U.S. ATLAS M&&O Estimate
Cost Book AY$

Funding All **Funding Type:** All

Institutions: All

WBS Number: 3.3 **Description:** U.S. ATLAS M&O Estimate

Institution : **Contact**

U.S. ATLAS Maintenance and Operations (M&O) includes detector specific costs allocated to subsystems and Common Fund cost related to overall experimental operations.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	22688	0	0	22688	41	15594	0	7054	8883.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional B/I	586	586	586	586	352	352	3048
	24.624	24.624	25.265	25.922	15.975	16.39	132.800
Faculty B/I	4400	4400	3520	1056	1056	1056	15488
	292.118	292.118	252.945	75.605	77.566	79.583	1069.935
Grad Student B/I	2640	2640	2640	1320	1320	1320	11880
	59.988	59.988	61.547	31.575	32.393	33.236	278.727
Post Doc B/I	4752	4752	3872	2376	2376	2376	20504
	158.299	158.299	153.789	104.782	107.5	110.298	792.967
Sr Research Scientist B/I	1936	1936	176	176	176	176	4576
	301.939	301.939	28.163	28.896	29.645	30.416	720.998
Technician B/I	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
Term Scientist B/I	469	0	0	0	0	0	469
	20.058	0	0	0	0	0	20.058
B/I Total	14783	14314	11144	5714	5280	5280	56515
	857.026	836.968	553.681	285.525	263.079	269.923	3066.202
Computer Professional MR	1617	1190	900	2409	1265	0	7381
	142.081	110.245	87.149	253.248	136.432	0	729.155
Electrical Engineer MR	0	1760	2060	0	0	753	4573
	0	217.523	239.638	0	0	103.105	560.266
Mechanical Engineer MR	0	4172	2780	176	0	0	7128
	0	515.629	352.52	22.899	0	0	891.048
Technician MR	0	2224	3944	3564	1087	400	11219
	0	194.339	237.745	220.957	102.584	38.731	794.356

MR Total	1617	9346	9684	6149	2352	1153	30301
	142.081	1037.736	917.052	497.104	239.016	141.836	2974.825
Computer Professional R	5187	4845	5598	3697	5179	4612	29118
	443.516	343.182	416.506	240.995	404.841	430.107	2279.147
Designer R	1107	352	0	0	0	0	1459
	97.625	18.55	0	0	0	0	116.175
Electrical Engineer R	4474	8588	4026	3736	3976	1963	26763
	337.35	765.221	334.777	385.6	432.998	206.247	2462.193
Grad Student R	0	1760	0	0	0	0	1760
	0	39.072	0	0	0	0	39.072
Mechanical Engineer R	3187	1440	1931	895	1181	1801	10435
	317.028	119.558	184.929	94.058	128.585	181.639	1025.797
Technician R	5353	6232	6569	6429	4198	4885	33666
	341.199	368.784	439.21	445.017	319.115	393.94	2307.265
R Total	19308	23217	18124	14757	14534	13261	103201
	1536.718	1654.367	1375.422	1165.67	1285.539	1211.933	8229.649
Total	35708	46877	38952	26620	22166	19694	190017
	2535.825	3529.071	2846.155	1948.299	1787.634	1623.692	14270.676

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other B/I	0.0	0.0	0.0	8.4	0.0	8.9	19.274
Travel B/I	7.5	12.5	15.9	13.2	13.5	13.9	114.800
B/I Total	7.5	12.5	15.9	21.6	13.5	22.7	134.074
Other MR	0.0	150.2	198.1	173.7	140.3	0.0	740.653
Travel MR	0.0	60.5	50.3	22.6	23.2	0.0	233.855
MR Total	0.0	210.7	248.3	196.3	163.5	0.0	974.508
Other R	635.7	1110.5	474.1	645.0	583.7	678.5	4421.734
Travel R	344.0	142.8	129.3	185.3	154.7	177.8	1524.099
R Total	979.7	1253.3	603.4	830.4	738.4	856.4	5945.833
Total	987.2	1476.5	867.6	1048.2	915.3	879.1	7054.415

WBS Number: 3.3 **Description:** Liquid Argon

Institution : **Contact**

The M&O estimate for the Liquid Argon Calorimeter includes costs for the commissioning, pre-operations, test beam activities, operations, maintenance, CERN living expense supplements, travel and CERN common costs. It is divided into sections describing the mechanical and electrical systems, test beams, and CERN common costs.

1) Model for the cost estimates of the M&O for the mechanical systems:**Details of Estimate:**
The cost estimate for the pre-operations, commissioning, maintenance and operations of the mechanical components of the Liquid Argon Calorimeter is based on the assumption that US will continue to be responsible for its deliverables: barrel cryostat, feedthroughs, FCal and for the cryogenics. In the construction project, the US contributes ~50% of the total cost of those components. There are three stages of the M&O program: (1) FY03-FY04 - commissioning of the cryostat with its temporary cryogenics in the surface building 180 and the commissioning of the Liquid Nitrogen refrigerator in the USA15; (2) FY05-FY07 - integration and re-commissioning of the cryostat, of the feedthroughs vaccum an dcontrol systems and of the cryogenics in the final configuration in the experimental pit; (3) FY08-FY12 - operations and periodic maintenance of the experiment.

Barrel cryostat pre-operations involve continuous cold tests both in Bldg.180 prior to the transport to the pit and after its installation in the experimental hall. The work will include welding of the cryostat shut after the installation of the calorimeter modules and completion o f all the tests, installation and commissioning of the solenoid magnet. A complete check of the feedthroughs' vacuum and their monitoring systems will be done after the completion of module installation in Bldg.180. Several feedthroughs will be disconnected from the vacuum system for the transport to the experimental hall to allow for proper crane operations. They will have to be reassembled in the pit and another complete vacuum and monitoring check will be done in FY06. The temporary cryostat cryogenics system assembled in Bldg.180 in FY03 will be operational in FY04 and FY05. The final cryogenics will be commissioned in FY06 after the installation in the pit.
Similar procedure will be followed for the Endcap cryostats where the purity monitors and cryogenics control software will start operations in
bldg 180 for the cold tests, while the final test and operations will commence after the transport to the cavern.
The operational system of the LN2 refrigerator and of the inter-connects will be commissioned in FY05 and FY06.

During the experiment operations a CERN based crew will be supported by the CERN Common Costs. Calibration of the monitoring equipment (including quality meters), maintenance of the data bases and of the repair stations for feedthroughs' components, quality meters and of the monitoring electronics will remain US responsibility. BNL, Stony Brook and the Arizona groups will maintain the test and repair equipment throughout the period of the experiment. BNL will also maintain the control software for the cryostat and cryogenics systems.

2) Model for the cost estimates of the M&O for the electronics and electrical systems

The components of the system crate: pedestals, warm cables and base planes, have been already installed on the barrel end endcapC cryostats and will be installed on the endcapA cryostat in 2003. The crates and the readout board system will be installed on the cryostats after their move to the expoerimental pit i.e., in FY05-FY06. Several pedestals will have to be removed for the transport and re-installed in the pit due to the physical conflict with the transport.
The commisioning will start in the West Hall in FY04. A portable full readout crate system and a test station will be used to check the status of each calorimeter module after the each cryostat is closed but before it is welded shut. The pre-operations will include: the full crate test of the readout system, the long-term boards burn-in facility, a portable full crate test station for the commissioning of the calorimeter modules in Bldg. 180, the commissioning of the electronics readout after its installation on the detector (in the pit) and the specialized electronics for the beam tests. The system crate, optical links, Level 1 trigger system, and the ROD system will require costs for pre-operations. A long-term burn-in of the integrated system crate will be performed to flush out the infant mortality components before the commencement of operations. Documentation update (including final layouts and drawings) will be made during the commissioning stage.

The estimates for operations and maintenance are based on the LHC run model of 7 months of proton-proton collisions, 2 months of heavy ion collisions and 3 months detector access per year. For such model, the ATLAS Liquid Argon Electronics
Coordination group estimated a need for the on-site electronics operations crew of 1 supervisory Electrical Engineer and 5 electronics technicians working in shifts. This crew (paid from the CERN Common costs with a 20% US share) will identify problem boards/components, replace with spares (if accessible) and run simple diagnostic tests. It is

expected that during the standaqrd yearly access additional experts from the home institutions will be needed at

CERN to help in de-bugging and problem solving as they arise. Simple repairs will be made at CERN. Boards with more difficult problems will be sent for repairs to the "home" institutions (Nevis, BNL, Pittsburgh, SMU) responsible for their maintenance. Each institution will maintain the expertise and the necessary test and repair equipment. In addition, these institutions will need to update the supply of spares from time to time as needed. This model is similar to that used e.g., at PHENIX, D0 and ZEUS.

Maintenance and operations of the Liquid Argon Calorimeter electronics in FY07-FY12 covers the following seven categories:
front-end electronics, level 1 trigger interface, ROD system electronics, power supplies, detector control and cooling systems, cables, crates, and connectors, optical links.
The numbers of the units are as follows:
The number of the Front-End Boards installed in the system:

Type	Number
Front End Board	1524
Calibration Board	122
Tower Builder Board	120
Tower Driver Board	20
Controller	114
Monitoring Board	146
LV Boards (HEC)	24
Total	2070

There are 2 cooling plates for each board and an extensive, water based cooling system.

There are 4 main types of power supplies.

Type & number installed	number of units/supply
Front End Crate supplies	63 & 18
ROD VME crate supplies	54 & 4
Level 1 Interface Crate supplies	8 & 4
HEC LV Supplies	8 & 12

The (Optical) Link components are:

Connection/type	number installed
FEB-ROD/optical	1524
ROD-FEB optical/Cu	762
System crate/optical	114
FT-Baseplane/Cu (flex)	3048
TBB-Receiver/Cu (shielded TP)	240
TDB-Receiver/Cu (shielded TP)	120

The Level 1 trigger receiver/monitor system, located in the USA15 cavern, will consist of eight 9-U VME crates filled with 16 modules each. Each module contains 64 analog channels.

The modules in the ROD system (not including TTC hardware) are:

Type	Number installed
ROD modules	192
TBM modules	16
SPAC modules	16
Total	224

The estimated failure rate of the FEB components is based on the engineering judgment and on the experience of the D0, H1 and ZEUS experiments. The failure rate will require a replacement with spares of about 100-150 readout boards during the yearly access. These boards will be diagnosed and repaired during the operations period and made ready as spares for the next access cycle. During the access, US based technicians and postdocs will

supplement the operating crew, as a single board replacement will require a minimum of 3 people for 3-4 hours. This is after the experiment has been opened and the scaffolding and access platforms have been set up. It is estimated that it will take 2 weeks to open the detector and two weeks to close it down. Duirng that period safety interlocks for HV, lasers etc., must be monitored. The US institutions must maintain a crew of technicians and a fraction of high-level electrical engineers for problem diagnoses and repairs. It is expected that during the operation's period FY07-FY12, the electrical engineers will work on the R&D and on the design of electronics for the LHC upgrade, but that they will be available for special tasks and consultations. The specialized test equipment, which will be quite heavily used, must be kept operational and up to date. For the purpose of estimating the maintenance cost for such equipment, it was assumed that it would be replaced every three years.

3) Model for the cost estimates of the M&O for the test beams activities

There are three test beam periods for ATLAS LAr systems: 1) during the August 2003 - April 2004 the Combined Barrel test run will measure a complete electromagnetic and hadronic calorimeters responses to the electrons and pions. 2) The calibration run for the FCAL is scheduled for June-September 2003. 3) A combined EMEC/HEC/FCAL

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	22688	0	0	22688	41	15594	0	7054	8883.0	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Computer Professional B/I	586	586	586	586	352	352	3048
	24.624	24.624	25.265	25.922	15.975	16.39	132.800
Faculty B/I	4400	4400	3520	1056	1056	1056	15488
	292.118	292.118	252.945	75.605	77.566	79.583	1069.935
Grad Student B/I	2640	2640	2640	1320	1320	1320	11880
	59.988	59.988	61.547	31.575	32.393	33.236	278.727
Post Doc B/I	4752	4752	3872	2376	2376	2376	20504
	158.299	158.299	153.789	104.782	107.5	110.298	792.967
Sr Research Scientist B/I	1936	1936	176	176	176	176	4576
	301.939	301.939	28.163	28.896	29.645	30.416	720.998
Technician B/I	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
Term Scientist B/I	469	0	0	0	0	0	469
	20.058	0	0	0	0	0	20.058
B/I Total	14783	14314	11144	5714	5280	5280	56515
	857.026	836.968	553.681	285.525	263.079	269.923	3066.202
Computer Professional MR	1617	1190	900	2409	1265	0	7381
	142.081	110.245	87.149	253.248	136.432	0	729.155
Electrical Engineer MR	0	1760	2060	0	0	753	4573
	0	217.523	239.638	0	0	103.105	560.266
Mechanical Engineer MR	0	4172	2780	176	0	0	7128
	0	515.629	352.52	22.899	0	0	891.048
Technician MR	0	2224	3944	3564	1087	400	11219
	0	194.339	237.745	220.957	102.584	38.731	794.356

MR Total	1617	9346	9684	6149	2352	1153	30301
	142.081	1037.736	917.052	497.104	239.016	141.836	2974.825
Computer Professional R	5187	4845	5598	3697	5179	4612	29118
	443.516	343.182	416.506	240.995	404.841	430.107	2279.147
Designer R	1107	352	0	0	0	0	1459
	97.625	18.55	0	0	0	0	116.175
Electrical Engineer R	4474	8588	4026	3736	3976	1963	26763
	337.35	765.221	334.777	385.6	432.998	206.247	2462.193
Grad Student R	0	1760	0	0	0	0	1760
	0	39.072	0	0	0	0	39.072
Mechanical Engineer R	3187	1440	1931	895	1181	1801	10435
	317.028	119.558	184.929	94.058	128.585	181.639	1025.797
Technician R	5353	6232	6569	6429	4198	4885	33666
	341.199	368.784	439.21	445.017	319.115	393.94	2307.265
R Total	19308	23217	18124	14757	14534	13261	103201
	1536.718	1654.367	1375.422	1165.67	1285.539	1211.933	8229.649
Total	35708	46877	38952	26620	22166	19694	190017
	2535.825	3529.071	2846.155	1948.299	1787.634	1623.692	14270.676

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other B/I	0.0	0.0	0.0	8.4	0.0	8.9	19.274
Travel B/I	7.5	12.5	15.9	13.2	13.5	13.9	114.800
B/I Total	7.5	12.5	15.9	21.6	13.5	22.7	134.074
Other MR	0.0	150.2	198.1	173.7	140.3	0.0	740.653
Travel MR	0.0	60.5	50.3	22.6	23.2	0.0	233.855
MR Total	0.0	210.7	248.3	196.3	163.5	0.0	974.508
Other R	635.7	1110.5	474.1	645.0	583.7	678.5	4421.734
Travel R	344.0	142.8	129.3	185.3	154.7	177.8	1524.099
R Total	979.7	1253.3	603.4	830.4	738.4	856.4	5945.833
Total	987.2	1476.5	867.6	1048.2	915.3	879.1	7054.415

WBS Number: 3.3.1 **Description:** Mechanical M&O Estimate

Institution : **Contact** Not available

The mechanical M&O estimate for the Liquid Argon Calorimeter includes costs for pre-operations, commissioning, operations and maintenance.
Comments: US contributes ~50% of the cost of the ATLAS LAr mechanical components: cryostats, feedthroughs, cryogenics and FCal. US will continue to be responsible for its deliverables during the commissioning, operations and maintenance stage of the experiment. There are three stages of the M&O program: (1) FY03-FY04 - commissioning of the cryostat with its temporary cryogenics and of the FCal in the surface building 180 (West Hall); (2) FY05-FY07 - integration and re-commissioning of the cryostat and cryogenics in their final configuration in the experimental pit; (3) FY08-FY12 - experiment operations with periodic maintenance.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	6187	0	0	6187	41	4736	0	1411	2713.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional B/I	586	586	586	586	352	352	3048
	24.624	24.624	25.265	25.922	15.975	16.39	132.800
Faculty B/I	2640	2640	2640	704	704	704	10032
	200.95	200.95	206.175	56.411	57.874	59.379	781.739
Grad Student B/I	2640	2640	2640	1320	1320	1320	11880
	59.988	59.988	61.547	31.575	32.393	33.236	278.727
Post Doc B/I	2112	2112	1232	616	616	616	7304
	87.97	87.97	55.221	28.329	29.064	29.82	318.374
Sr Research Scientist B/I	176	176	176	176	176	176	1056
	27.449	27.449	28.163	28.896	29.645	30.416	172.018
Term Scientist B/I	293	0	0	0	0	0	293
	12.244	0	0	0	0	0	12.244
B/I Total	8447	8154	7274	3402	3168	3168	33613
	413.225	400.981	376.371	171.133	164.951	169.241	1695.902
Mechanical Engineer MR	0	652	0	176	0	0	828
	0	80.583	0	22.899	0	0	103.482
Technician MR	0	264	308	704	0	0	1276
	0	23.069	27.614	64.76	0	0	115.443
MR Total	0	916	308	880	0	0	2104
	0	103.652	27.614	87.659	0	0	218.925
Computer Professional R	1057	1938	2233	1275	1353	1353	9209
	69.867	81.437	113.779	74.363	79.831	81.908	501.185
Designer R	300	0	0	0	0	0	300
	28.087	0	0	0	0	0	28.087
Electrical Engineer R	0	0	135	0	0	0	135
	0	0	17.119	0	0	0	17.119

Mechanical Engineer R	3187	1440	1931	895	1181	1801	10435
	317.028	119.558	184.929	94.058	128.585	181.639	1025.797
Technician R	1453	665	1708	1392	1788	1788	8794
	127.132	59.208	153.862	128.938	169.652	174.068	812.860
R Total	5997	4043	6007	3562	4322	4942	28873
	542.114	260.203	469.689	297.359	378.068	437.615	2385.048
Total	14444	13113	13589	7844	7490	8110	64590
	955.339	764.836	873.674	556.151	543.019	606.856	4299.875

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other MR	0.0	75.5	85.0	115.8	0.0	0.0	308.019
Travel MR	0.0	28.0	5.1	10.5	0.0	0.0	65.899
MR Total	0.0	103.5	90.1	126.3	0.0	0.0	373.918
Other R	140.0	62.0	72.8	16.8	129.6	158.5	658.165
Travel R	86.0	18.8	23.6	34.2	47.0	58.2	378.929
R Total	226.0	80.8	96.4	51.1	176.6	216.6	1037.094
Total	226.0	184.3	186.5	177.4	176.6	216.6	1411.012

WBS Number: 3.3.1.1 **Description:** Pre-operations and commissioning

Institution : **Contact** Not available

Details of Estimate:

The calorimeter (barrel and two endcaps) will be completed on the surface and will be operated using temporary cryogenics, controls and readout. It will be then transferred to the pit and integrated with the rest of the detector. This will require changes to the cryogenics, controls and readout. Pre-operations shall include:

1. Updating the documentation in CDD format to include all the changes to the hardware from the pre-operations stage of the experiment. The documentation to be updated includes, as a minimum, new drawings, procedures and software.
2. Acceptance test procedure, and data recording including calculations required by the CERN safety group.
3. Integration tooling and fixtures including calculations needed for integration and installation in the pit. .
4. Cryostat operations on the surface (common cost item).
5. Facilities setup that include as a minimum, equipment, and a safety program
6. Pre-operations of hardware.
7. Disassembly and re-assembly of feedthroughs for the move from Building 180 to the pit.

During the pre operations stage of the experiment, the documentation in CDD format will be updated to reflect the changes made to the hardware during commissioning. An integration acceptance test procedure will be generated and data recorded. In addition, integration tooling and fixtures will be developed for integrating level 3 subsystems.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
548	0	0	548	0	421	0	127	239.3	0.0

MANPOWER (k$) SUMMARY:

	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Term Scientist B/I	293	0	0	0	0	0	293
	12.244	0	0	0	0	0	12.244
B/I Total	293	0	0	0	0	0	293
	12.244	0	0	0	0	0	12.244
Mechanical Engineer MR	0	652	0	0	0	0	652
	0	80.583	0	0	0	0	80.583
MR Total	0	652	0	0	0	0	652
	0	80.583	0	0	0	0	80.583
Computer Professional R	440	0	0	0	0	0	440
	43.94	0	0	0	0	0	43.940
Designer R	300	0	0	0	0	0	300
	28.087	0	0	0	0	0	28.087
Mechanical Engineer R	1077	150	0	0	0	0	1227
	133.109	18.539	0	0	0	0	151.648
Technician R	687	500	0	0	0	0	1187
	60.197	44.517	0	0	0	0	104.714
R Total	2504	650	0	0	0	0	3154
	265.333	63.056	0	0	0	0	328.389
Total	2797	1302	0	0	0	0	4099
	277.577	143.639	0	0	0	0	421.216

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	23.0	0.0	0.0	0.0	0.0	34.718
MR Total	0.0	23.0	0.0	0.0	0.0	0.0	34.718
Other R	22.0	0.0	0.0	0.0	0.0	0.0	24.747
Travel R	43.5	2.5	0.0	0.0	0.0	0.0	67.304
R Total	65.5	2.5	0.0	0.0	0.0	0.0	92.051
Total	65.5	25.5	0.0	0.0	0.0	0.0	126.769

WBS Number: 3.3.1.1.1 **Description:** Cryostat

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	98	0	0	98	0	87	0	11	49.4	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer MR	0 0	352 43.505	0 0	0 0	0 0	0 0	352 43.505
MR Total	0 0	352 43.505	0 0	0 0	0 0	0 0	352 43.505
Mechanical Engineer R	352 43.505	0 0	0 0	0 0	0 0	0 0	352 43.505
R Total	352 43.505	0 0	0 0	0 0	0 0	0 0	352 43.505
Total	352 43.505	352 43.505	0 0	0 0	0 0	0 0	704 87.010

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	10.0	0.0	0.0	0.0	0.0	0.0	11.150
R Total	10.0	0.0	0.0	0.0	0.0	0.0	11.150
Total	10.0	0.0	0.0	0.0	0.0	0.0	11.150

WBS Number: 3.3.1.1.1.1 **Description:** Cryostat documentation update

Institution : BNL-M&O **Contact** J. Sondericker

Cryostat documentation update. CERN safety group requires a complete documentation of any cryogenics system in operation. The documentation must be submitted in the CDD format. For the cryostat the documentation will need to be updated twice: once for the operations in the West Hall and the second time after the move to the experimental pit. It is expected that some of the interfaces will be modified during the integration.

Details of Estimate:

Labor assumes 1/5 FTE of a mechanical engineer in FY05 and FY06 (J. Sondericker/ M. Rehak) to update the cryostat documentation and to provide calculations required for the integration in the pit. It also includes the Designer for drawing preparation and update (J. Farrel). One needs to review and upload 20 drawings into the CDD. Time estimate is 1 day per drawing or 160 hours in FY04 and 160 hours in FY05.Travel: - 4 trips to CERN in FY05 and 4 in FY06 at $2500per trip or $15000. The final review must be done after the move of the cryostat to the final position and start of final operations in FY07.

Management reserve.

The elements of this task are put into management reserve for 05, 06 and 07

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	98	0	0	98	0	87	0	11	49.4	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer MR	0	352	0	0	0	0	352
	0	43.505	0	0	0	0	43.505
MR Total	0	352	0	0	0	0	352
	0	43.505	0	0	0	0	43.505
Mechanical Engineer R	352	0	0	0	0	0	352
	43.505	0	0	0	0	0	43.505
R Total	352	0	0	0	0	0	352
	43.505	0	0	0	0	0	43.505
Total	352	352	0	0	0	0	704
	43.505	43.505	0	0	0	0	87.010

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	10.0	0.0	0.0	0.0	0.0	0.0	11.150
R Total	10.0	0.0	0.0	0.0	0.0	0.0	11.150
Total	10.0	0.0	0.0	0.0	0.0	0.0	11.150

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.1.1.2 **Description:** Feedthrough

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	22	0	0	22	0	22	0	0	12.4	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer R	105	0	0	0	0	0	105
	12.977	0	0	0	0	0	12.977
Technician R	100	0	0	0	0	0	100
	8.903	0	0	0	0	0	8.903
R Total	205	0	0	0	0	0	205
	21.88	0	0	0	0	0	21.880
Total	205	0	0	0	0	0	205
	21.88	0	0	0	0	0	21.880

WBS Number: 3.3.1.1.2.1 **Description:** Signal FT Documentation update

Institution : BNL-M&O **Contact** T. Muller

Documentation update for the signal feedthroughs. CERN safety group requires a complete documentation of any vacuum and cryogencis system in operation. The documentation has to be done in the CDD format. The documentation will have to be updated twice: once for the operations in the West Hall and the second time after the move to the experimental pit. It is expected that some of the interfaces will be modified during integration.

Details of Estimate:

Labor assumes 1/7 FTE in FY03, 1/17 FTE in FY04 and FY05 and 1/30 FTE in FY06 of a mechanical engineer (T. Muller). In addition a work of a Designer (J. Farrel) is needed to update the feedthrough's documentation drawings. Task includes an update of drawings and upload into CDD. There are 15 drawings including FT assembly drawings. Each drawing will need an average of 10 hours for review and update. Total of 150 hours in 2005 and 150 hours in 2006.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
13	0	0	13	0	13	0	0	7.4	0.0

MANPOWER (k$) SUMMARY:

	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer R	105 12.977	0 0	0 0	0 0	0 0	0 0	105 12.977
R Total	105 12.977	0 0	0 0	0 0	0 0	0 0	105 12.977
Total	105 12.977	0 0	0 0	0 0	0 0	0 0	105 12.977

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.1.2.2 **Description:** HV FT Documentation Update

Institution : SUNY SB **Contact** Not available

Documentation update for the HV feedthroughs. CERN safety group requires a complete documentation of any vacuum and cryogenic system in operation. Some interfaces are modified during the installation. It is expected that more changes will occur during the integration.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	9	0	0	9	0	9	0	0	5.1	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician R	100 8.903	0 0	0 0	0 0	0 0	0 0	100 8.903
R Total	100 8.903	0 0	0 0	0 0	0 0	0 0	100 8.903
Total	100 8.903	0 0	0 0	0 0	0 0	0 0	100 8.903

WBS Number: 3.3.1.1.2.2.1 **Description:** HV FT Documentation Update - SBU

Institution : SUNY SB **Contact** Not available

Documentation update for the HV feedthroughs. CERN safety group requires a complete documentation of any vacuum and cryogenic system in operation. Some interfaces are modified during the installation. It is expected that more changes will occur during the integration.

An update and upload of the information on the filter box and overall assembly will require a labor of a senior technician in FY06. There are 10 drawings for the filter box and 6 drawings for the cabling at 10 hours per drawing

Details of Estimate:

Labor assumes 1/10 FTE of a mechanical designer in FY06 to update the HV Feedthrough documentation.

Base & infrastructure;
Labor assumes 1/10 Physicist in FY06 to review and support documentation update.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
9	0	0	9	0	9	0	0	5.1	0.0

MANPOWER (k$) SUMMARY:

	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician R	100 8.903	0 0	0 0	0 0	0 0	0 0	100 8.903
R Total	100 8.903	0 0	0 0	0 0	0 0	0 0	100 8.903
Total	100 8.903	0 0	0 0	0 0	0 0	0 0	100 8.903

CONTINGENCY FACTORS:

Risk				*Weight*				Cont %
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule		
0	0	0	0	0	0	0		0

WBS Number: 3.3.1.1.2.2.2 **Description:** HV FT Documentation Update - BNL

Institution : BNL-M&O **Contact** Not available

Documentation update for the HV feedthroughs. CERN safety group requires a complete documentation of any vacuum and cryogenic system in operation. Some interfaces are modified during the installation. It is expected that more changes will occur during the integration.

BNL: Upload to CDD of the HV mechanical assembly drawings, update test results on **Details of Estimate:**
bellows, welding certification etc., will require work of aq Mechanical Engineer (T. Muller) consisting of 15 days ib FY04 and 15 days in FY05. It will also require 1 month labor of a Designer (J. Farrel) in FY04 and 1 month in FY05. This represents 1/17 FTE of a mechanical engineer and 1/12 of a mechanical designer in FY04 and FY05.

Base & infrastructure;
Labor assumes 1/10 Physicist in FY06 to review and support documentation update.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	Cost	Schedule	Design	Technical	Cost	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.1.3 **Description:** Cryogenics

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	409	0	0	409	0	300	0	109	170.5	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer MR	0	300	0	0	0	0	300
	0	37.078	0	0	0	0	37.078
MR Total	0	300	0	0	0	0	300
	0	37.078	0	0	0	0	37.078
Computer Professional R	440	0	0	0	0	0	440
	43.94	0	0	0	0	0	43.940
Designer R	300	0	0	0	0	0	300
	28.087	0	0	0	0	0	28.087
Mechanical Engineer R	620	150	0	0	0	0	770
	76.627	18.539	0	0	0	0	95.166
Technician R	587	500	0	0	0	0	1087
	51.294	44.517	0	0	0	0	95.811
R Total	1947	650	0	0	0	0	2597
	199.948	63.056	0	0	0	0	263.004
Total	1947	950	0	0	0	0	2897
	199.948	100.134	0	0	0	0	300.082

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	23.0	0.0	0.0	0.0	0.0	34.718
MR Total	0.0	23.0	0.0	0.0	0.0	0.0	34.718
Other R	12.0	0.0	0.0	0.0	0.0	0.0	13.597
Travel R	38.5	2.5	0.0	0.0	0.0	0.0	61.004
R Total	50.5	2.5	0.0	0.0	0.0	0.0	74.601
Total	50.5	25.5	0.0	0.0	0.0	0.0	109.319

WBS Number: 3.3.1.1.3.1 **Description:** Documentation update

Institution : BNL-M&O **Contact** J. Sondericker

Documentation update for the cryogenics. CERN safety group requires a complete documentation of any cryogenics system in operation. The documentation has to be provided in the CDD format. The documentation will need to be updated twice: once for the operations in the West Hall in FY04 and the second time after the move to the experimental pit in FY05 and integration in FY06. The cryogenics control systems are different for the two operations. IN Bldg. 180 the LN2 is vented. In the experimental hall there is a LN2 recovery and re-circulation system. Software controls use different programming schemes.

Labor assumes Mechanical Engineer (J. Sondericker): 1/12 FTE in FY05 and 1/12 FTE in **Details of Estimate:**
FY06 to write the operations manual and a Mechanical Designer (Y. Farrah) to update the documentation of the software operations for the refrigerator and for the implementation of the safety procedures for the operations in the pit: 1/6 FTE in FY05 - FY07.
. Travel:- 1 trip to CERN0year in FY05 - FY07 at $2500per trip

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	76	0	0	76	0	65	0	11	37.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Designer R	300 28.087	0 0	0 0	0 0	0 0	0 0	300 28.087
Mechanical Engineer R	150 18.539	150 18.539	0 0	0 0	0 0	0 0	300 37.078
R Total	450 46.626	150 18.539	0 0	0 0	0 0	0 0	600 65.165
Total	450 46.626	150 18.539	0 0	0 0	0 0	0 0	600 65.165

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	3.0	0.0	0.0	0.0	0.0	4.528
MR Total	0.0	3.0	0.0	0.0	0.0	0.0	4.528
Travel R	4.5	0.0	0.0	0.0	0.0	0.0	6.793
R Total	4.5	0.0	0.0	0.0	0.0	0.0	6.793
Total	4.5	3.0	0.0	0.0	0.0	0.0	11.321

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.1.1.3.2 **Description:** Cryogenics Commissioning

Institution : BNL-M&O **Contact** Not available

Commissioning of all cryogenic equipment.
Commissioning in the West Hall will require the following tasks:
1. Around the clock cold tests support.
2. Closing of the Cold Vessel - Support in closing of the Cold Vessel which includes:
   A. Monitoring installation of the Omega seals in preparation for welding the cryostat flanges shut.
   B. Certification welding samples prepared, test samples welded, evaluation, and supervision
   C. Monitor torquing of cold vessel bolts
   D. Supervision of welding safety practices to prevent superinsulation fires.
   E. Pump - down of individual flange seals and leak check.
3. Feedthrough Vacuum and Monitoring
   A. Complete testing of the Feedthrough Good and Bad Vacuum systems
   B. Commissioning of the Feedthrough head flange heater system to avoid condensation on temperature monitoring instrumentation
4. Solenoid Magnet Installation
   A. Installation of the Solenoid Magnet in the Cryostat.
   B. Installation of super insulation blankets.
   C. Provide support to KEK to install SC buss bar and shield to He supply dewar.
   D. Magnetic field test measurement in the West Hall
   E. Commissioning of the solenoid magnet system
5. Test of the barrel cryostat Insulating Vacuum System - Commission the insulating Vacuum System of the warm barrel cryostat vessels by
   He leak checking the entire warm vessel while under vacuum.
6. Cold test - Commissioning the BC Cryogenic System by cooling down the cold vessel, filling with LAr and warming to 89K operating conditions.
7. Commissioning in the cavern

Details of Estimate:

The resources to accomplish the above tasks will require 1/12 FTE in , FY05 and 1/4FTE in FY06 of a Mechanical Engineer (J. Sondericker - 2 weeks each year at CERN to supervise commissioning and to discuss the implementation of the refrigerator control system + 2 weeks each year at BNL to work with the industrial companies and with the CERN safety groups on the operations analysis), 1/2 FTE of the Software Professional (Y. Farrah) in FY05 - FY07 to implement the program and to provide the interfaces to the LAr control system

1/6 FTE ME in FY04 to provide the calculations needed for the solenoid magnet integration with the cryostat
1/6 FTE of the mechanical engineer (M. Rehak) in FY05 to provide the calculations for the tilecal interface with the cryostat during the system integration in the pit.
1/4 FTE of software professional (Y Farrah} in FY06 to provide support for the cooldown to commission cryostat.
1/6 FTE of a Technician (Wheeler) in FY04 for the Quality Meters commissioning in the West Hall.
1/3 FTE of a technician (Wheeler) in FY05 for the dis-assembly and recommissionig of the cryostat interfaces in the pit .
1/3 FTE of a Technician (Wheeler) in FY06 for the disassassembly and recommissioning of the cryostat interfaces in the pit.

Materials: $20,000 is needed in FY03 for connections needed in Bldg.180. Based on the past experience $10,000 / year of material will be required in FY04, $15000 FY05 and $10,000 in FY06, and 4 trips at $2500 per trip in FY04-FY07.
Commisioning in the cavern will continue through FY07.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
280	0	0	280	0	190	0	90	108.2	0.0

MANPOWER	FY 06 (hrs)	FY 07 (hrs)	FY 08 (hrs)	FY 09 (hrs)	FY 10 (hrs)	FY 11 (hrs)	Total (hrs)
Mechanical Engineer MR	0	300	0	0	0	0	300
	0	37.078	0	0	0	0	37.078
MR Total	0	300	0	0	0	0	300
	0	37.078	0	0	0	0	37.078
Computer Professional R	440	0	0	0	0	0	440
	43.94	0	0	0	0	0	43.940
Mechanical Engineer R	470	0	0	0	0	0	470
	58.088	0	0	0	0	0	58.088
Technician R	587	0	0	0	0	0	587
	51.294	0	0	0	0	0	51.294
R Total	1497	0	0	0	0	0	1497
	153.322	0	0	0	0	0	153.322
Total	1497	300	0	0	0	0	1797
	153.322	37.078	0	0	0	0	190.400

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	20.0	0.0	0.0	0.0	0.0	30.190
MR Total	0.0	20.0	0.0	0.0	0.0	0.0	30.190
Other R	11.0	0.0	0.0	0.0	0.0	0.0	12.265
Travel R	29.0	2.5	0.0	0.0	0.0	0.0	47.549
R Total	40.0	2.5	0.0	0.0	0.0	0.0	59.814
Total	40.0	22.5	0.0	0.0	0.0	0.0	90.004

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.1.1.3.3 **Description:** HV Feedthrough Commissioning

Institution : SUNY SB **Contact** Not available

Commissioning of the HV feedthroughs.
Task includes the commissioning o fthe HV connections after the move of each of the three sections of the calorimeters (barrel and two endcaps) to the experimental pit; conncetion of the new HV cables to the FT filter boxes. Re-connection of the temperature sensors and of the heater connectors. Creation of the data bases in the CERN CDD

Details of Estimate:

Labor estimate is based on the past experience. It will require 1 week per feedthrough (i.e.,5 to 6 weeks) of a technician in FY05.
Travel: 6 trips (two per cryostat) at $2,500/trip or $15,000.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
53	0	0	53	0	45	0	8	25.3	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician R	0	500	0	0	0	0	500
	0	44.517	0	0	0	0	44.517
R Total	0	500	0	0	0	0	500
	0	44.517	0	0	0	0	44.517
Total	0	500	0	0	0	0	500
	0	44.517	0	0	0	0	44.517

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	1.0	0.0	0.0	0.0	0.0	0.0	1.332
Travel R	5.0	0.0	0.0	0.0	0.0	0.0	6.662
R Total	6.0	0.0	0.0	0.0	0.0	0.0	7.994
Total	6.0	0.0	0.0	0.0	0.0	0.0	7.994

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.1.4 **Description:** Forward Calorimeter

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	19	0	0	19	0	12	0	6	7.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Term Scientist B/I	293 12.244	0 0	0 0	0 0	0 0	0 0	293 12.244
B/I Total	293 12.244	0 0	0 0	0 0	0 0	0 0	293 12.244
Total	293 12.244	0 0	0 0	0 0	0 0	0 0	293 12.244

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	5.0	0.0	0.0	0.0	0.0	0.0	6.300
R Total	5.0	0.0	0.0	0.0	0.0	0.0	6.300
Total	5.0	0.0	0.0	0.0	0.0	0.0	6.300

WBS Number: 3.3.1.1.4.1 **Description:** FCAL Documentation update

Institution : U. of Arizona **Contact** L. Shaver

Documentation update FCAL. The FCAL assembly will be completed in FY04. CERN safety group requires a complete documentation of any cryogenic system in operation. Some interfaces are modified during the installation. It is expected that more changes will occur during the integration. Electronics channel wiring and mapping mistakes have to be identified and corrected in software and data bases. These can be completed only after the end of all

Details of Estimate:

Labor assumes 1/4 FTE of a mechanical engineer/designer in FY05 to update the FCAL documentation. (20 production drawings + integration drawings). Travel 1 trip at $2500. 1/4 of ME in FY06. Travel - 2 trips in FY06 are required.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
19	0	0	19	0	12	0	6	7.0	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Term Scientist B/I	293 12.244	0 0	0 0	0 0	0 0	0 0	293 12.244
B/I Total	293 12.244	0 0	0 0	0 0	0 0	0 0	293 12.244
Total	293 12.244	0 0	0 0	0 0	0 0	0 0	293 12.244

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	5.0	0.0	0.0	0.0	0.0	0.0	6.300
R Total	5.0	0.0	0.0	0.0	0.0	0.0	6.300
Total	5.0	0.0	0.0	0.0	0.0	0.0	6.300

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.2 **Description:** Operations

Institution : **Contact** Not available

Operations shall include:
Calibration and monitoring of the equipment during experiment run time.
Maintaining databases.
ATLAS data taking.
Maintenance for accessible parts and replacement as needed. Consumables are included in common costs.

Details of Estimate:

Calibration and monitoring of the equipment will be performed during the experiment run time that is expected to start in FY07. ATLAS data taking, database maintenance, and support will be provided. Routine checking and maintenance will be carried out for accessible parts of the subsystem. For those parts of the system that are inaccessible, failures will be logged and whatever recovery procedures are necessary will be executed. Hardware, software, and physicist technical support and management will be required. During the operations phase, personnel will be required to provide hardware support, software support and supervise the operations of the cryostat, the Liquid nitrogen refrigeration system, the quality meter monitors, HV Feedthroughs. Additional work will be needed to design and monitor interfaces of the components under direct US responsibility with those under the ATLAS collaboration responsibility. This will include the interface of the

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	3813	0	0	3813	0	3596	0	216	2043.4	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional B/I	586	586	586	586	352	352	3048
	24.624	24.624	25.265	25.922	15.975	16.39	132.800
Faculty B/I	2640	2640	2640	704	704	704	10032
	200.95	200.95	206.175	56.411	57.874	59.379	781.739
Grad Student B/I	2640	2640	2640	1320	1320	1320	11880
	59.988	59.988	61.547	31.575	32.393	33.236	278.727
Post Doc B/I	2112	2112	1232	616	616	616	7304
	87.97	87.97	55.221	28.329	29.064	29.82	318.374
Sr Research Scientist B/I	176	176	176	176	176	176	1056
	27.449	27.449	28.163	28.896	29.645	30.416	172.018
B/I Total	8154	8154	7274	3402	3168	3168	33320
	400.981	400.981	376.371	171.133	164.951	169.241	1683.658
Computer Professional R	517	1760	2055	1175	1175	1175	7857
	21.725	73.957	106.105	69.939	71.753	73.62	417.099
Electrical Engineer R	0	0	135	0	0	0	135
	0	0	17.119	0	0	0	17.119
Mechanical Engineer R	1960	880	1495	735	745	745	6560
	165.38	63.669	143.31	81.872	84.777	86.983	625.991
Technician R	590	0	1144	1144	1144	1144	5166
	51.556	0	103.161	105.847	108.59	111.417	480.571
R Total	3067	2640	4829	3054	3064	3064	19718
	238.661	137.626	369.695	257.658	265.12	272.02	1540.780

Total	11221	10794	12103	6456	6232	6232	53038
	639.642	538.607	746.066	428.791	430.071	441.261	3224.438

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other MR	0.0	0.0	5.1	0.0	0.0	0.0	5.720
MR Total	0.0	0.0	5.1	0.0	0.0	0.0	5.720
Other R	0.0	12.0	0.0	5.3	10.8	5.5	38.643
Travel R	22.5	4.3	10.3	23.7	29.7	30.5	171.925
R Total	22.5	16.3	10.3	29.0	40.5	36.0	210.568
Total	22.5	16.3	15.4	29.0	40.5	36.0	216.288

WBS Number: 3.3.1.2.1 **Description:** Cryostat

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	432	0	0	432	0	408	0	24	231.6	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Sr Research Scientist B/I	176 27.449	176 27.449	176 28.163	176 28.896	176 29.645	176 30.416	1056 172.018
B/I Total	176 27.449	176 27.449	176 28.163	176 28.896	176 29.645	176 30.416	1056 172.018
Computer Professional R	0 0	0 0	160 16.393	160 16.82	160 17.256	160 17.705	640 68.174
Mechanical Engineer R	160 19.775	0 0	160 20.289	160 20.817	160 21.357	160 21.912	800 104.150
R Total	160 19.775	0 0	320 36.682	320 37.637	320 38.613	320 39.617	1440 172.324
Total	336 47.224	176 27.449	496 64.845	496 66.533	496 68.258	496 70.033	2496 344.342

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	0.0	0.0	0.0	5.3	5.4	5.5	24.460
R Total	0.0	0.0	0.0	5.3	5.4	5.5	24.460
Total	0.0	0.0	0.0	5.3	5.4	5.5	24.460

WBS Number: 3.3.1.2.1.1 **Description:** Cryostat operations

Institution : BNL-M&O **Contact** Sondericker

Provide hardware and software support to the cryostat during the operations phase. The support consists of monitoring the cryostat controls for the temperature, pressure and liquid levels. A data base updates and modifications will be done. Periodic review of the performance parameters will be done by cryostat design engineer. Software professional will provide yearly updates of the operations and control software.

Details of Estimate:

Labor costs assume 160 hours/year of ME and 160 hours/year of software professional (based on the past experience in D0 experiment) in FY06 to FY12. Travel 2 trips/year in FY06-FY12 at $2500/ trip or $35,000.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
432	0	0	432	0	408	0	24	231.6	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Sr Research Scientist B/I	176 27.449	176 27.449	176 28.163	176 28.896	176 29.645	176 30.416	1056 172.018
B/I Total	176 27.449	176 27.449	176 28.163	176 28.896	176 29.645	176 30.416	1056 172.018
Computer Professional R	0 0	0 0	160 16.393	160 16.82	160 17.256	160 17.705	640 68.174
Mechanical Engineer R	160 19.775	0 0	160 20.289	160 20.817	160 21.357	160 21.912	800 104.150
R Total	160 19.775	0 0	320 36.682	320 37.637	320 38.613	320 39.617	1440 172.324
Total	336 47.224	176 27.449	496 64.845	496 66.533	496 68.258	496 70.033	2496 344.342

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	0.0	0.0	0.0	5.3	5.4	5.5	24.460
R Total	0.0	0.0	0.0	5.3	5.4	5.5	24.460
Total	0.0	0.0	0.0	5.3	5.4	5.5	24.460

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.2.2 **Description:** Feedthrough

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	556	0	0	556	0	483	0	73	274.6	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer R	0	0	240	240	240	240	960
	0	0	30.433	31.225	32.035	32.869	126.562
Technician R	0	0	704	704	704	704	2816
	0	0	63.713	65.372	67.066	68.812	264.963
R Total	0	0	944	944	944	944	3776
	0	0	94.146	96.597	99.101	101.681	391.525
Total	0	0	944	944	944	944	3776
	0	0	94.146	96.597	99.101	101.681	391.525

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	5.1	0.0	0.0	0.0	5.720
MR Total	0.0	0.0	5.1	0.0	0.0	0.0	5.720
Other R	0.0	0.0	0.0	5.3	10.8	5.5	25.263
Travel R	2.5	3.5	0.0	7.9	8.1	8.3	41.817
R Total	2.5	3.5	0.0	13.2	18.9	13.9	67.080
Total	2.5	3.5	5.1	13.2	18.9	13.9	72.800

WBS Number: 3.3.1.2.2.1 **Description:** Signal Feedthroughs operations

Institution : BNL-M&O **Contact** Not available

Provide hardware support to the signal feethroughs during the operations phase.
Monitoring and control of the signal feedthrough temperature and nitrogen gas flow and of the status of the vacuum system will be required.
CERN safety requirements impose a yearly validation of every relief valve. There are 120 relief valves each needing 5 hours access. This work will be shared with the CERN based operations crew. Maintenace of the test and repair equipment at BNL will be needed.

Details of Estimate:

To support the hardware, 1/7 FTE ME, and 1/5 FTE Technician from FY07 to FY12 will be required.
Material: $5,000/year will be needed to maintain and test the repair station at BNL starting in FY04 to FY12.
Travel 1 trip/year from FY06 to FY12 at $ 2,500 or $20,000 total will also be required.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
354	0	0	354	0	318	0	36	180.8	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer R	0	0	240	240	240	240	960
	0	0	30.433	31.225	32.035	32.869	126.562
Technician R	0	0	352	352	352	352	1408
	0	0	31.558	32.38	33.219	34.084	131.241
R Total	0	0	592	592	592	592	2368
	0	0	61.991	63.605	65.254	66.953	257.803
Total	0	0	592	592	592	592	2368
	0	0	61.991	63.605	65.254	66.953	257.803

MATERIAL SUMMARY:

FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	5.1	0.0	0.0	0.0	5.720
MR Total	0.0	0.0	5.1	0.0	0.0	0.0	5.720
Other R	0.0	0.0	0.0	5.3	5.4	5.5	18.067
Travel R	0.0	0.0	0.0	2.6	2.7	2.8	12.230
R Total	0.0	0.0	0.0	7.9	8.1	8.3	30.297
Total	0.0	0.0	5.1	7.9	8.1	8.3	36.017

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.2.2.2 **Description:** HV Feedthroughs operations

Institution : SUNY SB **Contact** Not available

Provide hardware support to the High Voltage Feethrough's during the operations phase.
The system will operate in two stages: FY04-FY06 in the West Hall and in the pit with a full access to the feedthroughs; and
FY07-FY12 with a yearly access to the pit.
Monitoring and control of the HV feedthrough temperature and dry air as well as of the performance of the HV filter

Labor costs assume 1/10 FTE of a Technician (J. Steffens) starting in FY04 and FY05 and **Details of Estimate:**
1/5 technician from FY06 to FY12, monitoring equipment cost of $5000 consisting of CANBUS I/O and a PC is required in FY06. Tools replacement ($5k) will be needed in FY10.
Travel: 2 trips/year at $2500/trip or $45,000 from FY04 to FY12.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
202	0	0	202	0	165	0	37	93.8	0.0

MANPOWER (k$) SUMMARY:

	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician R	0	0	352	352	352	352	1408
	0	0	32.155	32.992	33.847	34.728	133.722
R Total	0	0	352	352	352	352	1408
	0	0	32.155	32.992	33.847	34.728	133.722
Total	0	0	352	352	352	352	1408
	0	0	32.155	32.992	33.847	34.728	133.722

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	0.0	0.0	0.0	0.0	5.4	0.0	7.196
Travel R	2.5	3.5	0.0	5.3	5.4	5.5	29.587
R Total	2.5	3.5	0.0	5.3	10.8	5.5	36.783
Total	2.5	3.5	0.0	5.3	10.8	5.5	36.783

CONTINGENCY FACTORS:

Risk				*Weight*				Cont %
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule		
0	0	0	0	0	0	0		0

WBS Number: 3.3.1.2.3 **Description:** Cryogenics

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	635	0	0	635	0	550	0	85	312.3	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Post Doc B/I	352 19.673	352 19.673	352 20.185	176 10.355	176 10.624	176 10.9	1584 91.410
B/I Total	352 19.673	352 19.673	352 20.185	176 10.355	176 10.624	176 10.9	1584 91.410
Computer Professional R	0 0	0 0	135 13.832	135 14.192	135 14.56	135 14.939	540 57.523
Electrical Engineer R	0 0	0 0	135 17.119	0 0	0 0	0 0	135 17.119
Mechanical Engineer R	300 37.078	0 0	215 27.263	80 10.408	80 10.678	80 10.956	755 96.383
Technician R	590 51.556	0 0	440 39.448	440 40.475	440 41.524	440 42.605	2350 215.608
R Total	890 88.634	0 0	925 97.662	655 65.075	655 66.762	655 68.5	3780 386.633
Total	1242 108.307	352 19.673	1277 117.847	831 75.43	831 77.386	831 79.4	5364 478.043

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	0.0	12.0	0.0	0.0	0.0	0.0	13.380
Travel R	5.0	0.0	10.3	10.5	10.8	11.1	71.955
R Total	5.0	12.0	10.3	10.5	10.8	11.1	85.335
Total	5.0	12.0	10.3	10.5	10.8	11.1	85.335

WBS Number: 3.3.1.2.3.1 **Description:** Quality Meter

Institution : BNL-M&O **Contact** Sondericker

The Quality Meter consists of the mechanical system and an electronic cards that provide capacitance to current conversion. Costs are based on providing mechanical, electrical hardware and software support to the quality meter during the operations. Hardware support includes checking of the quality meters operations and calibration at least three times per year. Software support consists of monitoring the quality meter controls for temperature pressure and liquid levels. The monitoring requires knowledge of the PLC control language. First two years of operations will require preservation of the mechanical know-how at BNL. Long-term operations support will be provided by the CERN

Labor costs assume:**Details of Estimate:**
1/13 FTE ME, and 1/13 FTE EE for hardware support in FY06 and FY08, and 1/13 FTE SW Prof for software support in FY06 to FY12.
Travel: - 2 trips/year at $2500/ trip or $30,000 from FY06 to FY12.

Labor in FY06+07 put into management contingency

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	151	0	0	151	0	105	0	46	59.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional R	0	0	135	135	135	135	540
	0	0	13.832	14.192	14.56	14.939	57.523
Electrical Engineer R	0	0	135	0	0	0	135
	0	0	17.119	0	0	0	17.119
Mechanical Engineer R	0	0	135	0	0	0	135
	0	0	17.119	0	0	0	17.119
R Total	0	0	405	135	135	135	810
	0	0	48.07	14.192	14.56	14.939	91.761
Total	0	0	405	135	135	135	810
	0	0	48.07	14.192	14.56	14.939	91.761

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	0.0	12.0	0.0	0.0	0.0	0.0	13.380
Travel R	0.0	0.0	5.1	5.3	5.4	5.5	32.204
R Total	0.0	12.0	5.1	5.3	5.4	5.5	45.584
Total	0.0	12.0	5.1	5.3	5.4	5.5	45.584

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.1.2.3.2 **Description:** Cryogenics operations

Institution : BNL-M&O **Contact** Not available

Provide hardware and software support to the cryogenics during the operations phase.
During FY04 and FY05 this will support operations in the West Hall. Starting in FY06, this will support operations in the experimental pit.
Task includes periodic checks of the LN2 refrigerator, valves, pumps, etc. It includs monitoring of the cryogenics controls for the temperature, pressure and the liquid levels and provides upgrades to the BNL generated control code. Since the software for the cryogenics controls will have to be made compatible with the software procedures under development for the LHC (not yet established), there will be a need to change the language and to modify control tools after the start of operations when the LHC system is stable.

T Labor costs assume:**Details of Estimate:**
1/6 FTE ME, in FY04 to FY07. 1/3 of the technician will be needed during the commissioning in the pit in FY06-FY07
Mechanical engineer (Sondericker) will update the specifications and make them compatible with running conditions. He will provide a supervision fo rthe maintenance of the LN2 refrigerator.
1/20 FTE ME, 1/4 FTE technician in FY08 to FY12 for hardware support.
Software Support: 1/3 FTE of a software professional in FY06
Travel: - 2 trips/year at $2500/ trip or $45,000 from FY04 to FY12.

Management Contingency
FY04 and FY05
1/4 FTE technician - for hardware support, and 1/3 FTE SW Prof for software support to provide support for the cryogenics system operations in the west Hall and to provide updates of the BNL generated control code
FY06 labor put into management contingency

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	484	0	0	484	0	444	0	40	252.5	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Post Doc B/I	352 19.673	352 19.673	352 20.185	176 10.355	176 10.624	176 10.9	1584 91.410
B/I Total	352 19.673	352 19.673	352 20.185	176 10.355	176 10.624	176 10.9	1584 91.410
Mechanical Engineer R	300 37.078	0 0	80 10.144	80 10.408	80 10.678	80 10.956	620 79.264
Technician R	590 51.556	0 0	440 39.448	440 40.475	440 41.524	440 42.605	2350 215.608
R Total	890 88.634	0 0	520 49.592	520 50.883	520 52.202	520 53.561	2970 294.872
Total	1242 108.307	352 19.673	872 69.777	696 61.238	696 62.826	696 64.461	4554 386.282

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	5.0	0.0	5.1	5.3	5.4	5.5	39.751

R Total	5.0	0.0	5.1	5.3	5.4	5.5	39.751
Total	5.0	0.0	5.1	5.3	5.4	5.5	39.751

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.1.2.4 **Description:** FCAL

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	2189	0	0	2189	0	2156	0	34	1224.9	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional B/I	586 24.624	586 24.624	586 25.265	586 25.922	352 15.975	352 16.39	3048 132.800
Faculty B/I	2640 200.95	2640 200.95	2640 206.175	704 56.411	704 57.874	704 59.379	10032 781.739
Grad Student B/I	2640 59.988	2640 59.988	2640 61.547	1320 31.575	1320 32.393	1320 33.236	11880 278.727
Post Doc B/I	1760 68.297	1760 68.297	880 35.036	440 17.974	440 18.44	440 18.92	5720 226.964
B/I Total	7626 353.859	7626 353.859	6746 328.023	3050 131.882	2816 124.682	2816 127.925	30680 1420.230
Computer Professional R	517 21.725	1760 73.957	1760 75.88	880 38.927	880 39.937	880 40.976	6677 291.402
Mechanical Engineer R	1500 108.527	880 63.669	880 65.325	255 19.422	265 20.707	265 21.246	4045 298.896
R Total	2017 130.252	2640 137.626	2640 141.205	1135 58.349	1145 60.644	1145 62.222	10722 590.298
Total	9643 484.111	10266 491.485	9386 469.228	4185 190.231	3961 185.326	3961 190.147	41402 2010.528

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	15.0	0.8	0.0	0.0	5.4	5.5	33.693
R Total	15.0	0.8	0.0	0.0	5.4	5.5	33.693
Total	15.0	0.8	0.0	0.0	5.4	5.5	33.693

WBS Number: 3.3.1.2.4.1 **Description:** FCAL operations

Institution : U. of Arizona **Contact** Not available

Provide hardware and software support to the FCAL during the commissioning and operations phase. The software support consists of monitoring the FCAL controls for temperature, pressure, liquid levels and electronics responses and provides changes to the software.
Commissioning is divided into three phases: commissioning and cold tests of the endcaps in building 180, commissioning of the endcaps in the experiemntal hall, and commissioning of bothe endcaps simultaneously with the final DAQ system using horizontal muons fr0om the single beam
LHC operations.

Update december 06: full time software support is needed for the commissioning of Fcal

Commissioning starts in 2005 and will continue through FY06. Single beam operations start **Details of Estimate:**
in FY07.
Labor costs assume 1/2 FTE ME starting in FY06 to FY08 and 5/16 FTE Computer professional starting in FY06 to FY08 and 3/20 FTE ME and 3/20 FTE Software professional in FY09 to FY12. Travel: 6 trips in FY06, 2 trips/year at $2500/trip or $45,000

Base and Infrastructure
Hardware support for this effort will require:
FY06 to FY08
1 FTE faculty
1 FTE Post doc
1 FTE grad student

FY 09 to FY12
2/10 FTE faculty
1/4 FTE post doc
1/4 FTE grad student

Base & infrastructure
Effort required for the software controls consists of:
FY06 to FY08
1/2 FTE faculty
1/3 FTE software professional
1/2 FTE grad student

FY 09 to FY12
1/4 FTE faculty
2/10 FTE software professional
1/2 FTE grad student

update december 06: 1 FTE software support is needed for the commissioning and 0.5 FTE compouter professional will be needed during operations

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	2189	0	0	2189	0	2156	0	34	1224.9	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Computer Professional B/I	586 24.624	586 24.624	586 25.265	586 25.922	352 15.975	352 16.39	3048 132.800

Faculty B/I	2640	2640	2640	704	704	704	10032
	200.95	200.95	206.175	56.411	57.874	59.379	781.739
Grad Student B/I	2640	2640	2640	1320	1320	1320	11880
	59.988	59.988	61.547	31.575	32.393	33.236	278.727
Post Doc B/I	1760	1760	880	440	440	440	5720
	68.297	68.297	35.036	17.974	18.44	18.92	226.964
B/I Total	7626	7626	6746	3050	2816	2816	30680
	353.859	353.859	328.023	131.882	124.682	127.925	1420.230
Computer Professional R	517	1760	1760	880	880	880	6677
	21.725	73.957	75.88	38.927	39.937	40.976	291.402
Mechanical Engineer R	1500	880	880	255	265	265	4045
	108.527	63.669	65.325	19.422	20.707	21.246	298.896
R Total	2017	2640	2640	1135	1145	1145	10722
	130.252	137.626	141.205	58.349	60.644	62.222	590.298
Total	9643	10266	9386	4185	3961	3961	41402
	484.111	491.485	469.228	190.231	185.326	190.147	2010.528

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Travel R	15.0	0.8	0.0	0.0	5.4	5.5	33.693
R Total	15.0	0.8	0.0	0.0	5.4	5.5	33.693
Total	15.0	0.8	0.0	0.0	5.4	5.5	33.693

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.1.3 **Description:** Maintenance

Institution : **Contact** Not available

Maintenance shall include:
Spare part kit to repair at CERN and at the institution sites. The spare parts shall account for part wear out rate, and part obsolescence.

Scheduled maintenance that includes equipment removal and reinstallation, calibration and alignment, test equipment at the CERN and institution sites - on site repair, and off - site repair.

Project Management to supervise the staff and to perform project maintenance planning and control

US ATLAS maintenance tasks will be required on the following level 3 subsystems A. **Details of Estimate:**
Cryogenics, B. Quality meters, C. Signal and HV Feedthroughs. The cryostat will be accessed for maintenance approximately every ten years and therefore no cost for maintenance will be estimated. The cryogenics, Quality Meters and the feedthroughs will require US ATLAS manpower to support maintenance functions at CERN. The signal and HV feedthroughs and Quality Meters, will also require spare parts on hand at CERN to support the maintenance task. During access, failed control units: ELMB, valves, temperature and pressure gauges will be repaired or replaced with spares every three to five years on average. Repair of these failed modules will be performed at CERN by the maintenance staff. The estimate is based on working 200 days/year and that 50 days/year will be used for access, leaving 150 days (a total of 900 man-days per year) for on site repair and maintenance.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	1827	0	0	1827	41	718	0	1068	431.1	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer MR	0	0	0	176	0	0	176
	0	0	0	22.899	0	0	22.899
Technician MR	0	264	308	704	0	0	1276
	0	23.069	27.614	64.76	0	0	115.443
MR Total	0	264	308	880	0	0	1452
	0	23.069	27.614	87.659	0	0	138.342
Computer Professional R	100	178	178	100	178	178	912
	4.202	7.48	7.674	4.424	8.078	8.288	40.146
Mechanical Engineer R	150	410	436	160	436	1056	2648
	18.539	37.35	41.619	12.186	43.808	94.656	248.158
Technician R	176	165	564	248	644	644	2441
	15.379	14.691	50.701	23.091	61.062	62.651	227.575
R Total	426	753	1178	508	1258	1878	6001
	38.12	59.521	99.994	39.701	112.948	165.595	515.879
Total	426	1017	1486	1388	1258	1878	7453
	38.12	82.59	127.608	127.36	112.948	165.595	654.221

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)

Other MR	0.0	75.5	79.8	115.8	0.0	0.0	302.299
Travel MR	0.0	5.0	5.1	10.5	0.0	0.0	31.181
MR Total	0.0	80.5	85.0	126.3	0.0	0.0	333.480
Other R	118.0	50.0	72.8	11.6	118.8	152.9	594.775
Travel R	20.0	12.0	13.3	10.5	17.3	27.7	139.700
R Total	138.0	62.0	86.2	22.1	136.1	180.6	734.475
Total	138.0	142.5	171.1	148.4	136.1	180.6	1067.955

WBS Number: 3.3.1.3.1 **Description:** Cryostat-Maint of Interfaces

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	277	0	0	277	0	141	0	136	80.2	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	220	440	0	0	660
	0	0	19.724	40.475	0	0	60.199
MR Total	0	0	220	440	0	0	660
	0	0	19.724	40.475	0	0	60.199
Technician R	0	0	220	0	220	220	660
	0	0	19.724	0	20.762	21.302	61.788
R Total	0	0	220	0	220	220	660
	0	0	19.724	0	20.762	21.302	61.788
Total	0	0	440	440	220	220	1320
	0	0	39.448	40.475	20.762	21.302	121.987

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	18.0	6.0	18.9	0.0	0.0	47.833
MR Total	0.0	18.0	6.0	18.9	0.0	0.0	47.833
Other R	18.0	0.0	21.5	0.0	19.4	19.9	88.009
R Total	18.0	0.0	21.5	0.0	19.4	19.9	88.009
Total	18.0	18.0	27.5	18.9	19.4	19.9	135.842

WBS Number: 3.3.1.3.1.1 **Description:** Maint of mechanical facility

Institution : BNL-M&O **Contact** Not available

Maintenance of the mechanical facility including replacement of broken equipment

Details of Estimate:

Maintenance of the mechanical facility at CERN (for replacement and problem shooting) and at BNL (for repairs) including replacement of broken equipment (including specialized welding and cutting tools) is estimated at $18k/year from FY05 to FY12. Repairs and updates on maintenance and inspection procedures will require labor of 1/8 FTE MT in FY05 to FY12

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
277	0	0	277	0	141	0	136	80.2	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	220	440	0	0	660
	0	0	19.724	40.475	0	0	60.199
MR Total	0	0	220	440	0	0	660
	0	0	19.724	40.475	0	0	60.199
Technician R	0	0	220	0	220	220	660
	0	0	19.724	0	20.762	21.302	61.788
R Total	0	0	220	0	220	220	660
	0	0	19.724	0	20.762	21.302	61.788
Total	0	0	440	440	220	220	1320
	0	0	39.448	40.475	20.762	21.302	121.987

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	18.0	6.0	18.9	0.0	0.0	47.833
MR Total	0.0	18.0	6.0	18.9	0.0	0.0	47.833
Other R	18.0	0.0	21.5	0.0	19.4	19.9	88.009
R Total	18.0	0.0	21.5	0.0	19.4	19.9	88.009
Total	18.0	18.0	27.5	18.9	19.4	19.9	135.842

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.3.2 **Description:** Feedthrough

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	390	0	0	390	41	106	0	244	83.3	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	88	88	88	0	0	264
	0	7.69	7.89	8.095	0	0	23.675
MR Total	0	88	88	88	0	0	264
	0	7.69	7.89	8.095	0	0	23.675
Technician R	0	165	168	248	248	248	1077
	0	14.691	15.198	23.091	23.69	24.307	100.977
R Total	0	165	168	248	248	248	1077
	0	14.691	15.198	23.091	23.69	24.307	100.977
Total	0	253	256	336	248	248	1341
	0	22.381	23.088	31.186	23.69	24.307	124.652

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	15.0	43.1	12.6	0.0	0.0	78.858
Travel MR	0.0	2.5	2.6	2.6	0.0	0.0	11.618
MR Total	0.0	17.5	45.7	15.3	0.0	0.0	90.476
Other R	20.0	0.0	0.0	11.6	13.0	44.3	109.438
Travel R	10.0	0.0	0.0	10.5	2.7	8.3	43.877
R Total	30.0	0.0	0.0	22.1	15.7	52.6	153.315
Total	30.0	17.5	45.7	37.4	15.7	52.6	243.791

WBS Number: 3.3.1.3.2.1 **Description:** Signal Feedthrough Maintenance

Institution : BNL-M&O **Contact** Not available

Maintenance of the Signal feedthroughs

Details of Estimate:

Cost for spare parts required to support the feedthroughs maintenance is $30,000 in FY05 and $15000 in FY06 and FY07, and $12.000 per year in FY08 to FY12. 1/20 FTE of technician per year is needed to maintain the feedthrough repair facility and equipmentl

Travel: 4 trips/year at $2500/trip in FY05 and 2 trips/year in FY 06, and 1 trip/year in FY07 to FY12 or $30,000 total.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
216	0	0	216	41	24	0	152	36.5	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	88	88	88	0	0	264
	0	7.69	7.89	8.095	0	0	23.675
MR Total	0	88	88	88	0	0	264
	0	7.69	7.89	8.095	0	0	23.675
Technician R	0	0	88	88	88	88	352
	0	0	7.89	8.095	8.305	8.521	32.811
R Total	0	0	88	88	88	88	352
	0	0	7.89	8.095	8.305	8.521	32.811
Total	0	88	176	176	88	88	616
	0	7.69	15.78	16.19	8.305	8.521	56.486

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	15.0	43.1	12.6	0.0	0.0	78.858
Travel MR	0.0	2.5	2.6	2.6	0.0	0.0	11.618
MR Total	0.0	17.5	45.7	15.3	0.0	0.0	90.476
Other R	15.0	0.0	0.0	0.0	13.0	13.3	46.002
Travel R	5.0	0.0	0.0	0.0	2.7	2.8	15.805
R Total	20.0	0.0	0.0	0.0	15.7	16.1	61.807
Total	20.0	17.5	45.7	15.3	15.7	16.1	152.283

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.1.3.2.2 **Description:** HV Feedthrough Maintenance

Institution : SUNY SB **Contact** Not available

Maintenance of the HV feedthrough (including HV distribution boxes):

The repair and test station fo rthe HV filter network will be set up and maintained at SUNY SB. Task involves a periodic safety check of the HV system including temperature monitoring and control. Periodic replacement of the failed filter modules with spares will be done. Failed units will be sent for repairs at Stony Brook.

Update december 06: The procedures for burnout of shorts require opening of the HV feedthroughs and isolation of individual supply lines

Details of Estimate:

1/6 FTE Technician in FY05 for setting up the maintenance and repair facility. Travel: - 4 trips in FY05 at $2500/trip or $10,000.
Cost for spare parts, tools, and shipping is $28k in FY05, FY08, and FY11 and $11.5k from FY06, FY07 and FY09< FY10 and FY12.

The filter box repair station maintenance will include scope for the corona check and HV crate with power supply and soldering tools. The estimate is for 10 channels out of 5000 to fail each year and need repairs. It takes 2 days per channel to repair it and retest I.e., 20 days/year of a technician or 1/10 FTE/ year from FY07 to FY12 .
Travel: 2 trips/year at $2500/trip or $45,000 from FY04 to FY12

management contingency

Material cost reevaluated
Base and infrastructure support for the HV feedthroughs:
1/2 FTE faculty in FY07 and FY08 and 1/10 faculty in FY09 to FY12.
1/2 grad student in FY07 and FY08 and 1/4 grad student in FY09 to FY12.

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	174	0	0	174	0	82	0	92	46.8	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Technician R	0	165	80	160	160	160	725
	0	14.691	7.308	14.996	15.385	15.786	68.166
R Total	0	165	80	160	160	160	725
	0	14.691	7.308	14.996	15.385	15.786	68.166
Total	0	165	80	160	160	160	725
	0	14.691	7.308	14.996	15.385	15.786	68.166

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other R	5.0	0.0	0.0	11.6	0.0	31.0	63.436
Travel R	5.0	0.0	0.0	10.5	0.0	5.5	28.072
R Total	10.0	0.0	0.0	22.1	0.0	36.6	91.508

Total	10.0	0.0	0.0	22.1	0.0	36.6	91.508

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.1.3.3 **Description:** Cryogenics

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	907	0	0	907	0	263	0	644	149.7	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer MR	0	0	0	176	0	0	176
	0	0	0	22.899	0	0	22.899
Technician MR	0	176	0	176	0	0	352
	0	15.379	0	16.19	0	0	31.569
MR Total	0	176	0	352	0	0	528
	0	15.379	0	39.089	0	0	54.468
Mechanical Engineer R	150	150	176	0	176	176	828
	18.539	18.539	22.318	0	23.492	24.104	106.992
Technician R	176	0	176	0	176	176	704
	15.379	0	15.779	0	16.61	17.042	64.810
R Total	326	150	352	0	352	352	1532
	33.918	18.539	38.097	0	40.102	41.146	171.802
Total	326	326	352	352	352	352	2060
	33.918	33.918	38.097	39.089	40.102	41.146	226.270

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	42.5	30.8	84.2	0.0	0.0	175.608
Travel MR	0.0	2.5	2.6	7.9	0.0	0.0	19.563
MR Total	0.0	45.0	33.3	92.1	0.0	0.0	195.171
Other R	80.0	50.0	51.3	0.0	86.4	88.6	397.328
Travel R	7.5	5.0	5.1	0.0	8.1	8.3	51.384
R Total	87.5	55.0	56.4	0.0	94.5	97.0	448.712
Total	87.5	100.0	89.8	92.1	94.5	97.0	643.883

WBS Number: 3.3.1.3.3.1 **Description:** Quality Meters

Institution : BNL-M&O **Contact** Not available

Quality Meters

Details of Estimate:

Labor costs assume 1/6 ME in FY05, and 1/10 FTE ME in FY06 to FY12. Cost for spare parts is $12,500 in FY05, and $30K/year (15% of construction manufacturing cost) in FY06 to FY12. Spare parts cost for the quality meter mechanical parts and for the electronic boards is $50k/year starting in FY05 to FY12.Travel: - 1 trip/year at $2500 per trip or $20,000 total from FY05 to FY12.

Management Contingency
FY07
Labor costs assume 1/6 FTE ME. Cost for spare parts in $12,500. Travel:- 1 trip at $2500 per trip or $2500 total.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	399	0	0	399	0	152	0	247	86.2	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Mechanical Engineer MR	0	0	0	176	0	0	176
	0	0	0	22.899	0	0	22.899
MR Total	0	0	0	176	0	0	176
	0	0	0	22.899	0	0	22.899
Mechanical Engineer R	150	150	176	0	176	176	828
	18.539	18.539	22.318	0	23.492	24.104	106.992
R Total	150	150	176	0	176	176	828
	18.539	18.539	22.318	0	23.492	24.104	106.992
Total	150	150	176	176	176	176	1004
	18.539	18.539	22.318	22.899	23.492	24.104	129.891

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	42.5	30.8	31.6	0.0	0.0	116.920
Travel MR	0.0	2.5	2.6	2.6	0.0	0.0	11.618
MR Total	0.0	45.0	33.3	34.2	0.0	0.0	128.538
Other R	30.0	0.0	0.0	0.0	32.4	33.2	106.642
Travel R	2.5	0.0	0.0	0.0	2.7	2.8	12.031
R Total	32.5	0.0	0.0	0.0	35.1	36.0	118.673
Total	32.5	45.0	33.3	34.2	35.1	36.0	247.211

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.1.3.3.2 **Description:** Cryogenics Maintenance

Institution : BNL-M&O **Contact** Not available

Maintenance of the Cryogenics

Details of Estimate:

Labor assumes technician 1/6 FTE in FY04 and FY05, and 1/10 FTE technician in FY06 to FY12 for maintenance and recalibration costs including refrigerator and all interconnects. Travel: - 2 trips/year at $2500 per trip or $40,000 total from FY04 to FY12. Spare Parts at $ 50,000 per year will also be required.

Management Contingency in FY06

FY04

Labor assumes technician 1/6 FTE
Travel: - 2 trips/year at $2500 per trip or $5000
Refrigerator spare parts $50,000

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	508	0	0	508	0	112	0	397	63.5	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	176	0	176	0	0	352
	0	15.379	0	16.19	0	0	31.569
MR Total	0	176	0	176	0	0	352
	0	15.379	0	16.19	0	0	31.569
Technician R	176	0	176	0	176	176	704
	15.379	0	15.779	0	16.61	17.042	64.810
R Total	176	0	176	0	176	176	704
	15.379	0	15.779	0	16.61	17.042	64.810
Total	176	176	176	176	176	176	1056
	15.379	15.379	15.779	16.19	16.61	17.042	96.379

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	0.0	52.6	0.0	0.0	58.688
Travel MR	0.0	0.0	0.0	5.3	0.0	0.0	7.945
MR Total	0.0	0.0	0.0	57.9	0.0	0.0	66.633
Other R	50.0	50.0	51.3	0.0	54.0	55.4	290.686
Travel R	5.0	5.0	5.1	0.0	5.4	5.5	39.353
R Total	55.0	55.0	56.4	0.0	59.4	60.9	330.039
Total	55.0	55.0	56.4	57.9	59.4	60.9	396.672

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.1.3.4 **Description:** FCAL

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	252	0	0	252	0	208	0	44	118.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional R	100 4.202	178 7.48	178 7.674	100 4.424	178 8.078	178 8.288	912 40.146
Mechanical Engineer R	0 0	260 18.811	260 19.301	160 12.186	260 20.316	880 70.552	1820 141.166
R Total	100 4.202	438 26.291	438 26.975	260 16.61	438 28.394	1058 78.84	2732 181.312
Total	100 4.202	438 26.291	438 26.975	260 16.61	438 28.394	1058 78.84	2732 181.312

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	2.5	7.0	8.2	0.0	6.5	11.1	44.439
R Total	2.5	7.0	8.2	0.0	6.5	11.1	44.439
Total	2.5	7.0	8.2	0.0	6.5	11.1	44.439

WBS Number: 3.3.1.3.4.1 **Description:** FCAL

Institution : U. of Arizona **Contact** Not available

FCAL maintenance Support

Supporting the FCAL will require the following resources:**Details of Estimate:**

ME 1/7 FTE FY07 to FY12
Computer Professional 1/10 FTE FY07 to FY12

Travel 1 trip/year or $17,500 total from FY06 to FY12

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	252	0	0	252	0	208	0	44	118.0	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Computer Professional R	100	178	178	100	178	178	912
	4.202	7.48	7.674	4.424	8.078	8.288	40.146
Mechanical Engineer R	0	260	260	160	260	880	1820
	0	18.811	19.301	12.186	20.316	70.552	141.166
R Total	100	438	438	260	438	1058	2732
	4.202	26.291	26.975	16.61	28.394	78.84	181.312
Total	100	438	438	260	438	1058	2732
	4.202	26.291	26.975	16.61	28.394	78.84	181.312

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Travel R	2.5	7.0	8.2	0.0	6.5	11.1	44.439
R Total	2.5	7.0	8.2	0.0	6.5	11.1	44.439
Total	2.5	7.0	8.2	0.0	6.5	11.1	44.439

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2 **Description:** Electronic M&O Estimate

Institution : **Contact** Not available

The electronic M&O estimate for the Liquid Argon Calorimeter includes costs for pre-operations,operations, and

Model for the cost estimates of the M&O for the electronics and electrical systems **Details of Estimate:**

The front-end readout of the LAr calorimeter will be installed on the detector in FY05 through FY07 after the calorimeter's transport and integration in the pit. The pre-operations will include: the full crate test of the readout system, the long-term boards burn-in facility, a portable full crate test station for the commissioning of the calorimeter modules (in Bldg. 180) before the welding shut of the cryostat, the commissioning of the electronics readout after its installation on the detector (in the pit) and the specialized electronics for the beam tests. The system crate, optical links, Level 1 trigger system, and the ROD system will require costs for pre-operations. A long-term burn-in of the integrated system crate will be performed to flush out the infant mortality components before the commencement of operations. Documentation update (including final layouts and drawings) will be made during the commissioning stage.'

The commissioning will be done separately for th ethree cryostats. It will be followed by the final commissioning phase of running a complete system with the final DAQ both for the cosmic rays and for the single beam operations.

The estimates for operations and maintenance are based on the LHC run model of 7 months of proton-proton collisions, 2 months of heavy ion collisions and 3 months detector access per year. For such model, the ATLAS Liquid Argon Electronics
Coordination group estimated a need for the on-site electronics operations crew of 1 supervisory Electrical Engineer and 5 electronics technicians working in shifts. This crew (paid from the CERN Common costs with a 20% US share) will identify problem boards/components, replace with spares (if accessible) and run simple diagnostic tests. Simple repairs will be made at CERN. Boards with more difficult problems will be sent for repairs to the "home" institutions (Nevis, BNL, Pittsburgh, SMU) responsible for their maintenance. Each institution will maintain the expertise and the necessary test and repair equipment. In addition, these institutions will need to update the supply of spares from time to time as needed. This model is similar to that used e.g., at PHENIX, D0 and ZEUS.

Maintenance and operations of the Liquid Argon Calorimeter electronics in FY07-FY12 covers the following seven categories:
front-end electronics, level 1 trigger interface, ROD system electronics, power supplies, detector control and cooling systems, cables, crates, and connectors, optical links.
The numbers of the units are as follows:
The number of the Front-End Boards installed in the system:

Type	Number
Front End Board	1524
Calibration Board	122
Tower Builder Board	120
Tower Driver Board	20
Controller	114
Monitoring Board	146
LV Boards (HEC)	24
Total	2070

There are 2 cooling plates for each board and an extensive, water based cooling system.

There are 4 main types of power supplies.

Type & number installed	number of units/supply
Front End Crate supplies	63 & 18
ROD VME crate supplies	54 & 4
Level 1 Interface Crate supplies	8 & 4
HEC LV Supplies	8 & 12

The (Optical) Link components are:

Connection/type	number installed
FEB-ROD/optical	1524

System crate/optical	114
FT-Baseplane/Cu (flex)	3048
TBB-Receiver/Cu (shielded TP)	240
TDB-Receiver/Cu (shielded TP)	120

The Level 1 trigger receiver/monitor system, located in the USA15 cavern, will consist of eight 9-U VME crates filled with 16 modules each. Each module contains 64 analog channels.

The modules in the ROD system (not including TTC hardware) are:

Type	Number installed
ROD modules	192
TBM modules	16
SPAC modules	16
Total	224

The estimated failure rate of the FEB components is based on the engineering judgment and on the experience of the D0, H1 and ZEUS experiments. The failure rate will require a replacement with spares of about 100-150 readout boards during the yearly access. These boards will be diagnosed and repaired during the operations period and made ready as spares for the next access cycle. During the access, US based technicians and postdocs will supplement the operating crew, as a single board replacement will require a minimum of 3 people for several hours. US institutions must maintain a crew of technicians and a fraction of high-level electrical engineers for problem diagnoses and repairs. It is expected that during the operation's period FY07-FY12, the electrical engineers will work on the R&D and on the design of electronics for the LHC upgrade, but that they will be available for special tasks and

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	13689	0	0	13689	0	10392	0	3297	5904.5	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Faculty B/I	1760	1760	880	352	352	352	5456
	91.168	91.168	46.77	19.194	19.692	20.204	288.196
Post Doc B/I	2640	2640	2640	1760	1760	1760	13200
	70.329	70.329	98.568	76.453	78.436	80.478	474.593
Sr Research Scientist B/I	1760	1760	0	0	0	0	3520
	274.49	274.49	0	0	0	0	548.980
Technician B/I	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
Term Scientist B/I	176	0	0	0	0	0	176
	7.814	0	0	0	0	0	7.814
B/I Total	6336	6160	3870	2312	2112	2112	22902
	443.801	435.987	177.31	114.392	98.128	100.682	1370.300
Computer Professional MR	1617	1190	900	2409	1265	0	7381
	142.081	110.245	87.149	253.248	136.432	0	729.155
Electrical Engineer MR	0	1760	2060	0	0	753	4573
	0	217.523	239.638	0	0	103.105	560.266
Mechanical Engineer MR	0	3520	2780	0	0	0	6300
	0	435.046	352.52	0	0	0	787.566

Technician MR	0	1960	3636	2860	792	400	9648
	0	171.27	210.131	156.197	74.744	38.731	651.073
MR Total	1617	8430	9376	5269	2057	1153	27902
	142.081	934.084	889.438	409.445	211.176	141.836	2728.060
Computer Professional R	4130	2907	3365	1982	3386	3259	19029
	373.649	261.745	302.727	147.168	305.042	348.199	1738.530
Designer R	807	352	0	0	0	0	1159
	69.538	18.55	0	0	0	0	88.088
Electrical Engineer R	3154	8148	3451	3296	3096	1523	22668
	245.066	741.691	293.516	349.411	370.459	180.173	2180.316
Grad Student R	0	1760	0	0	0	0	1760
	0	39.072	0	0	0	0	39.072
Technician R	3900	5272	4566	4742	2410	2802	23692
	214.067	283.798	258.9	288.943	149.463	191.308	1386.479
R Total	11991	18439	11382	10020	8892	7584	68308
	902.32	1344.856	855.143	785.522	824.964	719.68	5432.485
Total	19944	33029	24628	17601	13061	10849	119112
	1488.202	2714.927	1921.891	1309.359	1134.268	962.198	9530.845

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other B/I	0.0	0.0	0.0	8.4	0.0	8.9	19.274
Travel B/I	7.5	12.5	15.9	13.2	13.5	13.9	114.800
B/I Total	7.5	12.5	15.9	21.6	13.5	22.7	134.074
Other MR	0.0	74.7	100.8	57.9	127.3	0.0	404.456
Travel MR	0.0	22.5	35.9	12.1	13.5	0.0	126.745
MR Total	0.0	97.2	136.7	70.0	140.8	0.0	531.201
Other R	368.0	741.5	108.1	277.1	121.9	177.0	1992.845
Travel R	173.0	111.5	44.1	63.7	32.9	44.3	638.456
R Total	541.0	853.0	152.3	340.9	154.8	221.3	2631.301
Total	548.5	962.7	304.9	432.4	309.1	244.0	3296.576

WBS Number: 3.3.2.1 **Description:** Pre-Operations and Commissioning

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	2105	0	0	2105	0	1623	0	482	922.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	880	880	0	0	0	0	1760
	45.584	45.584	0	0	0	0	91.168
Post Doc B/I	880	880	0	0	0	0	1760
	23.443	23.443	0	0	0	0	46.886
Term Scientist B/I	176	0	0	0	0	0	176
	7.814	0	0	0	0	0	7.814
B/I Total	1936	1760	0	0	0	0	3696
	76.841	69.027	0	0	0	0	145.868
Computer Professional MR	0	260	0	0	0	0	260
	0	17.373	0	0	0	0	17.373
Electrical Engineer MR	0	0	300	0	0	0	300
	0	0	16.46	0	0	0	16.460
Technician MR	0	200	880	880	0	0	1960
	0	17.477	44.17	45.32	0	0	106.967
MR Total	0	460	1180	880	0	0	2520
	0	34.85	60.63	45.32	0	0	140.800
Computer Professional R	2110	868	900	600	0	0	4478
	176.134	68.039	61.7	42.204	0	0	348.077
Designer R	807	352	0	0	0	0	1159
	69.538	18.55	0	0	0	0	88.088
Electrical Engineer R	2404	4112	1575	500	0	0	8591
	159.383	264.065	80.337	28.148	0	0	531.933
Grad Student R	0	1760	0	0	0	0	1760
	0	39.072	0	0	0	0	39.072
Technician R	1880	1620	990	1760	0	0	6250
	105.579	76.111	56.518	90.64	0	0	328.848
R Total	7201	8712	3465	2860	0	0	22238
	510.634	465.837	198.555	160.992	0	0	1336.018
Total	9137	10932	4645	3740	0	0	28454
	587.475	569.714	259.185	206.312	0	0	1622.686

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	6.0	0.0	0.0	0.0	0.0	8.976
Travel MR	0.0	20.0	0.0	0.0	0.0	0.0	30.190
MR Total	0.0	26.0	0.0	0.0	0.0	0.0	39.166
Other R	186.0	25.0	0.0	26.3	0.0	0.0	239.919
Travel R	90.5	47.5	10.3	0.0	0.0	0.0	203.119
R Total	276.5	72.5	10.3	26.3	0.0	0.0	443.038
Total	276.5	98.5	10.3	26.3	0.0	0.0	482.204

WBS Number: 3.3.2.1.3 **Description:** System Crate Integration

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	1127	0	0	1127	0	772	0	356	438.4	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional MR	0	260	0	0	0	0	260
	0	17.373	0	0	0	0	17.373
Electrical Engineer MR	0	0	300	0	0	0	300
	0	0	16.46	0	0	0	16.460
Technician MR	0	200	880	880	0	0	1960
	0	17.477	44.17	45.32	0	0	106.967
MR Total	0	460	1180	880	0	0	2520
	0	34.85	60.63	45.32	0	0	140.800
Computer Professional R	630	40	600	600	0	0	1870
	62.914	2.673	41.133	42.204	0	0	148.924
Designer R	660	0	0	0	0	0	660
	61.791	0	0	0	0	0	61.791
Electrical Engineer R	770	820	520	500	0	0	2610
	55.2	43.851	28.531	28.148	0	0	155.730
Technician R	1380	1320	440	1760	0	0	4900
	86.742	64.809	22.085	90.64	0	0	264.276
R Total	3440	2180	1560	2860	0	0	10040
	266.647	111.333	91.749	160.992	0	0	630.721
Total	3440	2640	2740	3740	0	0	12560
	266.647	146.183	152.379	206.312	0	0	771.521

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	20.0	0.0	0.0	0.0	0.0	30.190
MR Total	0.0	20.0	0.0	0.0	0.0	0.0	30.190
Other R	140.3	15.0	0.0	26.3	0.0	0.0	184.252
Travel R	49.5	42.5	10.3	0.0	0.0	0.0	141.197
R Total	189.8	57.5	10.3	26.3	0.0	0.0	325.449
Total	189.8	77.5	10.3	26.3	0.0	0.0	355.639

WBS Number: 3.3.2.1.3.1 **Description:** Crate Documentation update

Institution : BNL-M&O **Contact** Takai

Crate Documentation update.
Task includes an update of drawings and documentation in the CDD format of all mechanical drawings, services, power and water connections etc.

Basis of Estimate: Engineering judgement

Details of Estimate: Labor cost assumes 1/3 FTE of a mechanical designer (Jason Farrel), 1/4 software professional (Saroj Kandasamy) to design and implement the data basis i n FY05 and FY06
The estimate is based on upgrading 16 drawings 4 times with changes at an average of 10 hours per drawing. It is assumed that at least 4 iterations of design changes would be required during commissioning and electrical testing in the pit.

Base & infrastructure

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	106	0	0	106	0	106	0	0	60.1	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional R	440	0	0	0	0	0	440
	43.94	0	0	0	0	0	43.940
Designer R	660	0	0	0	0	0	660
	61.791	0	0	0	0	0	61.791
R Total	1100	0	0	0	0	0	1100
	105.731	0	0	0	0	0	105.731
Total	1100	0	0	0	0	0	1100
	105.731	0	0	0	0	0	105.731

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.3.2 **Description:** System Electronic Integration

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Full crate system test. Task includes supervision and debugging of the pre-production series of the FEBs and integration of the electronics system in the crate at BNL. It also includes a production of special VME readout boards replacing the ROD system that will not be available for this test. The design and construction will start in FY03 and continue in FY04. It will also include tests of the cooling system, power supplies, links,DCS, etc.

Basis of Estimate: Engineering judgement

Details of Estimate: The task will require

In FY04: ¼ FTE of an electrical engineer (J. Ban) to supervise the production and to debug the boards (20 boards at 3 days each);
¼ of an electrical technician (N. Bishop) to manage the components stock and re-work
Cost of hardware components: $15,000. Cost of test equipment - power supply, crate, etc, $15,000.

Base & infrastructure
Labor costs assumes ¼ experienced Physicist in FY04 for technical guidance and decision making during integration.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.3.3 **Description:** Facilities

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Test and maintenance system for the FEB at CERN. The system will be built in FY04 and used for the pre-operations in the West Hall. In FY05-FY12 this system will be used for the testing and identification of problems of the FEBs removed from the experiment due to malfunction.
US share of the overall cost of the test station is 59% (following the MOU share). The test station system will include: VME crate, front-end crate, power supply, cooling, links, trigger modules, level 1 receiver, DAQ, ROD and test and maintenance equipment. The system will be located initially in the West Hall and then moved to the facility located near Point 1. The operations of the facility will be supported by the common costs.

Labor costs assume **Details of Estimate:**
1/6 FTE EE in FY05 for the overall system design and supervision of its construction; 1/6 FTE ET for procurements and assembly. For the purpose of this estimate we assume that the cooling system will be adapted from the BNL test system.
Material costs include: test equipment (scope $20k, soldering equipment $5k, pulse generators $10k, VME bus analyzer $3k, small tools and supplies $12k) I.e, $50k total.
Tools replacement will be needed every 3 years on average or $15k/year in FY05-FY07.
Travel:- 4 trips at $2500/trip or $10,000 will be required in FY05 - FY07.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	267	0	0	267	0	180	0	86	102.3	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	880	880	0	0	1760
	0	0	44.17	45.32	0	0	89.490
MR Total	0	0	880	880	0	0	1760
	0	0	44.17	45.32	0	0	89.490
Technician R	0	0	0	1760	0	0	1760
	0	0	0	90.64	0	0	90.640
R Total	0	0	0	1760	0	0	1760
	0	0	0	90.64	0	0	90.640
Total	0	0	880	2640	0	0	3520
	0	0	44.17	135.96	0	0	180.130

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	16.0	15.0	0.0	26.3	0.0	0.0	57.318
Travel R	10.0	10.0	3.1	0.0	0.0	0.0	29.078
R Total	26.0	25.0	3.1	26.3	0.0	0.0	86.396
Total	26.0	25.0	3.1	26.3	0.0	0.0	86.396

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.2.1.3.4 **Description:** Systems Crate Pre-operations

Institution : BNL-M&O **Contact** Not available

Engineering and technical manpower required to run the System Crate in the ATLAS hall at CERN.

Details of Estimate: Costs assume 1/4 FTE EE 1/2 FTE ET, and 1/12 FTE SW Prof will be needed for pre-operations in FY05. In FY06 and FY07, 1/7 FTE EE, 1/2 FTE FT, and 1/9 Computer Professional will be required. Travel: - 8 trips/year at $2500/trip or $60,000 will be required in FY05 to FY07.

Base & infrastructure
½ FTE Experienced Physicist to oversee and provide technical support for pre-operations of the System Crate in FY06 and FY07. Travel: - 4 trips/year at $2500/trip will be required.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	210	0	0	210	0	105	0	105	59.6	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	200	0	0	0	0	200
	0	17.477	0	0	0	0	17.477
MR Total	0	200	0	0	0	0	200
	0	17.477	0	0	0	0	17.477
Computer Professional R	190	0	0	0	0	0	190
	18.974	0	0	0	0	0	18.974
Electrical Engineer R	200	0	0	0	0	0	200
	24.718	0	0	0	0	0	24.718
Technician R	500	0	0	0	0	0	500
	43.691	0	0	0	0	0	43.691
R Total	890	0	0	0	0	0	890
	87.383	0	0	0	0	0	87.383
Total	890	200	0	0	0	0	1090
	87.383	17.477	0	0	0	0	104.860

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	20.0	0.0	0.0	0.0	0.0	30.190
MR Total	0.0	20.0	0.0	0.0	0.0	0.0	30.190
Travel R	29.5	20.0	0.0	0.0	0.0	0.0	74.720
R Total	29.5	20.0	0.0	0.0	0.0	0.0	74.720
Total	29.5	40.0	0.0	0.0	0.0	0.0	104.910

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.2.1.3.5 **Description:** System Crate pre-ops - optical links

Institution : Southern Methodist University **Contact** Not available

Engineering and technical manpower for pre-operations and commissioning of the optical links at CERN.

FY04: Design and implementation of the links for the combined calorimeter test beam. Task includes design, building, installation and commissioning of 20 transition boards and link: PCB layout, PCB manufacturing, component loading, fibers, connectors, opto-electronics components,installation in the test beam and software modifications.

FY05, FY06 and FY07:
1) Commissioning of the optical links between FEB and ROD (1638 units), creation of the monitoring software, data bases and graphic displays.
2) Design and construction of links for the FEB and the ROD test stations (number of links not yet determined).

Commissioning of the links will occure in separate periods for the three cryostats: barrel in FY05/06, EndcapC in FY06 and EndcapA in FY06/07.
Each period will require separate travel.

FY04: Initial commsisioning of the optical links for the barrel calorimeter in the pit. 1/12 FTE**Details of Estimate:**

EE
FY05 and FY06:
1) Commissioning of the optical links between FEB and ROD (1638 units), creation of the monitoring software, databases and graphic displays. 2) Design and construction of links for the FEB and ROD test stations (number of links needed not yet determined)

Basis of estimate: Material cost: $5k for optical power meter and fiber splicing and test equipment, $5k for the equipment to repair optical connectors, $8k for the portable digital scope in FY06, $20k for the components of the test stations links in FY05; project labor: in FY05: 1/3 FTE EE, ½ FTE Et, 1/3 FTE software professional; in FY06: 1/6 FTE EE, ¼ FTE ET, 1/6 FTE software professional; travel: 8 trips in FY05 and FY06, 8 trips in FY07 at $2,5k each.

Base and infrastructure: 1/3 FTE experienced physicist + 1 postdoc +1/2 graduate student. Travel: 6 trips @$2.5k per year or $30k.

Labor and material reduced and moved to MC for FY06

Update December 06: the commissioning period extended through 2008.
Work will be shared by SMU Engineers and techs: Annie Xiang, Andy Liu and John Yang

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	310	0	0	310	0	237	0	73	134.7	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Computer Professional MR	0	260	0	0	0	0	260
	0	17.373	0	0	0	0	17.373
Electrical Engineer MR	0	0	300	0	0	0	300
	0	0	16.46	0	0	0	16.460
MR Total	0	260	300	0	0	0	560
	0	17.373	16.46	0	0	0	33.833
Computer Professional R	0	40	600	600	0	0	1240
	0	2.673	41.133	42.204	0	0	86.010

Electrical Engineer R	350	600	300	500	0	0	1750
	18.717	32.086	16.46	28.148	0	0	95.411
Technician R	0	440	0	0	0	0	440
	0	21.758	0	0	0	0	21.758
R Total	350	1080	900	1100	0	0	3430
	18.717	56.517	57.593	70.352	0	0	203.179
Total	350	1340	1200	1100	0	0	3990
	18.717	73.89	74.053	70.352	0	0	237.012

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other R	35.7	0.0	0.0	0.0	0.0	0.0	35.667
Travel R	10.0	12.5	7.2	0.0	0.0	0.0	37.399
R Total	45.7	12.5	7.2	0.0	0.0	0.0	73.066
Total	45.7	12.5	7.2	0.0	0.0	0.0	73.066

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.3.6 **Description:** System Crate - Crate Burn In

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Setup, and perform long term burn-in on the integrated Front-End readout System Crate and maintain the burn-in test setup. Determine any long-term aging degradation that may cause experiment performance problems.

Details of Estimate:

1/2 FTE EE will be required for setup in FY05 (install system elements, connect power, integrate and debug) and 1/2 FTE, ET per year in FY06 - FY07 to operate and maintain it. Cost for equipment (power supplies, support structures, and water-cooling system) $25K in FY04 to FY06.

Base & Infrastructure
1 FTE Senior Physicist in FY04 to FY07

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
151	0	0	151	0	108	0	43	61.5	0.0

MANPOWER (k$) SUMMARY:

	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician R	880 43.051	880 43.051	440 22.085	0 0	0 0	0 0	2200 108.187
R Total	880 43.051	880 43.051	440 22.085	0 0	0 0	0 0	2200 108.187
Total	880 43.051	880 43.051	440 22.085	0 0	0 0	0 0	2200 108.187

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	43.0	0.0	0.0	0.0	0.0	0.0	43.000
R Total	43.0	0.0	0.0	0.0	0.0	0.0	43.000
Total	43.0	0.0	0.0	0.0	0.0	0.0	43.000

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.3.7 **Description:** Crate burn-in

Institution : Southern Methodist University **Contact** Not available

Long term burn-in of the Feb and link components: ADC s, Optical transmitters and optical receivers

The accelerated aging test will consists of the high temperature opven operated for 6 month **Details of Estimate:**
with components operation monitored on-line.
Labor 1/8 of EE in FY06 nad FY07, materials $10,000

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
84	0	0	84	0	36	0	48	20.2	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Electrical Engineer R	220 11.765	220 11.765	220 12.071	0 0	0 0	0 0	660 35.601
R Total	220 11.765	220 11.765	220 12.071	0 0	0 0	0 0	660 35.601
Total	220 11.765	220 11.765	220 12.071	0 0	0 0	0 0	660 35.601

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	45.7	0.0	0.0	0.0	0.0	0.0	48.267
R Total	45.7	0.0	0.0	0.0	0.0	0.0	48.267
Total	45.7	0.0	0.0	0.0	0.0	0.0	48.267

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.4 **Description:** Front End Board

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	60	0	0	60	0	47	0	13	26.7	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Electrical Engineer R	440 23.53	440 23.53	0 0	0 0	0 0	0 0	880 47.060
R Total	440 23.53	440 23.53	0 0	0 0	0 0	0 0	880 47.060
Total	440 23.53	440 23.53	0 0	0 0	0 0	0 0	880 47.060

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	10.0	0.0	0.0	0.0	0.0	0.0	12.600
R Total	10.0	0.0	0.0	0.0	0.0	0.0	12.600
Total	10.0	0.0	0.0	0.0	0.0	0.0	12.600

WBS Number: 3.3.2.1.4.1 **Description:** FEB Documentation update

Institution : Southern Methodist University **Contact** J. Ye

Documentation update optical links

Basis of Estimate: Engineering judgement

Details of Estimate: Task includes review and update of documentation for optical links in CDD format. The layout and drawings for the optical transmitter (FEB side), optical receiver (ROD side), fiber distribution system, patch panels and laser eye-safety boxes.
Labor costs assume ¼ FTE of an electrical engineer (A. Liu) in FY05 and FY06. The material costs for software licences (schematic capture and layout) $8,000. Travel - 4 trips to CERN/year at $2500 per trip or $20,000

Base & infrastructure
Labor cost assumes 1/10 Physicist in FY 05 to review and support documentation update

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	60	0	0	60	0	47	0	13	26.7	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Electrical Engineer R	440	440	0	0	0	0	880
	23.53	23.53	0	0	0	0	47.060
R Total	440	440	0	0	0	0	880
	23.53	23.53	0	0	0	0	47.060
Total	440	440	0	0	0	0	880
	23.53	23.53	0	0	0	0	47.060

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	10.0	0.0	0.0	0.0	0.0	0.0	12.600
R Total	10.0	0.0	0.0	0.0	0.0	0.0	12.600
Total	10.0	0.0	0.0	0.0	0.0	0.0	12.600

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.5 **Description:** Level 1 Trigger

Institution : **Contact** W. Cleland

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	619	0	0	619	0	567	0	53	321.9	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	880	880	0	0	0	0	1760
	45.584	45.584	0	0	0	0	91.168
Post Doc B/I	880	880	0	0	0	0	1760
	23.443	23.443	0	0	0	0	46.886
Term Scientist B/I	176	0	0	0	0	0	176
	7.814	0	0	0	0	0	7.814
B/I Total	1936	1760	0	0	0	0	3696
	76.841	69.027	0	0	0	0	145.868
Computer Professional R	880	528	0	0	0	0	1408
	75.535	45.321	0	0	0	0	120.856
Electrical Engineer R	747	2200	780	0	0	0	3727
	46.069	136.245	36.717	0	0	0	219.031
Grad Student R	0	1760	0	0	0	0	1760
	0	39.072	0	0	0	0	39.072
Technician R	500	300	300	0	0	0	1100
	18.837	11.302	11.596	0	0	0	41.735
R Total	2127	4788	1080	0	0	0	7995
	140.441	231.94	48.313	0	0	0	420.694
Total	4063	6548	1080	0	0	0	11691
	217.282	300.967	48.313	0	0	0	566.562

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	6.0	0.0	0.0	0.0	0.0	8.976
MR Total	0.0	6.0	0.0	0.0	0.0	0.0	8.976
Other R	10.0	10.0	0.0	0.0	0.0	0.0	20.000
Travel R	11.0	5.0	0.0	0.0	0.0	0.0	23.760
R Total	21.0	15.0	0.0	0.0	0.0	0.0	43.760
Total	21.0	21.0	0.0	0.0	0.0	0.0	52.736

WBS Number: 3.3.2.1.5.1 **Description:** L1 Trig documentation update

Institution : University of Pittsburg **Contact** B. Cleland

Details of Estimate:

Documentation update Level 1 trigger to be done in the CDD format an dtransmitted to the ATLAS database.

Task includes a review and update of technical layout and drawings (5 layer sum boards, 7 drawings for the level 1 receiver system) remapping boards specifications (20 drawings) at 2 days/ drawing.

Labor costs assume 64 man-days of EE (j. Rabel) and ¼ FTE technician (G. Zuk) in FY04.

The material costs for software licenses (Schematic captures and layout software) is $10,000.
Travel: - 2 trips to CERN at $2500 per trip or $5,000.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.5.2 **Description:** Pre-operations Level 1 Trigger

Institution : University of Pittsburg **Contact** V. Paolone

Engineering and technical manpower required to commission the Level 1 Trigger Receiver System at CERN. Task includes pulsing of the system and comparing the signal transmission withy the output of the real data signals. This systems provides unique capability to diagnose analog signals problems in the front-end readout chain. The commissioning of the calorimeter system will be done in four sessions parallel to the commissioning of the front end crates and will take place during FY05 - FY07. 128 boards at 2 days/board will be commissioned.

Update december 06: additional work requires new remapping boards and new summing boards for the inner wheel of the EMEC
The commissioning is done in several stages due to unavailability of the power supplies for the FECs

Labor costs assume:**Details of Estimate:**
64 days of EE and 64 days of ET in FY04;
5/12 FTE of EE and 5/12 FTE ET per year in FY 05 - FY07
Material costs include digital scope ($20k), pulse generator ($6k), spectrum analyzer ($17k), small tools, voltmeters, PC and cables ($10k) or a total of $53k
Travel: -2 trips at $2,500 in FY04 and 4 extended trips/year to CERN at $4,000 per trip in FY05 - FY07.

Part of the cost is put into management contingency

Base & Infrastructure
1/2 FTE Faculty and 1/2 Post Doc in FY05 to FY06.

update december 05: The commisioning involves 1 EE, 1.5 FTE term scientist and 1 grad student working as technician

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	404	0	0	404	0	372	0	33	211.2	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Faculty B/I	880	880	0	0	0	0	1760
	45.584	45.584	0	0	0	0	91.168
Post Doc B/I	880	880	0	0	0	0	1760
	23.443	23.443	0	0	0	0	46.886
Term Scientist B/I	176	0	0	0	0	0	176
	7.814	0	0	0	0	0	7.814
B/I Total	1936	1760	0	0	0	0	3696
	76.841	69.027	0	0	0	0	145.868
Electrical Engineer R	600	1760	780	0	0	0	3140
	27.528	80.749	36.717	0	0	0	144.994
Grad Student R	0	1760	0	0	0	0	1760
	0	39.072	0	0	0	0	39.072
Technician R	500	300	300	0	0	0	1100
	18.837	11.302	11.596	0	0	0	41.735
R Total	1100	3820	1080	0	0	0	6000
	46.365	131.123	48.313	0	0	0	225.801

Total	3036	5580	1080	0	0	0	9696
	123.206	200.15	48.313	0	0	0	371.669

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other MR	0.0	6.0	0.0	0.0	0.0	0.0	8.976
MR Total	0.0	6.0	0.0	0.0	0.0	0.0	8.976
Travel R	11.0	5.0	0.0	0.0	0.0	0.0	23.760
R Total	11.0	5.0	0.0	0.0	0.0	0.0	23.760
Total	11.0	11.0	0.0	0.0	0.0	0.0	32.736

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.5.3 **Description:** FEB documentation update

Institution : Columbia U. (Nevis Laboratory) **Contact** J. Parsons

Task include review and update of the FEB documentation in the CDD format after the completion of the commissioning of the readout system on the detector. In FY06 it will require a review and updaqte of 25 schematics and layout drawings and 5 mechanical assembly drawings. It will also include creation in FY05 and update in FY06-FY07 of the data base for the components on the FEB.

Details of Estimate:

Labor include in FY05 1/12 of the EE to review the drawings and 1/2 FTE Computer Professional to create the data base.
In FY06 and FY07 1/12 FTE of computer professional will be needed for a final review and update of the data base.

Material cost: data base license and software licence fees $10k/year in FY04-FY06

update january 2007: Manpower: 0.15 FTE EE (B. Sippach)
0.1 FTE EE (L. Zhang)
0.3 FTE Comp pro (W. Seligman)

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	215	0	0	215	0	195	0	20	110.7	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional R	880	528	0	0	0	0	1408
	75.535	45.321	0	0	0	0	120.856
Electrical Engineer R	147	440	0	0	0	0	587
	18.541	55.496	0	0	0	0	74.037
R Total	1027	968	0	0	0	0	1995
	94.076	100.817	0	0	0	0	194.893
Total	1027	968	0	0	0	0	1995
	94.076	100.817	0	0	0	0	194.893

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	10.0	10.0	0.0	0.0	0.0	0.0	20.000
R Total	10.0	10.0	0.0	0.0	0.0	0.0	20.000
Total	10.0	10.0	0.0	0.0	0.0	0.0	20.000

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.6 **Description:** ROD System

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	299	0	0	299	0	238	0	61	135.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional R	600	300	300	0	0	0	1200
	37.685	20.045	20.567	0	0	0	78.297
Designer R	147	352	0	0	0	0	499
	7.747	18.55	0	0	0	0	26.297
Electrical Engineer R	447	652	275	0	0	0	1374
	34.584	60.439	15.089	0	0	0	110.112
Technician R	0	0	250	0	0	0	250
	0	0	22.837	0	0	0	22.837
R Total	1194	1304	825	0	0	0	3323
	80.016	99.034	58.493	0	0	0	237.543
Total	1194	1304	825	0	0	0	3323
	80.016	99.034	58.493	0	0	0	237.543

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	35.7	0.0	0.0	0.0	0.0	0.0	35.667
Travel R	20.0	0.0	0.0	0.0	0.0	0.0	25.562
R Total	55.7	0.0	0.0	0.0	0.0	0.0	61.229
Total	55.7	0.0	0.0	0.0	0.0	0.0	61.229

WBS Number: 3.3.2.1.6.1 **Description:** ROD Documentation update

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Documentation update ROD. The PU of the ROD has been designed at Nevis and implemented at LAPP. The documentation update will include all changes made during the production and commissioning stages.
Labor cost assume 1/12 FTE of EE (W. Sipach) to review the drawings (10 drawings) in FY06.

Basis of Estimate: Engineering judgement

Details of Estimate: Labor costs assume 1/12 FTE Electrical Engineer, AND 1/15 of an electrical designer in FY05.The material costs for artwork is $2,000.

Base & infrastructure
Labor cost assumes 1/10 Physicist in FY 05 to review and support documentation update

Update January 2007: Manpower 0.1 FTE EE (B. Sippach)
0.1 FTE EE (L. Zhang)
0.2 FTE Comp Pro (W. Seligman)

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	89	0	0	89	0	89	0	0	50.7	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Designer R	147	352	0	0	0	0	499
	7.747	18.55	0	0	0	0	26.297
Electrical Engineer R	147	352	0	0	0	0	499
	18.541	44.396	0	0	0	0	62.937
R Total	294	704	0	0	0	0	998
	26.288	62.946	0	0	0	0	89.234
Total	294	704	0	0	0	0	998
	26.288	62.946	0	0	0	0	89.234

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.6.2 **Description:** FEB pre-operations in West Hall

Institution : Columbia U. (Nevis Laboratory) **Contact** Parsons

Engineering and technical manpower required for pre-operations of the Feb in the test system used in West Hall at CERN and in the temporary
arrangements in the cavern

Management Contingency**Details of Estimate:**

Costs assume 1/12 FTE EE (J. Ban) will be needed in FY05-FY07.
Travel: - 4 trips/year in FY05-FY07 at $2500/trip

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	13	0	0	13	0	0	0	13	0.0	0.0

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	10.0	0.0	0.0	0.0	0.0	0.0	12.600
R Total	10.0	0.0	0.0	0.0	0.0	0.0	12.600
Total	10.0	0.0	0.0	0.0	0.0	0.0	12.600

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.6.3 **Description:** HV - SBU

Institution : SUNY SB **Contact**

Engineering and technical manpower required to commission the HV system at CERN.
Task includes commissioning of HV feethrough an dHV power supplies.

Details of Estimate:

Costs assume SW Prof will be needed to write the ROD based link monitoring and control software for the ROD crate CPU. 80 hours in FY05 and 1/4 FTE in FY06.
Travel: 2 trips to CERN at $2,500 each in FY05 - for the discussion with other ROD software designers and in FY06 for the installation.

Update december 06; cost assumes SB professor supervising technican (Steffens) 0.2 FTE/year plus travel

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	47	0	0	47	0	40	0	7	23.0	0.0

MANPOWER SUMMARY: (k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional R	300	0	0	0	0	0	300
	17.64	0	0	0	0	0	17.640
Technician R	0	0	250	0	0	0	250
	0	0	22.837	0	0	0	22.837
R Total	300	0	250	0	0	0	550
	17.64	0	22.837	0	0	0	40.477
Total	300	0	250	0	0	0	550
	17.64	0	22.837	0	0	0	40.477

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	5.0	0.0	0.0	0.0	0.0	0.0	6.662
R Total	5.0	0.0	0.0	0.0	0.0	0.0	6.662
Total	5.0	0.0	0.0	0.0	0.0	0.0	6.662

CONTINGENCY FACTORS:	*Risk* Technical	*Risk* C o s t	*Risk* Schedule	*Risk* Des i gn	*Weight* Technical	*Weight* C o s t	*Weight* Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.1.6.4 **Description:** System crate Pre-ops ROD - SMU

Institution : Southern Methodist University **Contact** Not available

Details of Estimate:

Engineering and technical manpower required to commission the ROD System at CERN

Costs assume 1/6 SW Computer Professional (T. Ryan) and 1/4 EE (Wakeland) will be needed in FY05 and FY06. Travel 4 trips/year at $2500/trip
Part of the fY07 cost is put into management contingency

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
150	0	0	150	0	108	0	42	61.3	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional R	300	300	300	0	0	0	900
	20.045	20.045	20.567	0	0	0	60.657
Electrical Engineer R	300	300	275	0	0	0	875
	16.043	16.043	15.089	0	0	0	47.175
R Total	600	600	575	0	0	0	1775
	36.088	36.088	35.656	0	0	0	107.832
Total	600	600	575	0	0	0	1775
	36.088	36.088	35.656	0	0	0	107.832

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	35.7	0.0	0.0	0.0	0.0	0.0	35.667
Travel R	5.0	0.0	0.0	0.0	0.0	0.0	6.300
R Total	40.7	0.0	0.0	0.0	0.0	0.0	41.967
Total	40.7	0.0	0.0	0.0	0.0	0.0	41.967

CONTINGENCY FACTORS:

	Risk				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2 **Description:** Operations

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	6186	0	0	6186	0	5464	0	721	3104.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	440 22.792	440 22.792	440 23.385	176 9.597	176 9.846	176 10.102	1848 98.514
Post Doc B/I	880 23.443	880 23.443	1760 74.515	1320 64.114	1320 65.777	1320 67.489	7480 318.781
Sr Research Scientist B/I	1760 274.49	1760 274.49	0 0	0 0	0 0	0 0	3520 548.980
B/I Total	3080 320.725	3080 320.725	2200 97.9	1496 73.711	1496 75.623	1496 77.591	12848 966.275
Computer Professional MR	1617 142.081	930 92.872	900 87.149	2409 253.248	1265 136.432	0 0	7121 711.782
Technician MR	0 0	0 0	1760 88.341	1980 110.877	0 0	0 0	3740 199.218
MR Total	1617 142.081	930 92.872	2660 175.49	4389 364.125	1265 136.432	0 0	10861 911.000
Computer Professional R	2020 197.515	2039 193.706	2465 241.027	1382 104.964	3386 305.042	3259 348.199	14551 1390.453
Electrical Engineer R	400 42.426	2740 337.562	1600 198.815	1300 164.158	1600 209.28	980 128.073	8620 1080.314
Technician R	1860 94.507	2420 121.903	2420 125.073	1120 54.838	1340 77.022	1340 79.026	10500 552.369
R Total	4280 334.448	7199 653.171	6485 564.915	3802 323.96	6326 591.344	5579 555.298	33671 3023.136
Total	8977 797.254	11209 1066.768	11345 838.305	9687 761.796	9087 803.399	7075 632.889	57380 4900.411

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel B/I	7.5	7.5	7.7	7.9	8.1	8.3	70.948
B/I Total	7.5	7.5	7.7	7.9	8.1	8.3	70.948
Travel MR	0.0	2.5	0.0	2.6	2.7	0.0	11.822

MR Total	0.0	2.5	0.0	2.6	2.7	0.0	11.822
Other R	61.0	78.0	43.1	37.9	21.6	33.2	338.318
Travel R	82.5	48.0	23.1	27.4	16.2	27.7	300.242
R Total	143.5	126.0	66.2	65.3	37.8	60.9	638.560
Total	151.0	136.0	73.9	75.8	48.6	69.3	721.330

WBS Number: 3.3.2.2.1 **Description:** Motherboard System

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.2 **Description:** Preamp/Calibration

Institution : BNL-M&O **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	176	0	0	176	0	176	0	0	100.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	0	220	0	0	220
	0	0	0	20.237	0	0	20.237
MR Total	0	0	0	220	0	0	220
	0	0	0	20.237	0	0	20.237
Computer Professional R	50	50	50	50	50	50	300
	4.993	4.993	5.123	5.256	5.393	5.533	31.291
Technician R	220	220	220	0	220	220	1100
	19.224	19.224	19.724	0	20.762	21.302	100.236
R Total	270	270	270	50	270	270	1400
	24.217	24.217	24.847	5.256	26.155	26.835	131.527
Total	270	270	270	270	270	270	1620
	24.217	24.217	24.847	25.493	26.155	26.835	151.764

WBS Number: 3.3.2.2.2.1 **Description:** Preamp Operations

Institution : BNL-M&O **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	176	0	0	176	0	176	0	0	100.0	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	0	220	0	0	220
	0	0	0	20.237	0	0	20.237
MR Total	0	0	0	220	0	0	220
	0	0	0	20.237	0	0	20.237
Computer Professional R	50	50	50	50	50	50	300
	4.993	4.993	5.123	5.256	5.393	5.533	31.291
Technician R	220	220	220	0	220	220	1100
	19.224	19.224	19.724	0	20.762	21.302	100.236
R Total	270	270	270	50	270	270	1400
	24.217	24.217	24.847	5.256	26.155	26.835	131.527
Total	270	270	270	270	270	270	1620
	24.217	24.217	24.847	25.493	26.155	26.835	151.764

CONTINGENCY FACTORS:	*Risk* Technical	C o s t	Schedule	Des i gn	*Weight* Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.2.2 **Description:** Calibration Operations

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.3 **Description:** System Crate

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	5299	0	0	5299	0	4931	0	368	2801.5	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Post Doc B/I	0	0	880	880	880	880	3520
	0	0	50.462	51.775	53.118	54.5	209.855
Sr Research Scientist B/I	1760	1760	0	0	0	0	3520
	274.49	274.49	0	0	0	0	548.980
B/I Total	1760	1760	880	880	880	880	7040
	274.49	274.49	50.462	51.775	53.118	54.5	758.835
Computer Professional MR	1617	930	900	2409	1265	0	7121
	142.081	92.872	87.149	253.248	136.432	0	711.782
Technician MR	0	0	1760	1760	0	0	3520
	0	0	88.341	90.64	0	0	178.981
MR Total	1617	930	2660	4169	1265	0	10641
	142.081	92.872	175.49	343.888	136.432	0	890.763
Computer Professional R	1970	1989	2415	1332	3336	3209	14251
	192.522	188.713	235.904	99.708	299.649	342.666	1359.162
Electrical Engineer R	300	2640	1500	1200	1500	880	8020
	37.838	332.974	194.108	159.328	204.325	122.989	1051.562
Technician R	1200	1760	1760	880	880	880	7360
	58.706	86.102	88.341	45.32	46.495	47.705	372.669
R Total	3470	6389	5675	3412	5716	4969	29631
	289.066	607.789	518.353	304.356	550.469	513.36	2783.393
Total	6847	9079	9215	8461	7861	5849	47312
	705.637	975.151	744.305	700.019	740.019	567.86	4432.991

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel B/I	7.5	7.5	7.7	7.9	8.1	8.3	70.948
B/I Total	7.5	7.5	7.7	7.9	8.1	8.3	70.948
Travel MR	0.0	2.5	0.0	2.6	2.7	0.0	11.822
MR Total	0.0	2.5	0.0	2.6	2.7	0.0	11.822
Other R	0.0	55.0	30.8	0.0	13.0	22.2	120.902

Travel R	62.5	30.0	5.1	7.4	5.4	16.6	164.495
R Total	62.5	85.0	35.9	7.4	18.4	38.8	285.397
Total	70.0	95.0	43.6	17.9	29.2	47.1	368.167

WBS Number: 3.3.2.2.3.1 **Description:** Readout elec comm. and ops

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

The FEB will be commissioned after their installation on the detector during FY05 and FY07. The detector operations and maintenance will be in FY07-FY12.
The commissioning task includes supervision and problem solving during commissioning, creation and maintenace of the monitoring and calibration data bases, creation of graphic displays, etc. The commissioning fill follow th einstallation for each of the three cryostata. The final phase will consists of the commissionning of the overall system with the final DAQ.
During the experiment operations it is estimated that about 100 FEB boards will be replaced from spares during each yearly access. They will be diagnosed at CERN by the CERN based operations crew. About 10% of them will be

Details of Estimate:

For FY06 and FY07 1/6 FTE EE to supervise and solve the problems during the commissioning; 1FTE ET in FY06 and 1/2 FTE in FY07 to perform the commissioning. For FY06, 1/2 FTE Software Professional to create and maintain monitoring and calibration software, databases and graphic displays.
Travel: 4 trips in FY05 , FY06 6 trips, FY07 4 trips at $2,500 and $30,000 CERN living expenses supplement/year

In FY07-FY12:
1 FTE ET to support electronics boards: repairs, replacement of spares, replenishing of stock, additional radiation qualifications, maintenance of the test and repairs station, etc.; 1/6 FTE Software Professional to maintain and update the FEB monitoring and calibration software.
Material replacement cost of the test setup will require $15k/year for the tools replacement. Shipping cost $5k/year.
Travel: 1 trip/year at $2500 per trip

Management Contingency
1/2 FTE Software Professional to create and maintain monitoring and calibration software, data bases and graphic displays in FY05
travel: $15k in FY05 to support the technician during the commissioning.

Technician and computer professional moved to MC for FY06+07

Base & infrastructure
1/4 FTE experienced physicist, 1 FTE faculty, 2 FTE postdocs, and 2 grad students will be required to support hardware and provide technical expertise in FY07 and FY08. During the next phase of the experiment operations, this number will be reduced and 0.2 FTE faculty, 1 FTE post doc, and 1 grad student will be needed during FY09 to FY012. Travel 2rips/year at $2,500 per trip or $30,000 total from FY07 to FY12.

update december 06: commissionig o fthe Febs has slipped by 2 years. The number of problem boards is large: 50% require intervention and 15% require replacement and repairs.
Work is provided by electrical engineers: J. Ban(at CERN) and W. Sippach(at Nevis) and a CERN based technician

At CERN: Manpower 0.5 FTE EE (J. Ban)
1.0 FTE ET (A. Akimov)
0.5 FTE Ee (F. Spano)
0.5 FTE Ee (K. Copic)
M&S Tools and repair equipment $30k
accelerated FEB lifetime test, FEB test station, spares, shipping
At Nevis Manpower 0.5 FTE ET (N. Bishop)
M&S Tools and repair equipment $5k

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
2298	0	0	2298	0	2082	0	216	1183.0	0.0

MANPOWER	FY 06 (hrs)	FY 07 (hrs)	FY 08 (hrs)	FY 09 (hrs)	FY 10 (hrs)	FY 11 (hrs)	Total (hrs)
Technician MR	0	0	1760	1760	0	0	3520
	0	0	88.341	90.64	0	0	178.981
MR Total	0	0	1760	1760	0	0	3520
	0	0	88.341	90.64	0	0	178.981
Computer Professional R	300	0	800	300	880	800	3080
	25.751	0	70.454	27.108	81.578	76.091	280.982
Electrical Engineer R	300	2640	1500	1200	1500	880	8020
	37.838	332.974	194.108	159.328	204.325	122.989	1051.562
Technician R	1200	1760	1760	880	880	880	7360
	58.706	86.102	88.341	45.32	46.495	47.705	372.669
R Total	1800	4400	4060	2380	3260	2560	18460
	122.295	419.076	352.903	231.756	332.398	246.785	1705.213
Total	1800	4400	5820	4140	3260	2560	21980
	122.295	419.076	441.244	322.396	332.398	246.785	1884.194

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	0.0	55.0	30.8	0.0	13.0	22.2	120.902
Travel R	50.0	20.0	2.6	0.0	0.0	2.8	94.922
R Total	50.0	75.0	33.3	0.0	13.0	24.9	215.824
Total	50.0	75.0	33.3	0.0	13.0	24.9	215.824

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.3.2 **Description:** Crate ops Software Support

Institution : BNL-M&O **Contact** Not available

Operations software support for the Crate

Details of Estimate:

Software support will be required for detector operations as related to the crate. The software support includes:
1. Software maintenance during detector operations as related to the crate
2. Commissioning support
3. Data organization and storage
4. Data Quality Control

Software support will also be required for the Slow Control System operations. This includes:
1. Front _End Crate monitoring and configuration
2. Power supply system monitoring and configuration
3. Cooling monitoring

7/16 FTE SW professional in FY04, 5/8 FTE SW PROFESSIONAL IN FY05, FY06 (Saroj Kandasamy), 13/15 FTE SW Professional in FY07 and 5/8 FTE SW prof. per year starting in FY08 to FY12 will be required to support the software for crate commissiong, crate slow controls, data organization and control, maintaining all the databases and quality control. Travel 4 trips per year from FY07 to FY12 at $2500/trip or $60000

Base & infrastructure
Labor costs assume 1/10 Physicist and 1/2 FTE post doc in FY07 and FY09 and 1/10 FTE physicist and 1/4 FTE post doc in FY 10 to 12 to support the software and provide technical expertise for crate controls, status of the crate cooling system, crate voltages and temperatures, and maintain all the databases. Travel – 1 trip per year at $2500/trip or $25000

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	841	0	0	841	0	826	0	15	469.5	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional MR	445	930	600	1144	0	0	3119
	44.439	92.872	61.476	120.264	0	0	319.051
MR Total	445	930	600	1144	0	0	3119
	44.439	92.872	61.476	120.264	0	0	319.051
Computer Professional R	495	424	500	0	1144	1144	3707
	49.432	42.342	51.23	0	123.382	126.593	392.979
R Total	495	424	500	0	1144	1144	3707
	49.432	42.342	51.23	0	123.382	126.593	392.979
Total	940	1354	1100	1144	1144	1144	6826
	93.871	135.214	112.706	120.264	123.382	126.593	712.030

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	2.5	0.0	0.0	0.0	0.0	3.774
MR Total	0.0	2.5	0.0	0.0	0.0	0.0	3.774
Travel R	0.0	7.5	0.0	0.0	0.0	0.0	11.321
R Total	0.0	7.5	0.0	0.0	0.0	0.0	11.321
Total	0.0	10.0	0.0	0.0	0.0	0.0	15.095

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.3.3 **Description:** BNL ops Physicist support and management

Institution : BNL-M&O **Contact** Not available

Operations Physicist support and management for BNL equipment

Details of Estimate:

Labor cost assumes 1 FTE experienced physicist starting in FY05 to FY07 and 1/2 FTE post doc in FY08 to FY12 dedicated for problems that will occur in operations of the Crate. Travel – 3 trips per year at $2500/ trip or $60,000.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	879	0	0	879	0	808	0	71	459.1	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Post Doc B/I	0	0	880	880	880	880	3520
	0	0	50.462	51.775	53.118	54.5	209.855
Sr Research Scientist B/I	1760	1760	0	0	0	0	3520
	274.49	274.49	0	0	0	0	548.980
B/I Total	1760	1760	880	880	880	880	7040
	274.49	274.49	50.462	51.775	53.118	54.5	758.835
Total	1760	1760	880	880	880	880	7040
	274.49	274.49	50.462	51.775	53.118	54.5	758.835

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel B/I	7.5	7.5	7.7	7.9	8.1	8.3	70.948
B/I Total	7.5	7.5	7.7	7.9	8.1	8.3	70.948
Total	7.5	7.5	7.7	7.9	8.1	8.3	70.948

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.3.5 **Description:** LAr Data Base Operation

Institution : BNL-M&O **Contact** Not available

LAr ATLAS Database operations include:**Details of Estimate:**

1. Design, implementation, and maintenance of a database for the electronics production.
2. Integration of the databases in the CERN/ATLAS computing facilities.
3. Implementation and maintenance of the installation databases during detector commissioning.
4. Maintenance and management of the front-end configuration database during DAQ operations.
5. Maintenance and operations of Condition Databases.

1/2 FTE in FY04 (Soroj Kandasamy), 1FTE in FY05 and FY06, 3/4 FTE in FY07 to FY12 of a computer professional to support the Lar ATLAS data base operations.
Travel: 1 trip/year at $2,500/trip in FY04 to FY12 or $22,500

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	991	0	0	991	0	967	0	24	549.7	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional MR	585 58.42	0 0	150 15.39	1265 132.984	1265 136.432	0 0	3265 343.226
MR Total	585 58.42	0 0	150 15.39	1265 132.984	1265 136.432	0 0	3265 343.226
Computer Professional R	1175 117.339	1265 126.326	1115 114.22	0 0	0 0	1265 139.982	4820 497.867
R Total	1175 117.339	1265 126.326	1115 114.22	0 0	0 0	1265 139.982	4820 497.867
Total	1760 175.759	1265 126.326	1265 129.61	1265 132.984	1265 136.432	1265 139.982	8085 841.093

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel MR	0.0	0.0	0.0	2.6	2.7	0.0	8.048
MR Total	0.0	0.0	0.0	2.6	2.7	0.0	8.048

Travel R	2.5	2.5	2.6	0.0	0.0	2.8	15.601
R Total	2.5	2.5	2.6	0.0	0.0	2.8	15.601
Total	2.5	2.5	2.6	2.6	2.7	2.8	23.649

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.3.6 **Description:** SMU Data Base Operation

Institution : Southern Methodist University **Contact** Not available

Task includes creation and maintenance of the optical links monitoring system interfaced to the DAQ, creation of the data base and graphic displays as well as safety interlock for the lasers.
Update december 06: new tasks include merger and maintenance of the cosnstruction and condition data bases to be used during data taking

Details of Estimate:

Task will require 1/12 FTE software professional in FY05 and 1/3 FTE Software Professional in FY06 and FY07 to create the monitoring and control software and interface it with the DAQ system; 1/12 FTE from FY07 to FY12 of a computer professional to support the data base operation.
Travel: 4 trips/year at $2,500/trip.

Update december 06: task requires 1/2 FTE research scientisy or software professional in 07 , 08 and 09

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
290	0	0	290	0	247	0	43	140.3	0.0

MANPOWER SUMMARY:

(k$)	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Computer Professional MR	587 39.222	0 0	150 10.283	0 0	0 0	0 0	737 49.505
MR Total	587 39.222	0 0	150 10.283	0 0	0 0	0 0	737 49.505
Computer Professional R	0 0	300 20.045	0 0	1032 72.6	1312 94.689	0 0	2644 187.334
R Total	0 0	300 20.045	0 0	1032 72.6	1312 94.689	0 0	2644 187.334
Total	587 39.222	300 20.045	150 10.283	1032 72.6	1312 94.689	0 0	3381 236.839

MATERIAL SUMMARY:

FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	10.0	0.0	0.0	7.4	5.4	11.1	42.651
R Total	10.0	0.0	0.0	7.4	5.4	11.1	42.651
Total	10.0	0.0	0.0	7.4	5.4	11.1	42.651

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.4 **Description:** Front End Board

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

WBS Number: 3.3.2.2.4.1 **Description:** FEB operations Software Support

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.5 **Description:** Level 1 Trigger

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	657	0	0	657	0	358	0	300	203.2	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	440 22.792	440 22.792	440 23.385	176 9.597	176 9.846	176 10.102	1848 98.514
Post Doc B/I	880 23.443	880 23.443	880 24.053	440 12.339	440 12.659	440 12.989	3960 108.926
B/I Total	1320 46.235	1320 46.235	1320 47.438	616 21.936	616 22.505	616 23.091	5808 207.440
Electrical Engineer R	100 4.588	100 4.588	100 4.707	100 4.83	100 4.955	100 5.084	600 28.752
Technician R	440 16.577	440 16.577	440 17.008	240 9.518	240 9.765	240 10.019	2040 79.464
R Total	540 21.165	540 21.165	540 21.715	340 14.348	340 14.72	340 15.103	2640 108.216
Total	1860 67.4	1860 67.4	1860 69.153	956 36.284	956 37.225	956 38.194	8448 315.656

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	61.0	23.0	12.3	37.9	8.6	11.1	217.416
Travel R	10.0	18.0	18.0	9.5	0.0	0.0	82.313
R Total	71.0	41.0	30.3	47.4	8.6	11.1	299.729
Total	71.0	41.0	30.3	47.4	8.6	11.1	299.729

WBS Number: 3.3.2.2.5.2 **Description:** Pitts ops support and mgmt

Institution : University of Pittsburg **Contact** V. Paolone

Operations support and management of the Level 1 receiver system and layer sum boards.
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Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	549	0	0	549	0	358	0	191	203.2	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	440 22.792	440 22.792	440 23.385	176 9.597	176 9.846	176 10.102	1848 98.514
Post Doc B/I	880 23.443	880 23.443	880 24.053	440 12.339	440 12.659	440 12.989	3960 108.926
B/I Total	1320 46.235	1320 46.235	1320 47.438	616 21.936	616 22.505	616 23.091	5808 207.440
Electrical Engineer R	100 4.588	100 4.588	100 4.707	100 4.83	100 4.955	100 5.084	600 28.752
Technician R	440 16.577	440 16.577	440 17.008	240 9.518	240 9.765	240 10.019	2040 79.464
R Total	540 21.165	540 21.165	540 21.715	340 14.348	340 14.72	340 15.103	2640 108.216
Total	1860 67.4	1860 67.4	1860 69.153	956 36.284	956 37.225	956 38.194	8448 315.656

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	56.0	18.0	7.2	32.6	8.6	5.5	191.482
R Total	56.0	18.0	7.2	32.6	8.6	5.5	191.482
Total	56.0	18.0	7.2	32.6	8.6	5.5	191.482

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.5.3 **Description:** Pitts operations support

Institution : University of Pittsburg **Contact** Savinov

Operations support for software controls of the LV1 system. Task will include update of the control software in the DAQ system that monitors the performance of the LV1 receiver system. Operational system upgrades will be done

Details of Estimate:

Travel will be 4 trip per year at $2,500/trip from FY05 to FY12.

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
108	0	0	108	0	0	0	108	0.0	0.0

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	5.0	5.0	5.1	5.3	0.0	5.5	25.934
Travel R	10.0	18.0	18.0	9.5	0.0	0.0	82.313
R Total	15.0	23.0	23.1	14.7	0.0	5.5	108.247
Total	15.0	23.0	23.1	14.7	0.0	5.5	108.247

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.5.4 **Description:**

Institution : **Contact** Savinov

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.2.6 **Description:** ROD System

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	53	0	0	53	0	0	0	53	0.0	0.0

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	10.0	0.0	0.0	10.5	10.8	11.1	53.434
R Total	10.0	0.0	0.0	10.5	10.8	11.1	53.434
Total	10.0	0.0	0.0	10.5	10.8	11.1	53.434

WBS Number: 3.3.2.2.6.1 **Description:** ROD ops Software Support

Institution : Southern Methodist University **Contact** Not available

Operations software support for the ROD.
Task includes maintenance of the ROD based software for the monitoring of the optical links and data quality. This software is independent of the DAQ. Work will be done by the Software professional supporting the optical links. It is expected that ROD problems and maintenance schedule will be independent of that for the front-end crate and a separate travels will be required.

Travel: 4 trip/year at $2,500 per year. In FY06-FY12**Details of Estimate:**

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
53	0	0	53	0	0	0	53	0.0	0.0

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	10.0	0.0	0.0	10.5	10.8	11.1	53.434
R Total	10.0	0.0	0.0	10.5	10.8	11.1	53.434
Total	10.0	0.0	0.0	10.5	10.8	11.1	53.434

CONTINGENCY FACTORS:

Risk				*Weight*				Cont %
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule		
0	0	0	0	0	0	0		0

WBS Number: 3.3.2.3 **Description:** Maintenance

Institution : **Contact** Not available

Maintenance shall include:
Spare part kit to repair at the CERN and institution sites. The spare parts shall account for part wear out rate, and part obsolescence.

Scheduled maintenance that includes equipment removal and reinstallation, calibration and alignment, test equipment at the CERN and institution sites, on site repair, and off site repair.

Project Management to supervise the staff and perform project maintenance planning and control

Details of Estimate: Maintenance of the Liquid Argon Calorimeter electronics can be split into seven categories:

Front End Electronics
Level 1 trigger interface
ROD system electronics
Power Supplies
Detector Control and cooling systems
Cables, crates, and connectors
Optical Links
During access, failed units will be repaired or replaced with spares. Repair of these failed modules will be performed at CERN by the maintenance staff or at the US ATLAS manufacturing site during the following running period.
If the repair decision is to be off site, due to technical complexity and/or cost, at least one technician experienced in each of the above areas shall be maintained at the manufacturing institution. Each of the level 3 systems will require equipment for the testing of system components. Some of this will be specialized test equipment (such as an operating front end crate, spectrum analyzer, TDR etc.) and some will be normal electronic tools (oscilloscopes, meters etc.) that will be expensed under CERN common costs. The specialized test equipment, which will be quite heavily used, must be kept operational and up to date. For the purpose of estimating the maintenance cost for such equipment, it was assumed that it would be replaced every three years.The estimate is based on working 200days/year and that 50 days/year will be used for access, leaving 150days (a total of 900 MD per year) for on site

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
5398	0	0	5398	0	3305	0	2093	1877.8	0.0

MANPOWER (k$) SUMMARY:

	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	440	440	440	176	176	176	1848
	22.792	22.792	23.385	9.597	9.846	10.102	98.514
Post Doc B/I	880	880	880	440	440	440	3960
	23.443	23.443	24.053	12.339	12.659	12.989	108.926
Technician B/I	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
B/I Total	1320	1320	1670	816	616	616	6358
	46.235	46.235	79.41	40.681	22.505	23.091	258.157
Electrical Engineer MR	0	1760	1760	0	0	753	4273
	0	217.523	223.178	0	0	103.105	543.806
Mechanical Engineer MR	0	3520	2780	0	0	0	6300
	0	435.046	352.52	0	0	0	787.566

Technician MR	0	1760	996	0	792	400	3948
	0	153.793	77.62	0	74.744	38.731	344.888
MR Total	0	7040	5536	0	792	1153	14521
	0	806.362	653.318	0	74.744	141.836	1676.260
Electrical Engineer R	350	1296	276	1496	1496	543	5457
	43.257	140.064	14.364	157.105	161.179	52.1	568.069
Technician R	160	1232	1156	1862	1070	1462	6942
	13.981	85.784	77.309	143.465	72.441	112.282	505.262
R Total	510	2528	1432	3358	2566	2005	12399
	57.238	225.848	91.673	300.57	233.62	164.382	1073.331
Total	1830	10888	8638	4174	3974	3774	33278
	103.473	1078.445	824.401	341.251	330.869	329.309	3007.748

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other B/I	0.0	0.0	0.0	8.4	0.0	8.9	19.274
Travel B/I	0.0	5.0	8.2	5.3	5.4	5.5	43.852
B/I Total	0.0	5.0	8.2	13.7	5.4	14.4	63.126
Other MR	0.0	68.7	100.8	57.9	127.3	0.0	395.480
Travel MR	0.0	0.0	35.9	9.4	10.8	0.0	84.733
MR Total	0.0	68.7	136.7	67.3	138.1	0.0	480.213
Other R	121.0	638.5	65.0	212.9	100.3	143.8	1414.608
Travel R	0.0	16.0	10.8	36.4	16.7	16.6	135.095
R Total	121.0	654.5	75.8	249.3	117.0	160.4	1549.703
Total	121.0	728.2	220.7	330.3	260.5	174.8	2093.042

WBS Number: 3.3.2.3.1 **Description:** Motherboard System

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.2 **Description:** Preamps/Calibration

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

WBS Number: 3.3.2.3.2.1 **Description:** Preamps/Calibration

Institution : BNL-M&O **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.2.2 **Description:** Calibration

Institution : BNL-M&O **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.3 **Description:** System Crate

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	4819	0	0	4819	0	2874	0	1945	1632.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Electrical Engineer MR	0	1760	1760	0	0	753	4273
	0	217.523	223.178	0	0	103.105	543.806
Mechanical Engineer MR	0	3520	2780	0	0	0	6300
	0	435.046	352.52	0	0	0	787.566
Technician MR	0	1760	996	0	792	400	3948
	0	153.793	77.62	0	74.744	38.731	344.888
MR Total	0	7040	5536	0	792	1153	14521
	0	806.362	653.318	0	74.744	141.836	1676.260
Electrical Engineer R	350	1196	176	1196	1196	443	4557
	43.257	135.476	9.657	142.616	146.314	47.016	524.336
Technician R	160	792	716	1422	630	1022	4742
	13.981	69.207	60.301	126.015	54.539	93.914	417.957
R Total	510	1988	892	2618	1826	1465	9299
	57.238	204.683	69.958	268.631	200.853	140.93	942.293
Total	510	9028	6428	2618	2618	2618	23820
	57.238	1011.045	723.276	268.631	275.597	282.766	2618.553

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other B/I	0.0	0.0	0.0	8.4	0.0	8.9	19.274
Travel B/I	0.0	5.0	5.1	5.3	5.4	5.5	39.751
B/I Total	0.0	5.0	5.1	13.7	5.4	14.4	59.025
Other MR	0.0	68.7	100.8	57.9	127.3	0.0	395.480
Travel MR	0.0	0.0	35.9	9.4	10.8	0.0	84.733
MR Total	0.0	68.7	136.7	67.3	138.1	0.0	480.213
Other R	65.0	630.5	62.6	181.8	90.6	138.2	1288.028
Travel R	0.0	10.0	7.7	36.4	14.0	16.6	117.605
R Total	65.0	640.5	70.3	218.2	104.6	154.8	1405.633
Total	65.0	714.2	212.1	299.2	248.1	169.3	1944.871

WBS Number: 3.3.2.3.3.1 **Description:** PS maintenance - BNL

Institution : BNL-M&O **Contact** Not available

There are 4 main types of power supplies. They are:

Type	Number installed	Number of units/supply
Front End Crate Supplies	63	18
ROD VME crate Supplies	54	4
Level 1 Interface Crate Supplies	6	4
HEC LV Supplies	8	12

Supplies located in high radiation areas will have a high probability of failure (10%/year)

upadate december 06: IN ADDITION TO FIRST RETROFITTING THERE IS A NEED OFR A SECOND RETROFIT, ADDITIONAL TESTING, REVERSE ENGINEERING AND BACKUP SOLUTION

Repair of switching supplies will consist of replacing the supply with a spare during access, **Details of Estimate:**
then replacing the bricks, which have failed during the following running period.
For the front end electronics, the number of such failures is estimated to be 0.1 X 63 X 18 = 113 bricks/year. For the LV supplies for the HEC, the corresponding number is 0.1 X 8 X 12 = 10 bricks/year, bringing the total to 123 bricks/year. If the cost of each brick is
$133.3, this will contribute about $16.6K/year to the maintenance cost. Assuming that each replacement job requires ½ day, the manpower required to service the front end electronics is estimated to be 40 MD/year. It is assumed that these two systems comprise the largest part of the supply maintenance problem, but probably not more than half of it. To obtain an estimate for all of the power supply maintenance, the assumption is to double these figures. It is envisioned a test station that will include an oscilloscope and a spectrum analyzer. The cost of setting up the test and repair station is $40k in FY06. The cost to maintain such a system is about $23K/year. The technical staff off site at the responsible institution needed to provide technical expertise is about 2/10 FTE EE/year starting in FY07.
Summarizing the costs:

Labor	EET 120MD/year or 1/10 FTE in FYO6 and 1/3 FTE in FYO7 to FY12. EE 1/5 FTE in FY06 and 6/10 FTE in FY07 to FY12
Spares	$8k/year in FY07 to FY12
Equipment	$ 39k/year in FY06 to FY12
Travel	2 Trips/year at $2500 per trip in FY07 to FY12 or $30,000

Base & infrastructure
Labor assumes 1 FTE/year from FY07 to FY12 of an experienced physicist to provide technical support to the maintenance task off and on-site. Travel 2 trips /year at $2,500 per trip or $30,000.

Update december 06: additional costs include enginnering for failure analysis of retrofitted units, reverse engineering, second retrofitting, additional testing and backup solution

costs assume
power supply engineer 1 FTE in 07
reverse engineering 90k,
additional testing 1 FTE technician
backup solution (Wiener) 197k
failure analysis 60K
additional testing 2 FTE
reinstallation 2 FTE
cost of anticipated shipping, travel maintenance and repairs of the LV units
some of it is in management contingency

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
3528	0	0	3528	0	2336	0	1192	1327.0	0.0

MANPOWER	FY 06 (hrs)	FY 07 (hrs)	FY 08 (hrs)	FY 09 (hrs)	FY 10 (hrs)	FY 11 (hrs)	Total (hrs)
Electrical Engineer MR	0	1760	1760	0	0	753	4273
	0	217.523	223.178	0	0	103.105	543.806
Mechanical Engineer MR	0	3520	2780	0	0	0	6300
	0	435.046	352.52	0	0	0	787.566
Technician MR	0	1760	520	0	0	400	2680
	0	153.793	46.62	0	0	38.731	239.144
MR Total	0	7040	5060	0	0	1153	13253
	0	806.362	622.318	0	0	141.836	1570.516
Electrical Engineer R	350	1020	0	1020	1020	267	3677
	43.257	126.064	0	132.708	136.149	36.587	474.765
Technician R	160	0	0	510	510	110	1290
	13.981	0	0	46.914	48.13	10.651	119.676
R Total	510	1020	0	1530	1530	377	4967
	57.238	126.064	0	179.622	184.279	47.238	594.441
Total	510	8060	5060	1530	1530	1530	18220
	57.238	932.426	622.318	179.622	184.279	189.074	2164.957

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other B/I	0.0	0.0	0.0	8.4	0.0	8.9	19.274
Travel B/I	0.0	5.0	5.1	5.3	5.4	5.5	39.751
B/I Total	0.0	5.0	5.1	13.7	5.4	14.4	59.025
Other MR	0.0	68.7	46.2	57.9	48.2	0.0	246.378
Travel MR	0.0	0.0	30.8	6.8	5.4	0.0	64.865
MR Total	0.0	68.7	77.0	64.7	53.6	0.0	311.243
Other R	40.0	572.3	0.0	52.6	35.0	0.0	780.385
Travel R	0.0	5.0	0.0	22.7	0.0	0.0	41.790
R Total	40.0	577.3	0.0	75.3	35.0	0.0	822.175
Total	40.0	651.0	82.1	153.7	94.0	14.4	1192.443

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.3.2 **Description:** Opt Links and sys cable maint

Institution : Southern Methodist University **Contact** Not available

The task includes replacement spares for the optical links components.
The Optical Link components are:

Connection	Type	Number Installed
FEB-ROD	optical	1524
ROD-FEB	optical/Cu	762
System FEB crate	optical	114
FT-Baseplane	Cu (flex)	3048
TBB – Receiver	Cu (shielded TP)	240
TDB – Receiver	Cu (shielded TP)	120

The optical links are active devices and are therefore subject to component failure.
Components that are located in the radiation area will be subject to radiation qualification of each batch.

Assuming that the transmitters will fail at a rate of 5% per year, and the repair is to replace **Details of Estimate:**
the part, the cost for this task is $53.3K, and is based on a transmitter cost $266.6/transmitter. The associated labor, assuming ½ MD per replacement is 38MD.
Copper cables are passive, so component failure is not a problem. Oxidation does occur, and at the same rate, the flex cables will need to be replaced and the connectors on the trigger cables will also have to be replaced. The cost associated with this maintenance is only manpower. It is assumed that the time to replace either is ½ MD and that the probability of failure is 1%/year. This leads to a manpower cost of) 0.01 X (3048+240+120) X 0.5 = 17 MD/year. The cost for each flex cable is about $333.3, leading to a replacement cost of $10K/year. The test equipment required will include optical link and cable testing equipment. The maintenance budget for this item is estimated at $15K/year The technical staff off site at the responsible institution needed to provide technical expertise is ½ FTE EE/year
Summarizing the costs:

Labor	EET	1/5 FTE in FY07 and FY08, 1/15FTE from FY07 to FY12.
	EE	1/10 FTE starting in FY07 to FY12

Failure replacement needs are assumed to decrease by 50% for FY09 to FY12

Spares	$8K/year from FY07 to FY12
Replacement	$ 10K/year in FY09 to FY12
Test equipment Maintenance	$ 33k/year in FY07 to FY12
Travel -	4 trips/year at $2500 per trip.

Base & infrastructure
Labor assumes ½ FTE/year in FY07 to FY08 of an experienced physicist to provide technical support to the maintenance task off and on-site, and 1/2 FTE faculty, 1/2 postdoc, and 1 FTE grad student. All support is reduced by 50% for FY09 to FY12.Travel 2 trips /year at $2,500 per trip or $30,000 total.

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	374	0	0	374	0	104	0	270	59.3	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Technician MR	0	0	300	0	0	0	300
	0	0	15.221	0	0	0	15.221
MR Total	0	0	300	0	0	0	300
	0	0	15.221	0	0	0	15.221
Electrical Engineer R	0	176	176	176	176	176	880
	0	9.412	9.657	9.908	10.165	10.429	49.571

Technician R	0	0	100	120	120	120	460
	0	0	5.074	6.247	6.409	6.575	24.305
R Total	0	176	276	296	296	296	1340
	0	9.412	14.731	16.155	16.574	17.004	73.876
Total	0	176	576	296	296	296	1640
	0	9.412	29.952	16.155	16.574	17.004	89.097

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Other R	0.0	0.0	42.1	54.2	55.6	57.1	217.842
Travel R	0.0	0.0	7.7	8.4	14.0	11.1	51.959
R Total	0.0	0.0	49.8	62.6	69.7	68.1	269.801
Total	0.0	0.0	49.8	62.6	69.7	68.1	269.801

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.3.3 **Description:** Crates maintenance

Institution : BNL-M&O **Contact** Not available

The Front End Crates should require little maintenance, except for the case when a baseplane and/or the power bus needs to be replaced due to a bad connector. This is a major repair job that must be done during the access period.

Details of Estimate:

Manpower during an access is not counted in this estimate, as all available personnel will probably be used for the time available. However, the baseplane replacement cost is included. Assuming a failure rate of 3% (3 baseplanes per year) the replacement cost will be $9K/year. The technical staff off site at the responsible institution needed to provide technical expertise is 1/10 FTE EE/year

Summarizing the costs:

Labor	EET 1/10 FTE/year starting in FY07 to FY12
Replacement	$26K/year starting in FY07 to FY12

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	251	0	0	251	0	96	0	154	54.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	176	0	176	0	352
	0	0	15.779	0	16.61	0	32.389
MR Total	0	0	176	0	176	0	352
	0	0	15.779	0	16.61	0	32.389
Technician R	0	176	0	176	0	176	528
	0	15.379	0	16.19	0	17.042	48.611
R Total	0	176	0	176	0	176	528
	0	15.379	0	16.19	0	17.042	48.611
Total	0	176	176	176	176	176	880
	0	15.379	15.779	16.19	16.61	17.042	81.000

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	26.7	0.0	28.1	0.0	61.053
Travel MR	0.0	0.0	0.0	2.6	0.0	0.0	3.973
MR Total	0.0	0.0	26.7	2.6	28.1	0.0	65.026
Other R	0.0	26.0	0.0	25.3	0.0	28.8	89.284
R Total	0.0	26.0	0.0	25.3	0.0	28.8	89.284
Total	0.0	26.0	26.7	27.9	28.1	28.8	154.310

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.2.3.3.4 **Description:** DCS and monitoring maintenance

Institution : BNL-M&O **Contact** Not available

The Detector Control System(DCS), cooling system and monitoring systems are clearly critical areas for maintenance, as it is heavily relied on for the maintenance of other operations. The equipment used in this system is particularly robust, so one might expect the replacement and spare parts to be low, compared to other systems.

Details of Estimate:

For the DCS electronics, a rough estimate is 1% of the cost of the installed electronics per year would be needed for replacement. The total cost of the DCS electronics is estimated at $100K, so it estimated that about $2K/year for replacement costs for this system.

Close monitoring and maintenance of the cooling system will be especially important, since a cooling failure can have disastrous consequences for the electronics. Cooling system maintenance implies several operations like verification, test and eventually replacement of the following parts:
Cooling Plates
Cooling Blocks and the O-rings
Taigon pipes and fittings to the manifolds
Manifold
Quick insertion fittings
Temperature sensors

Maintenance costs for the cooling system are also difficult to estimate. Monitoring of the system will be especially important, since a cooling failure can have disastrous consequences for the electronics.
Cooling Plates: The coolant may clog the channels in the plates and replacement will be required. The frequency of cooling plate channel clogging depends on the water hardness in the main distribution system. It is assumed that cooling plates (of which there are 3048 in the
experiment) will need to be replaced at a rate of approximately 40 per year, at a cost of $50 each. The job of removing and reattaching a cooling plate is long, due to the large number of screws and the care required when handling a front end board. It is estimated that there will be a need for 1/4 MD of contract labor per plate for replacement.
Cooling Blocks and the O-rings: All O-rings and especially the ones that interface to the plates will deteriorate under radiation. It is expected that 5% of the 1540 O-rings or approximately 80 would fail per year. The manpower required is estimated at 1/4 MD of contract labor for each O-ring replacement. The replacement cost is estimated at $20
Taigon pipes and fittings to the manifolds: the fittings on the pipes have an automatic lock-in mechanism that can age with time. It is expected that 1% of the 2250 fittings or 20 would fail per year. The manpower required is estimated at 1/4MD contract labor for each fitting. The replacement cost is estimated at $90
Manifold routine flow checks and cleaning operations will be required. It is estimated that the 26 flow checks and 3 cleaning operations will be required per year. Each flow check and cleaning operation would probably require 1/8MD and 2MD of contract labor respectively.
Quick insertion fittings: These fittings are located on the manifolds and they are taped in. The O-ring in the fitting will probably deteriorate. There are 5,168 fittings, and 2% or 100 are expected to deteriorate per year. The manpower is estimated at 1/4MD of contract labor per fitting. The replacement cost is estimated at $450
Temperature Sensors: These 130 sensors will have to be checked 26 times per year, and recalibrated 2 times per year. It is also estimated that 13 will have to replaced per year. The contract labor is estimated at 1/4MD per occurance for checking, and 5MD per occurance for calibration. Replacement of failed temperature sensors is estimated at 1/4MD of contract labor per temperature sensor. The replacement cost is estimated at $30 each in small quantities. It is assumed that the temperature sensors are accessible during experiment operations.

The setup needed to test both the DCS and the components of the cooling system will be one DSC station to test and service all monitoring equipment, and a spare cooling circulation system. It is estimated the cost to maintain this system will be $1K/year. There is a cooling system for the power supplies, but the cooling plates used in that system are more robust, and will probably have a much smaller maintenance problem.
Summarizing the costs:

Labor	EET 78MD/year from FY07 to FY12
Replacement	$ 7240/year in FY07 to FY12
Travel -	2 trips in FY07 to FY12 at $2500 per trip or $30,000 total

Base & infrastructure
Labor assumes ½ FTE/year in FY07 and FY08, and 1/4 FTE/year in FY09 to FY12 of an experienced physicist to

provide technical support to the maintenance task off and on-site. Travel 1 trip in FY07, FY09, and FY12 at $2,500 /trip or $37,500 total.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	420	0	0	420	0	337	0	82	191.7	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	0	0	616	0	616
	0	0	0	0	58.134	0	58.134
MR Total	0	0	0	0	616	0	616
	0	0	0	0	58.134	0	58.134
Technician R	0	616	616	616	0	616	2464
	0	53.828	55.227	56.664	0	59.646	225.365
R Total	0	616	616	616	0	616	2464
	0	53.828	55.227	56.664	0	59.646	225.365
Total	0	616	616	616	616	616	3080
	0	53.828	55.227	56.664	58.134	59.646	283.499

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	7.4	0.0	7.8	0.0	17.001
Travel MR	0.0	0.0	5.1	0.0	5.4	0.0	15.895
MR Total	0.0	0.0	12.6	0.0	13.2	0.0	32.896
Other R	0.0	7.2	0.0	7.6	0.0	8.0	25.516
Travel R	0.0	5.0	0.0	5.3	0.0	5.5	23.856
R Total	0.0	12.2	0.0	12.9	0.0	13.6	49.372
Total	0.0	12.2	12.6	12.9	13.2	13.6	82.268

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.3.5 **Description:** Electronics facility maintenance

Institution : BNL-M&O **Contact** Not available

Task involves a maintenance of the repair facility for the electrical systems under BNL responsibilities

Facility maintenance includes:**Details of Estimate:**

1. Replacement of broken or worn out equipment and tooling.
2. Equipment calibration

The cost to perform these functions is estimated at $25k/year from FY 05 to FY12 for equipment and equipment calibration, and $15K from FY08-12 for replacement of tooling.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	246	0	0	246	0	0	0	246	0.0	0.0

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	20.5	0.0	43.2	0.0	71.048
MR Total	0.0	0.0	20.5	0.0	43.2	0.0	71.048
Other R	25.0	25.0	20.5	42.1	0.0	44.3	175.001
R Total	25.0	25.0	20.5	42.1	0.0	44.3	175.001
Total	25.0	25.0	41.0	42.1	43.2	44.3	246.049

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.4 **Description:** Front End Board

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

WBS Number: 3.3.2.3.4.1 **Description:** Front End Readout Elec spares

Institution : Columbia U. (Nevis Laboratory) **Contact**

Task includes a repayment of the CERN loan to buy components for the spare modules of the Front End Boards at the time of their initial purchase. This is motivated by the cost and lack of future availability of chips in DMILL technology. The US share of the loan is 20% and amount to $312,000. The loan will be repaid in FY06 and FY07. The repayment is part of the CERN common costs.

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.5 **Description:** Level 1 Trigger

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	525	0	0	525	0	380	0	144	216.2	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	440	440	440	176	176	176	1848
	22.792	22.792	23.385	9.597	9.846	10.102	98.514
Post Doc B/I	880	880	880	440	440	440	3960
	23.443	23.443	24.053	12.339	12.659	12.989	108.926
B/I Total	1320	1320	1320	616	616	616	5808
	46.235	46.235	47.438	21.936	22.505	23.091	207.440
Electrical Engineer R	0	100	100	300	300	100	900
	0	4.588	4.707	14.489	14.865	5.084	43.733
Technician R	0	440	440	440	440	440	2200
	0	16.577	17.008	17.45	17.902	18.368	87.305
R Total	0	540	540	740	740	540	3100
	0	21.165	21.715	31.939	32.767	23.452	131.038
Total	1320	1860	1860	1356	1356	1156	8908
	46.235	67.4	69.153	53.875	55.272	46.543	338.478

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	56.0	8.0	2.5	31.1	9.7	5.5	126.580
Travel R	0.0	6.0	3.1	0.0	2.7	0.0	17.490
R Total	56.0	14.0	5.5	31.1	12.4	5.5	144.070
Total	56.0	14.0	5.5	31.1	12.4	5.5	144.070

WBS Number: 3.3.2.3.5.1 **Description:** Level 1 trigger elec maintenance

Institution : University of Pittsburg **Contact** Not available

Maintenance of the Level 1 receiver system and layer sum boards.
Their replacement with spares will follow the FEB maintenance and repair schedule.
Level 1 receiver system will have an independent on-line monitoring system and the problem boards will be accessible for replacement during the experiment operations. The test station will be constructed at CERN to diagnose the problems. Most likely problem will occur on the daughter boards that can be replaced with spares. The faulty boards will be sent to Pittsburgh for repairs. About 6 motherboards of the LV1 system will have problems each year. About 100 layer sum boards (out of 3000) will require repairs each year.

Details of Estimate:

Labor cost will include labor of the electronics operations crew supported by the common costs. The repairs of the motherboards done at Pittsburgh will require 2 days of EE and two days of ET per board I.e., 12 days of EE and ET per year. The repairs of the layer sum boards will require 1/2 day per board or 50 man-days of ET per year.
Total labor is: 1/17 FTE EE and 1/4 FTE ET per year for FY07-FY12.
Material cost will include the diagnostic equipment at CERN - 9U VME crate ($6k), signal generator and scope will be the same as used in commissioning and will require replacement in FY09 ($26k). Data monitoring and logging PC ($3k) will be replaced in FY07 and FY10.
Pittsburgh test an repair equipment will include 2 independent test and repair stations. Each will consists of a pule generator ($5k), multiplexer ($1k), ADC ($5k), VME crate ($5k) and a PC ($3k). One scope ($20k) will be shared between the two setups. The total cost of the test stations is $56k in FY06. Shipping cost is estimated at $5k/year for FY06-FY12.

Physicist base funding support for equipment

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	525	0	0	525	0	380	0	144	216.2	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Faculty B/I	440	440	440	176	176	176	1848
	22.792	22.792	23.385	9.597	9.846	10.102	98.514
Post Doc B/I	880	880	880	440	440	440	3960
	23.443	23.443	24.053	12.339	12.659	12.989	108.926
B/I Total	1320	1320	1320	616	616	616	5808
	46.235	46.235	47.438	21.936	22.505	23.091	207.440
Electrical Engineer R	0	100	100	300	300	100	900
	0	4.588	4.707	14.489	14.865	5.084	43.733
Technician R	0	440	440	440	440	440	2200
	0	16.577	17.008	17.45	17.902	18.368	87.305
R Total	0	540	540	740	740	540	3100
	0	21.165	21.715	31.939	32.767	23.452	131.038
Total	1320	1860	1860	1356	1356	1156	8908
	46.235	67.4	69.153	53.875	55.272	46.543	338.478

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	56.0	8.0	2.5	31.1	9.7	5.5	126.580
Travel R	0.0	6.0	3.1	0.0	2.7	0.0	17.490
R Total	56.0	14.0	5.5	31.1	12.4	5.5	144.070
Total	56.0	14.0	5.5	31.1	12.4	5.5	144.070

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.6 **Description:** ROD System

Institution : **Contact** Not available

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	55	0	0	55	0	51	0	4	28.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician B/I	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
B/I Total	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
Total	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel B/I	0.0	0.0	3.1	0.0	0.0	0.0	4.101
B/I Total	0.0	0.0	3.1	0.0	0.0	0.0	4.101
Total	0.0	0.0	3.1	0.0	0.0	0.0	4.101

WBS Number: 3.3.2.3.6.2 **Description:** HV maintenance Stony Brook

Institution : SUNY SB **Contact** Not available

HV feedthrough will need to be open every time there is a HV problem within the detector requiring isolation of HV

estimated effort is 0.2 FTE technican (Steffens)**Details of Estimate:**

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	55	0	0	55	0	51	0	4	28.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician B/I	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
B/I Total	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717
Total	0	0	350	200	0	0	550
	0	0	31.972	18.745	0	0	50.717

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel B/I	0.0	0.0	3.1	0.0	0.0	0.0	4.101
B/I Total	0.0	0.0	3.1	0.0	0.0	0.0	4.101
Total	0.0	0.0	3.1	0.0	0.0	0.0	4.101

CONTINGENCY FACTORS:	*Risk*				*Weight*			Cont %
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.6.3 **Description:**

Institution : SUNY-SB **Contact** Not available

Maintenance of the HV distribution system

Details of Estimate:

The HV system will need repalcement of capacitors and technical expertise in isolating HV lines for each fault within the detector.
The estimated effort is 0.2 FTE technician (Steffens)

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.2.3.6.4 **Description:**

Institution : **Contact** Not available

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.3 **Description:** Beam Test

Institution : **Contact** Not available

Beam Tests were performed in 2001-2004. The new round of beam tests is requested but not yet approved for 2006-

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	819	0	0	819	0	466	0	354	264.6	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	0	0	295	0	295
	0	0	0	0	27.84	0	27.840
MR Total	0	0	0	0	295	0	295
	0	0	0	0	27.84	0	27.840
Computer Professional R	0	0	0	440	440	0	880
	0	0	0	19.464	19.968	0	39.432
Electrical Engineer R	1320	440	440	440	880	440	3960
	92.284	23.53	24.142	36.189	62.539	26.074	264.758
Technician R	0	295	295	295	0	295	1180
	0	25.778	26.448	27.136	0	28.564	107.926
R Total	1320	735	735	1175	1320	735	6020
	92.284	49.308	50.59	82.789	82.507	54.638	412.116
Total	1320	735	735	1175	1615	735	6315
	92.284	49.308	50.59	82.789	110.347	54.638	439.956

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	12.3	0.0	13.0	0.0	28.178
Travel MR	0.0	10.0	9.2	0.0	9.7	0.0	41.211
MR Total	0.0	10.0	21.5	0.0	22.7	0.0	69.389
Other R	15.0	76.0	0.0	33.7	10.8	13.3	165.328
Travel R	25.0	12.5	0.0	30.5	10.8	10.0	118.987
R Total	40.0	88.5	0.0	64.2	21.6	23.3	284.315
Total	40.0	98.5	21.5	64.2	44.3	23.3	353.704

WBS Number: 3.3.3.1 **Description:** FCAL Hadronic Tail Measurement

Institution : U. of Arizona **Contact** J. ratherfoord

During comprehensive reviews, the LHCC referees stated that the tails of hadronic showers be measured to provide the system response calibration. In order to measure the hadronic shower tails, a special calorimeter module located downstream of the module 0 calorimeter has to be built. Arizona has been assigned the leadership role in the test and will take on additional responsibilities. The test beam is available at CERN during FY03 and FY04 only. Since ROD will not be available and a version 0 of the FEB will be used, special optical links and modified DAQ will need to be put in place.

The beam tests completed in 2004 did not use final electronics and did not reach required precision. A new round of runs have been requested for 2006-2007

The costs for the Liquid Argon tail catcher module are:**Details of Estimate:**

Design and Engineering	160 hours ME in FY03, and 100 hours ME in FY04
Materials	$34,000 in FY03 and $31000 inFY04
Commissioning and Test beam setup	1/3 FTE MT in FY04, 1/5 FTE ME in FY05
Cabling and Connections	160 hours ME in FY03 (base)
Travel 3 trips/year in FY04 and FY05 $2,500/trip or $15,000	
Construction	1/3 FTE MT In FY04
Shipping & installation	1/8 FTE ME in FY04
Mount	1/4 FTE ME in FY04
Software	1/14 FTE SW Prof. In FY04
	1/6 FTE SW Prof. In FY04

Base & infrastructure
Labor costs assumes for mechanical assembly 1 FTE faculty and 1/2 FTE post doc per year in FY03 and FY04 to supervise and provide technical support.

Management Contingency FY04

For the planning purpose the cost of the beam tests is listed here for FY06-FY07.

Materials and cables $10,000 in FY06
Commissioning of the new data acquisitin setup 1/4 FTE EE in FY06 and FY07
Travel 4 trips/year

update december 06: beam test time frame slipped by 2 years
additional requirement is to measure radiation resistance of th ematerials
0.5 FTE ME D. Tompkins, 0.5 FTE computer professional A. Savine

U.S. ATLAS % share of activity: 30.00%

Cost Summary: (All)	**Base Cost (k$)**	**Cont Cost (k$)**	**Cont %**	**Total Cost (k$)**	**EDIA Labor (k$)**	**Mfg Labor (k$)**	**EDIA Matls (k$)**	**Mfg Matls (k$)**	**FTEs All**	**FTEs Other**
	318	0	0	318	0	182	0	137	103.1	0.0

MANPOWER (k$) SUMMARY:	**FY 06 (hrs) (k$)**	**FY 07 (hrs) (k$)**	**FY 08 (hrs) (k$)**	**FY 09 (hrs) (k$)**	**FY 10 (hrs) (k$)**	**FY 11 (hrs) (k$)**	**Total (hrs)**
Computer Professional R	0	0	0	440	440	0	880
	0	0	0	19.464	19.968	0	39.432
Electrical Engineer R	880	0	0	440	440	0	1760
	68.754	0	0	36.189	37.127	0	142.070

R Total	880	0	0	880	880	0	2640
	68.754	0	0	55.653	57.095	0	181.502
Total	880	0	0	880	880	0	2640
	68.754	0	0	55.653	57.095	0	181.502

MATERIAL SUMMARY:	**FY 06 (k$)**	**FY 07 (k$)**	**FY 08 (k$)**	**FY 09 (k$)**	**FY 10 (k$)**	**FY 11 (k$)**	**Total w/ overhead (k$)**
Travel MR	0.0	10.0	0.0	0.0	0.0	0.0	12.600
MR Total	0.0	10.0	0.0	0.0	0.0	0.0	12.600
Other R	15.0	0.0	0.0	21.1	10.8	0.0	59.036
Travel R	20.0	0.0	0.0	21.1	10.8	0.0	65.336
R Total	35.0	0.0	0.0	42.1	21.6	0.0	124.372
Total	35.0	10.0	0.0	42.1	21.6	0.0	136.972

CONTINGENCY FACTORS:	***Risk***				***Weight***			**Cont %**
	Technical	**C o s t**	**Schedule**	**Des i gn**	**Technical**	**C o s t**	**Schedule**	
	0	0	0	0	0	0	0	0

WBS Number: 3.3.3.2 **Description:** Test Beam - optical links

Institution : Southern Methodist University **Contact** Not available

Engineering and technical manpower for pre-operations and commissioning of the optical links at CERN.

FY04: Design and implementation of thelinks for the combined calorimeter test beam. Task includes design, building, installation and commissioning of 20 transition boards and link: PCB layout, PCB manufacturing, component loading, fibers, connectors, opto-electronics components,installation in the test beam and software modifications.

Details of Estimate:

FY04: Design and construction of the links for the Combined Calorimeter Test Beam: 20 transition boards + links(fibers, connectors, optical transmitters and receivers). Software adaptation.

Basis of estimate: material cost: components and boards production $40k (quotes+past experience), test equipment $25k; project labor: 1/3 FTE EE(A. Liu) + ½ FTE ET (M. Knee) + 1/6 software professional (T. Ryan); travel: 4 trips @ $2.5k each or $10k.

Base & infrastructure: 1/3 FTE experienced physicist (J. Ye) + ½ graduate student (L. Lu), travel 2 trips of 1 month @$4k each or $8k.

Commissioning of optical links for the new round of beam tests will require 1/4 FTE EE and 2 trips/year in FY05 and FY06

Update Dec 06: Maintenance of the compatibility of th elinks with rFEC electronics will continue throgh the experiment's support for the test beams

U.S. ATLAS % share of activity: 60.00%

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
133	0	0	133	0	123	0	11	69.7	0.0

MANPOWER SUMMARY: (k$)

	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Electrical Engineer R	440	440	440	0	440	440	2200
	23.53	23.53	24.142	0	25.412	26.074	122.688
R Total	440	440	440	0	440	440	2200
	23.53	23.53	24.142	0	25.412	26.074	122.688
Total	440	440	440	0	440	440	2200
	23.53	23.53	24.142	0	25.412	26.074	122.688

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	5.0	3.5	0.0	0.0	0.0	0.0	10.710
R Total	5.0	3.5	0.0	0.0	0.0	0.0	10.710
Total	5.0	3.5	0.0	0.0	0.0	0.0	10.710

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.3.3 **Description:** Front-end readout commissioning

Institution : Columbia U. (Nevis Laboratory) **Contact** J. Parsons

Task include installation and commissioning of the readout system for the test beams H6 and H8. This will include the installation of the pre-series FEBs in the H8 test beam and modified module-0 FEBs in the H6 test beam.

Labor estimate include 1/6 FTE EE and 1/8 FTE ET in FY04 for H8 beam.**Details of Estimate:**
Supprt of the FCAL test beam electronics located in the H6 test beam area will require 1/8 FTE ET in FY05.
Travel inlcude 4 trips at $2,500 each or $10,000 in FY04 for H8 beam line and 1 trip at $2,500 for the H6 beam line

U.S. ATLAS % share of activity: 10.00%

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
64	0	0	64	0	0	0	64	0.0	0.0

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	0.0	64.0	0.0	0.0	0.0	0.0	64.000
R Total	0.0	64.0	0.0	0.0	0.0	0.0	64.000
Total	0.0	64.0	0.0	0.0	0.0	0.0	64.000

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.3.4 **Description:** Beam test equipment modification

Institution : BNL-M&O **Contact** L.Shaver

Beam test equipment modification

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	304	0	0	304	0	162	0	142	91.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	0	0	295	0	295
	0	0	0	0	27.84	0	27.840
MR Total	0	0	0	0	295	0	295
	0	0	0	0	27.84	0	27.840
Technician R	0	295	295	295	0	295	1180
	0	25.778	26.448	27.136	0	28.564	107.926
R Total	0	295	295	295	0	295	1180
	0	25.778	26.448	27.136	0	28.564	107.926
Total	0	295	295	295	295	295	1475
	0	25.778	26.448	27.136	27.84	28.564	135.766

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	12.3	0.0	13.0	0.0	28.178
Travel MR	0.0	0.0	9.2	0.0	9.7	0.0	28.611
MR Total	0.0	0.0	21.5	0.0	22.7	0.0	56.789
Other R	0.0	12.0	0.0	12.6	0.0	13.3	42.292
Travel R	0.0	9.0	0.0	9.5	0.0	10.0	42.941
R Total	0.0	21.0	0.0	22.1	0.0	23.3	85.233
Total	0.0	21.0	21.5	22.1	22.7	23.3	142.022

WBS Number: 3.3.3.4.1 **Description:** Crate

Institution : BNL-M&O **Contact** L.Shaver

The crate system is different for different calorimeter modules due to the differences of the baseplanes needed. Therefore, changes to the crate will be needed for different segements of the test beam run.This will include the power bus, warm cables, baseplanes and connections to the LV power supply.
Additional changes of the pedestal will be needed to adapt it to the geometry of the test beam cryostat.

Update crate to latest configuration. Estimated time: 1/6 FTE of the technician in FY04 and **Details of Estimate:**
1/6 FTE of the technician in FY05. Material cost will include $10k in FY04 for the shop tasks and components.

U.S. ATLAS % share of activity: 100.00%

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.3.4.2 **Description:** Cooling

Institution : BNL-M&O **Contact** L.Shaver

Cooling. We will need to supply the manifolds for the two test beam systems as well as the hardware for the connections to the individual boards.
Each board will have two cooling plates with the connection to the water manifolds.

Details of Estimate:

Supply new cooling plates, manifold, manifold block assembly, water pipes,main water supply connections, and front panel
Commissioning of the setup at CERN before the test beam run and the preparation of the cooling manifolds for each cryostat will require
in FY04: 1/5 FTE of the designer and 1/6 FTE of the technician.
In FY05 1/6 FTE of the technician.
Travel: 1 trip/year for 3 weeks in FY04 and FY05

U.S. ATLAS % share of activity: 100.00%

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.3.4.3 **Description:** Power Supplies

Institution : BNL-M&O **Contact** L.Shaver

Prototypes of the final configuration of the power supplies will be provided. The cost of the units will be covered by the construction project. The installation if the test beam areas and special connections will be part of the test beam costs.

Update december 2006: addidtional costs associated with second retfofiitting including additional testing, reverse

Task of providing the updated power supplies for the test beams will include installation of **Details of Estimate:**
the units, connections and setting up of the DCS. Labor needed is for setting up the DCS inteface and prepare connections from crate to the PS and commission the system. This requires 1/12 FTE ET in FY04 and FY05 . Travel 2 trips of 2 weeks in FY04 and 1 trip of two weeks in FY05.

update december 06:

U.S. ATLAS % share of activity: 20.00%

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.3.4.4 **Description:** Feedthrough

Institution : BNL-M&O **Contact** L.Shaver

A final feedthrough will be installed on the test beam cryostat to provide the compatibility with the final experimental hardware. Old feedthrough has different pin carriers, cables and pigtails with different impedance. The replacement will use the spare feedthrough (cost included in the construction project) that will need to be modified for different interfaces with the test beam cryostat.

Details of Estimate:

The task of replacing the feedthrough with an updated one will require in FY04: one month of a designer to prepare the drawings for the modifications and 2 month of a technician to implement the changes. Travel 1 trip of 2 weeks for the installation. Material cost is estimated at $10,000 for the machine shop time and

U.S. ATLAS % share of activity: 100.00%

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.3.4.5 **Description:** Mother board system

Institution : BNL-M&O **Contact** L.Shaver

The electromagnetic Module will be rebuilt for the test beam run using the spares production electrodes. BNL will supply a new set of the final production mother boards. These mother boards have been produced as spares in the construction project but did not go through the final testing procedures.

Task includes a complete set of mother boards for one module. **Details of Estimate:**
Labor required: 1/6 FTE of electrical technician in FY04 (Pierrot Bichoneau), replacement parts for the mother boards spares $18,615 (there are 15 mother boards @$761+5 types fo 6 summing boards @$240)
travel to help in installation on the module - 1 trip of 2 weeks
and a shipping cost of $500.

U.S. ATLAS % share of activity: 60.00%

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	0	0	0	0	0	0	0	0	0.0	0.0

CONTINGENCY FACTORS:	*Risk*				*Weight*			
	Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
	0	0	0	0	0	0	0	0

WBS Number: 3.3.3.4.6 **Description:** Beam test equipment support

Institution : BNL-M&O **Contact** L.Shaver

Beam test equipment support

Details of Estimate: Provide support for the refurbished and new added equipment for the beam test: crate, cooling, power supplies, mother board system, feedthrough.
At this time the test beam activities past FY2005 have not been determined. Taking as example the test beam for the D0 experiment we assume that the additional test beam runs may occur in 2007 - 2012. The running costs to maintain and replace the equipment is estimated at $12k/year.
Labor cost is expected at 1 month of mechanical technician and 1 month of electrical technician/year and 2 trips of 3 weeks/year.

U.S. ATLAS % share of activity: 15.00%

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	304	0	0	304	0	162	0	142	91.8	0.0

MANPOWER (k$) SUMMARY:	FY 06 (hrs) (k$)	FY 07 (hrs) (k$)	FY 08 (hrs) (k$)	FY 09 (hrs) (k$)	FY 10 (hrs) (k$)	FY 11 (hrs) (k$)	Total (hrs)
Technician MR	0	0	0	0	295	0	295
	0	0	0	0	27.84	0	27.840
MR Total	0	0	0	0	295	0	295
	0	0	0	0	27.84	0	27.840
Technician R	0	295	295	295	0	295	1180
	0	25.778	26.448	27.136	0	28.564	107.926
R Total	0	295	295	295	0	295	1180
	0	25.778	26.448	27.136	0	28.564	107.926
Total	0	295	295	295	295	295	1475
	0	25.778	26.448	27.136	27.84	28.564	135.766

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other MR	0.0	0.0	12.3	0.0	13.0	0.0	28.178
Travel MR	0.0	0.0	9.2	0.0	9.7	0.0	28.611
MR Total	0.0	0.0	21.5	0.0	22.7	0.0	56.789
Other R	0.0	12.0	0.0	12.6	0.0	13.3	42.292
Travel R	0.0	9.0	0.0	9.5	0.0	10.0	42.941
R Total	0.0	21.0	0.0	22.1	0.0	23.3	85.233
Total	0.0	21.0	21.5	22.1	22.7	23.3	142.022

CONTINGENCY FACTORS:	*Risk* Technical	Cost	Schedule	Design	*Weight* Technical	Cost	Schedule	Cont %

WBS Number: 3.3.4 **Description:** CERN living expenses

Institution : BNL-M&O **Contact** Not available

CERN living expenses

U.S. ATLAS % share of activity: 100.00%

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	388	0	0	388	0	0	0	388	0.0	0.0

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	60.0	0.0	61.6	56.8	63.9	65.4	387.727
R Total	60.0	0.0	61.6	56.8	63.9	65.4	387.727
Total	60.0	0.0	61.6	56.8	63.9	65.4	387.727

WBS Number: 3.3.4.1 **Description:** M&O crew travel expenses

Institution : Columbia U. (Nevis Laboratory) **Contact** Not available

Details of Estimate:

The Lar CERN common costs makes provisions for an onsite electronics operation crew consisting of 6 people. The USATLAS share is 20% or 1.5 persons. It is expected that 1.5 electronics persons will be required from USATLAS from FY05 to FY012.. The travel costs for 1.5 persons will be $30k/year using the USATLAS guidelines for travel expenses. (Trips to CERN will take more than 8 weeks each). In addition, a mechanical person from USATLAS will be required to support the maintenance of the mechanical components from FY05 to FY012. The travel expenses here will also be $30k/year.

U.S. ATLAS % share of activity: 100.00%

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
388	0	0	388	0	0	0	388	0.0	0.0

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Travel R	60.0	0.0	61.6	56.8	63.9	65.4	387.727
R Total	60.0	0.0	61.6	56.8	63.9	65.4	387.727
Total	60.0	0.0	61.6	56.8	63.9	65.4	387.727

CONTINGENCY FACTORS:

Risk				*Weight*			
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule	Cont %
0	0	0	0	0	0	0	0

WBS Number: 3.3.5 **Description:** CERN common costs

Institution : **Contact** Not available

CERN common costs include US ATLAS share of costs levied by CERN, and costs associated with CERN facilities usage, equipment, and services.

U.S. ATLAS % share of activity: 21.80%

Cost Summary: (All)	Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
	1605	0	0	1605	0	0	0	1605	0.0	0.0

MATERIAL SUMMARY:	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	112.7	231.0	293.1	317.4	321.4	329.8	1605.396
R Total	112.7	231.0	293.1	317.4	321.4	329.8	1605.396
Total	112.7	231.0	293.1	317.4	321.4	329.8	1605.396

WBS Number: 3.3.5.1 **Description:** CERN common costs

Institution : BNL-common **Contact** Not available

The CERN common costs includes the costs for pre operations, operations, and maintenance. The US ATLAS share is 22% of the total CERN common costs for the experiment. Costs are derived from ATLAS_B_sept05_v13.xls whish is the CERN scrubbed Category B Common Costs submitted to the Resource Review Board.

Note: The present loan from CERN to the Lar collaboration is for 2.00MCHF with at least **Details of Estimate:**
1.4MCHF committed to FE Electronic (Spares). After the final FE Electronic (Spares) commitment the rest of the loan will be used in the same proportion of repayments for additional non-covered items like missing cables and missing funding for power supplies. The USATLAS portion of the loan is 22% of the total.The CERN common costs presented in the estimate is based on 1.4MCHF. An additional 600kCHF X 0.22 or 132kCHF will have to be repaid to CERN.

U.S. ATLAS % share of activity: 21.80%

Cost Summary: (All)

Base Cost (k$)	Cont Cost (k$)	Cont %	Total Cost (k$)	EDIA Labor (k$)	Mfg Labor (k$)	EDIA Matls (k$)	Mfg Matls (k$)	FTEs All	FTEs Other
1605	0	0	1605	0	0	0	1605	0.0	0.0

MATERIAL SUMMARY:

	FY 06 (k$)	FY 07 (k$)	FY 08 (k$)	FY 09 (k$)	FY 10 (k$)	FY 11 (k$)	Total w/ overhead (k$)
Other R	112.7	231.0	293.1	317.4	321.4	329.8	1605.396
R Total	112.7	231.0	293.1	317.4	321.4	329.8	1605.396
Total	112.7	231.0	293.1	317.4	321.4	329.8	1605.396

CONTINGENCY FACTORS:

Risk				*Weight*				
Technical	C o s t	Schedule	Des i gn	Technical	C o s t	Schedule		Cont %
0	0	0	0	0	0	0		0