LQCD-ext Risk Register

Version	Date	Description of Change
1	8/18/2009	Initial Risk Items for LQCD-ext (derived from LQCD project)
2	3/16/2010	Revised Risk Mitigation Strategies
3	7/21/2010	Revised Risk Management Plan V1.2
4	4/26/2011	Revised Risk Register for GPU/Ds extension purchase
5	4/27/2012	Revised Risk Register, particularly for Accelerated (GPU) Clusters

LQCD-ext FY12 Risk Register Pivot Table

Sum of Risk Rating	FY12 Risk Area				
Last Status	Cost	Schedule	Security Safeguard	Technology	Grand Total
Open					
1		0.25			0.25
2	0.25				0.25
3	0.125				0.125
4				0.025	0.025
5				0.025	0.025
7	0.125				0.125
8			0.125		0.125
10	0.125				0.125
11				0.125	0.125
12				0.25	0.25
13	0.125				0.125
16				0.025	0.025
17			0.125		0.125
18			0.025		0.025
19				0.025	0.025
20				0.025	0.025
21	0.25				0.25
24	0.125				0.125
25				0.125	0.125
26			0.25		0.25
27			0.125		0.125
28			0.025		0.025
29				0.25	0.25
30		0.675			0.675
Open Total	**1.125**	**0.925**	**0.675**	**0.875**	**3.6**
Grand Total	**1.125**	**0.925**	**0.675**	**0.875**	**3.6**

LQCDEXT PROJECT RISK REGISTER

ID FY12	Probability of Occurrence (Initial)	FY12 Risk Area	Description	Probability of Occurrence (FY12)	Impact of Occurrence (FY12)	Risk Rating	Last Status	Last Change	Intial Date	Last Update
1	Low	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	Open	Increased prob.	7/1/04	3/1/12
2	Low	Cost	Although cost projections for the current budget year are reasonably precise, projections for subsequent years become progressively uncertain.	Medium	Moderate	0.25	Open	No change	7/1/04	3/1/12
3	Low	Cost	Unexpected increases in life costs arise after systems are acquired.	Low	Moderate	0.125	Open	No change	7/1/04	3/1/12
4		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	Moderate	0.25	Open	Changed	7/1/04	3/1/12
5		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.	Low	Low	0.025	Open	No change	7/1/04	3/1/12
7	Low	Cost	Dependency: Host institutions will not provide space, network connectivity, and mass storage.	Low	Moderate	0.125	Open	Changed ratings	7/1/04	3/1/12
8	Low	Security Safeguard	Surity: A major failure of a facility due to natural disaster (destruction of buildings, utility systems)	Low	Severe	0.225	Open	Split into two risks	7/1/04	3/1/12
10		Cost	Agency personnel changes, limiting continuity and support for this investment.	Low	Moderate	0.125	Open	No change	7/1/04	3/1/12

LQCDEXT PROJECT RISK REGISTER

ID FY12	Probability of Occurrence (Initial)	FY12 Risk Area	Description	Probability of Occurrence (FY12)	Impact of Occurrence (FY12)	Risk Rating	Last Status	Last Change	Intial Date	Last Update
11	Low	Technology	A major system, such as a new cluster or a high performance network, simply fails to work and the investment does not meet technical goals.	Low	Severe	0.225	Open	Changed description	7/1/04	3/1/12
12		Technology	Performance: Changes in technology and staff can have adverse effects on the project.	Medium	Moderate	0.25	Open	No change	7/1/04	3/1/12
13	Medium	Cost	Changes in funding, due to alteration in administration policy, or legislative directives.	Low	Moderate	0.125	Open	No change	7/1/04	3/1/12
16		Technology	Changes in the mission and plans of the Office of Science.	Low	Low	0.025	Open	No change	7/1/04	3/1/12
17		Security Safeguard	Inappropriate use of computer resources by authorized or unauthorized personnel	Medium	Moderate	0.25	Open	Changed prob.	7/104	3/1/12
18		Security Safeguard	Unauthorized access to computing hardware can disclose private information.	Low	Low	0.025	Open	No change	6/1/05	3/1/12
19		Technology	Slow Internet data transfer rates among the three labs and external sites may inhibit productivity	Low	Low	0.025	Open	No change	6/1/05	3/1/12
20		Technology	Differing authentication schemes among the three labs makes data transfers difficult which limits productivity	Medium	Low	0.05	Open	Changed	6/1/05	3/1/12

LQCDEXT PROJECT RISK REGISTER

ID FY12	Probability of Occurrence (Initial)	FY12 Risk Area	Description	Probability of Occurrence (FY12)	Impact of Occurrence (FY12)	Risk Rating	Last Status	Last Change	Intial Date	Last Update
21		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	Moderate	0.25	Open	No change	8/8/05	3/1/12
24		Cost	Risk of unavailability of DOE funding beyond the end of the project (end of FY14)	Medium	Moderate	0.25	Open	Changed	7/7/07	3/1/12
25		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)	Low	Moderate	0.125	Open	New	7/21/09	3/1/12
26	Low	Security Safeguard	Surity: Utility system failure at one of the facilities	Medium	Moderate	0.25	Open	New: Split from another risk	7/21/09	3/1/12
27	Low	Security Safeguard	Reliability: Loss of nearline stored data.	Low	Moderate	0.125	Open	New: Split from another risk item	7/1/04	3/1/12
28		Security Safeguard	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	Open	New	8/18/09	3/1/12

ID FY12	Probability of Occurrence (Initial)	FY12 Risk Area	Description	Probability of Occurrence (FY12)	Impact of Occurrence (FY12)	Risk Rating	Last Status	Last Change	Intial Date	Last Update
29	Medium	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	Open	Revised text - 4/27/12	4/22/11	3/1/12

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ID FY12	Probability of Occurrence (Initial)	FY12 Risk Area	Description	Probability of Occurrence (FY12)	Impact of Occurrence (FY12)	Risk Rating	Last Status	Last Change	Intial Date	Last Update
30	High	Schedule	Extensive delays in the FY12 Congressional budget process may prevent the project from meeting the schedule for the year's deployment milestone.	Medium	Severe	0.45	Open	New	2/1/11	4/22/11

ID FY12	FY12 Risk Area	Description	Mitigation Strategy
1	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.	Over the past five years, the LQCDEXT investment team worked on multiple large cluster hardware procurements using DOE LQCD project (FY06-FY09) and the DOE SciDAC Lattice QCD Computing Project funds with significant success. Experienced professional staff follows the commodity market carefully and gains insight by evaluating prototype hardware. They meet with vendors frequently under non-disclosure agreement and are briefed on roadmaps for components such as processors, chipsets, motherboards, network interface cards and switches. In addition, working closely with manufacturers and system integrators, the team has the capability of testing prerelease components. Working with the manufacturers the team is aware of deficiencies 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.
2	Cost	Although cost projections for the current budget year are reasonably precise, projections for subsequent years become progressively uncertain.	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.
3	Cost	Unexpected increases in life costs arise after systems are acquired.	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.
4	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.	Clusters purchased by this investment are operated for three and a half years, and subsequently retired. These assumed lifetimes are consistent with historical life cycles observed on similar hardware over the last decade.
5	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.	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.
6	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).	Closed
7	Cost	Dependency: Host institutions will not provide space, network connectivity, and mass storage.	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 LQCDEXT 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.
8	Security Safeguard	Surity: A major failure of a facility due to natural disaster (destruction of buildings, utility systems)	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.
9	Technology	Monopoly: Community becomes such a large purchaser of components that it effects the market for them.	Closed
10	Cost	Agency personnel changes, limiting continuity and support for this investment.	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.
11	Technology	A major system, such as a new cluster or a high performance network, simply fails to work and the investment does not meet technical goals.	The project evaluates prototype machines before procuring and installing production hardware (annually). 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, 4 hour response, 48 hour repair service response.
12	Technology	Performance: Changes in technology and staff can have adverse effects on the project.	Project personnel continually study and understand changes in technology that impact the investment. The project maintains a broad range of expertise within its staff.

ID FY12	FY12 Risk Area	Description	Mitigation Strategy
13	Cost	Changes in funding, due to alteration in administration policy, or legislative directives.	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.
14	Security Safeguard	Loss of archival stored data.	Closed
15	Technology	Commercial technology does not fulfill expectations, and in the later years of the investment the project cannot meet technical objectives	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.
16	Technology	Changes in the mission and plans of the Office of Science.	The computing systems acquired by this investment for LQCDEXT 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.
17	Security Safeguard	Inappropriate use of computer resources by authorized or unauthorized personnel	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.
18	Security Safeguard	Unauthorized access to computing hardware can disclose private information.	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.
19	Technology	Slow Internet data transfer rates among the three labs and external sites may inhibit productivity	FNAL, BNL, and TJNAF network staff tunes parameters to optimize transfers. Scientific allocations of time on the LQCDEXT 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.~~) the data transfer rates or available bandwidth will not keep up with the amount of data to be transferred.
20	Technology	Differing authentication schemes among the three labs makes data transfers difficult which limits productivity	FNAL, BNL, and TJNAF network staff tunes parameters to optimize transfers. Scientific allocations of time on the LQCDEXT 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.
21	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.	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.
22	Schedule	Delay in the release of AMD Quad-processors for Jlan 7n cluster deployment	Closed
23	Schedule	Schedule concern for the processor & chipset delivery for FNAL FY08 cluster deployment	Closed
24	Cost	Risk of unavailability of DOE funding beyond the end of the project (end of FY14)	Closed
25	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)	LQCD project has been using multi-processor systems for a while now without experiencing any major software issues. However, there is a likelihood that the LQCD software may come across some issues with multiprocessor systems. The LQCD staff and the off-project LQCD software development team is watching for any such possibilities taking various actions as necessary.
26	Security Safeguard	Surity: Utility system failure at one of the facilities	There is a moderate possibility of a single-site utility failure. However, the deployment of SciDAC LQCDEXT 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.

LQCDEXT RISK MITIGATION STRATEGIES

ID FY12	FY12 Risk Area	Description	Mitigation Strategy
27	Security Safeguard	Reliability: Loss of nearline stored data.	The LQCD project makes every effort to provide adequate near-line storage to run the simulation jobs. This includes Lustre based storage at FNAL and NFS based storage at TJNAF. Related procedures and technologies are refined continuously. Currently, the project has more than ade-quate near-line storage. A formal decision has been made that LQCD project is not responsible for the archival storage data.
28	Security Safeguard	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.	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.
29	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).	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.
30	Schedule	Extensive delays in the FY12 Congressional budget process may prevent the project from meeting the schedule for the year's deployment milestone.	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.

Probability	**Value**	**Impact**	**Value**
High	0.75	Severe	0.9
Medium	0.5	Moderate	0.5
Low	0.25	Low	0.1

Risk Matrix

0.675	0.375	0.075
0.45	0.25	0.05
0.225	0.125	0.025

Risk rating

	Severe	Moderate	Low
High	0.675	0.375	0.075
Medium	0.45	0.25	0.05
Low	0.225	0.125	0.025

	A	B
1	**LQCD-ext FY12 Risk Rating**	
2		
3	**Sum of Risk Rating**	
4	**Last Status**	**Total**
5	Closed	0.875
6	Open	2.675
7	**Grand Total**	**3.55**