Report:

Associate Laboratory Director's Cost & Schedule Review of the CBETA Project

Review held at Brookhaven National Laboratory February 6-7, 2017

Final Report Date: February 13, 2017

Executive Summary

A Review of the CBETA project took place on February 6-7, 2017 at Brookhaven National Laboratory (BNL). The review was conducted at the request of BNL Associate Laboratory Director for Nuclear and Particle Physics, Berndt Mueller, with the overall objective of assessing the readiness of the project to start construction. The Review Panel noted many significant developments from prior reviews in refining the design and scope definition of the project and feels that construction can begin.

At the same time several important management tools need further evolution with emphasis on the schedule and risk registry for management of contingency. Creation of further contingency at the project level, either through consolidation of contingency at the estimate level, shedding of scope, or development of contingency through value engineering will be necessary to assure the success of the project.

Technical Systems

The project presented engineering designs that are sufficiently mature to begin construction. The major subsystems have been tested in operations and well documented (Gun, ILC, MLC, high power dump). Design of the magnets and girders appears to be in the engineering phase, while other systems (splitters, power supplies) are still in a conceptual design phase. In advancing the designs the project could benefit from a deeper analysis of element tolerances. This will provide rewards in a better understanding of the performance requirements for CBETA systems as well as potentially exposing opportunities for value engineering that will help provide latitude to manage project issues should they arise.

Refinement of the specifications of equipment will also help in development of the procurement documentation, which will in turn help assure that the procured material is fit for its intended purpose and will be available to the project in a timely manner.

Cost and Schedule

The project currently faces an extremely tightly defined environment for its execution, including a firm fixed budget, hard milestones with the sponsor (including two off-ramp go/no go milestones), and limited opportunity to reduce scope and still meet the technical objectives of the project. Currently, the estimated cash contingency for the project is assessed as the difference between the funds available, and the estimate of the cost for the planned scope, and at the top level of the project is only 2% of budget available. For this level of maturity, this would generally be regarded as too low overall. It is difficult to ascertain if the contingency is actually appropriate, since the risk registry does not yet include assessments of the cost and schedule impacts of mitigation of risks should they occur.

The schedule is being developed from bottom up estimates at the activity level, and the team showed that they have extensive basis of estimate documentation in a cloud based tool at Cornell referred to as BOX. While the number of activities in the schedule is commensurate with a project the scale of CBETA it is not yet fully logically linked or resource loaded. The project is working diligently to complete the schedule logic and resourcing to meet the contracted milestones.

Management

The project has done a commendable job of standing up an organization that blends the strengths of the partner institutions and their respective approaches to execution of projects. The Committee believes this lays a solid foundation for the success of the CBETA project. At the same time, the Committee notes with some concern the extremely tight schedule, cost and scope boundary conditions for execution of the project. The top level contingency of 2% seems low for this stage of the project. The Committee feels some contingency may reside within the individual estimates that should be explicitly identified, moved to the highest level in the project, and identified within the risk registry as a potential draw on contingency. Refinement of the design to evaluate potential scope contingency, as well as exercising continued value engineering to reduce the cost of the delivered scope should all be pursued to develop a contingency reserve that the project can deploy to deal with issues that do arise.

The current risk registry clearly identifies potential risks to the project, but does not quantify their possible impact or cost for mitigation, nor provide anticipated dates for their retirement. The Committee encourages the project to add these features to the risk registry as a tool to aid in the management of the contingency that is available. The logical linking of the schedule should also be accomplished with high priority to help the project navigate its execution.

Key Recommendations

- Complete the project schedule by April 7, 2017
- Review the cost estimate to ensure that all contingency is removed from individual estimates and collected at the highest level. Complete the review by March 17, 2017.
- Add impacts (cost and schedule) to the risk register to tie risk to contingency. Complete by March 3, 2017.
- Identify additional items for scope contingency and include decision dates for removal. Complete by March 17, 2017.
- Perform a cost and schedule re-evaluation before April 14, 2017.

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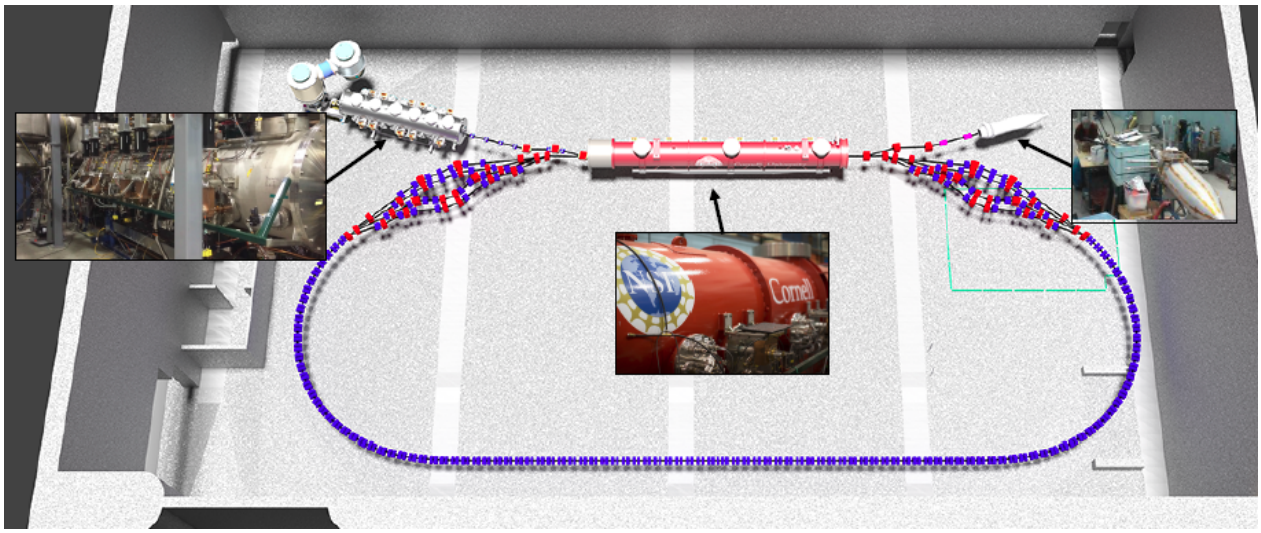
1-Introduction

The Cornell- Brookhaven ERL Test Accelerator (CBETA) is a collaborative research project funded by the New York State Energy Research and Development Authority (NYSERDA). Sited at the Wilson Laboratory on the Cornell Campus, the CBETA project will construct a multi-turn Energy Recovery Linac (ERL) with Fixed-Field Alternating Gradient (FFAG) return arcs. It is intended to serve as a prototype for the potential ERL at eRHIC, a future electron-ion collider being designed at BNL.

The project builds on over a decade of ERL research at Cornell and the CBETA itself will include a Photo-injector and Injector Cryomodule (ICM), superconducting Main Linac Cryomodule (MLC) and beam dump developed by that program. The novel FFAG return arcs will be constructed by BNL and the splitter/combiner transport system by Cornell.



The NYSERDA board approved funding for the project on October 31, 2016 against a series of milestones planned over the project duration of roughly 3 ½ years. Two of these milestones are 'Go/no-go' gatepoints for the project. The first in August 2017 is for operation of the MLC with beam. The second, scheduled for April 2018 includes a Fractional Arc Test that includes the first splitter line and FFAG girder. Total project funding of $25M is available.

To assess readiness of the project for the start of construction, BNL Associate Laboratory Director for Nuclear and Particle Physics, Berndt Mueller, prepared a charge (Appendix A) for a review team who were selected for their independence from the project (Appendix B). The review of the CBETA project took place on February 6-7, 2017 at Brookhaven National Laboratory. The agenda (Appendix C) included overview presentations as well as drill-down sessions on project management, and a selection of technical systems.

2-Technical Systems

The following sections are the assessments of the Technical Systems subcommittee against the specific technical systems related charge questions. Findings, Comments and Recommendations are also included.

2.1 – Findings

The project presented engineering design that is sufficiently mature. The major subsystems have been tested in operations and well documented (Gun, ILC, MLC, high power dump). Design of the magnets and girders appears to be in the engineering phase, while other systems (splitters, power supplies) are still in a conceptual design phase.

Following the presentations the Committee noted that the project team identified inconsistencies between the KPPs and the final Project Milestones 11 and 12.

A few important elements, including magnets and power supplies, are missing tolerance specifications. Tolerances for all of the splitter magnets at different fields are specified at 1E-4 level.

The Committee also found that the engineering estimate for commissioning is at 600 hours. Some of the commissioning effort is accounted in subsystem WBS.

2.2 – Comments

Based on the presented materials the Committee feels that the engineering design is sufficiently mature to warrant the start of construction. Our comments specifically focus on the element tolerances.

Magnet tolerances are defined in the good field region as Central field uniformity and Field integral uniformity. Can one manufacture and measure magnets that conform to these specs (Table 2.5.1 in the Design Report)? The prototype magnet series will prove crucial in this regard.

There are TBD's in the parameter table associated with magnet tolerance/field quality. Uncertainty in magnet specs will translate into uncertainty in budgetary estimates from vendor and may result in iterations on magnet alignment, shimming and mag measurements → Budget / schedule risk

Tolerances for power supply (stability / ripple) are not specified for the power supplies except for the correctors. Are the power supply specs consistent with the magnet specs?

We also comment that a more comprehensive set of technical specifications and drawings is required to proceed through procurement and fabrication of some of the components. The technical specifications should be based on balanced deliverables as excessive requirements on testing, measurements, project reporting and QA could substantially increase the cost of magnet procurement.

The Technical Committee's responses to the Charge Questions were as follows:

1-Technical

- Is the overall technical design conceptually sound and likely to meet the project's technical performance requirements?
    - **Yes.** The design is conceptually sound and major components (Gun, MLC) are based on tested and proven technology.
    - The Spreaders need to be further designed and element tolerance studies completed and iterated.

- Has a technical plan at a level of detail sufficient to support construction been presented and documented?
    - **Conditional yes.** Machine specifications matched to the commissioning requirements should be finalized and element specifications developed and iterated.
    - The technical plan should hinge on the minimum performance required by KPP and /or project milestones however it should not preclude the design performance at the full machine built-out.

2-Project Scope

- Are the project scope and specifications sufficiently well-defined to support detailed cost and schedule estimates?
    - **Yes.** The design is mature and appears to be studied well. Specifications need to be clarified and made consistent between subsystems (i.e. magnets vs power supplies) prior to their procurement.

- Are the scope apportionment and deliverables that are split between BNL and Cornell clearly established and well defined?
    - **Yes**

- Is a viable scope contingency plan in place, including decision criteria and branch points?
    - Scope contingency needs further work.
    - Budgetary contingency is low. The project may contain additional scope contingency in the level 2 estimates. Detailed commissioning simulations may indicate the minimal scope of power supplies and diagnostics needed for reaching KPP goals.

- Are the NYSERDA milestones well defined?
    - **Yes.** While NYSERDA milestones are well-defined but not all are harmonized with the KPPS. Requirements for milestones 11 and 12 should be clarified.

5-Risk

- Are risk analysis and mitigation strategies in place?
    - **YES.** Some of the mitigation plans in the risk registry are missing. Risks still need to be quantified in cost and schedule. Risks of major failures in the Gun, ILC or MLC are not addressed in sufficient detail and do not appear to be contained by the project.

- Is there a viable plan in place to track the risks as the project evolves?
    - **Not yet**

- Does the contingency estimate properly take into account the project risks.
    - The contingency budget at 2% of project cost seems insufficient at this time. More work is required to identify additional contingency and perform value engineering.

6-Documentation

- Has the necessary documentation been developed?
    - **Conditional Yes**. The project features a descriptive Design Report and a set of interface spreadsheets and Technical notes. It appears that the specification of magnet and power supply tolerances is not uniform between various documents. A standard specification list that is assigned to every element and maintained by the project would be helpful.

- Does it adequately support the start of construction?
    - **Yes**. The CBETA project should develop and optimize requirements for the vendors and reflect them in procurement documents.

2.3 – Recommendations

- Consider reducing scope of diagnostics and correction elements based on the outcome of detailed commissioning simulations and magnetic measurements of the arc and spreader magnets. This should be completed by the time of the commencement of major procurements.
- Develop a more complete set of tolerance studies focusing on maximum expected beta-beat for the uncorrelated quadrupole errors in the machine from different installation scenarios and connect the beta-beat with the element tolerances. This should be developed before completion of the magnet procurement documents.
- Invite the NSLS-II ID group to share their experience with handling Permanent Magnet Material for FFAG magnets.

3-Cost and Schedule

The following sections are the assessments of the Cost and Schedule Committee against the specific cost and schedule related charge questions. Findings, Comments and Recommendations are also included.

3.1 – Findings

A comprehensive cost estimate has been presented. It is organized in 13 level 2 WBS elements. The cost is captured in about 1500 activities. The length of the activities in terms of calendar days is between 10-40 workdays. An exception is WBS element 1.05 (FFAG magnets) which is described by only about 20 activities, the sum of which have considerable length of several months.

The cost estimate for many items to be procured is backed up by recent vendor quotes. The labor effort is based on previous experience or professional judgement. Costs appear to be fully burdened. Cornell has zero overhead rate on labor and materials, and 61% for project management, commissioning, travel and safety. BNL overhead rates vary from 13% to 36% for labor depending on category, 20%-35% for material depending on magnitude, 55% for travel, and assumed the utilization of Extraordinary Project Rates (not yet confirmed). There was no assumption document with this summarizing the information. The scheduled activities are not yet connected by logical relationships.

The total project cost is $24,531,865 with burden and escalation. The contingency of the project is estimated to $468,135 which corresponds to 2% of the project and is driven by what was cut from the construction scope after the project was vetted. The scope of the project includes quadrupole corrector magnets in the lattice but does not include power supplies in the budget.

The project date for single pass beam with energy recovery is set for October 31, 2019, and four pass beam with energy recovery (low current) on December 31, 2019. The end of the project is expected to be April 30, 2020.

The project has a good reporting procedure and established a document format for quarterly progress reports to funding agency. The first quarterly report will be submitted in near term. The project team plans to have monthly progress briefing between BNL and Cornell project management office, which will include areas of technical performance as well as the cost performance.

The technical team has a daily project meeting to track progress and report problems. The project team also receives monthly labor and expenditure reports. A process has been established for invoicing, accrual, and payment to capture monthly expenditures in a timely fashion ensure forward funding.

The team plans to do a more robust project task status assessment once the Resource Loaded Schedule (RLS) is completed. The project started the discussion of developing a formal process for task statusing and comparing the cost performance against the project plan.

The project has developed a set of BoE in the format of Excel spreadsheets. The BoE contains summary of labor, material, travel cost input. The backup documentation, such as vendor quotes, were presented and are centrally managed. The project presented cost summaries at WBS Level 2 and Level 3. The resource loaded schedule is still developing, and it is expected to be finished in 1 to 2 months. The project plans to generate yearly cost profile reports once RLS is completed.

The risk registry contains 83 risks including technical risks, manpower issues due to lack or loss of key personnel, delays in the funding, schedule delays, and lack of resources due to competing activities at Cornell or BNL.

3.2 – Comments

The detail and granularity of the cost estimate is considered adequate for a project of this size. The length of the activities is about right to ensure satisfactory accuracy. Drill down on the cost indicates that the cost estimate is likely to be complete in capturing all the necessary activities in general. The labor for FFAG PM Procurement however does not show the same level of detail (20 activities) which does not match this judgement. It will be important to describe the activities for FFAG magnet procurement in a more detailed fashion after the procurement strategies have been finalized. The committee also notes that the labor required for executing procurements (vendor visits, regular status meeting, and resolving issues, helping the vendor with technical problem etc.) is not explicitly shown everywhere.

The absence of the resource leveled schedule makes it hard to calculate escalation of the cost accurately. Nevertheless, the overall credibility and completeness of the cost estimate appears to be satisfactory. It is important to check the labor and material estimates to ensure that it does not contain hidden contingency, which will accumulate linearly and could lead to overestimation of the cost. The hidden contingency should be made explicit as an uncertainty of the estimate. Such uncertainties would contribute to the overall contingency but the contributions would be expected to accumulate statistically.

The risks are clearly documented. However, since there is no final schedule yet, an expectation for risk retirement dates cannot not yet be provided. Risk retirement dates would help to track and remove the risks as the project evolves. The risk table, though very detailed, should include the impact on the cost and schedule should the risk occur. At this stage it is not possible to asses if the contingency estimate presented by the project, 2%, properly takes into account the risks as there is no information on the impact on the cost and schedule of any of the risks.

The project team appears to be able to work closely together in monitoring the work progress. It will be beneficial for the project to establish a routine process for monthly task statussing and tracking of cost

performance, at a level that is appropriate for the size of the project for efficient management, for example, it could be done at WBS Level 3 or Level 2. Timely invoicing and payments need to be monitored carefully to ensure continuity in funding.

Monthly cost profiles are necessary for proper planning for cash flow and funding amendments. A procurement schedule and funding obligation profile are useful in planning for advance funding request. It would be useful to clarify if milestone 12 (4 turns) and end of the project is considered as schedule contingency.

The Cost & Schedule Committee's responses to the Charge Questions were as follows:

3-Cost and Schedule

- Are the cost, schedule and contingency estimates in support of construction credible and realistic?
    - Yes, but there are some concerns on contingency estimates.

- Is a statussing and reporting plan/structure in place to allow regular tracking of project progress and cost performance upon receipt of funds?
    - Good mechanism to track the progress but still developing formal cost performance measurement.

5-Risk

- Are risk analysis and mitigation strategies in place?
    - Yes

- Is there a viable plan In place to track the risks as the project evolves?
    - Needs improvement.

- Does the contingency estimate properly take into account the project risks?
    - The contingency estimate is low, and the project teams needs to work on a risk based contingency analysis.

6-Documentation

- Has the necessary documentation been developed?
    - Almost, a few documents need to be finalized, such as project schedule and cost profiles.

- Does it adequately support the start of construction?
    - The project should be able to start the construction while finalizing those documents

3.3 – Recommendations

- Complete the project schedule by April 7, 2017.

- Review the cost estimate to ensure that all contingency is removed from individual estimates and collected at the highest level. Complete the review by March 17, 2017.

4-Management

The following sections are the assessments of the Management Committee against the specific management-related charge questions. Findings, Comments and Recommendations are also included.

4.1 – Findings

The organizational structure for managing CBETA is articulated in the Project Management Plan and was presented to the review team. It now includes the addition of a BNL Project Manager.

NYSERDA milestones have been identified and agreed to by the parties. The project team is working against those with the Go/No Go milestones being especially critical. Some of the milestones are somewhat unclear.

A project schedule is under development but was not ready yet for a formal presentation to the review team.

Contingency was presented at ~2% and a limited amount of scope contingency was identified.

A Risk Register was developed and presented to the review team. It contained scored risks and mitigation strategies. The project team's assessment of the most significant risks were identified and explained further.

Cash Flow issues related to NYS funding were explained by the team and a description of the method used to ensure positive cash flow was presented.

The BNL Extraordinary Project Rate (EPR) has been assumed in developing the BNL cost estimate.

The CBETA Project team presented their approach to managing the CBETA project – combining best practices from both Cornell and Brookhaven.

4.2 – Comments

Excellent progress has been made in the development of the CBETA plans! These plans have matured significantly since the earlier review in July. The CBETA team should be proud of what they have accomplished in this short period of time.

The organizational structure of the CBETA project appears appropriate and to be working well. The assignment of the BNL Project Manager is a valuable addition to the team.

The review team found NYSERDA milestones 11 and 12 might be unclear and believe that some clarification could be beneficial.

The project schedule is under development but needs to be completed with some urgency so that the project team can be confident on their plans to successfully deliver the scope. This should be a top priority for the team.

The contingency as presented was not adequate for this stage of the project. The review team believes that there may be hidden contingency in the current estimates. This contingency should be identified and moved to the highest level to increase the percentage of contingency available to cover all project uncertainties and risks and to ensure that any available contingency goes to the highest priority project elements. Additionally, scope contingency will likely need to increase and value engineering efforts should continue. All effort should be made to increase the contingency as it is unlikely that the project can be successful without it.

The risk registry needs to have a quantitative assessment of cost and schedule impact for each identified risk. This is necessary to determine if the contingency is adequate.

The project team has a reasonable plan for addressing the NYS cash flow issues.

Given the very tight scope, cost, and schedule constraints of this project, it is imperative that the Project team confirms the assumption regarding the use of the BNL Extraordinary Project Rate. The CBETA team identified a significant impact without this assumption.

The Cornell and Brookhaven CBETA team members are working well in combining their best practices for managing projects. They should continue to capitalize on these as they track work progress and cost against their plan.

The Management Committee's responses to the Charge questions follow below.

2-Project Scope

- Are the project scope and specifications sufficiently well-defined to support detailed cost and schedule estimates?
    - **Yes.** The estimates are maturing, but schedule details have yet to be incorporated.
- Are the scope apportionment and deliverables that are split between BNL and Cornell clearly established and well defined?
    - **Yes.** The WBS structure clearly defines the deliverables and the responsible organizations.
- Is a viable scope contingency plan in place, including decision criteria and branch points?
    - **No.** Some scope contingency items have been identified, but they are not sufficient to provide adequate flexibility to deal with challenges that are likely to arise. Decision dates and associated risk elements with impact dollars need to be included in the plan.

- Are the NYSERDA milestones well defined?
    - **Generally, yes**. Requirements for milestones 11 and 12 may need to be clarified.

4-Management and ES&H

- Is the project being appropriately managed?
    - **Yes.** A strong team is in place and BNL and Cornell are working together to ensure success.
- Will the management model properly support the project goals?
    - **Yes.**
- Have the anticipated roles and responsibilities of both the institutions and the project principals been adequately defined and understood by all parties?
    - **Yes.** The roles are clearly described in the Project Management Plan.
- Is the project team populated with sufficiently dedicated personnel to the necessary WBS level, and in the Project Office?
    - **Yes.** The project now has the resources that it needs.
- Is there a sufficient level of Laboratory and University support to provide necessary oversight?
    - **Yes.** Both organizations provide individual and joint oversight functions.
- Is the project's ES&H plan well-tailored to the project's technical goals and scope, and is it soundly based?
    - **Yes.** The Project Management Plan refers to the ES&H policies and procedures at each institution.

5-Risk

- Are risk analysis and mitigation strategies in place?
    - **Partially.** A foundational registry was presented but it needs further development to be an effective tool.
- Is there a viable plan in place to track the risks as the project evolves?
    - **Not yet.** The tracking of risks is not yet fully developed. Impacts should be quantified and estimated retirement dates should be included.
- Does the contingency estimate properly take into account the project risks.
    - **No.** Without the above information, there is no way to tell how much contingency is enough based on risk.

6-Documentation

- Has the necessary documentation been developed?
    - **Not yet.** Some project documents and scope definition are fairly mature, but the schedule needs further development. An Assumptions Document should also be developed.
- Does it adequately support the start of construction?
    - **Yes**, for the initial phase of execution. The documentation needs further development to successfully carry the project through to completion. The project schedule needs to be completed and the scope contingency needs to be documented with decision points.

4.3 – Recommendations

Recommendations from the Management Committee are:

- Add impacts (cost and schedule) to the risk register to tie risk to contingency. Complete by March 3, 2017.
- Identify additional items for scope contingency and include decision dates for removal. Complete by March 17, 2017.
- Perform a cost and schedule re-evaluation before April 14, 2017.

Appendix A - Charge Memo

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Managed by Brookhaven Science Associates
for the U.S. Department of Energy

Associate Laboratory Director's Cost & Schedule Review of the C-Beta Project February 6 – 7, 2017 Charge to the Review Committee

The C-Beta Project, currently under development by Brookhaven National Laboratory and Cornell University, has been proposed and received preliminary acceptance from the New York State Energy and Research Authority (NYSERDA) with expected funding beginning in early 2017. Its principal goal is the construction of a multi-turn Energy Recovery Linac (ERL) with a Fixed-Field Alternating Gradient (FFAG) return loop, which will serve as a prototype for the potential ERL at eRHIC, a future electron-ion collider under design at BNL. The C-Beta accelerator is being jointly designed by Cornell and BNL, and deployed and operated at the Wilson Laboratory on the Cornell Campus.

The project plan is expected to adhere to the guidelines and requirements appropriate for modern projects of this magnitude, and to adequately support the anticipated construction activities and technical goals. The project has been asked to present a plan that is of sufficient maturity to support a project baseline and construction start. The committee should evaluate the project's readiness to move forward in this context. Should the committee identify any portions of the plan that require refinements, it is requested that, in addition to calling these out, they try to include in their evaluation a means by which the project team might buttress their case in the most timely and efficient manner possible.

It is requested that the review committee evaluate the following specific items:

1. Technical Design: Is the overall technical design conceptually sound and likely to meet the project's technical performance requirements? Has a technical plan at a level of detail sufficient to support construction been presented and documented?
2. Project Scope: Are the project scope and specifications sufficiently well-defined to support a detailed cost and schedule estimates? Are the scope apportionment and deliverables that are split between BNL and Cornell clearly established and well defined? Is a viable scope contingency plan in place, including decision criteria and branch points? Are the NYSERDA milestone well defined?
3. Cost and Schedule: Are the cost, schedule and contingency estimates in support of construction credible and realistic? Is a statussing and reporting plan/structure in place to allow regular tracking of project progress and cost performance upon receipt of funds?
4. Management and ES&H: Is the project being appropriately managed? Will the management model properly support the project goals? Have the anticipated roles and responsibilities of both the institutions and the project principals been adequately defined and understood by all parties? Is the project team populated with sufficiently dedicated personnel to the necessary WBS level, and in the Project Office? Is there a sufficient level of Laboratory and University support to provide the

necessary oversight? Is the project's ES&H plan well-tailored to the project's technical goals and scope, and is it soundly based?

5. Risk: Are risk analysis and mitigation strategies in place? Is there a viable plan in place to track the risks as the project evolves? Does the contingency estimate properly take into account the project risks?
6. Documentation: Has the necessary documentation been developed? Does it adequately support the start of construction?

The review will take place on Monday-Tuesday, February 6 – 7, 2017 at BNL. A closeout will be presented to the C-Beta project team, the Laboratory and Cornell prior to adjourning. A final report should be submitted to my office by close of business on Monday, February 13.

I very much appreciate your willingness to lend your time and expertise to this important step in the C-Beta review process, and look forward to receiving your assessment.

Sincerely,

Berndt Mueller
Associate Laboratory Director for Nuclear and Particle Physics
Brookhaven National Laboratory

Appendix B – Review Panel Membership

Review Panel Membership-

Technical Systems

- Timur Shaftan, BNL NSLS-II
- Michael Harrison, BNL NPP

Cost and Schedule

- Maria Chamizo Llatas, BNL NPP
- Xiaofeng Guo, BNL NPP
- Ferdinand Willeke, BNL CAD

Management

- Diane Hatton, BNL PPQM
- Don Hartill, Cornell University, Physics Department and CLASSE
- Erik Johnson, BNL NSLS-II (Committee Chair)

Appendix C – Review Agenda

Monday, 6 February 2017

Plenary

8:00 AM	Executive Session	Committee
8:30 AM	Welcome	J. Ritchie Patterson
8:40 AM	Project Overview & Plan	Stephen Peggs
9:25 AM	Project Cost, Schedule & Risk	Karl Smolenski
10:10 AM	BREAK	
10:30 AM	Report from the Independent Cost Review	Rob Michnoff
11:00 AM	Invoice Processing & Reporting	Stephanie LaMontagne
11:30 AM	Discussion	All
12:00	Lunch	

Drill Downs

1:00 PM	Project Management	Rob Michnoff
1:40 PM	FFAG Magnets & Girders	Joesph Tuozzolo
2:20 PM	Splitters	David Burke
3:00 PM	BREAK	
3:20 PM	Beam Commissioning	Adam Bartnik
4:00 PM	Accelerator Physics	Christopher Mayes
4:40 PM	Executive Session	Committee
6:00 PM	Adjourn	

Tuesday, 7 February 2017

Morning

8:00 AM	Answers to Questions, Discussion with Team
9:00 AM	Further Drill Downs, as required
10:00 AM	Executive Session
12:00	Working Lunch

Afternoon

1:00 PM	Executive Session – Dry Runs
2:30 PM	Closeout
3:00 PM	Adjourn

Appendix D – CBETA Contract Milestones with NYSERDA

BOLD milestones 4 & 6 are "go/no-go".

#	Milestone	Date
	NYSERDA funding start date	2016 Oct 31
1	Engineering design documentation complete	2017 Jan 31
2	Prototype girder assembled	2017 Apr 30
3	Magnet production approved	2017 June 30
4	**Beam through Main Linac Cryomodule**	**2017 Aug 31**
5	First arc production magnet tested	2017 Dec 31
6	**Fractional Arc Test: beam through MLC & prototype girder**	**2018 Apr 30**
7	Girder production run complete	2018 Nov 30
8	Final assembly & pre-beam commissioning complete	2019 Feb 28
9	Single pass beam with factor of 2 energy scan	2019 June 30
10	Single pass beam with energy recovery	2019 Oct 31
11	Four pass beam with energy recovery (low current)	2019 Dec 31
12	Project complete	2020 Apr 30

Appendix E – CBETA Management Chart

The following chart represents the organization and governance structure at the time of the review.