LQCD-ext II Project: Risk Register Summary

Sum of Risk Rating	Column Labels					
Row Labels	Cost	Schedule	Security	Service	Technolog	Grand Total
Exists	**0.925**	**0.375**	**0.075**	**0.775**	**1.325**	**3.475**
2 - Medium	**0.25**	**0.375**		**0.475**	**1**	**2.1**
01: Technology/systems may take longer than expected to become available		0.375				0.375
02: Cost projections for future years uncertain	0.25					0.25
05: Component performance-per-dollar may not improve as anticipated					0.25	0.25
08: Failure of a facility due to natural disaster				0.225		0.225
12: Technology changes have adverse effect					0.25	0.25
25: Conventional CPU roadmap encounters bottlenecks					0.25	0.25
40: TJNAF Computing Facilities Re-org				0.25		0.25
41: Software infrastructure may not be mature enough for newer computing architectures					0.25	0.25
3 - Low	**0.675**		**0.075**	**0.3**	**0.325**	**1.375**
03: Unexpected increases in life costs arise after systems are acquired.	0.125					0.125
04: Hardware acquired becomes obsolete before expected					0.05	0.05
07: Host institutions do not provide necessary infrastructure	0.125					0.125
10: Agency personnel changes reduce support for project	0.125					0.125
11: Major computer system failure					0.125	0.125
13: Changes in funding due to policy changes or new directives	0.125					0.125
16: Change in agency mission					0.025	0.025
17: Inappropriate use of computer resources			0.05			0.05
18: Unauthorized access to computing may disclose private information			0.025			0.025
19: Slow networking between sites inhibits productivity					0.025	0.025
20: Authentication differences affect inter-site transfers, productivity					0.05	0.05
21: Power costs could become substantial	0.05					0.05
26: Utility system failure at one of the facilities				0.125		0.125
27: Loss of nearline stored data				0.125		0.125
28: Stored data may get corrupted or lost				0.025		0.025
33: Reduced computing throughput due to summer high temperature loadsheds at FNAL				0.025		0.025
37: Staff changes have adverse effect					0.05	0.05
38: Inaccurate Storage Forecasting	0.075					0.075
39: Inadequate Lustre Support	0.05					0.05
Retired	**0.225**	**1.975**		**0.125**	**0.75**	**3.075**
Grand Total	**1.15**	**2.35**	**0.075**	**0.9**	**2.075**	**6.55**

Risk ID	Risk Title	Risk Area	Description	Probability of Occurrence	Impact of Occurrence	Risk Rating	Risk Priority
1	01: Technology/systems may take longer than expected to become available	Schedule	The schedule for achieving LQCD investment milestones might slip for the following reasons: a) Vendors may take longer than anticipated to bring new processors, memory systems, and/or interconnect systems to market; b) It may take longer than expected to bring new systems on-line for production use.	High	Moderate	0.375	2 - Medium
2	02: Cost projections for future years uncertain	Cost	Although cost projections for the current budget year are reasonably precise, projections for subsequent years become progressively uncertain.	Medium	Moderate	0.250	2 - Medium
3	03: Unexpected increases in life costs arise after systems are acquired.	Cost	Unexpected increases in life costs arise after systems are acquired.	Low	Moderate	0.125	3 - Low
4	04: Hardware acquired becomes obsolete before expected	Technology	Obsolecence: The hardware acquired by this investment becomes obsolete before the end of the planned operations and so does not deliver scientific computing for LQCD calculations in a cost-effective manner.	Medium	Low	0.050	3 - Low

5	05: Component performance-per-dollar may not improve as anticipated	Technology	Feasibility: The performance of commodity hardware components may not improve or their price may not drop as rapidly as anticipated, resulting in the investment failing to meet performance goals in the later years of the project.	Medium	Moderate	0.250	2 - Medium
6	06: Multi-processor systems fail more frequently as they grow more complex	Technology	Complex multi-processor systems fail more frequently as they grow in size, leading to failure of the project to meet technical performance goals (delivery of computing capability).	Low	Moderate	0.125	3 - Low
7	07: Host institutions do not provide necessary infrastructure	Cost	Dependency: Host institutions will not provide space, network connectivity, and mass storage.	Low	Moderate	0.125	3 - Low
8	08: Failure of a facility due to natural disaster	Service	Surity: A major failure of a facility due to natural disaster (destruction of buildings, utility systems)	Low	Severe	0.225	2 - Medium

9	09: Community purchases affect the market	Technology	Monopoly: Community becomes such a large purchaser of components that it affects the market for them.	Low	Moderate	0.125	3 - Low
10	10: Agency personnel changes reduce support for project	Cost	Agency personnel changes, limiting continuity and support for this investment.	Low	Moderate	0.125	3 - Low
11	11: Major computer system failure	Technology	A major system, such as a cluster or a high performance network, fails to meet performance specifications such that our ability to achieve scientific goals is compromised and the investment does not meet technical goals.	Low	Moderate	0.125	3 - Low
12	12: Technology changes have adverse effect	Technology	Performance: Changes in technology can have adverse effects on the project.	Medium	Moderate	0.250	2 - Medium
13	13: Changes in funding due to policy changes or new directives	Cost	Changes in funding, due to alteration in administration policy, or legislative directives.	Low	Moderate	0.125	3 - Low
14	14: Loss of archival stored data	Service	Loss of archival stored data.	Low	Moderate	0.125	3 - Low
15	15:Technology fails to meet expectations	Technology	Commercial technology does not fulfill expectations, and in the later years of the investment the project cannot meet technical objectives	Low	Moderate	0.125	3 - Low

16	16: Change in agency mission	Technology	Changes in the mission and plans of the Office of Science.	Low	Low	0.025	3 - Low
17	17: Inappropriate use of computer resources	Security	Inappropriate use of computer resources by authorized or unauthorized personnel	Medium	Low	0.050	3 - Low
18	18: Unauthorized access to computing may disclose private information	Security	Unauthorized access to computing hardware can disclose private information.	Low	Low	0.025	3 - Low
19	19: Slow networking between sites inhibits productivity	Technology	Slow Internet data transfer rates among the three labs and external sites may inhibit productivity	Low	Low	0.025	3 - Low
20	20: Authentication differences affect inter-site transfers, productivity	Technology	Differing authentication schemes among the three labs makes data transfers difficult which limits productivity	Medium	Low	0.050	3 - Low

21	21: Power costs could become substantial	Cost	The direct (electricity for computers) and indirect (electricity for cooling the computers) costs to the DOE could be substantial in the later years of the project.	Medium	Low	0.050	3 - Low
22	22: Delay in AMD Quad CPUs affects JLab deployment	Schedule	Delay in the release of AMD Quad-processors for Jlan 7n cluster deployment	Medium	Moderate	0.250	2 - Medium
23	23: Schedule delay in technology for FNAL FY08 deployment	Schedule	Schedule concern for the processor & chipset delivery for FNAL FY08 cluster deployment	Medium	Moderate	0.250	2 - Medium
24	24: DOE funding unavailable beyond FY14	Cost	Risk of unavailability of DOE funding beyond the end of the project (end of FY14)	Low	Severe	0.225	2 - Medium
25	25: Conventional CPU roadmap encounters bottlenecks	Technology	Conventional multi-processor systems may not perform adequately due to unforseen bottlenecks as core counts rise that are not addressed adequately in software, leading to failure of the project to meet technical performance goals (delivery of computing capability and/or capacity)	Medium	Moderate	0.250	2 - Medium
26	26: Utility system failure at one of the facilities	Service	Utility system failure at one of the facilities	Low	Moderate	0.125	3 - Low
27	27: Loss of nearline stored data	Service	Reliability: Loss of nearline stored data.	Low	Moderate	0.125	3 - Low

28	28: Stored data may get corrupted or lost	Service	Data Integrity: Some stored data may get corrupted or lost. Some LQCD data products, such as gauge configurations and very large quark propagators, are very valuable in terms of the computing required to reproduce them in case of loss or corruption.	Low	Low	0.025	3 - Low
29	29: GPU software infrastructure may not be available as expected	Technology	Starting in FY11, LQCD-ext began splitting funds for hardware purchases between conventional and GPU-accelerated clusters to address the predicted growing demand. However, the software libraries and/or physics applications necessary to fully exploit GPU and/or many-core-based systems may not be available in time to generate adequate user demand for the quantity of such deployed accelerated systems, leading to failure of the project to meet technical performance goals (delivery of computing capability and/or capacity).	Low	Moderate	0.125	3 - Low

30	30: Delay in FY12 Federal Budget process	Schedule	Extensive delays in the FY12 Federal budget process may prevent the project from meeting the schedule for the year's deployment milestone.	Medium	Severe	0.450	2 - Medium
31	31: Delay in FY13 Federal Budget process	Schedule	Extensive delays in the FY13 Federal budget process may prevent the project from meeting the schedule for the year's deployment milestone.	Medium	Moderate	0.250	2 - Medium
32	32: Delay in FY14 Federal Budget process	Schedule	Extensive delays in the FY14 Federal budget process may prevent the project from meeting the schedule for the year's deployment milestone.	High	Moderate	0.375	2 - Medium
33	33: Reduced computing throughput due to summer high temperature loadsheds at FNAL	Service	Starting in FY11, during very high temperature days at Fermilab, a fraction (30%, then 50% if temperatures are extremely high) of computing is brought offline to lower the produced heat load. The capacity of the cooling infrastructure in the computer room holding most of the FNAL LQCD hardware is exceeded on such days.	Low	Low	0.025	3 - Low

34	34: BlueGene/Q software infrastructure may not be available as expected	Technology	Starting in FY13, LQCD-ext included a BlueGene/Q prototype system and production system at BNL. However, the job scheduling software may not be available in time to fully exploit the compute cycles available in these systems, leading to failure of the project to meet technical performance goals (delivery of computing capability and/or capacity).	Medium	Moderate	0.250	2 - Medium
35.1	35.1: Delay in FY15 Federal Budget process - CR Scenario	Schedule	Extensive delays in the FY15 Federal budget process may prevent the project from meeting the schedule for the year's milestones. Result is that we operate under a CR.	Low	Low	0.025	3 - Low
35.2	35.2: Delay in FY15 Federal Budget process - Impasse Scenario	Schedule	Extensive delays in the FY15 Federal budget process may prevent the project from meeting the schedule for the year's milestones. Result is a complete impasse and no funds are released.	Low	Moderate	0.125	3 - Low
36	36: Delayed start in FY15 due to project transition	Schedule	Extensive delays in the new project/extension funding may prevent the project from meeting the schedule for the year's deployment milestone.	Medium	Moderate	0.250	2 - Medium
37	37: Staff changes have adverse effect	Technology	Performance: Changes in staff can have adverse effects on the project.	Medium	Low	0.050	3 - Low
38	38: Inaccurate Storage Forecasting	Cost	Changes in science algorithms or storage use patterns could lead to underestimation of future storage needs which drive up costs or limit the science that can be done with the deployed CPU's.	High	Low	0.075	3 - Low

39	39: Inadequate Lustre Support	Cost	Lustre may require more site effort than currently expected (for a fixed amount of storage) if vendor support or storage operating characteristics change.	Medium	Low	0.050	3 - Low
40	40: TJNAF Computing Facilities Re-org	Service	TJNAF is re-organizing its computing facilities to meet a PUE goal of 1.4 by December 2015. This will mean one or two full outages (power transitions, Lustre relocation) plus rolling downtime for compute cluster as racks are moved and/or reconfigured.	Medium	Moderate	0.250	2 - Medium
41	41: Software infrastructure may not be mature enough for newer computing architectures	Technology	41: Software infrastructure may not be mature enough for the latest highest-performing architectures to allow the project to exploit the otherwise most cost-effective hardware	Medium	Moderate	0.250	2 - Medium

Risk Status	Creation Date	Last Review Date	Next Review Date	Last Change	Mitigation Strategy
Exists	7/1/04	4/8/15	7/15/15	No change	For more than a decade now, the LQCD Integrated Project Team has worked on multiple large cluster hardware procurements with significant success. Experienced professional staff follow the commodity market carefully and gain insight by evaluating prototype hardware. They meet with vendors frequently under non-disclosure agreements and are briefed on roadmaps for components such as processors, chipsets, motherboards, network interface cards and switches. In addition to working closely with manufacturers and system integrators, the team has the capability of testing pre-release components. Working with the manufacturers, the team is aware of the strengths and weaknesses in vendor products. The team is able to determine whether new capabilities will actually provide any advantage in future system procurements. The team plans to use past procurement methodologies, fine tuning them as appropriate.
Exists	7/1/04	4/8/15	7/15/15	No change	Market information is gathered and prototypes are built throughout the lifetime of the project. Open procurements of commodity components allow for competitive prices. Since hardware is modular in nature, if prices exceed expectations in any given year, it is possible to deploy smaller machines. . A level of performance contingencies are maintained for all procurements.
Exists	7/1/04	4/8/15	4/15/16	No change	Hardware maintenance costs are included in procurement of components for each new system procured (each year). Operations costs are well understood based on years of similar operational experience. Each of the three host institutions (FNAL, TJNAF, and BNL) has operated computing equipment for LQCD computing for more than 10 years. Since the LQCD project is staffed by few key professionals, the loss of any of them is likely to affect the performance of the project; this risk is accepted “as-is” although the project does strive through cross-training and other efforts to maintain expertise across and among the staffs at the three sites.
Exists	7/1/04	4/8/15	4/15/16	4/8/2015: Mitigation strategy text: typically for 4.5 years (was 3 years)	Clusters purchased by this investment are operated typically for 4.5 years, and subsequently retired. These assumed lifetimes are consistent with historical life cycles observed on similar hardware over the last decade.

Exists	7/1/04	4/8/15	7/15/15	No change	In any year this risk is low for the current budget year since the price/performance ratio is well defined for the current year. However, the risk increases when planning for the succeeding year. The strategy is to follow the market carefully, and build prototypes before developing large production machines. Components of clusters are carefully selected for cost effectiveness. Thus, if the network performance does not improve as expected, money can be saved on nodes by selecting slower, more cost effective CPUs whose speed will not be wasted because the network limits overall performance. This savings on each node will enable purchasing a larger number of nodes. Performance goals are set more conservatively for the later years in the project to account for market evolution uncertainty. Shifting budget from conventional to GPU-accelerated clusters recovers expected performance levels for those codes that have been ported and optimized.
Retired	7/2/04	4/22/11	(none)	No longer an issue	Closed
Exists	7/1/04	4/8/15	4/15/16	No change	The required computer room space is available at each of the host institutions. Only a small fraction of the Internet bandwidth and mass storage of the laboratories is required to support the LQCD computing project. The experiments that are the main users of computer facilities are a high priority for each of the laboratories, and the computer space, and network and mass storage resources will continue to evolve to support these experiments in a way that will also meet the needs of this investment. Further, the project maintains Memoranda of Understanding (MOU) with each institution which detail the resources which are to be committed. In any given year, should one of the three host institutions predict that it would not be able to provide the required resources in a later year; the project will plan to shift deployment of hardware to one of the other host institutions.
Exists	7/1/04	4/8/15	7/15/15	No change	LQCD computer facilities are located within large buildings suitable for large computing installations. These building are not necessarily hardened for natural disasters. To make them disaster-proof would be extremely expensive. The impact of a disaster is severe because this will impact the scientific delivery schedule significantly. However, the probability of occurrence is low. The project accepts this risk.

Retired	7/1/04	3/1/12	(none)	Deemed to be a on-issue	Closed
Exists	7/1/04	4/8/15	4/15/16	No change	DOE staff has knowledge of the investment, and have been providing support for over six years. As the investment spans multiple programs, this expertise is not limited to a single individual, and so the impact of a single change is minimal. The existence of an Integrated Project Team, whose composition includes Federal personnel, also mitigate risks due to agency personnel changes. A rigorous review process has been established to mitigate risks, including monthly and quarterly reports and annual reviews.
Exists	7/1/04	4/8/15	4/15/16	4/8/2015: Clarify that this risk applies to all systems, even though the mitigation only treats the most likely case.	While this risk applies to all systems in principle, we focus our mitigation strategy on new systems since, in our experience, that is where this is much more likely to occur. The project evaluates prototype machines before procuring and installing production hardware. The project also builds appropriate acceptance criteria into major purchases. During the acceptance testing phase lasting 30 days, the system is tested thoroughly. If the system is deemed to be unacceptable, it can be returned to the supplier under the warranty condition. The project procures systems with a minimum 3 year warranty service. Also, each project purchase represents an addition of <= 50% to the deployed CPU power, which limits the impact of this risk. Even if a new system completely failed to perform despite the aforementioned safeguards, at worst only 1/3 of the post-purchase CPU power is affected. The loss of any one resource for 2-3 months would not result in a major impact on project deliverables.
Exists	7/1/04	4/8/15	7/15/15	No change	Project personnel continually study and understand changes in technology that impact the investment. The project maintains a broad range of expertise within its staff.
Exists	7/1/04	4/8/15	4/15/16	No change	The investment allocates resources and builds new computing capabilities on a yearly basis, so it is possible to adjust to changing funding levels. This is particularly so because the systems are modular, so reductions in funding can be adjusted for by reducing the size of the systems. Such reductions may delay reaching computational and scientific milestones. A strategy is not available which mitigates the loss of technical computing capability due to substantial decreases in funding.
Retired	7/1/04	7/21/09	(none)	Split into two risks	Closed
Retired	7/1/04	7/21/09	(none)	Deemed to be a non-issue	Based on the past experience of the project, commercial technology has fulfilled the expectations of the project. During the history of the project, this was never a problem. However, the project personnel continue to pursue comprehensive benchmarking and testing of individual components, building prototypes, and performing acceptance tests.

Exists	7/1/04	4/8/15	4/15/16	No change	The computing systems acquired by this investment for LQCD computing have a broad range of applicability in other areas of computational science and could be put into other scientific uses. This is an accepted “as-is” risk.
Exists	7/104	4/8/15	4/15/16	No change	The computing hardware acquired and operated by this investment is included in enclaves at each of the three sites (FNAL, TJNAF, and BNL). These enclaves have approved C&As according to Federal guidelines (NIST, DOE). Strong authentication is required for access to the systems. The computer resources are on private networks behind these secure systems. The project will coordinate security with the host laboratories. Usage is carefully monitored and controlled by batch systems. Performance is also carefully monitored, so any unauthorized usage would be quickly noticed and terminated. On clusters, batch systems automatically terminate user processes at the end of each job and before each new job starts up. Thus, any unauthorized process would be terminated.
Exists	6/1/05	4/8/15	4/15/16	No change	No classified information, sensitive data, or personally identifiable information is stored on the systems. No privacy risks are present because the lattice QCD systems acquired and operated by the investment contain no personally identifiable information. To enforce this, LQCD users are required to comply with security policies established by respective laboratories.
Exists	6/1/05	4/22/15	4/15/16	4/22/2015: Rewrote mitigation stategy to address improvements in networking in past few years.	At FNAL, a dedicated node to be used for intersite transfers (via GlobusOnline) was deployed in 2013 with 10 gigE connectivity to the internet and QDR Infiniband connectivity to the FNAL LQCD Lustre filesystem. When users report slow transfers, Fermilab networking staff have worked with external sites (for example, Globus Online, ANL, NCSA) to determine and repair the causes of any bottlenecks. Similarly, JLab has a dedicated 10 gigE / 40g IB data gateway hosting GlobusOnline, with (shared) 10 gigE to ESnet; network experts work with ESnet to diagnose any slow connections.
Exists	6/1/05	4/8/15	4/15/16	4/8/2015: Modest text change in mitigation strategy	FNAL, BNL, and TJNAF network staff tunes parameters to optimize transfers. Scientific allocations of time on the LQCD computing clusters takes into account the quantity of data which must be transferred between sites; if network performance would limit productivity, allocations are made such that analysis jobs would run at the same site as data are stored (i.e., to minimize transfers). This is an accepted risk for the project since controls for computer security protections are expected to become stricter in near future. Site Managers try to mitigate this risk by addressing helpdesk requests and better documentation.

Exists	8/8/05	4/8/15	4/15/16	No change	Project staff uses historical power trends to predict electrical costs. The project also tracks actual power consumption of new systems. The project also specifies power consumption criteria for new procurements to prefer lower power components. The project is always investigating new cost saving and effective computer cooling technologies.
Retired	7/7/07	3/16/10	(none)	No longer an issue	Closed
Retired	7/7/07	7/21/09	(none)	No longer an issue	Closed
Retired	7/7/07	10/15/14	(none)	10/15/2014: Retire risk since LQCD-ext II has achieved CD-3 approval.	The project must accept this risk. Since we will not know the future project/extension funding decision until after FY14 funds have been committed, we will address this by adding some flexibility to the FY14 acquisition in case some funds need to be held for operations of existing facilities to their end-of-life. See Risk Item #32 for a potential mitigation strategy.
Exists	7/21/09	4/8/15	7/15/15	4/8/2015: Increased probability to Medium	The LQCD computing project has been using multi-processor systems for a while now without experiencing any major software issues. However, there is a possibility that the LQCD software may come across some issues with multiprocessor systems, particularly with memory bandwidth constraints and complex caching behavior. Even so, peak flops and memory bandwidth per socket continues to rise, with trends that are known to be continuing for the next 2 years. The LQCD staff and the off-project LQCD software development team is watching for any issues, taking various actions as necessary
Exists	7/21/09	4/8/15	4/15/16	4/8/2015: Adjusted mitigation strategy text.	There is a moderate possibility of a single-site utility failure. However, the deployment of SciDAC LQCD software libraries at each site allows end users to shift their scientific production easily from one host institution to another. Should a significant disruption occur, critical scientific production (as determined by the Scientific Program Committee and the Lattice QCD Executive Committee) could continue by such a shift. This may require other less important production to be slowed or delayed. Note that no mitigation strategy is available which could sustain the normal rate of computations should one of the facilities suffer a major utility outage.
Exists	7/1/04	4/8/15	4/15/16	4/8/2015: Adjusted mitigation strategy text.	The LQCD computing project makes every effort to provide adequate near-line storage to run the simulation jobs. This includes Lustre based storage at FNAL and TJNAF. Related procedures and technologies are refined continuously. Currently, the project has more than adequate near-line storage. A formal decision has been made that LQCD project is not responsible for the archival storage data. The project refreshed all aging storage hardware in FY13, and in FY15 will being migrating from an older Lustre v1.8 to a more stable v2.5 release.

Exists	8/18/09	4/8/15	4/15/16	No change	The most precious LQCD data products (i.e., the most expensive to reproduce) are gauge configurations. By USQCD policy, overseen by the Executive Committee, to prevent against loss these configurations are stored on tape at two or more geographically diverse sites. The responsibilty for this storage is held by the individual physics collaborations that have generated the particular data ensembles. To guard against silent corruption, by policy these files must be written with checksum (32-bit CRC) data that can be compared on subsequent access to determine whether any data changes have occurred. The USQCD standard I/O library, QIO, can be used to calculate, store, and compare these CRC data. The USQCD user community are also urged in documentation and at the annual collaboration meeting to use this data integrity facility of QIO to guard quark propagator and other data products. Also, single gauge configurations can be regenerated from prior gauge configurations.
Retired	4/22/11	4/9/14	(none)	Retired 4/9/2014 since GPU software infrastructure is available nowadays.	4/13: SciDAC GPU libraries now include auto-tuning which can in many cases accomodate GPU architecture changes, such as the changes between the current NVIDIA "Kepler" and previous "Fermi" GPU, without requiring extensive re-optimization. 4/12: Each year the project assesses demand for the various hardware types based on proposals submitted by USQCD members to the allocation process. The project acquisition plan is modified annually based on these data to buy more or less accelerated hardware. 4/11: Large-scale GPU-accelerated clusters for LQCD were first deployed at JLab as part of the NP-funded ARRA LQCD project (2009-1013). Time on these clusters is allocated by the same USQCD Scientific Program Committee that allocates time on the LQCD-ext clusters. The LQCD-ext works very closely with the JLab ARRA project personnel to understand all aspects of GPU-accelerated clusters, including reliability, design, and user requirements. LQCD-ext also interacts with the Scientific Program Committe and USQCD Executive Committee to determine the level of demand for this type of resource. This projected demand is used to size the purchase of a GPU-accelerated cluster in any given year, and other user requirements are used to determine the optimal design. Should a given cluster not meet the needs of specific applications that emerge in a later year, subsequent GPU-accelerated cluster purchases can directly address these needs.

Retired	2/1/11	4/22/11	(none)	Retired - 4/9/2013	The project must accept this risk. The FY10 "Ds" procurement contract allows in FY11 for the purchase of additional racks through the exercise of options. LQCD-ext requested and received an extension until June 30 (from March 31) for these options. FY11 spending has been throttled at FNAL because of the continuing resolution. As a result, half of the planned "Ds" expansion was initiated once sufficient funds were available (Feb 2011). The rest of the "Ds" expansion will be initiated once the remaining FY11 funds are released. The planned GPU-accelerated cluster procurement will be delayed until FY11 funds are released; however, the project is preparing technical specifications and performing benchmarking of prototype hardware so that, once the funds are available, the procurement can proceed as rapidly as possible.
Retired	4/9/13	10/24/13	(none)	Retired - 10/24/2013	The project must accept this risk.
Retired	4/9/13	8/20/14	(none)	Retired - 8/20/2014	Because we are operating under a continuing budget resolution, project funds could possibly arrive in multiple disbursements. If realized, such a scenario would result in the project structuring the purchase such that equipment arrived over the course of many months, via a base purchase and one or more option purchases. The full system would not come online by the July 1 milestone date, but rather a fraction of the full system (the "base purchase") could come online by that date, with additional increments of computing capacity brought online following the schedule of receipt of equipment funds. In addition to the schedule impact, equipment costs would also likely be higher and so total deployed capacity would be lower. However, the project's Program Manager has asked the DOE that all equipment funds be made available in one disbursement. If this holds, the entire system would be released to production at one time. The time between receipt of funds and release to operation is approximately 7 months. To meet the July 1 milestone date, an RFP would have to be released to vendors by mid-January. The time between receipt of funds and release of an RFP is three to four weeks.
Exists	4/15/13	10/15/14	9/15/15	10/15/14: Reduce Impact to Low since work has been done, just not yet tested by sufficiently hot days.	Fermilab received DOE funding in FY14 to remediate the cooling issues at the GCC computer rooms. The external condenser units will be relocated in stages from ground level to the roof of the building. This work will be performed in stages during winter and spring 2014. When finished, the three GCC computer rooms should be able to operate at full capacity on the hottest summer days. 10/15/2014: This work has been done, but requires sufficiently hot weather to test. FNAL Summer 2014 had only 2 days above 90 degrees F, which was not sufficient. Review risk again after Summer 2015.

Retired	4/17/13	4/9/14	(none)	Retired 4/9/2014 since BG/Q software infrastructure is available nowadays.	Installation of Job scheduling software was unsuccessful on the prototype BlueGene/Q systems. To mitigate any deleterious effects on utilization of the resource, a manual system of allocations was established. Though more labor intensive, this manual method has been found to work well in practice and has demonstrated a sufficiently high utilization percentage of the machine.
Retired	10/24/13	3/25/15	(none)	3/25/2015: funds have flowed to sites, so risk is now moot.	The project must accept this risk. We can now cover 1 month of operations costs in case of short-term funding disruptions. Under CR rules, we will be able to maintain operations at expected levels and should be able to achieve our performance milestones. 10/15/2014: We are in CR until at least 12/15/2014. We will review 35.1/35.2 again at that time. 1/14/2015: Funding bill passed and signed 12/18/2014, but funds are not flowing yet. Keep risk active until we see the funds actually flowing from Office of Science.
Retired	10/24/13	1/14/15	(none)	Retired - 1/14/2015. Funding bill passed and signed into law 12/18/2014.	The project must accept this risk. We can now cover 1 month of operations costs in case of short-term funding disruptions. Beyond 1 month, we will have to reduce/eliminate operations support which will severely threaten our ability to meet our performance milestones.
Retired	10/24/13	8/20/14	(none)	Retired - 8/20/2014. There are no deployment goals for FY15.	The project must accept this risk. The risk has become moot since there are no deployment milestones in FY15.
Exists	7/1/04	4/22/15	4/15/16	4/22/2015: Set to impact to Low, add Notes about variants.	The project maintains staff depth in key roles: Project Manager, BNL Site Manager, FNAL Site Manager, and TJNAF Site Manager. For these roles, an active deputy exists who can fill the role if and when necessary. This should keep the impact of any one key staff member Low, assuming we lose only one key staff member within a period of 6 months.
Exists	8/20/14	10/15/14	10/15/15	10/15/14: Create per CD-2/3 report for LQCD-ext II	Annual review of storage needs and use patterns. Continue to employ storage "costing" in the allocation model to encourage efficient use of storage, as is done with CPU time, without negatively impacting science production. Discourage storage use not directly related to USQCD science goals.

Exists	8/20/14	4/8/15	4/15/16	No change	Annual review of effort expended in Lustre support and revision of forecasted support effort level. In FY15 in particular, we plan to upgrade Lustre systems to v2.5, which could spike the support effort required. We will track the upgrade effort expected/required to determine whether fallback plans are required. We can delay one or both site upgrades, slow one or both site upgrades to reduce effort expended to a tolerable level, or stagger the upgrades across the sits. The real impact is to draw personnel away from other tasks, thus degrading operations, which could have a scientific impact.
Exists	8/20/14	10/15/14	10/15/15	No change	TJNAF has to move to a hot-aisle containment computing center design with a new high efficiency UPS in order to meet a PUE goal value of 1.4 by December 2015. Cooling capacity and efficiency will also be upgraded during this transition. Storage and CPUs will moved a few racks at a time. Chip's plan is to use base-funded computing to augment project computing during this period in order to average 100% up-time for the project site across the year, but some excursions are expected at about the few percent level plus a few days of outages. There is not a lot of contingency in the plan. If a temporary external chiller were to fail, as one did in the past, then this could have a 1-3% impact on the overall average uptime for TJNAF.
Exists	4/22/15	4/22/15	7/15/16	4/22/2015: Added new risk. Similar to 29 (retired) and 25.	It is not necessary to suddenly have 100% of our software able to absorb a new architecture, as we are always running machines as much as 4 years older. Thus, in a single year, the newest machine might be only 25% - 33% of the total project capacity. In each procurement, we optimize the old+new machines to maximize science across a portfolio of applications (some more mature than others with respect to newest hardware). The computing project does not develop application software, and so can only interact with the complementary projects to attempt to optimize the science output across all relevant projects and machines.

Notes
If conventional clusters remain competitive for next two years, the risks will remain same.

Based on the experience of the LQCD project gained since 2006 with very large multiprocessor (multicore) systems, such systems have a proven record of reliability for LQCD production. Further, as the number of cores per processor and the number of processors per node has increased, the number of nodes in an LQCD cluster has started to decrease, lowering the complexity related to node count and networking. This is no longer a risk.

Archival storage is out of scope for the LQCD project. The project is not responsible for the archival data.
Technology is keeping pace

Transfer needs between FNAL and TJNAF are minimal. Transfer needs between FNAL and BNL are rare and the connectivity is excellent. Transfer needs between TJNAF and BNL are minimal. Transfer needs are more frequent from Leadership class computing to LQCD computing sites. Although transfer rates between ANL and FNAL are not an issue, there are sporadic issues with transfers from Oak Ridge to FNAL. Oak Ridge to TJNAF: any transfer problem occurs in bursts, mostly with propagators. Transfer problems are often solved by providing better tools to users (e.g. BBFTP, Globus Online) or suggesting procedural changes such as pre-staging from tape to disk.

Although delayed, the project received funding for FY10-11. Laboratory loaded the budget from the month of February 2010.
This item is being discussed when the new proposal process is underway, per plan.
Although it is possible to reduce the risk at FNAL by implementing remedial actions, there is no funding available. This is considered as an accepted risk and will remain true during FY12-14. In FY13 Fermilab will site new hardware in a second computing room that is not subject to summer high temperature loadsheds.
Probability of loss (partial loss) has increased because of the aging of storage hardware at FNAL.

TJNAF checks MD-5 checksum of files coming back from tape (and for raw data from experimental program calculates it soon after it is written to disk in the counting house). These checks insure that retrieved data is never corrupted by the tape library.

4/12: Since 2009, clusters accelerated with GPUs purchased under the LQCD ARRA project at TJNAF have had a very positive impact on physics production for those calculations for which optimized software was available. Since the beginning of the project in FY10, there was strong uptake by the user community for the use of GPU-based systems for nuclear physics calculations based on the clover-improved wilson action as well for a portion of the various BSM and other smaller projects. This demand was met for USQCD by ARRA hardware at TJNAF. Recently, there has been additional uptake by the portion of the community utilizing the staggered and HISQ actions; the resulting demand has been addressed by LQCD-ext GPU-accelerated hardware purchased in FY11.
Initiatives by the USQCD community are in progress to address the more complex problem of porting software for the Domain Wall action to GPUs.
4/11:This item will remain in the same status during FY12 to FY14. To date, among large LQCD projects, only Clover is GPU ready. Work on getting DWT, Staggered, and other projects is in progress. About 15% of smaller projects are GPU ready.

This condition causes the project to fall short of its GPU performance goals and perhaps just meet its CPU performance goals. While we mitigated the delay in acquiring new hardware by extending the life of existing systems, these could not deliver sufficient performance to make up for the delay.
While the facilities work in the GCC computer rooms has been completed, FNAL Facilities would like to wait one more year before declaring the loadsheds will no longer be necessary. They are significantly less likely now though, so probability has been reduced to Low.

Refocus this risk on performance milestones instead of just deployment milestones. We have no FY15 deployment milestones, but our performance may still be hindered if we lack funds for operations support.
Refocus this risk on performance milestones instead of just deployment milestones. We have no FY15 deployment milestones, but our performance may still be hindered if we lack funds for operations support.
Risk Item #24 treats the case of NO funding beyond FY14 for LQCD-ext. This risk item treats the case where the follow-on funding is approved, but the disbursement is delayed for some reason other than the Federal budget process.
While the impact of losing more key staff will be greater, the probability of this happening within a 6 month timeframe is lesser. The case of losing two key staff members for example might have a Moderate impact instead of Low, but the probability of this is considered Low instead of Medium. In either case, the Risk Priority is the same.

April 2015: gains in performance per dollar in the next 2 years are likely to be greatest on NVIDIA's and Intel's next generation chips, both of which will incorporate stacked memory and have even more cores than current chips. If enough software has not evolved to the point of being able to exploit these features well, the project might not be able to achieve project application performance per dollar to meet metrics on cost and schedule.

Probability	Value
High	0.75
Medium	0.50
Low	0.25

Impact	Value
Severe	0.9
Moderate	0.5
Low	0.1

<== 1. Change these values to co

Risk Rating Table

Prob \ Impact	Severe	Moderate	Low
High	0.675	0.375	0.075
Medium	0.450	0.250	0.050
Low	0.225	0.125	0.025

<== 3. Then, manually change the
Conditional formatting

Risk Priorities

Prioritization	Low Value	High Value	Risk Planning Level
1 - High	0.500	1.000	Detailed Risk Plan
2 - Medium	0.150	0.500	Modest Risk Plan
3 - Low	0.000	0.150	Minimal Risk Plan

<== 2. Change these "2 - Medium"

^^^ 4. And finally, remake the "Sur

ntrol Probability, Impact ranges.

shading in the matrix to represent Prioritization values
not programmed in the table yet.

" low/high values to alter Prioritization assignments in Risk Register.

nmary Table" pivot table

LQCD-ext II Project: Risk Register Revis

Version	Date	Modifier
1	8/18/2009	
2	3/16/2010	
3	7/21/2010	
4	4/26/2011	
5	4/27/2012	
6	4/30/2013	Rob Kennedy
7	2/18/2014	Rob Kennedy
8	3/27/2014	Rob Kennedy
9	4/22/2014	Rob Kennedy
10	8/20/2014	Rob Kennedy
11	10/15/2014	Rob Kennedy
12	10/28/2014	Rob Kennedy

sion History

Description of Change
Initial Risk Items for LQCD-ext (derived from LQCD project)
Revised Risk Mitigation Strategies
Revised Risk Management Plan V1.2
Revised Risk Register for GPU/Ds extension purchase
Revised Risk Register, particularly for Accelerated (GPU) Clusters
Reorganize and normalize. Updates by FNAL Site Managers. Include input from JLab, add entries for BG/Q.
Update risks based on semi-annual review begun in October 2013
Split Risk Item 12 into technical risk in Risk Item 12 and personnel risk in Risk Item 37. Address succession plan in
Update risks per LQCD-ext Risk Review 4/9/2014 (see review notes for details)
Update risks per LQCD-ext Risk Review 8/20/2014 (see review notes for details)
Update risks per LQCD-ext Risk Review 10/15/2014 (see review notes for details)
Adapt to the LQCD-ext II Project (changes to risk items themselves are now tracked in entries and in review notes)

Risk Areas	DO NOT CHANGE "Risk Areas"
Cost	
Schedule	
Security	
Service	
Technology	