DOE LHC Quarterly Review

Magnet Production
Cable Testing
Cost to Complete issues

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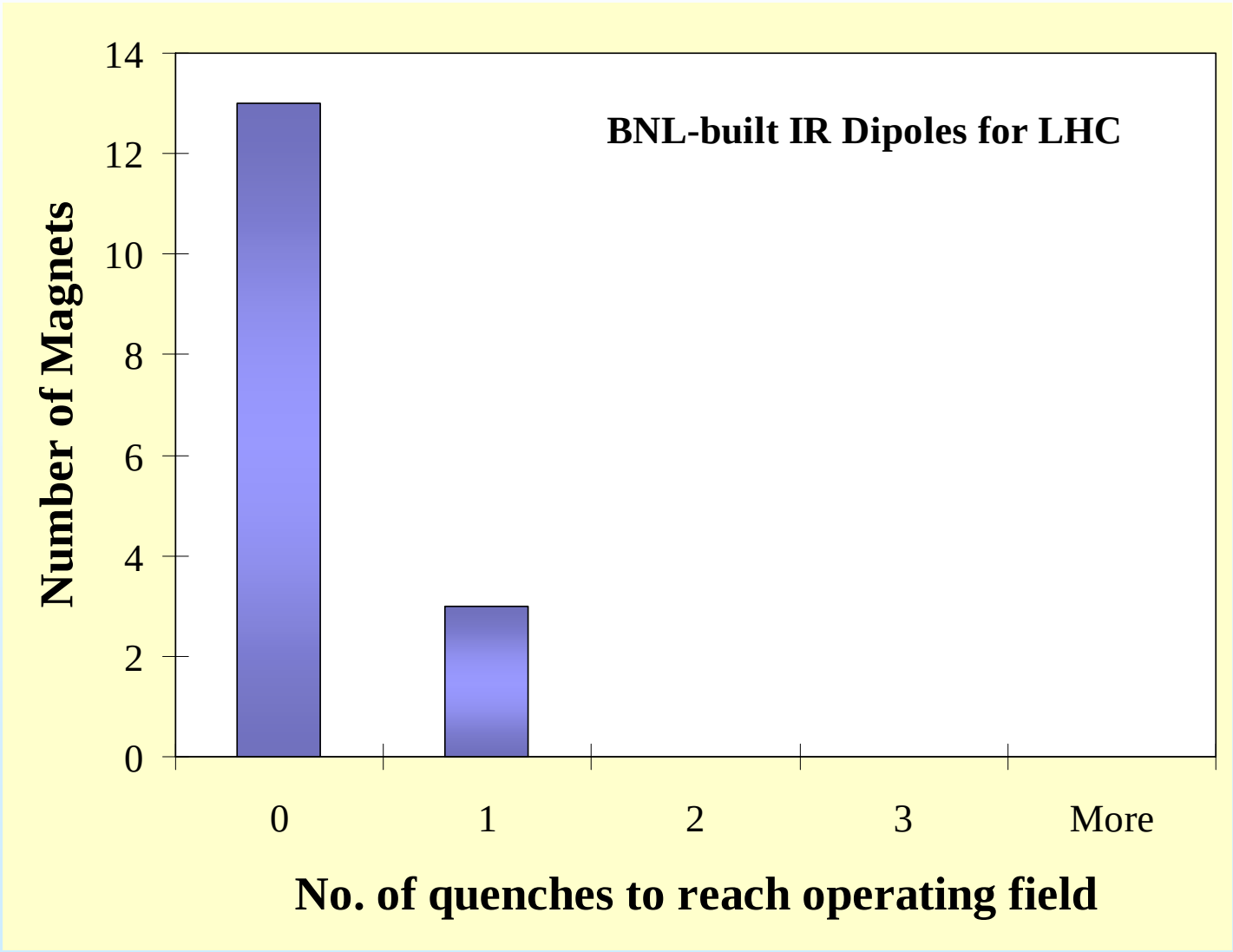
July 26, 2004

BNL Production Status

- Magnet production complete
- The last series of dipoles (D3's) is ready for cold test
- Four magnets not yet cold tested (1 D4, 3 D3's)

Magnet Performance

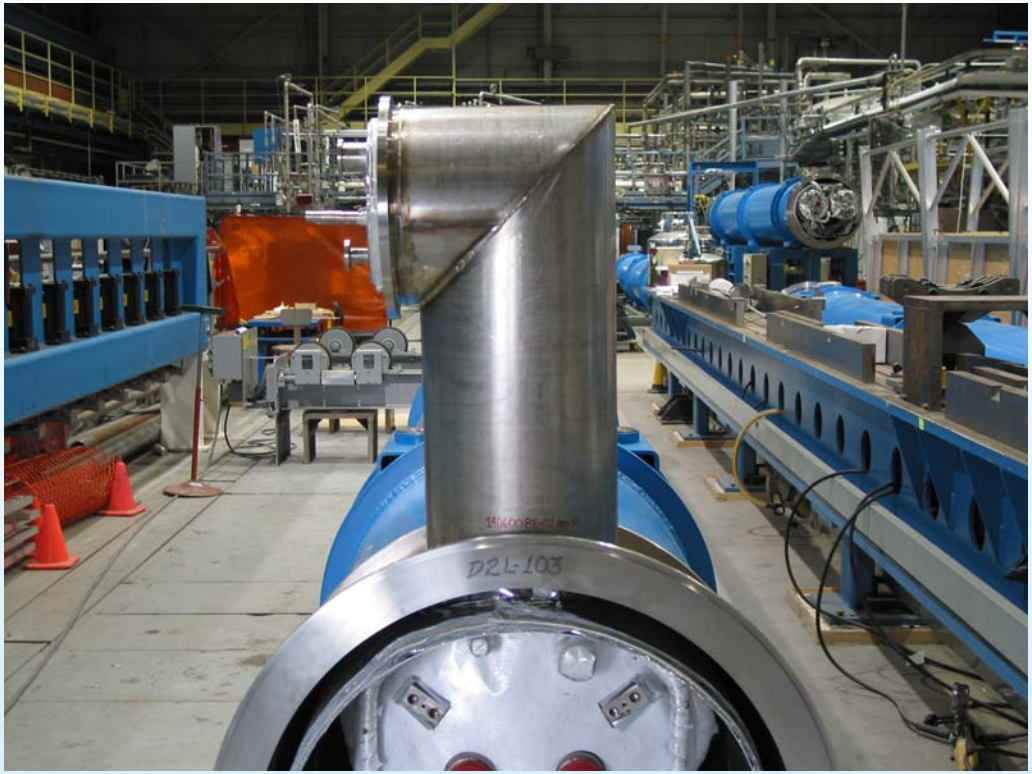


Issues during the past 12 months

Magnet Geometry

- We have needed to adjust the cold masses with welding to conform to the required sagitta. The cold masses tended to relax after final survey. This has resulted in more survey/weld/EDIA time than estimated.
- We have also needed to survey and re-position cryogenic and beam pipes to bring these some of these elements into tolerance (± 2mm). The fundamental problem is that with small quantities we do not have sophisticated fixturing of the type needed to ensure the desired accuracy. This has resulted in more survey/welding/EDIA hours than estimated

BNL LHC Magnet Production Status
Issue - Cryo-header Interface - QQS



In a similar fashion to the magnet interfacing some of the QQS pipe/flange positions were out of tolerance (± 5mm). Again no special fixturing to ensure accurate placement

BNL LHC Magnet Production Status
Magnet Testing Recent Experience

Testing from June 1, 2003 thru June 30, 2004

Date	Action	# of tests
6/16/03	D2#6: cooldown---LN2 leak, warmup	0.5
7/11/03	D2#6: cooldown---pipe cracked again, add clearan	0.5
7/21/03	D2#6: cooldown & test	1
8/12/03	D2#7: cooldown--- power outage	0.5
9/11/03	D2#7: cooldown & test	1
10/14/03	D2#8: cooldown & test	1
11/17/03	D2#9: cooldown & test	1
12/4/03	D1#5: cooldown and test	1
Dec03 to Feb04	Down for heat exchanger replacement, cable test priority	
3/24/04	D4#1: cooldown & test	1
5/5/04	D4#2: cooldown & test	1
6/18/04	D4#3: cooldown---weld cracked in LN2 line	0.5
Total tests since 6/1/03		9

Cost

	Total	Mat inc CS	Labor	Pwr
tal cost since 6/1/03	419.5	136.5	239.7	43.3
verage cost per test	46.61	15.17	26.63	4.81

Baseline called for 11 cool-downs to complete testing by May 04.

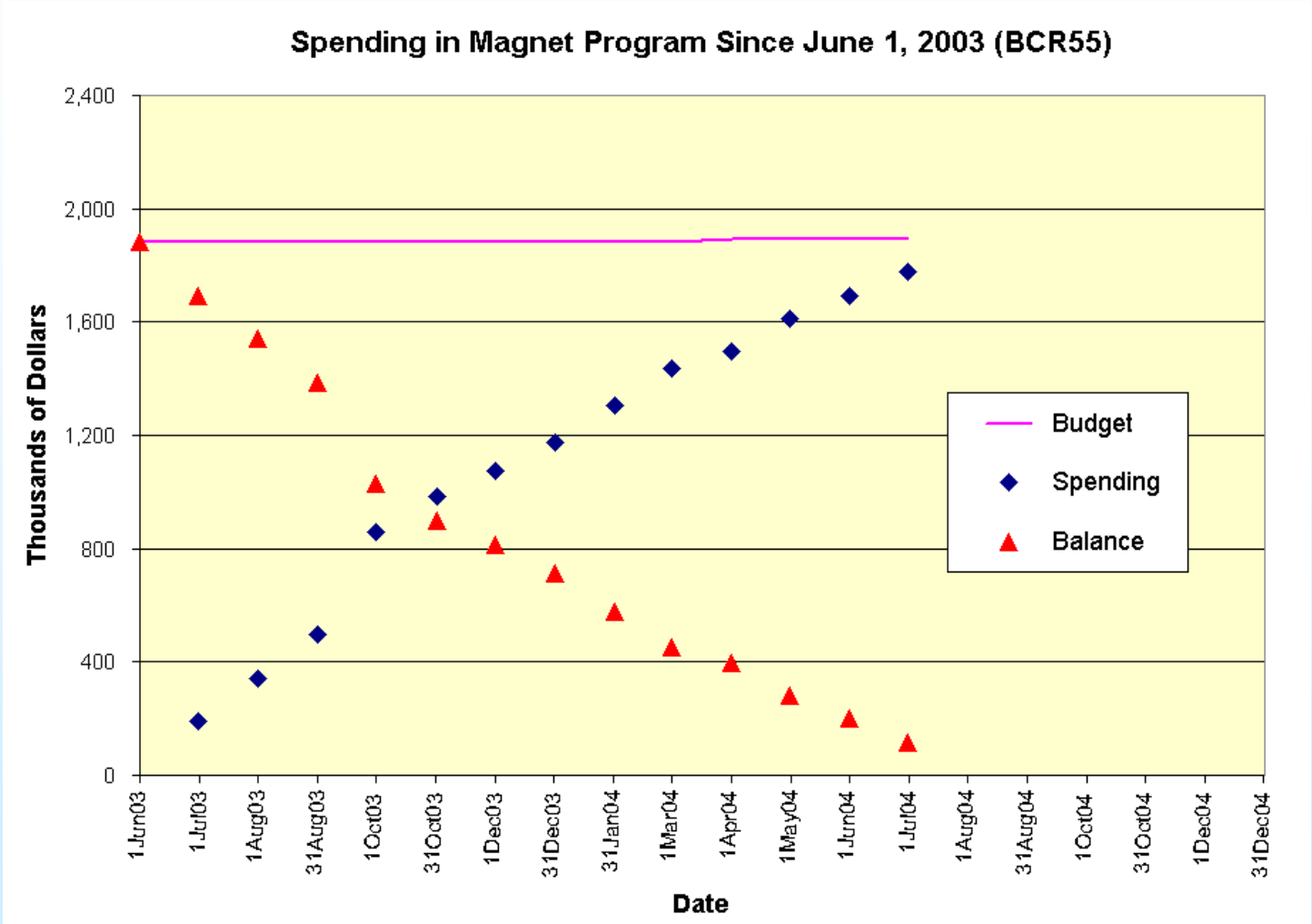
Even with the heat exchanger failure we accomplished this. Regrettably 4 of them did not yield a good test.

At this point estimate October 04 for 4 more tests

Cable Testing

- Cable testing continues as a level of effort task we are currently testing about ~70 samples per month.
- Testing baseline has testing through April 05
- Testing costs at $82K/ month (direct)
- No significant cost increases above baseline

Spending Rate



Monthly burn rate decreasing but not fast enough

Expenses for last 12 months

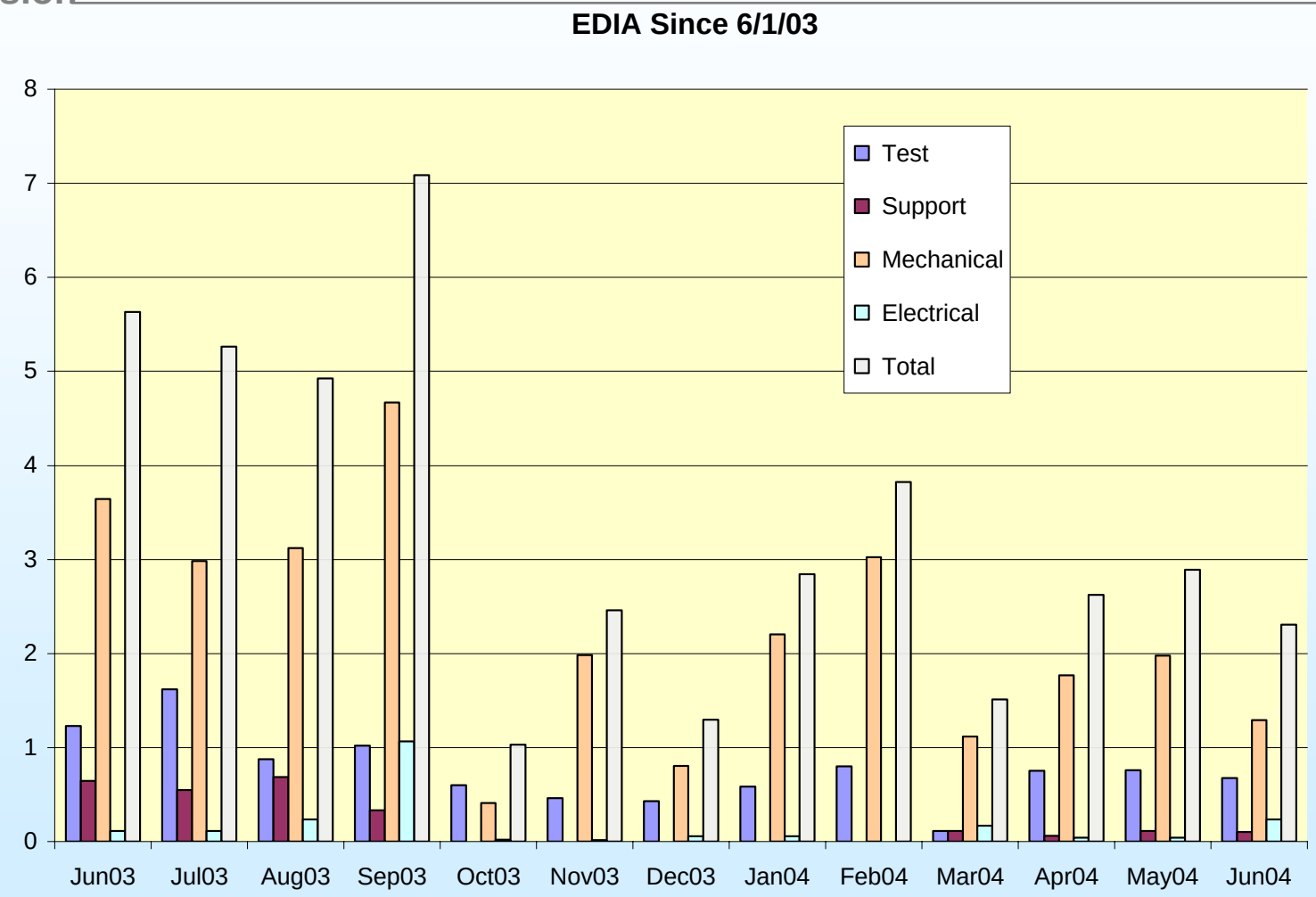
Expenses in Magnet Program Since June 1, 2003

		BAC	Spent before June 1	Spent since June 1	Total Spent	Balance
Tooling		1955.6	1,950.2	22.5	1,972.7	(17.1)
Production						
	Labor	2713.8	2,162.7	384.7	2,547.4	166.4
	Central Shops	2159.5	2,015.6	195.7	2,211.3	(51.8)
	Material	989.9	932.9	89.0	1,021.9	(32.0)
	Sp Procuremen	4262.9	4,122.8	4.0	4,126.8	136.1
	Subtotal	10126.1	9,234.0	673.4	9,907.4	218.7
Test						
	Labor	1282.1	1,050.5	239.7	1,290.2	(8.1)
	Central Shops	320.7	308.9	4.9	313.8	6.9
	Material	659.7	427.3	131.6	558.9	100.8
	Sp Procuremen	72.9	72.9	0.0	72.9	0.0
	El Power	277.3	126.7	43.3	170.0	107.3
	Subtotal	2612.7	1,986.3	419.5	2,405.8	206.9
EDIA						
	Labor	7508.8	7,147.3	663.8	7,811.1	(302.3)
	Material	29.2	29.5	0.0	29.5	(0.3)
	Subtotal	7538	7,176.8	663.8	7,840.6	(302.6)
Total Mag Prod						
	Tooling	1955.6	1,950.2	22.5	1,972.7	(17.1)
	Labor	11504.7	10,360.5	1,288.2	11,648.7	(144.0)
	Central Shops	2480.2	2,324.5	200.6	2,525.1	(44.9)
	Material	1678.8	1,389.7	220.7	1,610.4	68.4
	Sp Procuremen	4335.8	4,195.7	4.0	4,199.7	136.1
	El Power	277.3	126.7	43.3	170.0	107.3
	Total	22232.4	20,347.3	1,779.2	22,126.5	105.9
BCR	Check	22232.4	20,347.3	1,779.2	22,126.5	105.9
61	7.996	22240.4				113.9

Significant increase in EDIA arising from magnet acceptance. This has required a Q/C person 60%, ~ 50% of an engineering FTE, and ~20% of a scientific FTE.

BNL O/H rates are currently running ~2.5% above baseline.

EDIA Categories



LHC Project has been 'incremental' since the start of FY04 (as promised)

Cost to complete

Estimate to Complete the BNL Magnet Construction Program

Direct Cost

Item	Cde	MM	Each, $	#	Tot, $	Notes
D1 Interconnect						
Purchased Parts	M		39,060	1	39,060	
Central Shop	CS		43,820	1	43,820	
QQS Repairs						
Parts	M		2,850	4	11,400	
Welding	CS		1,450	4	5,800	
Labor	L		1,500	4	6,000	
Leak check and survey	L		2,000	4	8,000	
Magnet Acceptance						
Transport (round trip)	M		13,000	10	130,000	10 to be shipped: 1ea D1, 3 ea D2, D3, D4
Tech labor	L		1,600	10	16,000	
Survey	L		1,600	9	14,400	D1 complete
Engineering, MM	L	0.5	14,444	0	0	inc in EDIA below
QA, MM	L	0.6	9,112	0	0	inc in EDIA below
Testing						
Mat, av cost since 6/1/03	M		15,170	5	75,850	4 magnets remain, allow for 5 tests
Lab, av cost since 6/1/03	L		26,630	5	133,150	
Pwr, av cost since 6/1/03	P		4,810	5	24,050	
EDIA						
Av cost/month since Jan, 2004	L	2.67	12,372	6	198,199	recent average, for 6 months
Total					705,729	
Budget remaining, 7/1/04					113,900	
Difference					(591,829)	

Cost including OH

Summary	Code		Direct	OH	Tot, inc OH	
Material	M		256,310	54,876	311,186	
Labor	L		375,749	133,136	508,885	
Central Shops	CS		49,620	6,947	56,567	
Power	P		24,050	0	24,050	
Total			705,729	194,958	900,688	27.6%
Budget remaining, 7/1/04			113,900	31,465	145,365	estimate of OH remaining
Difference			(591,829)	(163,493)	(755,323)	

Magnet Production Cost Mitigation

- Potential cost savings:
  - Request CERN produce D1 interface parts from BNL drawings ($81K)
  - Request CERN ship empty boxes back to BNL ($50K)
  - Do not cold test the last (spare) D3 ($46K)
  - Attempt to adiabatically ramp down EDIA rather than continue throughout the balance of the program at 2.7 FTE's ($100K)

Magnet Production Cost Mitigation

Estimate to Complete the BNL Magnet Construction Program Revision 1

Direct Cost

Item	Cde	MM	Each, $	#	Tot, $	Notes
D1 Interconnect						
Purchased Parts	M		39,060	0	0	Tasked to CERN
Central Shop	CS		43,820	0	0	Tasked to CERN
QQS Repairs						
Parts	M		2,850	4	11,400	
Welding	CS		1,450	4	5,800	
Labor	L		1,500	4	6,000	
Leak check and survey	L		2,000	4	8,000	
Magnet Acceptance						
Transport (one way only)	M		8,000	10	80,000	10 to be shipped: 1ea D1, 3 ea D2, D3, D4
Tech labor	L		1,600	10	16,000	
Survey	L		1,600	9	14,400	D1 complete
Engineering, MM	L	0.5	14,444	0	0	inc in EDIA below
QA, MM	L	0.6	9,112	0	0	inc in EDIA below
Testing						
Mat, av cost since 6/1/03	M		15,170	3	45,510	4 magnets remain, 1 ea D4, 3 ea D3; skip one
Lab, av cost since 6/1/03	L		26,630	3	79,890	
Pwr, av cost since 6/1/03	P		4,810	3	14,430	
EDIA						
Av cost/month since Jan, 2004	L	1.34	12,372	6	99,471	50% of recent average, for 6 months
Total					380,901	
Budget remaining, 7/1/04					113,900	
Difference					(267,001)	

Cost including OH

Summary	Code		Direct	OH	Tot, inc OH	
Material	M		136,910	29,312	166,222	
Labor	L		223,761	79,283	303,044	
Central Shops	CS		5,800	812	6,612	
Power	P		14,430	0	14,430	
Total			380,901	109,407	490,308	28.7%
Budget remaining, 7/1/04			113,900	32,716	146,616	estimate of OH remaining
Difference			(267,001)	(76,692)	(343,692)	

Endgame

Even with cost mitigation measures and CERN 'help' we are still looking at a shortfall in magnet production of ~$270K (direct).

In FY05 the only BNL Project funding is for cable testing which runs thru April 05 at the rate of $82K/month (direct).

Truncating cable testing at the end of calendar 04 would produce an equivalent financial savings resulting a zero sum scenario.

Summary

- Technically we are/have progressed well. Magnet production complete. 10 magnets shipped to CERN, 10 to go.
- Cable testing is routine
- Cost to complete projection shows cash shortfall of ~$750K
- Cost mitigation will require some form of truncated cable testing.