(as of 08/05/2015)

Effort & Budget Summary

LEVEL OF EFFORT (FTE-yrs)

Site Management	<u>FY15</u> 0.50	<u>FY16</u> 0.50	<u>FY17</u> 0.50	<u>FY18</u> 0.50	<u>FY19</u> 0.50	Total
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	
Total	7.05	7.12	5.92	5.79	4.83	30.71
BUDGET (\$K)	1,954,035	1,878,841	1,719,986	1,482,747	1,391,966	
	(closed)					
	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	Total
Steady-state Operations			<u></u>	1110	<u></u>	20000
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
New Hardware Deployment						
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
Project Management						
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
Total Project Cost						
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
Total	2,000	3,000	3,000	3,000	3,000	14,000
CD-2/3 Budget Guidance Profile	2,000	3,000	3,000	3,000	3,000	14,000
Additional funding for larger budget		-	-	-	-	
Total CD-2/3 Planning Budget Profile	2,000	3,000	3,000	3,000	3,000	14,000
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.

(as of 08/05/2015)

Level of Effort Summary, by Site

LEVEL OF EFFORT (FTE-yrs)

LEVEL OF EFFORT (FIE-yis)	FY15	FY16	FY17	FY18	FY19	Total
Brookhaven						
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
Fermilab						
Site Management	0.20	0.20	0.20	0.20	0.20	
Steady-state Operations Support	0.20 2.76	0.20 2.64	2.16	2.11	0.20 2.00	
Deployment Planning	2.70		2.10	0.30	2.00 0.10	
Deployment Support	-	-	-	0.50	0.10	
Project Management	0.35	0.35	0.35	0.30	0.30	
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	15.01
Thomas Jefferson National Accelerator Facili	ity					
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
Total	0.50	0.50	0.70	0.70	0.50	
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	20.71
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	-	-	-	-	-	-
Total	0.50	0.50	0.50	0.10	0.10	1.70

BUDGET

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Steady-state Operations						
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
Total (Steady-state Ops)	280,482	282,776	285,139	40,634	41,208	930,239
New Hardware Deployment						
Personnel	-	-	-	-	-	-
Deployment Planning	-	_	_	_	_	-
Deployment Support	-	_	_	_	_	-
Travel						-
Equipment (compute)	-	-	-	-	-	-
Equipment (storage)	-	-	-	-	-	-
Total (New Deployment)	-	-	-	-	-	-
Project Management						
Personnel						-
Travel						-
M&S						-
Total (Project Mgmt)		-	-	-	-	-
Total Site Allocation						
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						
Total	280,482	282,776	285,139	40,634	41,208	930,239

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

Fermilab

LEVEL OF EFFORT (FTEs)

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Site Management	0.20	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	
Total	3.31	3.19	2.71	3.46	2.95	15.61

BUDGET

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Steady-state Operations						
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
Total (Steady-state Ops)	803,913	898,524	779,890	783,389	770,461	4,036,177
New Hardware Deployment						
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
Total (New Deployment)	-	16,786	22,570	1,401,693	1,515,606	2,956,655
Project Management						
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
Total (Project Mgmt)	118,298	135,351	139,172	144,107	148,160	685,089
Total Site Allocation						
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
Total	922,211	1,050,662	941,632	2,329,189	2,434,227	7,677,921

(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>
0.20	0.20	0.20	0.20	0.20	
3.04	2.43	2.11	2.03	1.58	
-	0.30	0.10	-	-	
-	0.50	0.30	-	-	
-	-	-	-	-	
3.24	3.43	2.71	2.23	1.78	13.40
	0.20 3.04	0.20 3.04 0.30 0.30 0.50	0.20 0.20 0.20 3.04 2.43 2.11 - 0.30 0.10 - 0.50 0.30	0.20 0.20 0.20 0.20 3.04 2.43 2.11 2.03 - 0.30 0.10 - - 0.50 0.30 -	0.20 0.20 0.20 0.20 0.20 3.04 2.43 2.11 2.03 1.58 - 0.30 0.10 - - - 0.50 0.30 - -

BUDGET

	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Steady-state Operations						
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
Total (Steady-state Ops)	747,555	562,189	515,784	514,617	432,137	2,772,283
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
Total (New Deployment)	-	1,021,334	1,200,278	22,936	28,109	2,272,657
Project Management						
Personnel	-	-	-	-	-	-
Travel	-	-	-	-	-	-
M&S	-	-	-	-	-	-
Total (Project Mgmt)	-	-	-	-	-	-
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
Total	747,555	1,583,523	1,716,062	537,553	460,246	5,044,939

(as of 08/05/2015)

Management Reserve

% of steady-state ops budget % of new hardware deployment budget	3% 20%					
Reference Values (from TPC Summary)	<u>FY15</u>	<u>FY16</u>	<u>FY17</u>	<u>FY18</u>	<u>FY19</u>	<u>Total</u>
Steady-state Operations Personnel Budget New Hardware Deployment Personnel Budget	1,543,737	1,451,490 198,800	1,288,814 94,348	1,229,140 277,829	1,134,306 138,267	6,647,486 709,243
<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 Adjustments	46,312	83,305	57,534	92,440	61,683	341,273
Adjustment in management reserve to balance the budget to the guidance 07/01/14 adjustment to offset reduction in	(17,597)					(17,597)
JLab salary support correlating with node count adjustment 07/01/14 adjustment to offset salary adjustments due to change in hardware split	17,249	(244)	(254)	(194)		16,557
from 60:40 to 50:50.	-	(22)	(116)	383	2,635	2,880

45,964

TOTAL

83,039 57,164 92,629 64,318

343,113

	А	В	С	D	E	F	G	н			ĸ		м	N	0	P	Q	R	S
1	~	U	Ŭ	U	L .		U		LOCD-Ext II	Cost Forecast - \$14	Million	<u> </u>			Ŭ		ų	K	9
2										s of 08/05/2015)									
3										1			Red font indicates	s changes since las	st revision				
4				1			II		Site	Staffing Model			1						
5										dated 8/05/2015									
6		r	-	1	1	1				100100 010012010			,	1					
7		Assumpti	ions:			1	1 1		Basis:	·					Planned Site D	eployments	I		Number of D
8		0.35	fte for ove	rall project m	anagement				Based on opera	ting experience									
9				age BNL site					Based on opera						FNAL	JLab	BNL		FNAL
10		0.2	fte to man	age cluster s	ite (FNAL, JLa	ab)			Based on opera	ting experience				FY15		0	0	FY15	5
11				, manage de					See assumption					FY16		1	0	FY16	5
12				oy new hard					See assumption					FY17		1	0	FY17	4
13					t for GPU dep						deploy new GF	PU cluster (Jan '14	4 ->)	FY18		0	0	FY18	4
14 15						s & maint.; and to		ise	Based on opera		ama laval aa hu	idented in EV42 4	C (1)	FY19	1	0	0	FY19	4
15				ate file server r base effort	aumin suppo	rt (Lustre/mass s	iorage)			ating experience (s ating experience (a		udgeted in FY12-1	14)		Y1 isolated buy	- 1 eluctor			JLab
16					es that can be	supported by or	e FTF			iting experience (a iting experience; L					Y1 Isolated buy Y2 buy with Y1+		luster	FY15	JLab 6.5
18						rted by one FTE						→ ort than cluster no	odes		Y1+Y2 option =			FY16	5.5
19						rted by one FTE						rds: 660 / fte; aver			Y1 + Y3 or later			FY17	4.75
20						with \$1M in equi		r year)		t cost data; see a					Cluster for < 12			FY18	4
21						M in equipment			Based on recent	t cost data; see a	ssumptions tab							FY19	4
22						st \$500K of the													
23						st \$50K of the pu													BNL
24									015). No impact o									FY15	0
25						located to storage				ved hardware bas								FY16	0
26 27						located to storage		13-19)	Storage budget	increased to refle	ct growing need	15						FY17 FY18	0
27						to deployment si to non-deployme		`										FY18 FY19	0
20						ng point (9q @ 3			(ac)							Legend		FTI9	0
30									ls;12k @ 168 GPL	Js: plus XeonPhi d	ards)						med Infiniband clus	ster	
31							21 nodes; Bc @				,								
32																YYG: future unna	amed GPU cluster		
		304	FNAL # of			g @ 152 GPUs;			140 @ 340 110003	,,						YYG: future unna YY/YY: designate	amed GPU cluster s combined purchas	ses that span fisca	al years; treated
33		304	FNAL # o						140 6 340 110003	, ,								ses that span fisca	al years; treated
33 34		Compute	hardware b	f GPUs - star	ting point (Dse ine (PEP)	g @ 152 GPUs;	FY14g @ 152 GI 847,000	PUs)	1,161,000	1,489,000	4,611,000			Initial Cluster No		YY/YY: designate: AL)	s combined purchas		
33 34 35		Compute	hardware b	f GPUs - star	ting point (Dsg	g @ 152 GPUs;	FY14g @ 152 GI 847,000	PUs)	1,161,000		4,611,000				de Counts (FN	YY/YY: designate: AL) Name	s combined purchas # nodes	# GPUs	al years; treated Cores
33 34 35 36		Compute	hardware b	f GPUs - star	ting point (Dse ine (PEP)	g @ 152 GPUs; - - (0)	FY14g @ 152 GI 847,000 (0)	PUs) 1,114,000 (2)	1,161,000 4	1,489,000 (1)	(0)					YY/YY: designate: AL) Name Ds	s combined purchas # nodes 421	# GPUs 0	
33 34 35 36 37		Compute Com	hardware b oute hardwa	f GPUs - star oudget baseli re budget over	ting point (Dse ine (PEP)	g @ 152 GPUs;	FY14g @ 152 GI 847,000 (0) FY16	PUs) 1,114,000 (2) FY17	1,161,000 4 FY18	<u>1,489,000</u> (1) FY19	(0) Total				de Counts (FN	YY/YY: designate: AL) Name Ds Bc	s combined purchas # nodes 421 224	# GPUs 0 0	
33 34 35 36 37 38		Compute Comp	hardware b bute hardwa hardware b	f GPUs - star <u>budget basel</u> re budget over budget (\$)	ting point (Dsg ine (PEP) run / (underrun)	g @ 152 GPUs; 	FY14g @ 152 GI 847,000 (0)	PUs) 1,114,000 (2) FY17 1,128,500	1,161,000 4 FY18 1,146,800	1,489,000 (1) FY19 1,405,448	(0)	-			de Counts (FN	YY/YY: designates AL) Name Ds Bc FY14c	s combined purchas # nodes 421 224 340	# GPUs 0	
33 34 35 36 37 38 39		Compute Comp Compute BG/Q con	<i>hardware b</i> pute hardwa hardware b npute hard	f GPUs - star <u>budget basel</u> re budget over budget (\$) ware budget	ting point (Ds ine (PEP) run / (underrun) (\$)	g @ 152 GPUs; - - (0)	FY14g @ 152 GI 847,000 (0) FY16 839,320	PUs) <u>1,114,000</u> (2) FY17 1,128,500 -	1,161,000 4 FY18 1,146,800	1,489,000 (1) FY19 1,405,448	(0) Total 4,520,068	BG/Q deployme	ent site		de Counts (FN	YY/YY: designate: AL) Name Ds Bc	s combined purchas # nodes 421 224	# GPUs 0 0	
33 34 35 36 37 38 39 40		Compute Compute BG/Q con Cluster co	hardware b bute hardwa hardware b npute hard ompute hard	f GPUs - star budget basel re budget over budget (\$) ware budget dware budget	ting point (Ds ine (PEP) run / (underrun) (\$)	g @ 152 GPUs; 	FY14g @ 152 Gl 847,000 (0) FY16 839,320 	PUs) 1,114,000 (2) FY17 1,128,500 - 1,038,220	1,161,000 4 FY18 1,146,800 1,055,056	1,489,000 (1) FY19 1,405,448 1,293,012	(0) Total 4,520,068 - 4,158,463	BG/Q deployme Cluster deploym	ent site nent site	FNAL Conven	ode Counts (FN) ntional Clusters	YY/YY: designates AL) Name Ds Bc FY14c Total	s combined purchas # nodes 421 224 <u>340</u> 985	# GPUs 0 0	Cores
33 34 35 36 37 38 39		Compute Compute BG/Q con Cluster co Storage ha	<i>hardware b</i> pute hardwa hardware b npute hard	f GPUs - star <u>oudget basel</u> re budget over oudget (\$) ware budget dware budget idget (\$)	ting point (Ds ine (PEP) run / (underrun) (\$)	g @ 152 GPUs; 	FY14g @ 152 GI 847,000 (0) FY16 839,320	PUs) <u>1,114,000</u> (2) FY17 1,128,500 -	1,161,000 4 FY18 1,146,800	1,489,000 (1) FY19 1,405,448	(0) Total 4,520,068	BG/Q deployme	ent site nent site r deployment site	FNAL Conven	de Counts (FN	YY/YY: designates AL) Name Ds Bc FY14c	s combined purchas # nodes 421 224 340	# GPUs 0 0	
33 34 35 36 37 38 39 40 41 42 43		Compute Compute BG/Q con Cluster co Storage has Storage has	hardware b bute hardware b hardware b npute hard mpute hard ardware bu	f GPUs - star <u>oudget basel</u> re budget over budget (\$) ware budget dware budget udget (\$) udget (\$)	ting point (Ds ine (PEP) run / (underrun) (\$)	g @ 152 GPUs; 	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359	PUs) 1,114,000 (2) FY17 1,128,500 - 1,038,220 67,710	1,161,000 4 FY18 1,146,800 1,055,056 68,808	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109	(0) Total 4,520,068 4,158,463 271,204	BG/Q deployme Cluster deploym BG/Q or Cluster	ent site nent site r deployment site nt site	FNAL Conven	ode Counts (FN) ntional Clusters	YY/YY: designates AL) Name Ds Bc FY14c Total Dsg	s combined purchas # nodes 421 224 340 985 76	# GPUs 0 0	Cores
33 34 35 36 37 38 39 40 41 42 43 44		Compute Comp Compute I BG/Q con Cluster co Storage hi Storage hi	hardware b bute hardwa hardware b npute hard ompute hard ardware bu ardware bu	f GPUs - star <u>pudget basel</u> re budget over budget (\$) ware budget dware budget digget (\$) idget (\$)	ting point (Ds ine (PEP) run / (underrun) (\$)	g @ 152 GPUs; 	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359	PUs) 1,114,000 (2) FY17 1,128,500 - 1,038,220 67,710	1,161,000 4 FY18 1,146,800 1,055,056 68,808	1,489,000 (1) FY19 1,405,448 1,293,012 84,327	(0) Total 4,520,068 4,158,463 271,204	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site	FNAL Conven	ode Counts (FN) ntional Clusters	YY/YY: designates AL) Ds Bc FY14c Total Dsg FY14g	s combined purchas # nodes 421 224 340 985 76 76 76	# GPUs 0 0	Cores
33 34 35 36 37 38 39 40 41 42 43 44 45		Compute Compute BG/Q con Cluster co Storage hi Storage hi Storage hi Total equi	hardware b bute hardware b npute hard ompute hard ardware bu ardware bu ardware bu ipment bud	f GPUs - star pudget basel re budget over budget (\$) ware budget dware budget dware budget dware budget (\$) idget (\$) idget (\$)	ting point (Dsg ine (PEP) run / (underrun) (\$) tt (\$)	g @ 152 GPUs; (0) FY15 - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,038,220 67,710 22,570 - 1,128,500	1,161,000 4 FY18 1,146,800 1,055,056 68,808 22,936 1,146,800	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448	(0) Total 4,520,068 - 4,158,463 271,204 90,401	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven	ode Counts (FN/ ntional Clusters - - - GPU Clusters	YY/YY: designate AL) Ds Bc FY14c Total Dsg FY14g Total	s combined purchas # nodes 421 224 340 985 76 76 76	# GPUs 0 0	Cores
33 34 35 36 37 38 39 40 41 42 43 44 45 46		Compute Compute BG/Q con Cluster co Storage hi Storage hi Storage hi Total equi	hardware b bute hardware b npute hard- ompute hard- ompute hard- ardware bu ardware bu ardware bu ipment budge	f GPUs - star <u>oudget basel</u> re budget over budget (\$) ware budget dware budget (\$) idget (\$) idget (\$	ting point (Dsg ine (PEP) run / (underrun) (\$) tt (\$) r IB clusters	g @ 152 GPUs; 	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786	PUs) 1,114,000 (2) FY17 1,128,500 67,710 2,570 1,128,500 50%	1.161.000 4 FY18 1.146.800 1.055.056 68.808 22.936 1.055.056 1.146.800 1.146.800	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 50%	(0) Total 4,520,068 - 4,158,463 271,204 90,401 - 4,520,068	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven	ode Counts (FN/ ntional Clusters - - - GPU Clusters	YY/YY: designate AL) Ds Bc FY14c Total Dsg FY14g Total	s combined purchas # nodes 421 224 340 985 76 76 76	# GPUs 0 0	Cores
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 47		Compute Compute I BG/Q con Cluster co Storage ha Storage ha Total equi % of comp Allocation	hardware b bute hardware b npute hard ompute hard ardware bu ardware bu ardware bu ipment bud pute budge for conv. c	f GPUs - star <u>budget basel</u> re budget over budget (\$) ware budget dware budget dware budget (\$) idget (\$) idget	ting point (Dsg ine (PEP) run / (underrun) (\$) tt (\$) r IB clusters	g @ 152 GPUs; (0) FY15 - - - - -	FY14g @ 152 Gl 847.000 (0) FY16 839.320 772,174 50.359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,038,220 67,710 22,570 1,128,500 50% 519,110	1.161.000 4 FY18 1.055,056 68,808 22,936 1,146,800 1,146,800 507,528	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 50% 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 - 4,520,068 2,079,231	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL	nde Counts (FN) ntional Clusters . GPU Clusters ode Counts (JLa	YY/YY: designate AL) Name Ds Bc FY14c Total Dsg FY14g Total Total	s combined purchas 421 224 340 985 76 76 152	# GPUs 0 0 0 152 152	Cores
33 34 35 36 37 38 39 40 41 42 43 44 44 45 46 47 48		Compute Compute BG/Q com Cluster cc Storage h: Storage h: Storage h: Total equi % of comp Allocation Direct porti	hardware b bute hardware b npute hard- mpute hard- ardware bu ardware bu ardware bu ipment bud poute budge for conv. c ion of conv. c	f GPUs - star <u>pudget basel</u> re budget over budget (\$) ware budget dware budget ddget (\$) idget (\$) idget (\$) idget (\$) idget (\$) t allocated fo cluster budget	run / (underrun) (\$) run / (underrun) (\$) et (\$) r IB clusters are (\$)	g @ 152 GPUs;	FY14g @ 152 Gl 847.000 (0) FY16 839,320 772,174 50,359 16,786 16,786 50% 386,087 386,087	PUs) 1,114,000 (2) FY17 1,128,500 67,710 22,570 2,570 1,128,500 50% 519,110 494,110	1,161,000 4 FY18 1,055,056 68,808 22,936 1,146,800 527,528 421,128	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 50%	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,922,831	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL	ode Counts (FN/ ntional Clusters - - - GPU Clusters	YYYYY: designate AL) Name Ds Bc FY14c Total Dsg FY14g Total ab) Name	# nodes 421 224 340 985 76 76 152 # nodes	# GPUs 0 0 0 152 152 # GPUs	Cores 16 16 Cores
33 34 35 36 37 37 38 39 40 41 41 42 43 44 45 46 47 47 48 49		Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Storage hi Storage ho Direct porti Overhead / Overhead /	hardware b hardware b nopute hard- mpute hard- mpute hard- mpute hard- ardware bu ardware bu ardware bu pipment bud pute budge for conv. c ion of conv. c	f GPUs - star <u>sudget baseli</u> re budget over budget (\$) ware budget dware budget (\$) idget (\$) idget (\$) idget (\$) idget (\$) t allocated fo cluster budget budget budget t allocater budget	run / (underrun) (\$) run / (underrun) (\$) et (\$) r IB clusters are (\$)	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 - 839,320 50% 386,087 386,087 386,087 25,000	PUs) 1,114,000 (2) FY17 1,128,500 67,710 22,570 1,128,500 50% 519,110 494,110 25,000	1.161.000 4 FY18 1.146.800 1.055.056 66.808 22,936 22,936 1,146.800 50% 527.528 421,128 106.402	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 50% 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,922,831 156,400	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL	nde Counts (FN)	YYYYY: designate AL) Ds Bc FY14c Total Dsg FY14g Total ab) Name 9q	* nodes 421 224 340 985 76 76 152 * nodes 320	# GPUs 0 0 152 152 152 # GPUs 0	Cores 16 16 16 8
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50		Compute Compute BG/Q com Cluster cc Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct porti Overhead j	hardware b boute hardware b npute hardware bu ardware bu ardware bu ardware bu pipment bud pote budge for conv. c for conv. c for conv. c for GPU h	f GPUs - star budget basel re budget over budget (\$) ware budget dware budget dware budget diget (\$) idget	run / (underrun) (\$) run / (underrun) (\$) et (\$) r IB clusters are (\$)	g @ 152 GPUs;	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 839,320 50% 386,087 361,087 25,000 386,087	PUs) 1,114,000 (2) FY17 1,128,500 1,038,220 67,710 22,570 1,128,500 519,110 494,110 25,000 519,110	1,161,000 4 FY18 1,046,800 1,055,056 68,808 22,936 1,146,800 50% 527,528 421,128 106,400 527,528	1,489,000 (1) FY19 1,405,448 1,233,012 84,327 28,109 1,405,448 50% 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 4,520,068 2,079,231 1,922,831 156,400 2,079,231	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL	nde Counts (FN)	YYYYY: designate AL) Ds Bc FY14c Total Dsg FY14g Total Total ab) Name 9q 10q	# nodes 421 224 340 985 76 76 152 # nodes 320 224	# GPUs 0 0 0 152 152 152 152 # GPUs 0 0	Cores 16 16 16 8 8 8
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51		Compute Compute B Compute B BG/Q com Cluster cc Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct porti Overhead J Allocation	hardware b hardware b npute hardwa mpute hard mpute hard ardware bu ardware bu ipment bud poute budge for conv. c ion of conv. c ion of conv. c ion of conv. c ion of conv. c	f GPUs - star budget baseli re budget over ware budget over dvare budget dvare budget dvare budget (\$) idget (\$) idget [\$) idget [\$] idget [\$] idg	run / (underrun) (\$) run / (underrun) (\$) et (\$) r IB clusters are (\$)	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 GI 847,000 (0) FY16 839,320 772,174 50,359 16,786 839,320 50% 386,087 25,000 386,087 25,000 386,087 26,000	PUs) 1,114,000 (2) FY17 1,128,500 67,710 22,570 1,128,500 50% 519,110 494,110 25,000 519,110 494,110	1.161.000 4 FY18 1.146.800 1.055,056 68,808 822,936 1.146,800 527,528 421,128 106,400 527,528 421,128	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 50% 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 156,400 2,079,231 156,400 2,079,231 1,922,831	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL	nde Counts (FN)	YYYYY: designate AL) Ds Bc FY14c Total Dsg FY14g Total ab) Name 9q 10q 12s	s combined purchas # nodes 421 224 340 985 76 76 76 152 # nodes 320 224 276	# GPUs 0 0 152 152 152 # GPUs 0	Cores 16 16 16 8
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52		Compute Compute B Compute B BG/Q com Cluster cc Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct porti Overhead J Allocation	hardware b boute hardware b npute hardware bu ardware bu ardware bu ardware bu pipment bud pote budge for conv. c for conv. c for conv. c for GPU h	f GPUs - star budget baseli re budget over ware budget over dvare budget dvare budget dvare budget (\$) idget (\$) idget [\$) idget [\$] idget [\$] idg	run / (underrun) (\$) run / (underrun) (\$) et (\$) r IB clusters are (\$)	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 839,320 50% 386,087 361,087 25,000 386,087	PUs) 1,114,000 (2) FY17 1,128,500 1,038,220 67,710 22,570 1,128,500 519,110 494,110 25,000 519,110	1,161,000 4 FY18 1,046,800 1,055,056 68,808 22,936 1,146,800 50% 527,528 421,128 106,400 527,528	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 4,520,068 2,079,231 1,922,831 156,400 2,079,231	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL	nde Counts (FN)	YYYYY: designate AL) Ds Bc FY14c Total Dsg FY14g Total Total ab) Name 9q 10q	# nodes 421 224 340 985 76 76 152 # nodes 320 224	# GPUs 0 0 0 152 152 152 152 # GPUs 0 0	Cores 16 16 16 8 8 8
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 53		Compute Compute Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct porti Overhead p Overhead p	hardware b houte hardware b npute hard mpute hard mpute hard ardware bu ardware bu ardware bu ardware bu bute budge for conv. c portion of conv. for GPU b ion of GPU b	f GPUs - star budget baseli re budget over budget (\$) ware budget over dware budget dware budget (\$) iddet (\$) iddet	ting point (Dsc ine (PEP) ran / (underrun) (\$) tr (\$) r IB clusters are (\$) get	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 GI 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 67,710 22,570 1,128,500 50% 519,110 494,110 25,000 519,110 494,110	1.161.000 4 FY18 1.146.800 1.055,056 68,808 822,936 1.146,800 527,528 421,128 106,400 527,528 421,128	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 156,400 2,079,231 156,400 2,079,231 1,922,831	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN)	YYYYY: designates AL) Name Bs C FY140 FY140 FY140 Total ab) Name 9q 10q 12s Total	s combined purchas # nodes 421 224 340 985 76 76 76 152 # nodes 320 224 276 820	# GPUs 0 0 0 152 152 152 152 # GPUs 0 0	Cores 16 16 16 8 8 8
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52		Compute Comp Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Storage hi Otal equi % of comp Allocation Direct porti Overhead g Estimated	hardware b houte hardware b npute hard mpute hard mpute hard ardware bu ardware bu ardware bu gipment bud for conv. c for conv. c mo d GPU b portion of GF portion of GF mo d GPU b	f GPUs - star budget baseli re budget over ware budget over dvare budget dvare budget dvare budget (\$) idget (\$) idget [\$) idget [\$] idget [\$] idg	ting point (Dsc ine (PEP) ran / (underrun) (\$) tr (\$) r IB clusters are (\$) get	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 GI 847,000 (0) FY16 839,320 772,174 50,359 16,786 839,320 50% 386,087 386,087 25,000 386,087 25,000	PUs) 1,114,000 (2) FY17 1,128,500 67,710 22,570 1,128,500 50% 519,110 494,110 25,000	1.161.000 4 FY18 1.146.800 1.055.056 68.808 22.936 1.146.800 527.528 421.128 106.400 527.528	1,489,000 (1) FY19 1,405,448 1,293,012 84,327 28,109 1,405,448 646,506 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,922,831 156,400 2,079,231 1,922,831 1,922,831 1,922,831 1,922,831 1,926,832 1,926,832 1,926,832 1,926,832 1,926,832 1,926,832 1,926,933 1,926,935 1,926,955 1,926,955 1,926,955 1,926,955 1,926 1,926,955	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN) ational Clusters . GPU Clusters ode Counts (JLa ational Clusters	YYYYY: designate AL) Ds Bc FY14c Total Dsg FY14g Total ab) Name 9q 10q 12s	s combined purchas # nodes 421 224 340 985 76 76 76 152 # nodes 320 224 276	# GPUs 0 0 152 152 # GPUs 0 0 0	Cores 16 16 16 8 8 8
33 34 35 36 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 55 56		Compute Comp Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Storage hi Otal equi % of comp Allocation Direct porti Overhead g Estimated	hardware b houte hardware b npute hard mpute hard mpute hard ardware bu ardware bu ardware bu gipment bud for conv. c for conv. c mo d GPU b portion of GF portion of GF mo d GPU b	f GPUs - star budget baseli re budget over budget (\$) ware budget dware budget dware budget dware budget (\$) idget (\$) idget (ting point (Dsc ine (PEP) ran / (underrun) (\$) tr (\$) r IB clusters are (\$) get	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,128,500 1,128,500 1,128,500 519,110 494,110 22,500 519,110 494,110 22,500 1,128,500 1,100 1	1.161.000 4 FY18 1.055.056 68.808 22,936 1.146.800 527.528 421.128 106.400 527.528 421.128 106.400 527.528	1.489,000 (1) FY19 1.405.448 1.203.012 84.327 28,109 1.405.448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,56,400 2,079,231 1,56,400 2,079,231 1,56,400 4,33	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN) ational Clusters . GPU Clusters ode Counts (JLa ational Clusters	YYYYY: designate AL) Ds Bc CFY14c Total Dsg FY14g FY14g Total ab) Name 9q 10g 12s Total 9g 9g	s combined purchas # nodes 421 241 340 985 76 76 76 76 76 76 76 20 224 276 820 36	# GPUs 0 152 152 152 # GPUs 0 0 0 144	Cores 16 16 16 8 8 8
33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57		Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct port Overhead g Estimated	hardware I hardware bu hardware bu ardware bu ardware bu ardware bu gridware bu gridware bu pipment bud bute budge for conv. c for GPU h on of corv. for GPU h portion of GF ard GPU t # of cluste # of GPUs	f GPUs - star budget baseli re budget over budget (\$) ware budget dware budget dware budget dware budget (\$) idget (\$) idget (ting point (Dsg ine (PEP) nun / (underrun) (\$) (\$) (\$) (\$) (\$) (\$) (\$) (\$) (\$) (\$	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,128,500 1,128,500 1,128,500 519,110 494,110 22,500 519,110 494,110 22,500 1,128,500 1,100 1	1.161.000 4 FY18 1.055.056 68.808 22,936 1.146.800 527.528 421.128 106.400 527.528 421.128 106.400 527.528	1.489,000 (1) FY19 1.405.448 1.203.012 84.327 28,109 1.405.448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,56,400 2,079,231 1,56,400 2,079,231 1,56,400 4,33	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN) ational Clusters . GPU Clusters ode Counts (JLa ational Clusters	YYYYY: designates AL) Name BS BC BC FY146 DS FY149 Total Total Sb) Name 9q 10q 128 Total 9g 10q 128	s combined purchas # nodes 421 224 340 985 76 76 76 76 152 # nodes 320 224 276 820 36 50	# GPUs 0 0 0 152 152 # GPUs 0 0 0 0 0 0 0 0	Cores 16 16 16 16 8 8 8 16 8 8 8 8 16 16 16 16 16 16 16 16 16 16
33 34 35 36 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 51 52 53 56 57 58		Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct port Overhead p Estimated Estimated	hardware b hardware b hardware bu ardware bu ardware bu ardware bu gipment bud porten bud porten drawere bu for conv. c for GPU h ion of GPU b portion of cas # of cluste # of GPUs iluster node	f GPUs - star <u>pudget basel</u> re <u>budget over</u> budget (\$) ware budget ware budget (\$) didget (\$) idget (\$) idget (\$) idget (\$) idget (\$) idget (\$) udget	ting point (Dsg ing (<u>PEP</u>) run / (underrun) (\$) tt (\$) r IB clusters are (\$) get hased	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,128,500 1,128,500 1,128,500 519,110 494,110 22,500 519,110 494,110 22,500 1,128,500 1,100 1	1.161.000 4 FY18 1.055.056 68.808 22,936 1.146.800 527.528 421.128 106.400 527.528 421.128 106.400 527.528	1.489,000 (1) FY19 1.405.448 1.203.012 84.327 28,109 1.405.448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,56,400 2,079,231 1,56,400 2,079,231 1,56,400 4,33	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN) ational Clusters . GPU Clusters ode Counts (JLa ational Clusters	VY/YY: designates AL.) Name Bc C FY14c FY14c FY14c FY14c Total bb) Name 9q 10q 10g 10g 10g 11g 12k	s combined purchas # nodes 421 224 340 985 76 76 76 76 76 224 224 224 224 224 224 36 50 7 42 152	# GPUs 0 0 0 152 152 152 152 # GPUs 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Cores 16 16 16 8 8 16 8 8 8 8 8 8 8 8 8 8 8 8
33 34 35 36 37 38 38 39 40 44 42 43 44 45 46 47 48 49 50 51 52 53 54 55 57 58 59 59		Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct port Overhead J Estimated Estimated Actual c	hardware I hardware bu hardware bu poute hardware bu ardware bu ardware bu ardware bu ardware bu ardware bu ordware bu gement bud oute budge for conv. c for conv.	f GPUs - star budget basel re budget over sudget (\$) ware budget dware budget dware budget dware budget diget (\$) idget (\$) id	ting point (Ds(ine (<i>FEP</i>) run / (underrun) (\$) tt (\$) tt (\$) get hased	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,128,500 1,128,500 1,128,500 519,110 494,110 22,500 519,110 494,110 22,500 1,128,500 1,100 1	1.161.000 4 FY18 1.055.056 68.808 22,936 1.146.800 527.528 421.128 106.400 527.528 421.128 106.400 527.528	1.489,000 (1) FY19 1.405.448 1.203.012 84.327 28,109 1.405.448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,56,400 2,079,231 1,56,400 2,079,231 1,56,400 4,33	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN) ational Clusters . GPU Clusters ode Counts (JLa ational Clusters	YVYYY: designates AL) Name BS BC FY142 Total Total Total Total Ab) Name 90 00 12s 12s Total 309 100 12s 12s 101 12s 101 12s 102 12s 102 12s 102 12s 12s 12s 12s 12s 12s 12s 12s 12s 12	s combined purchas # nodes 421 224 340 985 76 76 152 # nodes 320 224 276 820 36 50 7 42	# GPUs 0 0 1152 152 # GPUs 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Cores 16 16 16 16 16 16 8 8 8 16 8 8 8 8 16
$\begin{array}{c} 33\\ 34\\ 35\\ 35\\ 36\\ 37\\ 38\\ 39\\ 40\\ 41\\ 42\\ 43\\ 44\\ 45\\ 46\\ 47\\ 48\\ 49\\ 50\\ 51\\ 52\\ 53\\ 54\\ 55\\ 56\\ 57\\ 58\\ 59\\ 60\\ 60\\ \end{array}$		Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct port Overhead J Estimated Estimated Actual c	hardware I hardware bu hardware bu poute hardware bu ardware bu ardware bu ardware bu ardware bu ardware bu ordware bu gement bud oute budge for conv. c for conv.	f GPUs - star <u>pudget basel</u> <u>pudget (\$)</u> ware budget (\$) ware budget (\$) ware budget (\$) udget (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) udget (\$) videt (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) videt (\$) udget (\$) videt (\$)	ting point (Ds(ine (<i>FEP</i>) run / (underrun) (\$) tt (\$) tt (\$) get hased	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,128,500 1,128,500 1,128,500 519,110 494,110 22,500 519,110 494,110 22,500 1,128,500 1,100 1	1.161.000 4 FY18 1.055.056 68.808 22,936 1.146.800 527.528 421.128 106.400 527.528 421.128 106.400 527.528	1.489,000 (1) FY19 1.405.448 1.203.012 84.327 28,109 1.405.448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,56,400 2,079,231 1,56,400 2,079,231 1,56,400 4,33	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN)	VY/YY: designates AL.) Name Bc C FY14c Total Dgg FY14g Total bb) Name 9q 10q 12s Total 9g 10q 12s 12g 10g 11g 12k 12m Total	s combined purchas # nodes 421 224 340 985 76 76 152 # nodes 320 224 276 820 320 224 276 820 7 42 151	# GPUs 0 0 0 152 152 152 152 152 # GPUs 0 0 0 0 0 0 0 0 0 144 2000 288 64	Cores 16 16 16 16 8 8 8 8 16 8 8 8 16 16
33 34 34 36 37 36 37 39 40 44 42 44 45 66 50 51 50 51 51 52 53 54 55 56 57 55 56 57 59 60 60 61		Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct port Overhead J Estimated Estimated Actual c	hardware I hardware bu hardware bu poute hardware bu ardware bu ardware bu ardware bu ardware bu ardware bu ordware bu gement bud oute budge for conv. c for conv.	f GPUs - star <u>pudget basel</u> <u>pudget (\$)</u> ware budget (\$) ware budget (\$) ware budget (\$) udget (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) iddet (\$) udget (\$) videt (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) udget (\$) videt (\$) videt (\$) udget (\$) videt (\$)	ting point (Ds(ine (<i>FEP</i>) run / (underrun) (\$) tt (\$) tt (\$) get hased	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,128,500 1,128,500 1,128,500 519,110 494,110 22,500 519,110 494,110 22,500 1,128,500 1,100 1	1.161.000 4 FY18 1.055.056 68.808 22,936 1.146.800 527.528 421.128 106.400 527.528 421.128 106.400 527.528	1.489,000 (1) FY19 1.405.448 1.203.012 84.327 28,109 1.405.448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,56,400 2,079,231 1,56,400 2,079,231 1,56,400 4,33	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN)	VY/YY: designates AL.) Name Bc C FY14c Total Dgg FY14g Total bb) Name 9q 10q 12s Total 9g 10q 12s 12g 10g 11g 12k 12m Total	s combined purchas # nodes 421 224 340 985 76 76 76 76 76 224 224 224 224 224 224 36 50 7 42 152	# GPUs 0 0 0 152 152 152 152 152 # GPUs 0 0 0 0 0 0 0 0 0 144 2000 288 64	Cores 16 16 16 16 8 8 8 8 16 8 8 8 16 16
33 34 35 36 37 38 38 39 40 41 42 43 44 45 46 47 47 48 49 50 51 51 52 53 54 55 56 57 58 59 60 60		Compute Compute BG/Q con Cluster cc Storage hi Storage hi Storage hi Storage hi Total equi % of comp Allocation Direct port Overhead J Estimated Estimated Actual c	hardware I hardware bu hardware bu poute hardware bu ardware bu ardware bu ardware bu ardware bu ardware bu ordware bu gement bud oute budge for conv. c for conv.	f GPUs - star <u>pudget basel</u> <u>pudget (\$)</u> ware budget ware budget (\$) ware budget (\$) udget (\$) idget (\$) idget (\$) idget (\$) idget (\$) udget (\$) udget (\$) udget (\$) v. cluster budget r nodes purc purchased as purchased	ting point (Ds(ine (<i>FEP</i>) run / (underrun) (\$) tt (\$) tt (\$) get hased	g @ 152 GPUs; (0) FY15 - - - - - - - - - - - - -	FY14g @ 152 Gl 847,000 (0) FY16 839,320 772,174 50,359 16,786 	PUs) 1,114,000 (2) FY17 1,128,500 1,128,500 1,128,500 1,128,500 519,110 494,110 22,500 519,110 494,110 22,500 1,128,500 1,100 1	1.161.000 4 FY18 1.055.056 68.808 22,936 1.146.800 527.528 421.128 106.400 527.528 421.128 106.400 527.528	1.489,000 (1) FY19 1.405.448 1.203.012 84.327 28,109 1.405.448 50% 646,506 646,506 646,506 646,506	(0) Total 4,520,068 4,158,463 271,204 90,401 4,520,068 2,079,231 1,56,400 2,079,231 1,56,400 2,079,231 1,56,400 4,33	BG/Q deploymen Cluster deploym BG/Q or Cluster Non-deployment	ent site nent site r deployment site nt site ent	FNAL Conven FNAL Initial Cluster No JLab Conven	nde Counts (FN)	VY/YY: designates AL.) Name Bc C FY14c Total Dgg FY14g Total bb) Name 9q 10q 12s Total 9g 10q 12s 12g 10g 11g 12k 12m Total	s combined purchas # nodes 421 224 340 985 76 76 152 # nodes 320 224 276 820 320 224 276 820 7 42 151	# GPUs 0 0 0 152 152 152 152 152 # GPUs 0 0 0 0 0 0 0 0 0 144 2000 288 64	Cores 16 16 16 16 8 8 8 8 8 8 8 8 8 8 8 8 16 16