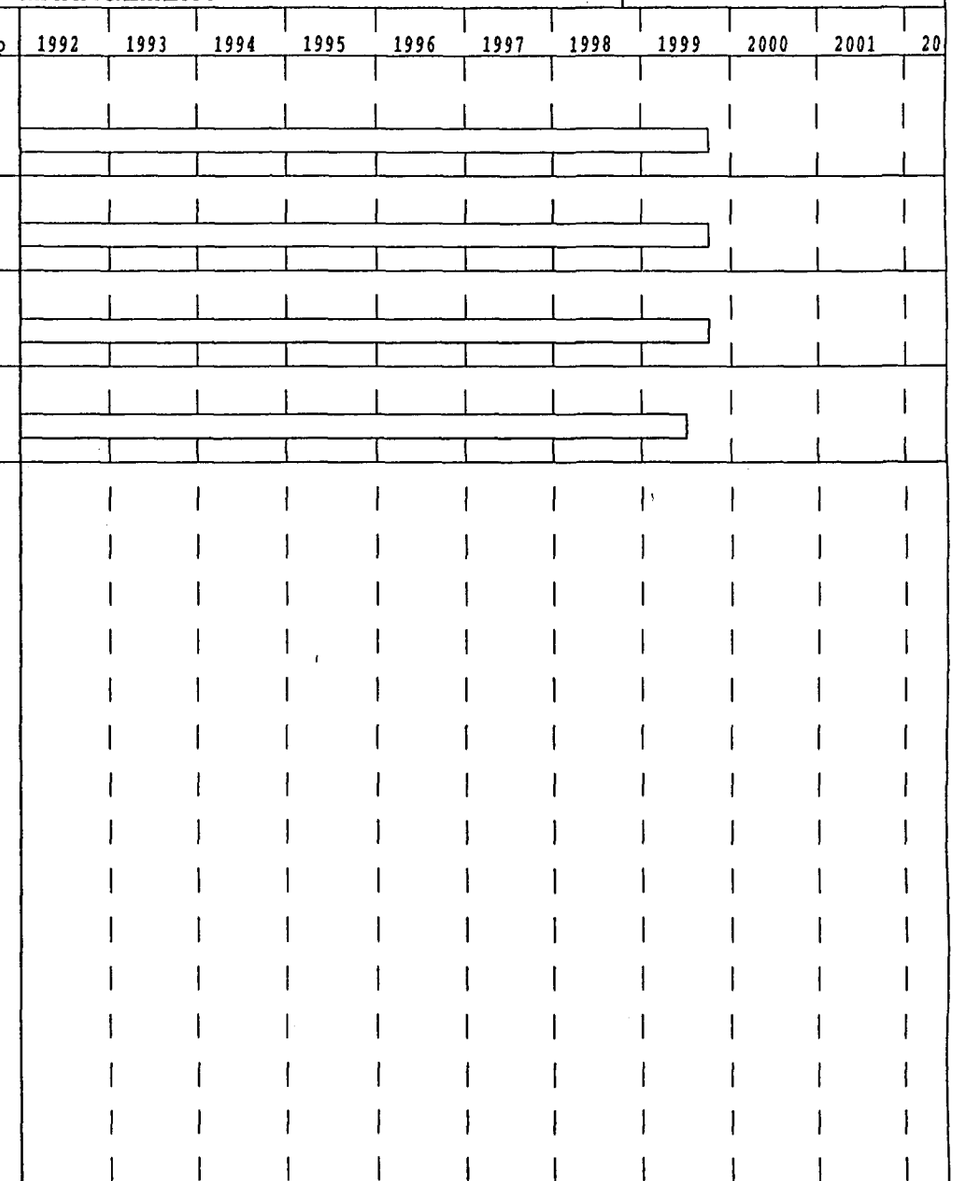
LEVEL II SUMMARY BASELINE SCHEDULE

90 PROJECT MANAGEMENT

GEM DETECTOR

Summary Description	Baseline Start	Baseline Finish	%Comp
BS:90.01 PROJECT MANAGEMENT, PLANNING, & CONTROLS	01JAN92	30SEP99	
BS:90.02 ENGINEERING & INTEGRATION	01JAN92	30SEP99	
BS:90.03 ENVIRONMENTAL SAFETY & HEALTH/QA	01JAN92	30SEP99	
BS:90.04 ADMINISTRATION	01OCT91	30JUN99	



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Actual

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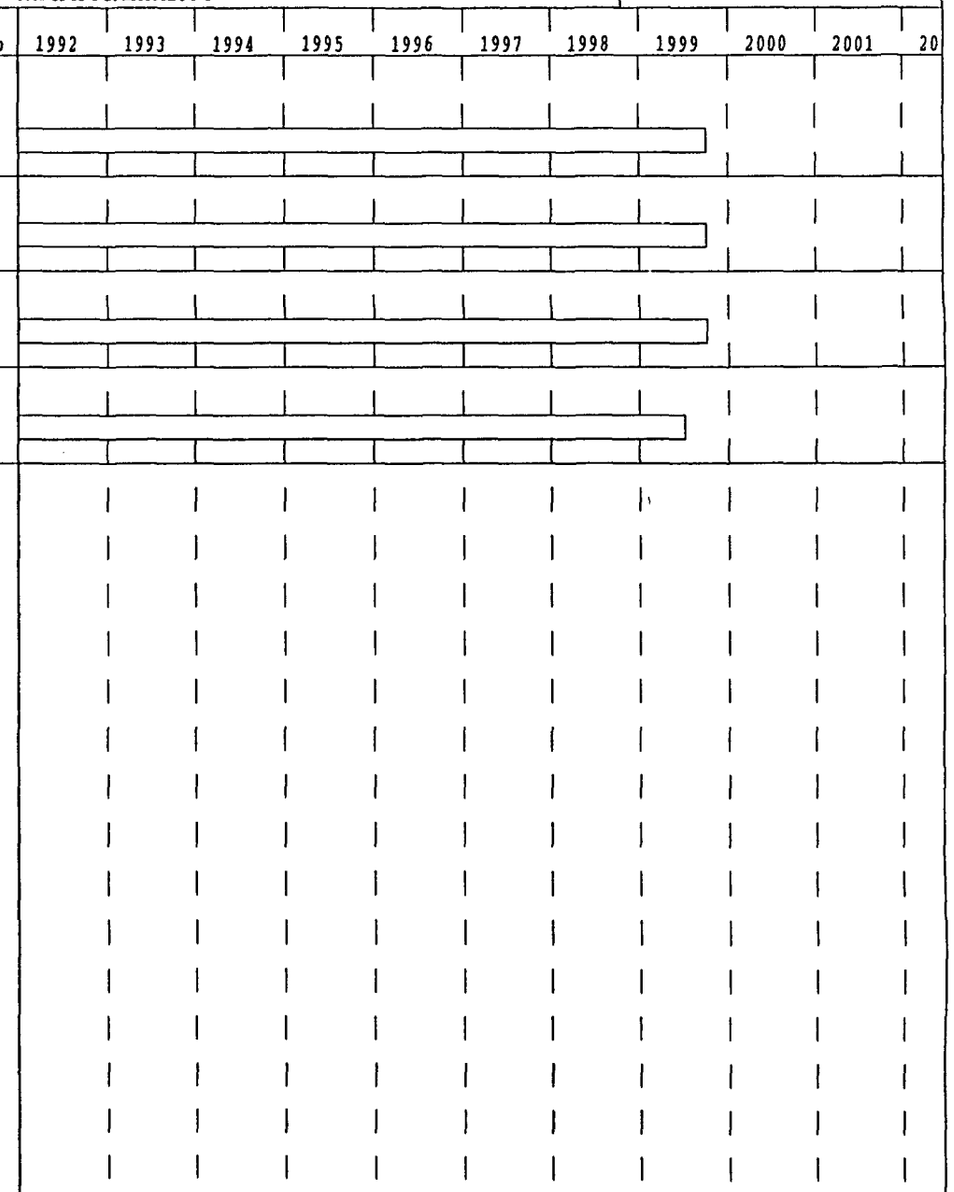
LEVEL III SUMMARY BASELINE SCHEDULE

90 PROJECT MANAGEMENT

GEM DETECTOR

Summary Description	Baseline Start/Finish	%Comp
WBS:90.01 PROJECT MANAGEMENT, PLANNING, & CONTROLS	01JAN92 30SEP99	
WBS:90.02 ENGINEERING & INTEGRATION	01JAN92 30SEP99	
WBS:90.03 ENVIRONMENTAL SAFETY & HEALTH/QA	01JAN92 30SEP99	
WBS:90.04 ADMINISTRATION	01OCT91 30JUN99	



Legend
Baseline
Critical
Float
Baseline Projected Actual

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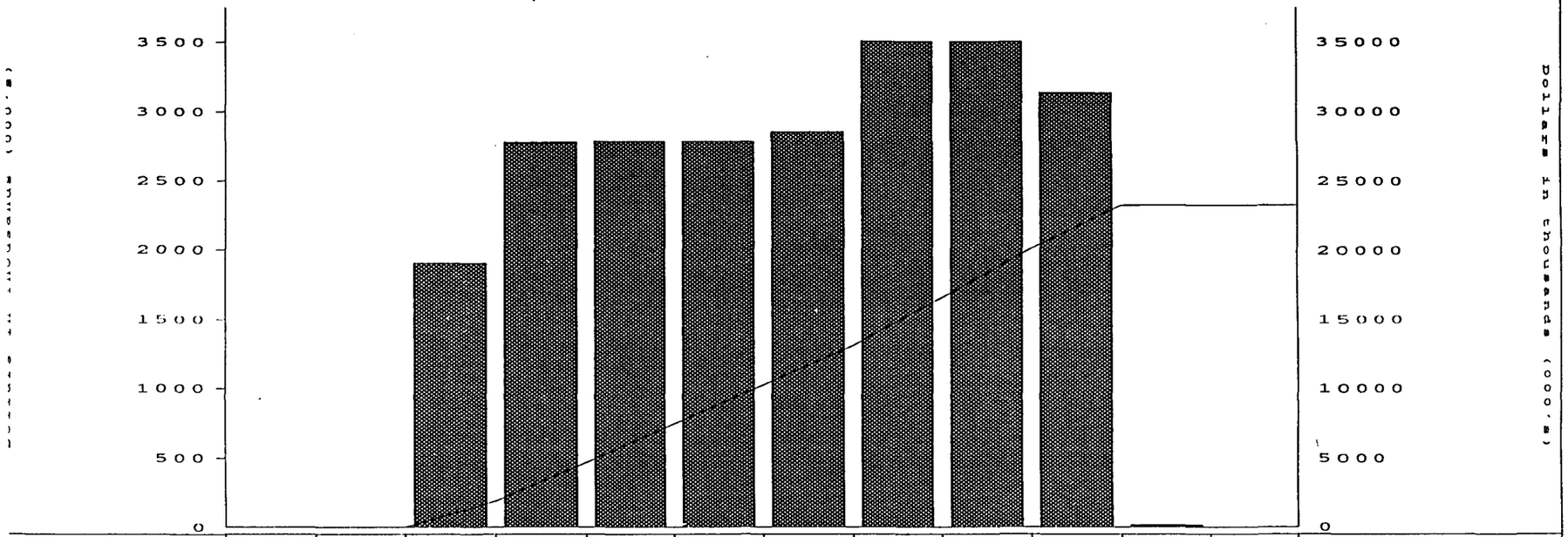
GEM Detector Report: GEM_FY	GEM DETECTOR WBS 90 - PROJECT MANAGEMENT	Date: 27APR93 Project: PM



		FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01
ıcr Bud	$k		1905	2780	2786	2786	2855	3504	3504	3136	17	
ım · Bud	$10k		191	468	747	1026	1311	1662	2012	2326	2327	2327

WBS 90.01 ENGINEERING & INTEGRATION
WBS 90.02 PROJECT MANAGEMENT, PLANN
WBS 90.03 ENVIRONMENTAL SAFETY & HE
WBS 90.04 ADMINISTRATION