

**LQCD-Ext II Cost Forecast - \$14 Million**  
(as of 08/05/2015)

**Effort & Budget Summary**

**LEVEL OF EFFORT (FTE-vrs)**

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Site Management	0.50	0.50	0.50	0.50	0.50	
Steady-state Operations Support	6.20	5.47	4.67	4.14	3.58	
Deployment Planning	0.00	0.30	0.10	0.30	0.10	
Deployment Support	0.00	0.50	0.30	0.50	0.30	
Project Management	0.35	0.35	0.35	0.35	0.35	
<b>Total</b>	<b>7.05</b>	<b>7.12</b>	<b>5.92</b>	<b>5.79</b>	<b>4.83</b>	<b>30.71</b>

1,954,035      1,878,841      1,719,986      1,482,747      1,391,966

**BUDGET (\$K)**

	(closed) <u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
<b><i>Steady-state Operations</i></b>						
Personnel	1,543,737	1,451,490	1,288,814	1,229,140	1,134,306	6,647,486
Travel	11,000	11,000	11,000	9,500	9,500	52,000
M&S (hardware, repairs, etc.)	281,000	281,000	281,000	100,000	100,000	1,043,000
Sub-total (SS Ops)	1,835,737	1,743,490	1,580,814	1,338,640	1,243,806	7,742,486
<b><i>New Hardware Deployment</i></b>						
Personnel	-	198,800	94,348	277,829	138,267	709,243
Travel	-	-	-	-	-	-
Equipment (compute)	-	772,174	1,038,220	1,055,056	1,293,012	4,158,463
Equipment (storage)	-	67,146	90,280	91,744	112,436	361,605
Sub-total (New Deployment)	-	1,038,120	1,222,848	1,424,629	1,543,715	5,229,311
<b><i>Project Management</i></b>						
Personnel	110,298	127,351	131,172	135,107	139,160	643,089
Travel	6,000	6,000	6,000	7,000	7,000	32,000
M&S	2,000	2,000	2,000	2,000	2,000	10,000
Sub-total (Project Mgmt)	118,298	135,351	139,172	144,107	148,160	685,089
<b><i>Total Project Cost</i></b>						
Personnel	1,654	1,778	1,514	1,642	1,412	8,000
Travel	17	17	17	17	17	84
M&S	283	283	283	102	102	1,053
Equipment (compute)	-	772	1,038	1,055	1,293	4,158
Equipment (storage)	-	67	90	92	112	362
Management Reserve	46	83	57	93	64	343
<b>Total</b>	<b>2,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>14,000</b>
CD-2/3 Budget Guidance Profile	2,000	3,000	3,000	3,000	3,000	14,000
Additional funding for larger budget	-	-	-	-	-	-
<b>Total CD-2/3 Planning Budget Profile</b>	<b>2,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>14,000</b>
Difference between budget and guidance	( )	( )	( )	( )	( )	( )
Compute hardware portion of difference	( )	( )	( )	( )	( )	( )

**Notes:**

- 1) Management reserve set at 20% of unspent deployment personnel budget and 3% of unspent steady-state ops personnel budget.
- 2) CD-1 planning guidance profile has been provided for a \$14M budget.
- 2) CD-2/3 budget profile has been set for a \$14M budget.

**LQCD-Ext II Cost Forecast - \$14 Million**  
(as of 08/05/2015)

**Level of Effort Summary, by Site**

**LEVEL OF EFFORT (FTE-yrs)**

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
<b>Brookhaven</b>						
Site Management	0.10	0.10	0.10	0.10	0.10	
Steady-state Operations Support (BG/Q)	0.40	0.40	0.40	-	-	
Steady-state Operations Support (Cluster)	-	-	-	-	-	
Deployment Planning	-	-	-	-	-	
Deployment Support	-	-	-	-	-	
Project Management	-	-	-	-	-	
Sub-total (BNL)	0.50	0.50	0.50	0.10	0.10	1.70
<b>Fermilab</b>						
Site Management	0.20	0.20	0.20	0.20	0.20	
Steady-state Operations Support	2.76	2.64	2.16	2.11	2.00	
Deployment Planning	-	-	-	0.30	0.10	
Deployment Support	-	-	-	0.50	0.30	
Project Management	0.35	0.35	0.35	0.35	0.35	
Sub-total (FNAL)	3.31	3.19	2.71	3.46	2.95	15.61
	2.96	2.84	2.36	3.11	2.60	
<b>Thomas Jefferson National Accelerator Facility</b>						
Site Management	0.20	0.20	0.20	0.20	0.20	
Steady-state Operations Support	3.04	2.43	2.11	2.03	1.58	
Deployment Planning	-	0.30	0.10	-	-	
Deployment Support	-	0.50	0.30	-	-	
Project Management	-	-	-	-	-	
Sub-total (JLab)	3.24	3.43	2.71	2.23	1.78	13.40
<b>Total</b>						
Site Management	0.50	0.50	0.50	0.50	0.50	
Steady-state Operations Support	6.20	5.47	4.67	4.14	3.58	
Deployment Planning	-	0.30	0.10	0.30	0.10	
Deployment Support	-	0.50	0.30	0.50	0.30	
Project Management	0.35	0.35	0.35	0.35	0.35	
Total	7.05	7.12	5.92	5.79	4.83	30.71
	6.70	6.77	5.57	5.44	4.48	

Total agrees with TPC Summary?      Yes      Yes      Yes      Yes      Yes

**LQCD-Ext II Cost Forecast - \$14 Million**  
(as of 08/05/2015)

**Brookhaven National Laboratory**

**LEVEL OF EFFORT (FTEs)**

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Site Management	0.10	0.10	0.10	0.10	0.10	0.50
Steady-state Operations Support (BG/Q)	0.40	0.40	0.40	-	-	1.20
Steady-state Operations Support (Cluster)	-	-	-	-	-	-
Deployment Planning	-	-	-	-	-	-
Deployment Support	-	-	-	-	-	-
Project Management	-	-	-	-	-	-
<b>Total</b>	<b>0.50</b>	<b>0.50</b>	<b>0.50</b>	<b>0.10</b>	<b>0.10</b>	<b>1.70</b>

**BUDGET**

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
<b>Steady-state Operations</b>						
Personnel	76,482	78,776	81,139	19,134	19,708	275,239
Site Management	17,510	18,035	18,576	19,134	19,708	92,963
Operations Support	58,972	60,741	62,563	-	-	182,276
Travel	3,000	3,000	3,000	1,500	1,500	12,000
M&S	201,000	201,000	201,000	20,000	20,000	643,000
(Hardware, repairs, spares, etc.)	20,000	20,000	20,000	20,000	20,000	-
IBM BG/Q Maintenance	181,000	181,000	181,000	-	-	543,000
<b>Total (Steady-state Ops)</b>	<b>280,482</b>	<b>282,776</b>	<b>285,139</b>	<b>40,634</b>	<b>41,208</b>	<b>930,239</b>
<b>New Hardware Deployment</b>						
Personnel	-	-	-	-	-	-
Deployment Planning	-	-	-	-	-	-
Deployment Support	-	-	-	-	-	-
Travel	-	-	-	-	-	-
Equipment (compute)	-	-	-	-	-	-
Equipment (storage)	-	-	-	-	-	-
<b>Total (New Deployment)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Project Management</b>						
Personnel	-	-	-	-	-	-
Travel	-	-	-	-	-	-
M&S	-	-	-	-	-	-
<b>Total (Project Mgmt)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Total Site Allocation</b>						
Personnel	76,482	78,776	81,139	19,134	19,708	275,239
Travel	3,000	3,000	3,000	1,500	1,500	12,000
M&S	201,000	201,000	201,000	20,000	20,000	643,000
Equipment	-	-	-	-	-	-
<b>Total</b>	<b>280,482</b>	<b>282,776</b>	<b>285,139</b>	<b>40,634</b>	<b>41,208</b>	<b>930,239</b>

**LQCD-Ext II Cost Forecast - \$14 Million**  
(as of 08/05/2015)

**Fermilab**

**LEVEL OF EFFORT (FTEs)**

	<b>FY15</b>	<b>FY16</b>	<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>Total</b>
Site Management	0.20	0.20	0.20	0.20	0.20	
Steady-state Operations Support	2.76	2.64	2.16	2.11	2.00	
Deployment Planning	-	-	-	0.30	0.10	
Deployment Support	-	-	-	0.50	0.30	
Project Management	0.35	0.35	0.35	0.35	0.35	
<b>Total</b>	<b>3.31</b>	<b>3.19</b>	<b>2.71</b>	<b>3.46</b>	<b>2.95</b>	<b>15.61</b>

**BUDGET**

	<b>FY15</b>	<b>FY16</b>	<b>FY17</b>	<b>FY18</b>	<b>FY19</b>	<b>Total</b>
<b>Steady-state Operations</b>						
Personnel	758,913	853,524	734,890	738,389	725,461	3,811,177
Site Management	59,896	76,486	78,781	81,144	83,579	379,886
Operations Support	699,016	777,038	656,110	657,245	641,882	3,431,291
Travel	5,000	5,000	5,000	5,000	5,000	25,000
M&S (hardware, repairs, tape, etc.)	40,000	40,000	40,000	40,000	40,000	200,000
<b>Total (Steady-state Ops)</b>	<b>803,913</b>	<b>898,524</b>	<b>779,890</b>	<b>783,389</b>	<b>770,461</b>	<b>4,036,177</b>
<b>New Hardware Deployment</b>						
Personnel	-	-	-	277,829	138,267	416,095
Deployment Planning	-	-	-	121,716	41,789	163,506
Deployment Support	-	-	-	156,112	96,477	252,590
Travel	-	-	-	-	-	-
M&S (compute hardware)	-	-	-	1,055,056	1,293,012	2,348,068
M&S (storage hardware)	-	16,786	22,570	68,808	84,327	192,491
<b>Total (New Deployment)</b>	<b>-</b>	<b>16,786</b>	<b>22,570</b>	<b>1,401,693</b>	<b>1,515,606</b>	<b>2,956,655</b>
<b>Project Management</b>						
Personnel	110,298	127,351	131,172	135,107	139,160	643,089
Travel	6,000	6,000	6,000	7,000	7,000	32,000
M&S	2,000	2,000	2,000	2,000	2,000	10,000
<b>Total (Project Mgmt)</b>	<b>118,298</b>	<b>135,351</b>	<b>139,172</b>	<b>144,107</b>	<b>148,160</b>	<b>685,089</b>
<b>Total Site Allocation</b>						
Personnel	869,211	980,876	866,062	1,151,325	1,002,888	4,870,362
Travel	11,000	11,000	11,000	12,000	12,000	57,000
M&S (SS Ops)	42,000	42,000	42,000	42,000	42,000	210,000
M&S (DME)	-	16,786	22,570	1,123,864	1,377,339	2,540,559
<b>Total</b>	<b>922,211</b>	<b>1,050,662</b>	<b>941,632</b>	<b>2,329,189</b>	<b>2,434,227</b>	<b>7,677,921</b>

**LQCD-Ext II Cost Forecast - \$14 Million**  
(as of 08/05/2015)

**Thomas Jefferson National Accelerator Facility**

**LEVEL OF EFFORT (FTE-yrs)**

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Site Management	0.20	0.20	0.20	0.20	0.20	
Steady-state Operations Support	3.04	2.43	2.11	2.03	1.58	
Deployment Planning	-	0.30	0.10	-	-	
Deployment Support	-	0.50	0.30	-	-	
Project Management	-	-	-	-	-	
<b>Total</b>	<b>3.24</b>	<b>3.43</b>	<b>2.71</b>	<b>2.23</b>	<b>1.78</b>	<b>13.40</b>

**BUDGET**

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
<b>Steady-state Operations</b>						
Personnel	704,555	519,189	472,784	471,617	389,137	2,557,283
Site Management	71,070	58,400	60,152	61,957	69,000	320,579
Operations Support	633,485	460,789	412,632	409,661	320,137	2,236,704
Travel	3,000	3,000	3,000	3,000	3,000	15,000
M&S (hardware, repairs, tape, etc.)	40,000	40,000	40,000	40,000	40,000	200,000
<b>Total (Steady-state Ops)</b>	<b>747,555</b>	<b>562,189</b>	<b>515,784</b>	<b>514,617</b>	<b>432,137</b>	<b>2,772,283</b>

**New Hardware Deployment**

Personnel	-	198,800	94,348	-	-	293,148
Deployment Planning	-	103,800	35,638	-	-	139,438
Deployment Support	-	95,000	58,710	-	-	153,710
Travel	-	-	-	-	-	-
M&S (compute hardware)	-	772,174	1,038,220	-	-	1,810,394
M&S (storage hardware)	-	50,359	67,710	22,936	28,109	169,114
<b>Total (New Deployment)</b>	<b>-</b>	<b>1,021,334</b>	<b>1,200,278</b>	<b>22,936</b>	<b>28,109</b>	<b>2,272,657</b>

**Project Management**

Personnel	-	-	-	-	-	-
Travel	-	-	-	-	-	-
M&S	-	-	-	-	-	-
<b>Total (Project Mgmt)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>

**Total Site Allocation**

Personnel	704,555	717,989	567,132	471,617	389,137	2,850,431
Travel	3,000	3,000	3,000	3,000	3,000	15,000
M&S (SS Ops)	40,000	40,000	40,000	40,000	40,000	200,000
M&S (DME)	-	822,534	1,105,930	22,936	28,109	1,979,509
<b>Total</b>	<b>747,555</b>	<b>1,583,523</b>	<b>1,716,062</b>	<b>537,553</b>	<b>460,246</b>	<b>5,044,939</b>

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(as of 08/05/2015)

**Management Reserve**

Baseline management reserve is set at a % of the steady-state operations personnel budget plus a % of the new hardware deployment personnel budget.	
% of steady-state ops budget	3%
% of new hardware deployment budget	20%

<u>Reference Values (from TPC Summary)</u>	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Steady-state Operations Personnel Budget	1,543,737	1,451,490	1,288,814	1,229,140	1,134,306	6,647,486
New Hardware Deployment Personnel Budget	-	198,800	94,348	277,829	138,267	709,243
<u>Management Reserve Budget</u>	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Baseline Budget	46,312	83,305	57,534	92,440	61,683	341,273
Adjustments						
-- Adjustment in management reserve to balance the budget to the guidance	(17,597)					(17,597)
-- 07/01/14 adjustment to offset reduction in JLab salary support correlating with node count adjustment	17,249	(244)	(254)	(194)		16,557
-- 07/01/14 adjustment to offset salary adjustments due to change in hardware split from 60:40 to 50:50.	-	(22)	(116)	383	2,635	2,880
<b>TOTAL</b>	<u>45,964</u>	<u>83,039</u>	<u>57,164</u>	<u>92,629</u>	<u>64,318</u>	<u>343,113</u>

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	<b>LQCD-Ext II Cost Forecast - \$14 Million</b>																		
2	(as of 08/05/2015)																		
3	Red font indicates changes since last revision.																		
4	<b>Site Staffing Model</b>																		
5	Updated 8/05/2015																		
7	<b>Assumptions:</b>																		
8	0.35 fte for overall project management																		
9	0.1 fte to manage BNL site																		
10	0.2 fte to manage cluster site (FNAL, JLab)																		
11	0.2 fte to plan, manage deployment																		
12	0.5 fte to deploy new hardware																		
13	0.0 fte of additional support for GPU deployment																		
14	0.2 fte/site of base admin support for ops & maint.; and to maintain expertise																		
15	0.5 Steady-state file server admin support (Lustre/mass storage)																		
16	0.125 Per cluster base effort																		
17	900 Number of cluster nodes that can be supported by one FTE																		
18	900 Number of GPUs that can be supported by one FTE (FNAL)																		
19	800 Number of GPUs that can be supported by one FTE (JLab)																		
20	225 Number of cluster nodes purchased with \$1M in equipment funds (per year)																		
21	160 Number of GPUs purchased with \$1M in equipment funds (per year)																		
22	21.28% M&S G&A rate at FNAL (% on the first \$500K of the purchase)																		
23	50.00% M&S G&A rate at JLab (% on the first \$50K of the purchase)																		
24	11.07% M&S G&A rate at BNL up to \$2M (Frank Quarrant- Chip Watson email thread 9/30/2015). No impact on baseline.																		
25	5% Fraction of total equipment budget allocated to storage hardware (FY10-12)																		
26	8% Fraction of total equipment budget allocated to storage hardware (FY13-19)																		
27	75% Fraction of storage budget allocated to deployment site (FY13-19)																		
28	25% Fraction of storage budget allocated to non-deployment site (FY13-19)																		
29	820 JLab # of conventional nodes - starting point (9q @ 328; 10q @ 224; 12s @ 275 nodes)																		
30	604 JLab # of GPUs - starting point (9g @ 248 GPUs; 10g @ 212 GPUs; 11g @ 32 GPUs; 12k @ 168 GPUs; plus XeonPhi cards)																		
31	985 FNAL # of conventional nodes starting point (Ds @ 421 nodes; Bc @ 224 nodes; FY14c @ 340 nodes)																		
32	304 FNAL # of GPUs - starting point (Dsg @ 152 GPUs; FY14g @ 152 GPUs)																		
34	<b>Compute hardware budget baseline (PEP)</b>																		
35	Compute hardware budget overrun / (underrun)																		
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<b>Planned Site Deployments</b>				Number of D
	FNAL	JLab	BNL	
FY15	0	0	0	FY15 5
FY16	0	1	0	FY16 5
FY17	0	1	0	FY17 4
FY18	1	0	0	FY18 4
FY19	1	0	0	FY19 4

  

<b>Initial Cluster Node Counts (FNAL)</b>				
	Name	# nodes	# GPUs	Cores
<b>FNAL Conventional Clusters</b>				
	Ds	421	0	
	Bc	224	0	
	FY14c	340	0	
	<b>Total</b>	<b>985</b>		
<b>FNAL GPU Clusters</b>				
	Dsg	76	152	16
	FY14g	76	152	16
	<b>Total</b>	<b>152</b>		

  

<b>Initial Cluster Node Counts (JLab)</b>				
	Name	# nodes	# GPUs	Cores
<b>JLab Conventional Clusters</b>				
	9q	320	0	8
	10q	224	0	8
	12s	276	0	16
	<b>Total</b>	<b>820</b>		
<b>JLab Accelerated Clusters</b>				
	9g	36	144	8
	10g	50	200	8
	11g	7	28	8
	12k	42	168	16
	12m	16	64	16
	<b>Total</b>	<b>151</b>		

  

Note: Retired machines typically taken offline by June 30 of the retirement year