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United States Government **Department of Energy**

memorandum

DATE: June 17, 2013

REPLY TO ATTN OF: Office of Science

SUBJECT: Operations Review of the RHIC Facility

TO: Daniel R. Lehman, Director, Office of Project Assessment

The Office of Nuclear Physics supports the operations of the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL). This memorandum is to request that you organize and conduct a review of RHIC operations on August 6-8, 2013 at BNL to evaluate present performance and cost of operations, in the context of the Fiscal Year (FY) 2014 President's Request.

The purpose of the review is to examine all the BNL/RHIC activities associated with facility operations supported by the Nuclear Physics program, the costs being incurred for each activity, whether these activities are required to achieve facility goals and objectives, and opportunities for increasing cost-effectiveness of this facility. In particular, it is requested that your review committee address the following questions:

1. Is the current scope of RHIC operations optimally organized to successfully achieve established science goals and facility objectives?
2. Are RHIC operations effectively planned and performed in pursuit of the established experimental program?
3. Are the costs for operating all aspects of the RHIC facility in support of the established experimental program reasonable and optimized?
4. Are all aspects of the RHIC facility and its operations appropriately and effectively managed?

I have asked Dr. Jehanne Gillo, Director of the Facilities and Project Management Division in the Office of Nuclear Physics Division to be the point-of-contact with your Office for this review. Please contact her if you have any questions or if there is any way our Office might provide assistance. Again, I wish to thank you for agreeing to chair this review. I would appreciate receiving the Committee's report within 60 days of the review.

Timothy J. Hallman
Associate Director of the Office of Science
for Nuclear Physics

Department of Energy
Committee Report

on the

Facility Operations Review

of the

Relativistic Heavy Ion Collider (RHIC)

February 2002

Department of Energy/Office of Science Operations Review of the Relativistic Heavy Ion Collider (RHIC) Project
August 6-8, 2013

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*Lead
SC Subcommittee

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EXECUTIVE SUMMARY

A Department of Energy (DOE) review of the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) was conducted during February 5-7, 2002, at the request of Dr. Dennis Kovar, Director of the Division of Nuclear Physics, Office of Science. The Committee was requested in the review charge to perform an analysis and evaluation of the present facility operations, and evaluate the impacts of different funding levels on the productivity of the facilities.

Overall, the Committee found the following concerning RHIC:

- The Laboratory mission is a key part of the Nation's Nuclear Physics program.
- The RHIC facility and associated research support is well managed and is producing first-rate science.
- The current funding for BNL is lean for meeting the mission of the Laboratory and for maintaining effective utilization of its facilities.

The Laboratory's mission for the RHIC facility is to, "operate, maintain and upgrade the U.S. Department of Energy's Relativistic Heavy Ion Collider accelerator, detectors and computing user facilities for performance of frontier research in relativistic heavy ion and proton spin nuclear physics; perform research and development work in accelerator science, experimental detector design and advanced computing methods for the productive evolution of the RHIC facility and to support the research missions of RHIC." The Committee believes this mission to be a key part of the Nation's Nuclear Physics program, and that BNL is dedicated to carrying out this mission.

Although the allocation of resources and staffing levels were examined in some depth, a detailed bottoms-up analysis of the resources and determination of whether the resources were optimized was not feasible in the time available. The Committee utilized its knowledge and experience to evaluate whether budget and staffing resource allocations were consistent with that of similar facilities and addressed the specific needs of this facility and its research program. Overall, the Committee found that RHIC is well managed and productive, and that resource and staff allocations were reasonable.

The successes of the Laboratory and users in rapidly extracting exciting physics resulting from the first RHIC runs have been stunning. In many ways, this success, although stressful, has proven their strength and resourcefulness. The Committee anticipates that as RHIC becomes more operationally experienced, the present levels of physics and experimental support are basically sufficient for a 30-week run, but increased funding will be needed for materials and supplies. The RHIC computing facility does, however, have a challenging task ahead and is one area that needs increased resources immediately. In accelerator operations, BNL is presently attempting to deal with a number of issues associated with reliability. Some of these are related to the older facilities (e.g., Alternating Gradient Synchrotron, tandems, RHIC cryo plant), and others are associated with the new components of RHIC. RHIC has a technically sound and operationally successful integrated ES&H program.

BNL management provided the Committee with a number of scenarios for incremental funding above and below the FY 2002 base of $104.5 million (excluding Waste Management funding). The reduced scenarios are not considered to be workable or sustainable in the long run and the Committee agrees. The constant level of effort presents a viable physics program and based on the benefits anticipated from the ongoing reliability improvements the number of weeks of running in the outyears should increase from the FY 2002 experience of 19 weeks. However, this scenario poses significant risks of major failures due to the lower than ideal level of accelerator maintenance. Further, R&D directed to improvements will not occur. The Committee believes that the optimum scenario should be approximately an additional $16 million in funding. It provides for the needs of a strong physics program, a responsible accelerator maintenance effort, and preparations for desired accelerator and detector upgrades. The Committee also supports BNL's priority ordering for spending incremental funds. In all cases, additional funding would provide for additional operations of RHIC for research and for a stronger development program for the collider complex and the associated experiments.

The Committee was concerned that medium- and long-range laboratory plans appear to be established without external review. In addition, the major scientific deliverables and the instrumentation and integrated luminosity required to accomplish them were not clearly articulated by BNL management as a science-driven basis for the requests for incremental funding. It is very important that planning for RHIC in the next five years be driven by a science-based vision of the Laboratory's imperative goals and plans to optimize the available and requested resources to reach those key goals. While BNL management and the users are working hard together on many of these issues, external perspective would be extremely

valuable. Possibilities include expanding the scope for the existing Program Advisory Committee or utilizing a new advisory group to help BNL develop and articulate this focus, or establishing the position of a RHIC Scientific Director.

In conclusion, the Committee found that RHIC is well-managed and producing first-rate science. The current funding is lean for meeting the mission of the Laboratory and for maintaining effective utilization of its facilities. Future increases in funding will be required for BNL to maintain their current contribution to the Nation's science. In addition, significantly more research could be performed if relatively small increases were made in the annual funding provided to RHIC.

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1. INTRODUCTION

On November 28, 2001, the Division of Nuclear Physics requested the Construction Management Support Division to perform an independent operations review of the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL). The Nuclear Physics office requested this review to evaluate the performance, the cost of operations, and the funding needed to effectively support the research mission. This review was considered necessary in the context of funding constraints and because of the emphasis on performance from the administration, Congress, and the Department of Energy (DOE).

In order to do this, the Committee was asked to examine all of BNL/RHIC activities associated with facility operations supported by the Nuclear Physics program, determine the real cost (especially manpower) that is being incurred by Nuclear Physics for each activity, advise whether these activities are required and in the best interest of the Nuclear Physics program, and explore options of reducing funding for this facility with an evaluation of the associated impacts. In particular, the charge memorandum asked the review Committee to:

1. Perform an analysis and evaluation of the present facility operations.

    - What is the mission of the facility?
    - How are resources currently used (bottoms-up analysis) to carry out this mission?
    - Are available resources optimized for the most productive program?

2. Evaluate the impacts of different funding levels on the productivity of the facilities.

    - What level of facility operations and scientific productivity could be sustained into the outyears with constant effort funding (at the FY 2002 Appropriations level)?
    - What benefits, in order of priority, could be realized with incremental funding above this level?

Brookhaven Science Association manages and operates BNL for DOE. BNL receives approximately $105 million annually from Nuclear Physics to support RHIC operations. RHIC is a unique international user facility used to perform frontier research in relativistic heavy ion and proton spin nuclear physics, and to perform R&D work in accelerator science, experimental detector design, and advanced computing methods. Approximately 1,000 researchers from United States and foreign institutions use the facility annually.

The review was conducted on February 5-7, 2002, at BNL and chaired by Daniel R. Lehman, Director of the Construction Management Support Division. To address the charge, the Committee divided into subcommittees that examined the experimental program; the accelerator operations; environmental, safety, and health activities; and management. Committee members were drawn from the Office of Science's multi-program laboratories, various universities, and the DOE Office of Science. Representatives from the Division of Nuclear Physics and the DOE area office observed the proceedings.

The review was based on formal presentations given by BNL, detailed discussions with BNL employees, and the Committee members' extensive experience. The first day was devoted to presentations given by BNL. These presentations provided an overview and response to the charge letter. On the second day, members of each subcommittee met with BNL counterparts in working sessions to discuss further details in the functional area for their respective subcommittees. The remaining time was spent on subcommittee working sessions, committee deliberations, and report writing. The Committee discussed the results of the review with BNL management in a closeout briefing on February 7, 2002.

It is hoped that the findings of this operations review are responsive to the Division of Nuclear Physics and provides a better understanding of both the costs to productively operate RHIC, and the impacts and the benefits if funding resources are changed.

2. PHYSICS and EXPERIMENTAL PROGRAM

2.1 Findings

The physics and experimental program support is provided by four departments within BNL. Within the Collider-Accelerator Department (C-AD), 31 FTEs ($6.4 million) are provided for support of RHIC experiments. The Physics Department hosts experimental groups for the BRAHMS (3.6 FTE and $0.6 million experimental support; 6.7 FTE and $1.3 million research), PHENIX (20.5 FTE and $5.4 million experimental support; 10.7 FTE and $2.0 million research) and STAR (23.5 FTE and $5.3 million experimental support; 9.5 FTE and $1.6 million research) experiments, as well as the RHIC Computing Facility (18.3 FTE and $4.7 million experimental support) and BNL's nuclear theory group. The experimental group for the PHOBOS experiment (2.7 FTE and $0.8 million experimental support; 4.1 FTE and $0.8 million research) resides in the Chemistry Department. The combined RHIC FY 2002 operations funding is $24.1 million for experimental support and $6.1 million for research. Capital equipment for experimental support is funded at $4.1 million (which includes a $1 million payback to General Plant Equipment in FY 2002) as part of the base funding and $4.0 million for the Additional Experimental Equipment (AEE) initiative. The Instrumentation Department provides support for specialized detector R&D and construction and long-term R&D initiatives. This department is supported by laboratory overhead.

BNL has an aggressive detector installation schedule and expects to substantially complete the AEE initiatives on the PHENIX detector at the end of FY 2002 and on the STAR detector by the beginning of FY 2004.

The Experimental Support and Facilities Division (ESFD) of the C-AD provides experiment and general C-AD support for AC power, water systems, installation, survey, mechanical and electrical services, engineering liaison, and communications. A three-man watch list is staffed 24-hours per day during accelerator operations for safety surveillance of the experimental areas and equipment and general support for experiment and accelerator operations. ESFD is responsible for safe installation and operation of experiments and technical support for planning, costing, and construction of experiments.

The Physics and Chemistry Department experimental groups integrate experiment support and research functions. One to six percent of the funding of each group is used to support visitors and users. The scientific staff devotes nominally 50 percent of their time to research, though this fraction is reported to have been significantly lower during the first two

years of operation. The RHIC Computing Facility provides a centralized data logging and analysis capability for all the RHIC experiments. The goal is to provide production-processing capacity for RHIC data, but not production simulation capability, which is expected to be found at other sites. The capacity of the system is being significantly increased to meet the rapidly rising demands of the experimental program. The larger experiments have been aiding the RHIC Computing Facility in providing shift coverage to ensure data logging requirements are met during a RHIC run. Average capital equipment purchases of $2.0 million per year are desired to address the long-term computing needs. A specific request of increases of 4.5 FTEs and $0.32 million for materials and supplies was presented as being necessary to assure the physics yield of RHIC is not constrained by the availability and reliability of computing.

The Instrumentation Division contains 47 staff members. Approximately 40 percent of its efforts are devoted to RHIC related initiatives including silicon drift detectors, low-noise CMOS electronics, and gas detectors. A small amount of effort is devoted to RHIC beam diagnostics instrumentation. These projects have accounted for approximately 90 man-years of effort. Ongoing projects include silicon detectors (four FTEs), gas detectors (three FTEs), microelectronics (eight FTEs), Beam Diagnostics (three FTEs), and photon counters (two FTEs).

BNL gave the following priorities for increased physics and experimental support funding:

1. Add additional manpower and consumable supplies to increase running time.
2. Begin R&D on detectors for higher luminosity running.
3. Increase equipment funding of the RHIC computer center and short-term detector upgrades.

Optimum funding was presented as requiring an additional $3.0 million per year in operations support, an additional $1.0 million per year in detector R&D and an additional $2.4 million per year in detector base equipment.

2.2 Comments

The successes of BNL and its users in rapidly extracting exciting physics results from the first RHIC runs have been stunning. These results have firmly placed RHIC at the center of relativistic heavy ion physics in the world. Such a performance required tremendous focus and effort by the users and BNL and they performed splendidly. The Committee was extremely impressed with the results.

In many ways, this success, although stressful, has proven their strength and resourcefulness. It has been demonstrated that experiments can operate effectively for an approximate 30-week colliding-beam run, the same length as the projected length for a "typical" full RHIC run in the future. The experiments remain in the installation and commissioning mode and have not yet achieved the planned efficiencies. However, the Committee anticipates that as operational procedures become more automated, equipment better understood, and faulty equipment shaken out, the present staffing levels of physics and experimental support are basically sufficient for a 30-week run. Indeed the support levels may be able to decrease slightly. The Committee anticipates the level of engineering effort could be reduced as the major installation projects are completed. The Committee does not see a compelling need for additional technical support manpower in the Experimental Support and Facilities Division in C-AD. Technical support in the Physics and Chemistry Divisions also appears adequate, although increased scientific manpower can almost always increase the pace of physics results. Increased consumables at the level of $0.1 million per week will be required for increased running.

The number of BNL post-doctoral appointments does appear relatively low for a research group of this size. However, the Committee considers this distribution between permanent staff, post-docs, and technical staff to be a management decision. Increasing the fraction of post-doctoral appointments could be a wise reallocation of resources as installation activities come to a close.

The RHIC Computing Facility does have a challenging task ahead and is one area that immediately needs increased resources. The large-scale online storage system and the installation of new analysis capacity are limited by the availability of manpower. Additional resources here would have a big impact on the science output.

The BNL Instrumentation Department is a unique resource that is providing a valuable mix of focused and long-range R&D for future RHIC detector and accelerator diagnostics upgrades. RHIC makes very effective use of the Instrumentation Department. Collecting this effort in one location provides BNL and RHIC with a broader skill set than RHIC by itself could support. At BNL, the funding model for this division makes sense.

The Committee was concerned that medium- and long-range laboratory plans (examples are significant detector R&D projects, the criteria and decisions for declaring RHIC experiments to be ended, or detector upgrades for increased luminosity) appear to be established without external review. While BNL management and the users are working together on many of these issues, external perspective would be extremely valuable.

2.3 Recommendations

1. BNL management should seek external and broadly focused viewpoints before committing to these planning decisions, either by using existing advisory committees or establishing new ones.

2. The staffing of the RHIC computing facility should immediately be increased by approximately three FTEs to ensure that the ever-growing analysis and logging capacities are available to the users in a timely fashion. The Committee concurs with the priority to devote $2 million of equipment funds per year to grow the analysis computing capacity at the level required by the expected experimental program.

3. ACCELERATOR OPERATIONS

3.1 Mission, Resources, and Optimization

3.1.1 Findings and Comments

The mission of the Accelerator Division, in support of the Nuclear Physics program, is stated to be:

> "To develop, improve and operate the suite of particle/heavy ion accelerators used to carry out the program of accelerator-based experiments at BNL; support of the experimental program including design, construction and operation of the beam transports to the experiments, plus support of detector and research needs of the experiments; to design and construct new accelerator facilities in support of the BNL and national missions. The C-A Department supports an international user community of over 1500 scientists. The Department performs all these functions in an environmentally responsible and safe manner under a rigorous conduct of operations approach."

RHIC has just completed its first substantial physics run. With the FY 2002 budget, RHIC will operate 17 weeks for physics. These weeks are already complete, and there will be no further operation in FY 2002. The present shutdown will last through FY 2002; the critical path item is detector upgrades.

At the end of the FY 2001 through FY 2002 run, availability was 40 percent. However, the Committee noted that RHIC availability is computed in a manner that does not permit direct comparison with other facilities. Machine studies, machine development, setup, scheduled maintenance, etc., count as downtime in addition to equipment failure. The goal for the next run is approximately 60 percent.

During the FY 2001 through FY 2002 run, the peak design luminosity goal of 2×10^{26} cm^{-2} s^{-1} was met. The peak luminosity was enhanced by lowering β^* a factor of two below design. However, the design goal of 1×10^9 ions per bunch was not met (achieved 0.75×10^9) and the integrated luminosity goal of 500 inverse microbarns during the FY 2001-FY 2002 run was not met; 80 inverse microbarns were achieved.

The Committee found that 50 inverse microbarns per week was the goal. The best week was the last run (20 inverse microbarns per week). The goal in the next run remains 50 inverse microbarns per week, to be achieved by increases in current, luminosity, lifetime, and availability. During the last four weeks of operation RHIC was run with polarized protons.

The Committee endorses the Accelerator Division mission. The RHIC operation has been a major success. While it has not yet met all its design goals, great progress has been made, and the design goals seem well within reach. The Committee offers its hearty congratulations.

Table 3-1 shows how the C-AD operations budget is broken down functionally in FY 2002. It should be noted that this analysis has been done by BNL, and the Committee has not changed the numbers, although the analysis was reviewed and questioned. The Committee noted that sufficient effort is directed at commissioning-related availability issues. The R&D effort is very similar to other laboratories, and is considered to be reasonable. These numbers are burdened (in K$).

Table 3-1. C-AD Operations Budget

Operations; less $6,989 for Utilities		$48,882.5	67%
User Support	$3,225.7		
Accelerator	$43,310.3		
Infrastructure	$2,346.5		
Availability Improvements		$15,867.4	22%
Increased Capabilities		$6,366.6	9%
R&D		$1,588.9	2%
		$72,705.3	100%

BNL is presently attempting to deal with a number of issues associated with availability. Some of these are related to the older facilities (e.g., AGS, tandems, RHIC cryo plant) and others are associated with the new components of RHIC. The numbers above reflect the emphasis on

solving these problems. Additionally, AIP money is directed exclusively at availability-maintainability improvements. The Committee noted some significant considerations regarding availability upgrades:

- Power supply and quench protection repairs
- Ramp control improvements
- AGS sextupole coil replacement
- Collider helium storage addition (AIP)
- Liquid nitrogen-based shut-down cooling system (AIP)
- AGS MMPS generator field supply upgrade (AIP)

Additionally, the Siemens motor generator set is in the process of being repaired after failing shortly following a scheduled overhaul by General Electric. It is not clear whether or not the RHIC program will have to pick up the expense of the present repairs. It is clear that the RHIC program needs the motor generator set repaired. This could have a large impact on the C-AD budget.

- The enhancement activities are primarily directed at removing the fundamental current limitations, improving polarized proton operation, and making modifications that allow two species collisions (deuteron on gold). The electron cooling upgrade, which will provide an increase of a factor of ten in integrated luminosity, remains a low- level R&D activity. The items presently being worked on include:
- Helical dipoles (Magnet Division)
- Solenoids in RHIC to suppress electron cloud instability
- Improvements to low-level radio frequency to allow more bunches
- Installation of transverse damper system
- Improvements to ramp controls to allow different species in the two rings

An additional metric is the ratio of effort to materials and supplies. With the cost of the utilities subtracted, unburdened effort consumes 67 percent of the budget, and procurements account for 33 percent. This is a typical and reasonable split.

The Committee discussed C-AD staffing levels with department management. It is noted that C-AD FTEs dropped from 346.4 in FY 2001 to 338.8 in FY 2002 (including the Nuclear Physics work done by the Magnet Division). BNL management believes that this has slowed down accelerator operational improvements. The Committee noted that the reduction in FTEs is spread evenly throughout the department. The staffing level is lean and consistent with work

being efficiently done. Comparisons with other laboratories would lead to the same conclusion. The RHIC program benefits from the buffer of manpower presently supporting the Spallation Neutron Source and the Booster Application Facility construction.

The Committee generally finds that the allocation of resources within the C-AD is well optimized and directed at the goals and missions stated. Furthermore, the Committee noted that the majority of the activities are directed at increasing the number of weeks, increasing availability, or enhancing machine performance. All of these activities will potentially increase the integrated luminosity—the primary accelerator figure of merit. The Committee noted that BNL is in the position where increased funding in any of these areas will result in improvements leading to increased luminosity. The Committee concurs that a C-AD increase, used efficiently, will lead to increases in integrated luminosity.

3.2 Funding Levels

3.2.1 Constant Effort Scenarios

3.2.1.1 Findings and Comments

The level of C-AD funding has been flat for the past two years (five percent per year reduction due to inflation), and has left the department very lean. Under a constant effort scenario, BNL has estimated that only 16 weeks of running per fiscal year is possible. Runs would be combined across fiscal year boundaries resulting in long shutdowns between runs. Many of the reliability improvements would be delayed.

The first run has identified a number of items requiring upgrade or repair, and work has started on them. The next years will likely identify additional items. If funding is not available to address these issues reliability will suffer, and the actual available time for physics will remain low. Integrated luminosity increases are anticipated by increasing the bunch intensity and by going to 110 bunches. The latter improvement will not occur until the vacuum blow up problem (perhaps caused by the electron cloud instability) is solved, which will cost some amount of money. If after several years reliability problems are solved, the Committee believes more time could be found for running potentially 25 weeks, but this would require cuts in staff to pay for power and other consumables related to running. Furthermore, as the Work for Others (WFO) arrangements are phased out, RHIC will not be able to pick up any of the staff presently assigned to these projects.

3.2.2 Incremental Increase Scenarios

3.2.2.1 Findings and Comments

The Committee feels that an increase of about $10 million, applied to additional running weeks, to the availability improvements, and to the machine enhancements discussed above, would likely lead to an increase in integrated luminosity by a factor of at least two and possibly a factor of eight in the long term (three to five years). This scenario provides for the additional staff needed to aggressively attack these availability problems and accelerator enhancements, staff that would primarily come from the WFO programs.

The RHIC complex faces many unique maintenance issues because of the reuse of the AGS (where some components date from the 1960s) and RHIC itself, which utilized many components that were purchased in the early 1980s.

The Committee believes that the RHIC management has identified major maintenance issues. Incremental funding discussed above will cover the many outstanding problems, but does not eliminate the possibility of an extended downtime because of aging components in critical systems.

BNL is considering replacing the Tandem accelerators with an EBIS (electron beam ion source) type injector at a cost of $11.3 million. The advantage of the EBIS project is that it will improve reliability and reduce maintenance costs. The payback period for the project was estimated by BNL to be 2.5 years. This would be achieved by reduced operational costs, the elimination of Tandem running for RHIC, and the need to replace its aged control system. If the EBIS project is to proceed, it needs to be endorsed by the BNL management in a timely manner, and baselined. An outside review by technical experts with the participation of DOE should be held to validate the baseline.

BNL has produced a concept for RHIC II that results in a tenfold increase in the luminosity for an approximate cost of $6 million (R&D) and $54 million (construction) for the upgrade of the collider.

The Committee believes that this concept has great merit and should be pursued vigorously since it offers a huge potential increase in luminosity at a cost that is a small fraction of the facility investment. Because of the large cost, it is important (even at the R&D stage) that this project be developed in conjunction with the detectors, the funding agencies, and the

scientific communities in the context of the larger Nuclear Physics program. The physics captured by the detectors with higher luminosity needs to justify the cost. The Committee believes that the BNL C-AD is ready to begin the R&D program in FY 2003 if asked to do so.

3.3 Recommendation

1. BNL should consider calculating accelerator availability in a manner that is directly comparable with other facilities that operate in a similar mode.

4. ENVIRONMENT, SAFETY and HEALTH

4.1 Findings and Comments

RHIC facility activities embrace rather systematic and comprehensive processes to ensure that safety and environmental protection are integrated into its work. The foundation process involves implementation of the BNL Standards Based Management System (SBMS) which translates ES&H related regulations, orders, and standards into a set of required ES&H program components that must be formalized, documented, and adhered to by all BNL organizational entities, including those identified as essential for RHIC. Nearly twenty specific SBMS driven documented ESHQ program components are required as applied to RHIC. These include Conduct of Operations, Training and Qualification, Hazard Assessment, Operations Procedure Manuals, Safety Inspection, Work Permit Program, Internal Assessments Program, Facility Use Agreements, etc. Each individual has formalized roles, responsibilities, accountabilities, and authorities documents (R^2A^2) that focuses the individual's attention to his/her expectations and thereby stipulates involvement of all individuals in integrating safety into all work activities.

A dedicated ESHQ subject matter expert team resides in the C-AD of the RHIC operations. Visibility to ESHQ is manifested by the fact that within C-AD, there is a position of Associate Department Chairperson for ESHQ, as well as a defined ESHQ Division. In-house environment and safety expertise is complemented and supplemented by purchase of some distributed services from BNL's ESHQ Directorate, as well as by service provided from the ESHQ Directorate through overhead. Some 19.6 dedicated FTEs are assigned through this arrangement of which approximately 70 percent is directed toward the Nuclear Physics activities at a cost of slightly over $2 million or 2.6 percent of the Nuclear Physics' budget. Overhead provided to ESHQ laboratory-wide support increases this cost to approximately 4.2 percent.

Safety and Environmental Protection expertise that is readily available encompasses the wide spectrum of expertise including electrical safety, chemical safety, pressure safety, industrial hygiene, environmental engineering, environmental compliance, health physics, safety engineering, fire protection, and training.

It is evident, based on discussions, that line management has accepted its responsibility for safety and environmental protection and holds its personnel accountable. The Integrated Safety Management (ISM) guiding principles and core functions are practiced in the conduct of work at RHIC. A formalized gap analysis for ISM implementation has been conducted and acted

upon. Laboratory ES&H processes are applied to users, service contractors, and construction contractors in order to ensure flow-down of ISM. Involvement of all levels of personnel in work planning is evident, including development of operating procedures.

RHIC benefits from the deliberations and work of a variety of ES&H related committees. Examples include the Accelerator Systems Safety Review Committee, the Experimental Safety Review Committee, the Radiation Safety Committee, the ALARA Committee, and the Safety Inspection Committee. These committees involve a variety of technical, scientific, and professional personnel drawn not only from RHIC but also from elsewhere within BNL. Experimental and operational safety reviews are standard practice. Work authorization is required with few exceptions. One of the exceptions involves self-authorization based on skill of the craft.

RHIC provides input into the BNL's Environment, Safety, Health and Infrastructure Management Plan process as one mechanism for capturing needs related to RHIC operations. Activity data sheets are provided to the Plan Coordinator for evaluation, binning, and prioritization at various times during the year. In this process, RHIC is in competition with others for limited GPP and discretionary laboratory operations funds.

A maturing self-assessment effort is evident at RHIC. It serves as a very useful feedback mechanism and stimulates continuous improvement. It is supplemented by the DOE Brookhaven Area Office (BAO) assessments of BNL, many of which involve RHIC. Some assessments are done jointly by the BAO and the Laboratory. BAO has a facility representative for RHIC.

RHIC took the lead for BNL in the ISO 14001 registration and is to be commended for that leadership effort. Thus, a formalized environmental management system is in place and seems to be working. Some employee feedback indicates this to be a most worthy effort that may have an invaluable return on investment. It was noted that the full Laboratory has now achieved ISO 14001 registration.

With consideration for the systematic processes in place and generated by the SBMS approach and the fact that some "right sizing" of dedicated ESHQ subject matter expertise has occurred over the past two to three years, it is concluded that the ESHQ function within RHIC may be optimal for current or even reduced run times. However, it would be further optimized as a result of additional funding. A 37-week running time (optimal) would not significantly stress the available existing ESHQ support effort. However, this does not take into consideration potential impacts of external regulations or direct charge for waste disposal.

In summary, RHIC has a technically sound and operationally successful integrated ES&H program based on SBMS. ESHQ manpower loading and costs appear to be optimized at that necessary to continue current operations, as well as for operations resulting from enhanced funding. Proceeding forward on the ongoing path by RHIC will continue to maintain safety and environmental protection as values and not just priorities.

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5. FUNDING

5.1 Findings and Comments

BNL presented a credible case that the current level of funding significantly constrains RHIC operations, as well as R&D for both detectors and the accelerator complex. In particular, in the mid-1990s, the Nuclear Science Advisory Committee recommended a 37-week running schedule (30 weeks for data taking and seven weeks for accelerator development and studies). The FY 2002 Nuclear Physics budget provides for 19 weeks as BNL has allocated the funds.

The Committee looked at BNL's allocation of funds and considered it to be reasonable in the short run. To support this, BNL presented general comparisons with other collider laboratories with a more detailed comparison to Fermilab. The latter comparison indicates a shortage of FTEs compared to the total budget. This supports BNL's assertion that the C-AD needs $4.6 million to hire additional staff. Direct comparison to Fermilab would indicate an even larger staff increase. However, this does not recognize differing accelerator running schedules, R&D programs, demographics, skills mix, and regional labor cost differentials. Further, such direct comparisons assume that the labor to materials and services mix is correct for one organization and not the other. Hence, the Committee accepts BNL's position concerning the long-term staffing needs of the C-AD.

The Committee agrees that the -10 percent funding scenario is not workable. The -5 percent scenario appears viable as a one-year crisis response, but does not appear to be sustainable in the longer run.

The constant level of effort presents a viable physics program and based on the benefits anticipated from the ongoing reliability improvements the number of weeks of running in the outyears should increase from the FY 2002 experience of 19 weeks. However, this scenario poses significant risks of major failures due to the lower than ideal level of accelerator maintenance. Further, R&D directed to improvements will not occur. The Committee believes that long-term operations at constant effort provides for a very lean program with no capability for growth.

The optimum scenario, in the view of BNL, provides for the needs of a strong physics program, a responsible accelerator maintenance effort, and preparations for desired accelerator and detector upgrades. As discussed below the Committee believes that similar results can be obtained for a somewhat lower funding level.

BNL presented the following table to address the various funding scenarios.

Funding Scenarios - Summary Level

Item (FY02 $M)	-10% ($M)	-5% ($M)	FY02 ($M)	OutYrs ($M)	Optimum ($M)
Accelerator Operations	69.5	70.8	**72.7**	72.7	87.9
Detector Operations Support	20.5	22.4	**24.1**	24.1	26.9
Accelerator Base Equip.	0.8	1.0	**1.1**	1.0	2.0
Detector Base Facility Equip.	1.7	3.1	**4.1**	3.2	7.4
Accel. Improv. Projects (AIP)	1.3	1.5	**2.5**	2.3	6.0
Accel. & Detector R&D Prog.	0.0	0.3	**0.0**	1.2	5.0
Waste Management	3.0	3.0	[3.0]*	3.0	3.0
Total Facility Base	**96.8**	**102.1**	**107.5**	**107.5**	**138.2**
Research Equipment	4.0	4.0	**4.0**	4.0	5.0
Colliding Beam Weeks	~~1~~	**10**	**14**	**14**	**30**
Studies/Comm. Weeks	~~3~~	3	**5**	5	7
	Not workable				
No. of RHIC Experiments	**2**	**3**	**4**	4	4

* Provided as Landlord funding to BNL in FY02

US Department of Energy
Brookhaven Science Associates

T. Kirk
February 5, 2002

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BNL presented a series of scenarios for funding increments of $5 million beyond the FY 2002 funding level, up to the optimum scenario.

Incremental Funding Scenarios - Summary Level

Item	+5M ($M)	+10M ($M)	'03BNL ($M)	+20M ($M)	+25M ($M)
Accelerator Operations	76.0	78.8	81.0	83.3	86.2
Detector Operations Support	25.2	26.1	26.1	27.1	27.1
Accelerator Base Equip.	1.1	1.1	1.1	1.4	1.7
Detector Base Facility Equip.	3.2	3.4	4.2	5.7	6.5
Accel. Improv. Projects (AIP)	2.3	3.0	3.0	3.5	4.0
Accel. & Detector R&D Prog.	1.6	2.0	2.8	3.5	4.0
Waste Management	3.0	3.0	3.0	3.0	3.0
Total Facility Base	**112.4**	**117.4**	**121.2**	**127.5**	**132.5**
Research Equipment	4.0	4.0	4.0	4.0	5.0
Colliding Beam Weeks	**20**	**25**	**26**	**30**	**30**
Studies/Comm. Weeks	5	5	5	5	7
No. of RHIC Experiments	**4**	**4**	**4**	**4**	**4**

* Provided as Landlord funding to BNL in FY02

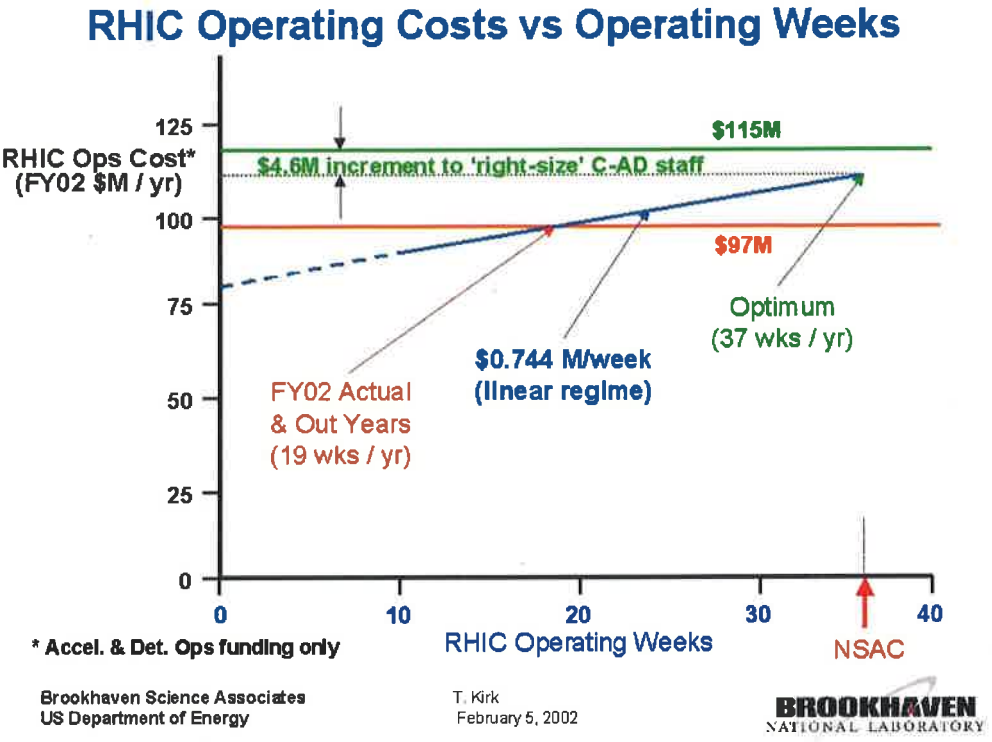
FY03 PB $121.2

US Department of Energy
Brookhaven Science Associates

T. Kirk
February 6, 2002

BROOKHAVEN NATIONAL LABORATORY

These scenarios bought increasing weeks of running and R&D directed towards the desired upgrades. A general algorithm for the weeks of running versus operating budget was presented as shown below.



While this graph is simply based on a linear connection of two data points, i.e., current and optimum scenarios, the Committee believes it to be an adequate first order method of fund allocation. Statements from some department heads supported, in part, the slope of $0.74 million cost per week of running, although it is to be noted that the same 30 weeks of physics operation are presented in the table above at a funding level $10.7 million less. If this were chosen as the high end data point the cost per week would be $0.56 million. This table also shows the "$4.6 million increment to 'right-size' the C-AD staff."

The Committee believes that a budget increase of approximately $16 million is appropriate. Specifically, the Committee arrived at the following allocations as being supportable. This is not to say that BNL would not make good use of the "optimum" budget as proposed.

Committee Funding Scenario (in FY 2002 dollars)

Item	FY02 ($M)	Committee ($M)
Accelerator Operations	72.7 [3]	82.7
Detector Operations Support	24.1	26.2 [1]
Accelerator Base Equip.	1.1	1.4
Detector Base Facility Equip.	4.1	5.7
Accel. Improv. Projects (AIP)	2.5	2.5 [2]
Accel. & Detector R&D Prog.	0.0 [3]	2.0 [4]
Total Facility Base	104.5	120.5
Colliding Beams Weeks	14	30
Studies/Comm. Weeks	5	5

The Committee's version provides a $10 million increment to accelerator operations and $2.1 million for detector operations support to permit an additional 16 weeks of accelerator uptime. Thus, a $12.1 million funding increase almost doubles the uptime. A total of $3.6 million funds accelerator and detector R&D and future detector upgrades.

In the intermediate term, BNL has plans to improve the polarized proton capability of the accelerator complex and is studying the upgrade or replacement of the tandem Van de Graaff accelerators. The former appears to be financially within reach in all increased funding scenarios while the latter is still in the study stage and hence a path forward was not presented.

The long-term RHIC Facility Upgrade Plan was presented as it was shown to the Nuclear Science Advisory Committee LRP Workshop (see below).

The Committee did not address the costs associated with this plan other than to note that the R&D funding was already behind schedule as BNL's FY 2002 allocation has not provided the $0.5 million detector R&D for which the plan above calls. Given the FY2003

[1] 16 extra weeks of running at approximately $0.10 million per week and $0.5 million for RCF

[2] The extra $1 million in the Lab's +$20 million scenario needs to be justified based on specific programmatic arguments should additional funds become available

[3] In FY 2002 the Accelerator Operations includes $1.6 million in Accelerator R&D.

[4] The extra $1.5 million in the Lab's +$20 million scenario needs to be justified based on specific programmatic arguments should additional funds become available.

RHIC Facility Upgrade Plan...
As Presented to NSAC LRP Workshop

Proposed time scales and funding for RHIC Upgrades

Machine and Detectors... FY 2002 M$

Luminosity upgrade [RHIC II]	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	Totals
Electron Cooling				2.0	15.0	15.0	15.0	7.0			54.0
RHIC II Detector Upgrades				5.0	10.0	15.0	15.0	15.0	10.0	10.0	80.0
Subtotals		0.0	0.0	7.0	25.0	30.0	30.0	22.0	10.0	10.0	134.0
RHIC II R&D [Operating funds]											
Machine R&D		1.0	2.0	3.0							6.0
Detector R&D	0.5	1.0	2.0	2.0	1.0	1.0	0.5				8.0
Subtotals	0.5	2.0	4.0	5.0	1.0	1.0	0.5				14.0
Total RHIC II	0.5	2.0	4.0	12.0	26.0	31.0	30.5	22.0	10.0	10.0	148.0

This is the assumed ramp-up of luminosity from the Au-Au design value...

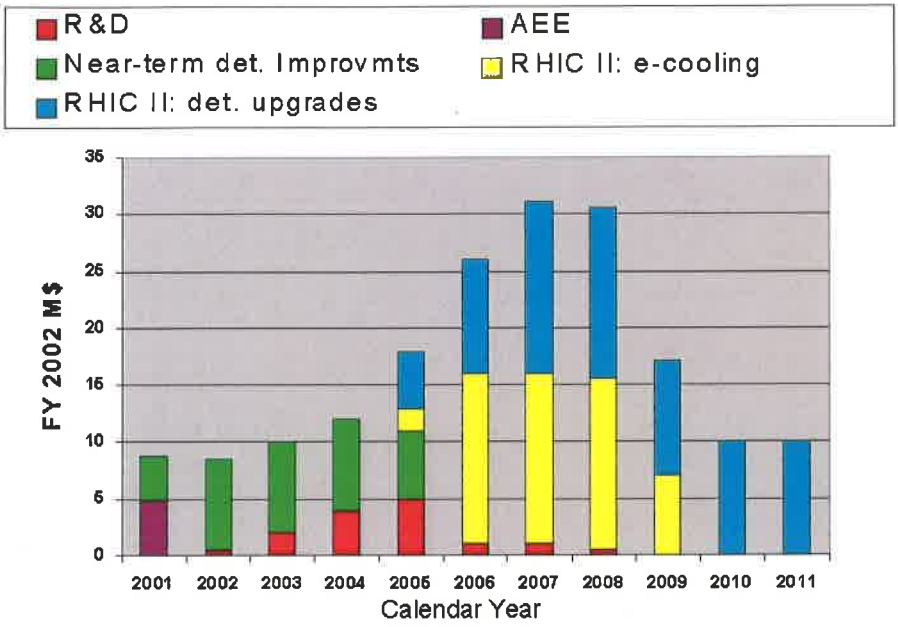
The first factor of 4 is funded from the on-going operations budget. The final factor of 10 is RHIC II:

	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11
Au-Au Luminosity	L_0	$2xL_0$	$4xL_0$	$4xL_0$	$4xL_0$	$4xL_0$	$4xL_0$	$4xL_0$	$40xL_0$	$40xL_0$

President's Budget allocation to BNL there is the opportunity to recover and stay on the R&D schedule. However, it was too soon after BNL was informed of the President's Budget allocations to RHIC to expect BNL to make definitive comments on this issue.

The overall upgrade plan is shown below. The Committee did not look into this plan in detail other than some of the near term efforts. The FY 2002 funding provides for a lean operation and additional funds would significantly improve the physics output, operational reliability, and provide for R&D necessary for future upgrades. The Committee believes an increase of about $16 million (in FY 2002 dollars) above the FY 2002 level is appropriate. The Committee supports BNL's priority ordering for spending incremental funds.

Proposed RHIC Upgrade Funding



6. MANAGEMENT

6.1 Overall Management

6.1.1 Findings

BNL is a multipurpose laboratory. The DOE Nuclear Physics program funds operations of RHIC, a flagship national user facility for the Nation's basic research community. The DOE Nuclear Physics Program also funds research in experimental and theoretical nuclear physics at BNL, as well as providing funds for carrying out various landlord responsibilities.

BNL's mission for the RHIC facility is to "operate, maintain and upgrade the U.S. Department of Energy's Relativistic Heavy Ion Collider accelerator, detectors and computing user facilities for performance of frontier research in relativistic heavy ion and proton spin nuclear physics; perform research and development work in accelerator science, experimental detector design and advanced computing methods for the productive evolution of the RHIC facility and to support the research missions of RHIC."

The RHIC facility includes the RHIC collider and the injector complex (Tandem/Linac/ Booster/Alternating Gradient Synchrotron); it is operated by the C-AD. The C-AD reports to the Laboratory Associate Director for High Energy and Nuclear Physics who has line authority and is responsible to direct this program. The Associate Director reports to the Laboratory Director.

The Physics Department, Instrumentation Division, and Superconducting Magnet Division also report to this Laboratory Associate Director. A significant component of the activities of each of these organizations supports the Nuclear Physics program at RHIC.

The Physics Department supports research at RHIC by in-house scientific staff and provides some support functions for outside users of RHIC. The Instrumentation Division develops new instrumentation for use in RHIC experiments. The Superconducting Magnet Division develops and tests new magnets for the facility and provides diagnostic and repair services for the various superconducting magnets of the facility.

BNL has developed important expertise in a number of areas that are important for conducting a successful science program at RHIC and that are, in addition, an important resource for the Nation's research community. Examples are:

- Superconducting magnet technology.
- Development of advanced detectors and instrumentation.
- Large scale computing and data processing

The Associate Director is advised by the HENP Program Advisory Committee (PAC), and provides review of and advice on RHIC and AGS experimental proposals submitted by users. In addition, the PAC provides annual advice on the beam species/energies schedule for RHIC running. Additional channels of input are provided by monthly meetings with the RHIC and AGS Users Executive Committee and the annual Users' Meeting.

Additional communication and coordination meetings are held at regular time intervals to facilitate detailed coordination between accelerator operation and the running of experiments. BNL serves its users well.

Planning for the RHIC program is the responsibility of the Associate Director. He receives input from his line managers, the PAC, the spokespersons of the RHIC experiments, and the Executive Committee of the User's Association.

6.1.2 Comments

The RHIC facility and associated research support is well managed. Resources appear to be used effectively to provide for the needs of the ongoing research program. BNL appears to be well poised to carry out the Nuclear Physics program at RHIC.

It is very important that planning for RHIC in the next five years be driven by a science-based vision of the measurements that are most important to accomplish and how to optimize the available and requested resources to reach those key goals. At this review, the major scientific deliverables and the instrumentation and integrated luminosity required to accomplish them were not clearly articulated to the Committee by the Laboratory management as a science-driven basis for the requests for incremental funding.

The Committee believes that the Laboratory would benefit from augmenting the intermediate and longe-range resource planning for the RHIC program so that the focus of the program on the most critical scientific goals is enhanced. The emerging competition from the LHC heavy ion program heightens the need to focus the RHIC program and its evolution on the most critical scientific goals.

6.2 Summary

BNL's mission in nuclear physics is a key part of the Nation's efforts in this important area of basic research. The RHIC facility is a flagship facility in this field and is the core of the Nuclear Physics program at Brookhaven. BNL management and its users are to be commended for the successful and timely commissioning of the RHIC facility and for the rapid start of a vigorous RHIC physics program.

The RHIC facility and the associated research programs are well managed. The Brookhaven staff is providing quality operation of the collider with limited resources, and the RHIC user community (researchers both from within and outside of the Laboratory) is utilizing RHIC to produce first-rate science.

The Laboratory indicates that funding at the FY 2002 Appropriations level in FY 2003 and the outyears would result in continued operation at the FY 2002 level of 19 weeks per year (14 weeks for research) with runs scheduled to bridge the fiscal year boundary with attendant problems from hot weather operations. R&D for accelerator and detectors would be started at the lowest level that can make progress. Funds for accelerator equipment would be held constant and equipment funds for detectors would be reduced.

The Committee believes that with constant effort funding at the FY 2002 base, the level of collider and detector operations including computing capabilities, R&D, and development of equipment is insufficient to meet the needs of the facility's user community and to achieve the most critical scientific goals for the facility.

The Committee was also asked to assess the benefits to the Nuclear Physics program that would result from an increase of funding for nuclear physics at Brookhaven above the FY 2002 Appropriations level. BNL management provided the committee with a number of scenarios for incremental funding above the FY 2002 base. In all cases the additional funding would provide for additional operations of RHIC for research and for a strong development program for the collider complex and the associated experiments.

The Committee supports BNL's request for a significant increase in funding for the RHIC program in order to provide the beam time and integrated luminosity needed for a strong scientific program and the investments to position the facility for the luminosity upgrade that would be provided by the RHIC II electron cooling.

The Committee supports an increase over the FY 2002 base of about $16 million for enhanced RHIC operation and investments related to future improvements of the facility.

6.3 Recommendations

1. BNL management should explore mechanisms to increase the science-driven focus on intermediate and long-range resource planning for the RHIC program. Possibilities include expanding the scope for the existing PAC or utilizing a new advisory group to help the Laboratory develop and articulate this focus, or establishing the position of a RHIC Scientific Director.

APPENDIX A

CHARGE MEMORANDUM

DOE F 1325.8
(08-93)

United States Government **Department of Energy**

memorandum

DATE: November 28, 2001

REPLY TO ATTN OF: Office of Science

SUBJECT: Operations Reviews of the CEBAF and RHIC Facilities

TO: Daniel R. Lehman, Director, Construction management Support Division, SC-81

The Nuclear Physics program supports the operations of two major national user facilities: the Continuous Electron Beam Accelerator Facility (CEBAF) at Thomas Jefferson National Accelerator Facility (TJNAF) and the Relativistic Heavy Ion Collider (RHIC) facility at Brookhaven National Laboratory (BNL). These facilities are supported to develop and provide capabilities that can be utilized to carry out world-class research programs.

This memorandum is to request that you organize and conduct reviews of the CEBAF and RHIC facilities to evaluate present performance and cost of operations, and what funding is needed to effectively support their research mission. In order to do this, your review committee should examine all the TJNAF/CEBAF and BNL/RHIC activities associated with facility operations supported by the Nuclear Physics program, determine the real cost (especially manpower) that is being incurred by Nuclear Physics for each activity, advise whether these activities are required and in the best interest of the Nuclear Physics program, and explore options of reducing funding for these facilities with an evaluation of the associated impacts. In particular, it is requested that your review committee:

1. Perform an analysis and evaluation of the present facility operations.
   - 1.1 What is the mission of the facility?
   - 1.2 How are resources currently used (bottoms up analysis) to carry out this mission?
   - 1.3 Are available resources optimized for the most productive program?

2. Evaluate the impacts of different funding levels on the productivity of the facilities.
   - 2.1 What level of facility operations and scientific productivity could be sustained into the outyears with constant effort funding (at the FY 2002 Appropriations level)?
   - 2.2 What benefits, in order of priority, could be realized with incremental funding above this level?

The TJNAF and BNL laboratories have agreed for the reviews to occur in the weeks of January 21st and February 4th, respectively. I have asked Jim Hawkins in the Nuclear Physics Division to be the point-of-contact with your office for this review. Please contact him if you have any questions or if there is any way our office might provide assistance. Again, I wish to thank you for agreeing to chair this review. I would appreciate receiving the committee's report within 60 days of the review.

Signed by

Dennis Kovar
Director
Division of Nuclear Physics

cc:
James Decker, SC-1
Milt Johnson, SC-1
S. Peter Rosen, SC-20
James Turi, SC-80
Mike Holland, DOE/BNL
Jerry Conley, DOE/TJNAF
Christoph Leemann, TJNAF
Peter Paul, BNL
Tom Kirk, BNL

APPENDIX B

REVIEW PARTICIPANTS

Department of Energy Operations Review of the Relativistic Heavy Ion Collider
February 5-7, 2002

Support

Casey Clark, DOE/SC

Daniel R. Lehman, DOE, Chairperson

SC1

Experimental Program

* Donald Geesaman, ANL
Peter Barnes, LANL
John Cooper, Fermilab
Barbara Jacak, Stony Brook
[Stanley Kowalski, MIT]

SC2

Accelerator Operations

* Rod Gerig, ANL
Stan Ecklund, SLAC
Stanley Kowalski, MIT
John Marriner, Fermilab
[Konrad Gelbke, MSU]

SC3

Management

* Jay Marx, LBNL
Bruce Chrisman, Fermilab
Lowell Ely, DOE/SC
Konrad Gelbke, MSU
Robert Wynveen, ANL

Observers

Dennis Kovar, DOE/SC
James Hawkins, DOE/SC
Gulshan Rai, DOE/SC
Stephen Steadman, DOE/SC
Jehanne Simon-Gillo, DOE/SC

LEGEND

Subcommittee
SC Chairperson
* Part-time Subcommittee Member
[ ] **Count: 15** (excluding observers)

APPENDIX C

REVIEW AGENDA

Department of Energy Operations Review
of the
Relativistic Heavy Ion Collider

AGENDA

Tuesday, February 5, 2002—Berkner Hall, Room B

8:00 am	DOE Executive Session ..... D. Lehman
9:00 am	Welcome ..... P. Paul
9:05 am	Laboratory Overview and Mission ..... T. Kirk
9:30 am	Staffing and Resources Needed for RHIC Operations ..... D. Lowenstein
10:15 am	Break
10:30 am	RHIC Accelerator System Operation ..... T. Roser
11:00 am	RHIC Detector Infrastructure Operations ..... P. Pile
11:30 am	RHIC Detector Operations ..... S. Aronson
12:00 pm	Lunch
1:00 pm	Tour
2:00 pm	RHIC Computing Center Operations ..... B. Gibbard
2:30 pm	RHIC Magnet Division Operations ..... M. Harrison
3:00 pm	RHIC ES&H Program ..... E. Lessard
3:15 pm	Break
3:30 pm	Breakout Sessions (Physics/Experimental; Accelerator; and Management)
4:30 pm	Subcommittee Executive Sessions
5:00 pm	DOE Executive Session
6:30 pm	Adjourn

Wednesday, February 6, 2002

8:30 am	Breakout Sessions (Physics/Experimental and Accelerator)
10:00 am	Breakout Sessions (Management and Administration)
12:00 pm	Lunch
12:30 pm	Breakout Sessions
2:30 pm	Subcommittee Executive Session
3:00 pm	DOE Executive Session

Thursday, February 7, 2002

8:00 am	Subcommittee Working Sessions
9:00 am	DOE Full Committee Executive Session Dry Run
12:00 pm	DOE Summary and Closeout with Laboratory Management
1:00 pm	Adjourn

DiFilippo, Lynanne

From:	Lehman, Daniel <Daniel.Lehman@science.doe.gov>
Sent:	Thursday, June 27, 2013 3:31 PM
To:	oliver.bruning@cern.ch; Rod Gerig (rod@aps.anl.gov); glasmacher@frib.msu.edu; Barbara Jacak (jacak@skipper.physics.sunysb.edu); ioanis@fnal.gov; 'louis@anl.gov'; McKeown, Robert (SC-JLAB); Meador, Stephen; Merrill, Ethan; Rej, Don (drej@lanl.gov); jurgen.schukraft@cern.ch; 'Seeman, John' (seeman@slac.stanford.edu); stanfield@fnal.gov; wyslouch@mit.edu
Cc:	Hallman, Timothy; Gillo, Jehanne; Dukes, Cassie; Farkhondeh, Manouchehr; Hafidi, Kawtar; Sowinski, James; Crescenzo, Frank (SC-BHSO); Zukowski, Elaine D; Lissauer, David; Roser, Thomas; DiFilippo, Lynanne; 'mueller@bnl.gov'; Rodgers, Karen; Clark, Casey
Subject:	DOE/SC Operations Review of the RHIC Project (BNL), August 6-8, 2013
Attachments:	BNL Campus_The Center.pdf; Agenda.docx; charge RHIC Ops.pdf; Contents.docx; REVCOM RHIC.xlsx; 0202RHICrpt w-appendices.docx

Dear Review Committee Member:

I would like to thank you for agreeing to serve as a member of the Department of Energy/Office of Science (DOE/SC) committee reviewing all activities supporting the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL). The Operations Review will take place at BNL, in Upton, New York on August 6-8, 2013.

The purpose of the review is to examine all the BNL/RHIC activities associated with facility operations supported by the Nuclear Physics program, the costs being incurred for each activity, whether these activities are required to achieve facility goals and objectives, and opportunities for increasing cost-effectiveness of this facility. The detailed charge to the committee is attached for your information, as well as the following documents:

- DOE/SC Review Participants
- Draft Agenda
- Report Outline/Writing Assignments
- BNL Campus Map
- 2002 DOE/SC Report

The review will begin on Tuesday, August 6, at 8:00 a.m. at the Brookhaven Center (Building 30) in the South Room, with a DOE Executive Session followed by RHIC Operations plenary presentations. On Wednesday, there will be parallel subcommittee sessions devoted to in-depth exploration of topics, followed by a DOE Executive Session. The committee will adjourn on Thursday, August 8, at 1:00 p.m. after a closeout presentation to BNL/RHIC project management to share the committee's findings and recommendations.

Review information will be made available to you, via website, approximately two weeks prior to the review. The project will provide this information to you directly. Copies of all presentation material will be provided to you at the beginning of the review.

I would like the chairperson of each subcommittee, after conferring with the members of his subcommittee, to provide a list of issues and/or questions that need to be addressed to David Lissauer (631-344-4966; lissauer@bnl.gov) and Thomas Roser (631-344-4966; roser@bnl.gov) by July 29. The agenda for the subcommittee presentations by the project and the time allotted for follow-up discussions between the

subcommittee and the project should be agreed by the subcommittee chair and the project.

REVIEW LOGISTICS

HOTEL: There is a block of rooms available at the Springhill Suites Long Island Brookhaven (2 Sawgrass Drive, Bellport, New York 11713). The group rate is $112.00 + tax per night. **All rooms that are not reserved by Monday, July 22 will be released** back into inventory for general sale.

To make your reservation for the review, please click on this link: Book King Studio at SpringHill Suites Long Island Brookhaven for $112.00 rate per night
You may also contact the hotel directly at 631-924-0090—the name of the Group is: RHIC Review

Information on other hotels in the area can be accessed at: http://www.bnl.gov/bnlweb/hotels.asp .

MAPS: Maps and directions for BNL and the surrounding area are located at: http://www.bnl.gov/bnlweb/maps.asp. A BNL campus map is also attached for your convenience.

SITE ACCESS: If you are a U.S. Citizen and have a DOE badge you are not required to obtain a visitor pass to enter the BNL site. Your name will be provided to the guard station. Guards will direct you to the correct building.

Those NOT in possession of a DOE badge or Foreign Nationals (whether or not you hold a DOE badge) should follow the directions below and complete a guest registration IMMEDIATELY.

Go to the BNL home page: http://www.bnl.gov
Click on the Guest Registration, which is located on the left-side toolbar, in the section "BNL Site Access".
Please follow the prompts and fill in the information as completely as possible.

If possible, it would be useful for you to bring your portable computer with word processing software to the review.

Again, I would like to express my appreciation for your willingness to serve on this committee. If there are any questions, please contact Steve Meador (301-903-0269, stephen.meador@science.doe.gov) or Casey Clark (301-903-5451; casey.clark@science.doe.gov).

Regards,
Daniel R. Lehman

Director
Office of Project Assessment, SC-28
Office of Science
U.S. Department of Energy
301-903-4840
daniel.lehman@science.doe.gov

Department of Energy / Office of Science Operations Review of the Relativistic Heavy Ion Collider (RHIC) Project
August 6-8, 2013

Daniel R. Lehman, DOE/SC, Chairperson

SC1 Experimental Program	SC2 Accelerator Operations	SC3 Management
* Bill Louis, LANL	* Rod Gerig, ANL	* Thomas Glasmacher, MSU
Barbara Jacak, Stony Brook	Oliver Bruning, CERN	Steve Meador, DOE/SC
Jurgen Schukraft, CERN	Ioanis Kourbanis, FNAL	Ethan Merrill, DOE/SC
Bolek Wyslouch, MIT	John Seeman, SLAC	Don Rej, LANL
		Ken Stanfield, retired FNAL

Observers

Tim Hallman, DOE/SC
Jehanne Gillo, DOE/SC
Manouchehr Farkhondeh, DOE/SC
Kawtar Hafidi, DOE/SC
James Sowinski, DOE/SC
Frank Crescenzo, DOE/BHSO

LEGEND

SC Subcommittee
* Chairperson

Count: 14 (excluding observers)

Department of Energy / Office of Science Operations Review of the Relativistic Heavy Ion Collider (RHIC) Project
August 6-8, 2013

Name:	Phone:	E-mail:
Oliver Bruning, CERN	41-227679161	Oliver.Bruning@cern.ch
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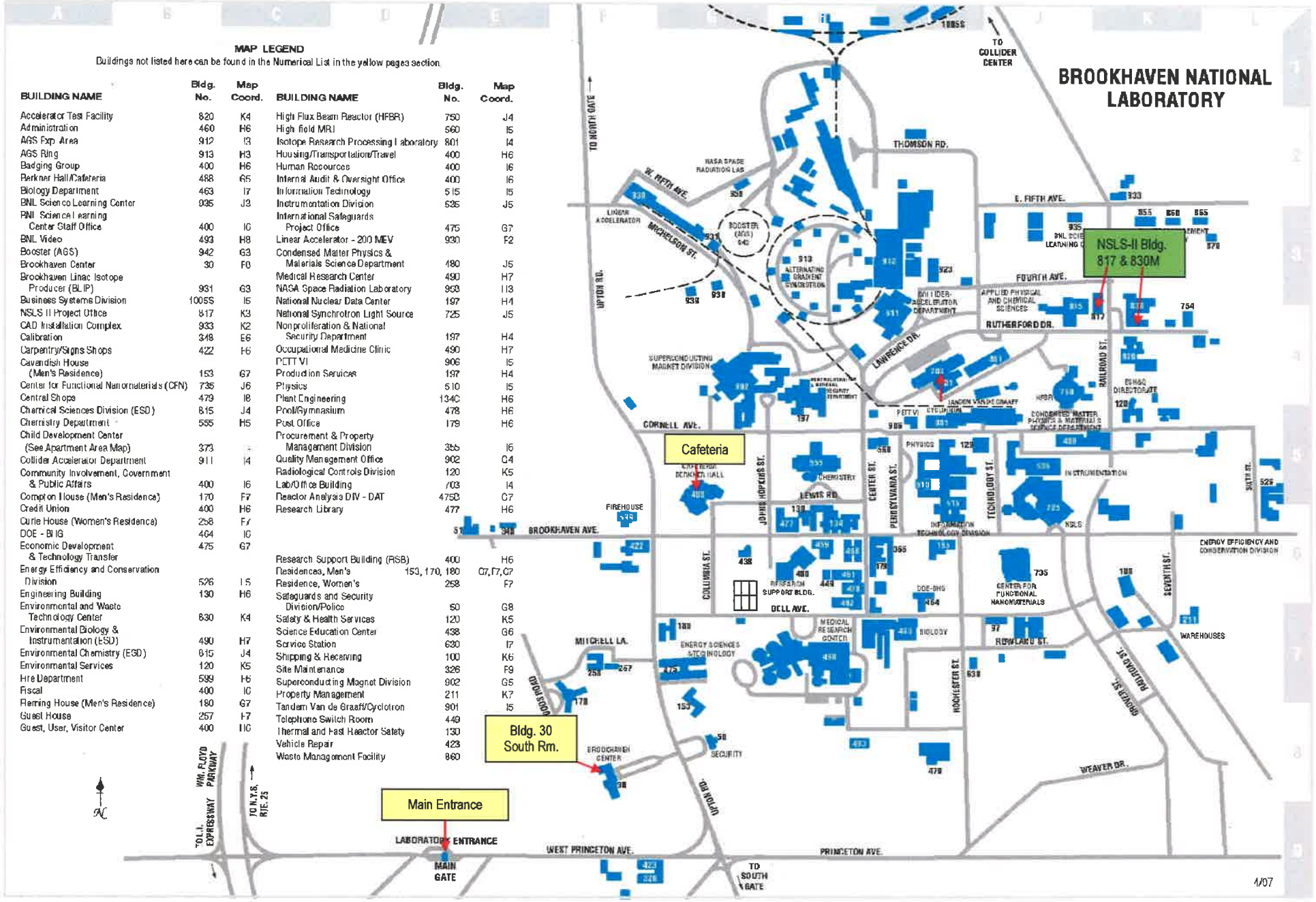
Don Rej, LANL	505-665-1883	drej@lanl.gov
Jurgen Schukraft, CERN	41 22 76 75955	jurgen.schukraft@cern.ch
John Seeman, SLAC	650-926-3566	seeman@slac.stanford.edu
Ken Stanfield, retired FNAL	630-840-3211	stanfield@fnal.gov
Bolek Wyslouch, MIT	617-253-5431	wyslouch@mit.edu


BROOKHAVEN NATIONAL LABORATORY
MAP LEGEND
Buildings not listed here can be found in the Numerical List in the yellow pages section.
BUILDING NAME | Bldg. No. | Map Coord.
Accelerator Test Facility 820 K4
Administration 460 H6
AGS Exp Area 912 I3
AGS Ring 913 H3
Badging Group 400 H6
Berkner Hall/Cafeteria 488 G5
Biology Department 463 I7
BNL Science Learning Center 935 J3
BNL Science Learning Center Staff Office 400 I6
BNL Video 493 H8
Booster (AGS) 942 G3
Brookhaven Center 30 F6
Brookhaven Linac Isotope Producer (BLIP) 931 G3
Business Systems Division 1005S I5
NSLS II Project Office 817 K3
CAD Installation Complex 933 K2
Calibration 348 E6
Carpentry/Signs Shops 422 H6
Cavendish House (Men's Residence) 153 G7
Center for Functional Nanomaterials (CFN) 735 J6
Central Shops 479 I8
Chemical Sciences Division (ESD) 815 J4
Chemistry Department 555 H5
Child Development Center (See Apartment Area Map) 373 -
Collider Accelerator Department 911 I4
Community Involvement, Government & Public Affairs 400 I6
Compton House (Men's Residence) 170 F7
Credit Union 400 H6
Curie House (Women's Residence) 258 F7
DOE - BHG 464 I6
Economic Development & Technology Transfer 475 G7
Energy Efficiency and Conservation Division 526 I5
Engineering Building 130 H6
Environmental and Waste Technology Center 830 K4
Environmental Biology & Instrumentation (ESD) 490 H7
Environmental Chemistry (ESD) 815 J4
Environmental Services 120 K5
Fire Department 599 H6
Fiscal 400 I6
Fleming House (Men's Residence) 180 G7
Guest House 257 F7
Guest, User, Visitor Center 400 I6
High Flux Beam Reactor (HFBR) 750 J4
High field MRI 560 I5
Isotope Research Processing Laboratory 801 I4
Housing/Transportation/Travel 400 H6
Human Resources 400 I6
Internal Audit & Oversight Office 400 I6
Information Technology 515 I5
Instrumentation Division 535 J5
International Safeguards Project Office 475 G7
Linear Accelerator - 200 MEV 930 F2
Condensed Matter Physics & Materials Science Department 480 J5
Medical Research Center 490 H7
NASA Space Radiation Laboratory 958 I13
National Nuclear Data Center 197 H4
National Synchrotron Light Source 725 J5
Nonproliferation & National Security Department 197 H4
Occupational Medicine Clinic 490 H7
PETT VI 906 I5
Production Services 197 H4
Physics 510 I5
Plant Engineering 134C H6
Pool/Gymnasium 478 H6
Post Office 179 H6
Procurement & Property Management Division 355 I6
Quality Management Office 902 G4
Radiological Controls Division 120 K5
Lab/Office Building 703 I4
Reactor Analysis DIV - DAT 475B G7
Research Library 477 H6
Research Support Building (RSB) 400 H6
Residences, Men's 153, 170, 180 G7, F7, G7
Residence, Women's 258 F7
Safeguards and Security Division/Police 50 G8
Safety & Health Services 120 K5
Science Education Center 438 G6
Service Station 630 I7
Shipping & Receiving 100 K6
Site Maintenance 326 F9
Superconducting Magnet Division 902 G5
Property Management 211 K7
Tandem Van de Graaff/Cyclotron 901 I5
Telephone Switch Room 449
Thermal and Fast Reactor Safety 130
Vehicle Repair 423
Waste Management Facility 860
NSLS-II Bldg. 817 & 830M
Cafeteria
Bldg. 30 South Rm.
Main Entrance
LABORATORY ENTRANCE
MAIN GATE
TO SOUTH GATE
TO COLLIDER CENTER
TO NORTH GATE
THOMSON RD.
W. FIFTH AVE.
E. FIFTH AVE.
FOURTH AVE.
RUTHERFORD DR.
CORNELL AVE.
BROOKHAVEN AVE.
LAWRENCE DR.
WEAVER DR.
BELL AVE.
MITCHELL LA.
LEWIS RD.
WEST PRINCETON AVE.
PRINCETON AVE.
UPTON RD.
WM. FLOYD PARKWAY
TO L.I. EXPRESSWAY
TO N.Y.S. RTE. 25
JOHNS HOPKINS ST.
CENTER ST.
PENNSYLVANIA ST.
TECHNOLOGY ST.
COLUMBIA ST.
RAILROAD ST.
ROWLAND ST.
ROCHESTER ST.
SEVENTH ST.
NORTHROP ST.
BERGEN ST.
SUPERCONDUCTING MAGNET DIVISION
CONDENSED MATTER PHYSICS & MATERIALS SCIENCE DEPARTMENT
APPLIED PHYSICAL AND CHEMICAL SCIENCES
COLLIDER-ACCELERATOR DEPARTMENT
ENERGY SCIENCES & TECHNOLOGY
ENERGY EFFICIENCY AND CONSERVATION DIVISION
CENTER FOR FUNCTIONAL NANOMATERIALS
ES&H&Q DIRECTORATE
INFORMATION TECHNOLOGY DIVISION
MEDICAL RESEARCH CENTER
RESEARCH SUPPORT BLDG.
BROOKHAVEN CENTER
SECURITY
FIREHOUSE
WAREHOUSES
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