Brookhaven National Laboratory

SNS

Ring and Transfer Lines Systems

M A R C H

MONTHLY REPORT

01 March – 31 March 2003

Performing Organization:	Brookhaven Science Associates
Location:	Brookhaven National Laboratory Upton, New York 11973-5000
Contract Period:	October 1998 – June 2006

Brookhaven National Laboratory
SNS MONTHLY PROGRESS REPORT
March 2003
Ring and Transfer Lines Systems

I. Senior Team Leader Assessment

1. TECHNICAL PROGRESS AND ACCOMPLISHMENTS

1) The 8th Accelerator Systems Advisory Committee review on SNS was held at ORNL (March 12-14, 2003). The committee acknowledged progress made by the BNL team.

2) A Ring diagnostics advisory review was held at BNL (March 26-27, 2003). The committee found BNL team to be "on track" with planned tasks, and recommend BNL to contribute not only on the design and construction but also on the test and commissioning of the ring diagnostics systems.

3) Eight HEBT 12cm quadrupole chambers and eight 21cm quadrupole chambers were delivered to ORNL ahead of schedule to meet ORNL's accelerated installation plan.

4) The 3rd and 4th ring half-cell magnet assemblies was shipped to ORNL, again ahead of schedule.

5) First-article ring sextupole (21S26) was constructed, measured, and accepted. Our vendor Alpha Magnetics now proceeds with production.

6) First-article multi-coil corrector magnets (36CDM30) was received from New England Technicalcoil, acceptance tested and magnetically measured; corrector magnet (41CDM30) was received from Alpha Magnetics and acceptance tested.

7) Tolerance issues on quadrupole pole length/width (26Q40) have been resolved after an intensive interaction between BNL and our vendor (Stangenes Inc.).

8) The subject of magnet interference between quadrupoles and sextupole/correctors is again under discussion between BNL and ORNL groups. Plans are made to measure actual assembly on the girder, and computer modeling is underway.

9) Efforts are made to ensure proper installation of electrical ground breaks in HEBT and RTBT of the SNS facility. Drawings for the HEBT ground breaks are modified to accommodate a deviation at ORNL.

10) The Estimate-To-Complete performed on ring/transport systems in February 2003 were accepted by the SNS project office.

11) Dr. P. Paul congratulated the BNL/SNS team at an all-hands luncheon for a job well done. Also addressing the team were Dr. T. Kirk and Dr. D. Lowenstein.

2. ISSUES AND ACTIONS

- None.

3. COST AND SCHEDULE STATUS

3.1 VARIANCE ANALYSIS AND PROJECT COST PERFORMANCE REPORTS

WBS 1.1.3 R&D

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
5115.0	5115.0	5112.9	0.00	0.0%	2.1	0.0%

Variance Statement: Cum variance is within thresholds. No analysis required.
No current period activity.

Project Impact: None.

Corrective Action: None.

WBS 1.5 Ring and Transfer Lines

BCWS	BCWP	ACWP	SV	%	CV	%
70684.8	71450.6	71836.1	765.74	1.1%	(385.5)	-0.5%

Variance Statement: Cum variance is within thresholds. No analysis required.
The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None

3.2 MILESTONE STATUS

WBS 1.5 and 1.1.3 have no level 0 milestones. Milestone status is listed below.

Milestones	Level 1	Level 2	Level 3	Level 4	Level 5
Project	0	1	3	13	125
FY03	0	0	0	0	7
Due in Next 30 days	0	0	0	0	1
Total Due at present	0	0	3	12	111
Made	0	0	3	12	100
Missed	0	0	0	0	11
Ahead of Schedule	0	0	0	0	0

3.3 PROJECT CRITICAL PATH ANALYSIS

The critical path item is Ring Diagnostics.

II. Detail R&D Subproject Status

WBS 1.1.3 – Ring System Development

All work covered by R&D funds is essentially complete.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
5115.0	5115.0	5112.9	0.00	0.0%	2.1	0.0%

Variance Statement: Cum variance is within thresholds. No analysis required.
No current period activity.

Project Impact: None.

Corrective Action: None.

III. Detail Line Item Subproject Status

WBS 1.5.1 – HEBT Systems

Phone conferences continued with Tesla during the month on the HEBT/RTBT 21Q40 magnets. G. Murdoch also visited them at the end of the month. The good news is that they are preparing 12 magnets for shipping. The bad news is that their first shipment is further delayed another 30 days to the end of April. Actual earliest BNL delivery would then be after May 15. Tesla still believes they can build and deliver the rest of the magnets before August 1.

HEBT/RTBT 21Q40/27CD30 magnet stand production in BNL Central Shops is progressing; first deliveries to METLAB, Pa. for painting will be at the end of April. New England Technicoil was visited during the month. The first article 27CD30 was assembled and being prepared for testing and shipping.

Eight 12cm quad chambers and eight 21cm quad chambers have arrived at SNS. Skin-cutting the BPM surface has solved the welding problem encountered earlier. The welding of the 12cm quadrupole chambers continues with twelve more ready for shipment to SNS. A few drift pipes were also assembled and welded. The production of HEBT chambers is ahead of schedule and meets the accelerated HEBT installation plan. With the repositioning of the HEBT ceramic break, the Q24 and Q25 drift pipes require ECNs. Drawings to change the Q33-Q34 doublet pipe into individual chambers are in checking.

Effort was expended to evaluate the position of the 8D533 magnet and relationship to the installed dipole chamber. It was confirmed that the existing bracket design is adequate and will not affect the positions of the momentum collimator and the scraper extraction pipe.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
6258.9	6345.0	6354.3	86.05	1.4%	(9.3)	-0.1%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.5.2 – Injection Systems

The kicker assembly work is moving along in the Bldg. 911B. The first production long kicker is in good shape. All machined parts are fitting together nicely. Coils and jumper bus bars are all matching up and connected. The assembly is ready for ceramic chamber. The coil vibration damping wedge clamps are being fabricated. Once the power supply is repaired, a long duration full power test will be performed on the first article magnet to check if there is any eddy current induced heating in the ceramic pipe. For this test a production beam pipe and bellows will be installed. In the vacuum lab, the first copper layer was successfully coated on the inner surface of the ceramic chamber. The vacuum group is preparing to coat the final layer of titanium nitride. Ceramic Magnetic Inc. has delivered all ferrites for the injection kickers. Ceramaseal has delivered two of the production long kicker chambers. These two ceramic chambers are being checked in Bldg. 919B. The remaining 5 ceramic chambers will be delivered in May. According to Macro-Metallics, the delivery date for the 4 short kicker ceramic chambers will be in the early April/03. A shipping plan for safely delivering the assembled magnet to ORNL is being worked with AGS rigging people.

Long coil magnetic measurements of the chicane outfitted with the second set of iron "z-bumps" have been completed. The results indicate that the field uniformity was better but the required parameters still have not been achieved. An analysis is underway for the third iteration.

New England Technicoil was visited to review progress on the other injection magnets. Chicane #2 machining has been completed and the magnet has been assembled and pinned. Chicane #3 and the dump septum are completing final machining and assembly and are being prepared for final inspection, alignment, and pinning. The coils for #2 have been wound and are being prepared for potting. The bids for chicane #1 have been received and the contract was awarded to the low bidder Alpha Magnetics.

The drawings for the special vacuum chambers for the injection region were completed and approved. Central Shops has started fabrication of these special chambers. They include the design of the new electron collector electrode and the addition electron collector viewing window.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
5784.7	5826.0	5909.1	41.24	0.7%	(83.1)	-1.4%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.5.3 – Magnet Systems

The third half-cell and fourth half-cell were shipped and the fifth half-cell was being prepared for shipping at the end of the month.

The last batch of 21Q40 magnets from phase I have been magnetically measured. We await delivery of phase II. The measurement stand was changed so that the corrector octupoles, 21CO26, could be measured. Five of the nine magnets in the series have been measured. Survey data were taken for the first octopole to verify the correlation between magnetic center and mechanical center.

Quest Machining the major subcontractor for Stangenes Inc. was visited during the month to verify the pinning of the first production 26Q40. The pinning was very well done and the magnet core meets the tolerance requirements. It is scheduled to be completed in mid-April. They claim that they will ship the magnets at a rate of one every three weeks.

There were phone conferences and e-mail exchanges with BINP during the month. They have redefined their production schedule again: the first production shipment will be 3 – 30Q58's and 2 – 30Q44's. BINP provided a shipping date of ~April 10 but the details of the shipping route and time have not been provided. A lot of effort was spent trying to straighten out the change orders to cover material shipped to BINP and shipping charges that were paid by BNL.

Magnetic measurements of the first article high field ring sextupole (21S26) have been successfully completed. The magnet was approved for production fabrication. Fabrication of the 26S26 first article continues. Machining of the magnet core steel was completed and coil potting is in process. Delivery is expected in April.

The first article 36CDM30 corrector magnet was received and acceptance tested. It was installed on the magnetic measurement stand and measurements of the skew quadrupole configuration have been completed and are being analyzed.

The new measuring coil and stand for large aperture multipole magnets has been assembled. The first article 26Q40 has been set up on the new measuring stand and the system is ready for test runs.

Alpha Magnetics delivered the 41CDM30 magnet in the production lot. Other than additional ground wrap that does not meet specification the magnet passed inspection testing. It will be measured in the large aperture measurement stand once the test runs are completed.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
13014.7	13121.9	13077.3	107.23	0.8%	44.7	0.3%

Variance Statement: Cum variance is within thresholds. No analysis is required.

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Project Impact: None.

Corrective Action: None.

WBS 1.5.4 – Power Supply Systems

- Two additional RF Tuning PS were shipped to BNL. The fourth and final unit will be shipped directly to ORNL during April.

- A meeting at IE Power/DPS has been scheduled for April to monitor progress with the Main Dipole PS, the Injection Bump PS, and the Medium Range PS production.

- Counting those units used for LANL and BNL, about 300 of the total number of 367 Low Field Corrector PS modules will have been delivered to ORNL by the end of March.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
1550.5	1614.7	1631.5	64.22	4.1%	(16.8)	-1.0%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.5.5 – Ring Vacuum System

The RF straight section doublet chamber front end has been modified to allow for additional pumping ports. The original straight tubes have been cut off at Central Shops in preparation for welding the pump tee onto the reducing cones. The pump tees have been ordered. The welding fixture for the straight section chambers has been retrofitted with new supports. The 14 inch aperture quick disconnect chain clamp has been tested with Helicoflex seals successfully. The joint typically sealed at a nominal torque of 300in-lbs. This seal cross section will be used in the

straight sections with various flange diameters including bolted flange and chain clamp. A designer is making layouts of the other straight section spool and pump tee pipes.

Three type-C halfcell chambers have been coated bringing the total to 26. Two injection kicker ceramic chambers have been coated with copper, and the flange-to-flange resistance is 0.033 Ohms and 0.043 Ohms.

Work continues on the vacuum rack layout, the PLC I/O assignment, the cable run list and the MPS input schemes, with frequent discussion with control and vacuum personnel at SNS. Some effort was expended confirming TMP I/O with controls group at SNS. The team leader attended the ASAC review and presented the vacuum system status.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
5818.5	5870.3	5944.9	51.76	0.9%	(74.6)	-1/3%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.5.6 – RF System

SNS Accelerator Physics

- The simulation code used for the electron proton instability has been generalized to include the effect of electron creation during the bunch passage. Simulations of both the SNS and PSR are underway and results will be presented at PAC 03.

Low Level RF

- Continued preparations for the ring llrf integration test.
- Design of first article D/A daughter card complete. Awaiting quotes for layout and assembly of boards.
- Design of first article A/D daughter card 50% complete.
- First article VME carrier card in preliminary design.

High Level RF

- Testing of the first final cavity complete as well as the first PA; Assembly of the remaining cavities, PA's and ps's are on schedule.
- First tuning PS tested very well, we are going to arrange the shipping of the remaining tuning PS directly to ORNL.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
8630.9	8903.5	8831.6	272.56	3.2%	71.9	0.8%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.5.7 – Ring Diagnostics

General:

- Presentation was given at the ASAC Review the week of March 10th. BNL hosted the Diagnostics Review Committee for Final Design Review of all systems the week of March 24th. To quote from the opening statement of the Committee Chair at the closeout - "The Diagnostics Team is well-focused, motivated, and on track". There was considerable discussion of handoff issues. Draft assignment of responsibilities for LabVIEW and Applications programming for all systems was completed, and commitment of manpower was secured.

BPM:

- Received five 12cm and four 30cm BPMs from brazing shop, which were then leak checked and assembled. Delivered 10 more 12cm HEBT BPMs to vacuum group. Received parts for the additional six 30cm BPMs from the shops. Parts are being cleaned in preparation for brazing.
- A baseband front-end amplifier board was fabbed, stuffed, and tested. Initial testing of low noise pre-amp indicates it is performing well. Noise<1.5nV/rtHz, gains within a few %. Bandwidth was slightly low and needs to be refined. Revised calculations of noise due to the new MUX and redesigned the circuitry to reduce noise. The RF front end and calibration design continues. Completed SNS RF BPM schematic incorporating recommendations made during the design review. PCI/timing decoder design efforts continue.
- Fiber has been pulled to bldg 817 to permit Controls to establish a testing station with full timing capabilities in our SNS diagnostics lab area.

IPM:

- Pressure rise testing in the RHIC Yellow beam confirm measurements made in the Blue beam and no measurable noise or background was observed due to the pressure rise, radiation, or electron clouds. We are investigating slight changes in the electrode geometry that will make the electric field more parallel.

- Requirements for the Electron Detector fast data acquisition system have been provided to Controls. Submitted a request to the design room for complete mechanical drawings of the SNS electron detector. Setting up a data acquisition system in RHIC for the electron detectors to be used during a pressure rise study.

BLM:

- Effort continues on sole source justification, required QA documents, and device specification to prepare for the purchase of all the BLM ion chamber detectors from LND, Inc. Leakage tests were performed on the first article chambers. Results are good, less than a few pA up to 4.5KV. A second prototype end cap design has been built using cost saving features.
- Construction continues on the AFE test stand. Discussions continue with Controls on IOC interface with the AFE test stand. A variety of parts have been ordered for the AFE chassis and the MPS comparator module. AFE back plane work continues. Construction of the AFE test stand continues. The MPS comparator PCB design continues.
- We worked with Controls on incorporating new Keithley components into the BLM ATE stand upgrade for use with the new LND detectors. Detailed radiation pattern measurements were taken at our Cesium-137 source to map the field so that we can determine the position that the new ION detector must be located to properly interpret the data.
- The requisition and sole source paperwork has been submitted for the ISEG HV supply.
- Effort on the movable BLM stand design is underway.
- We received delivery of the Rexolite Trompeter cable ends, these were forwarded to ORNL.

BCM:

- Testing of driver amplifier for calibrator has started. We have driven a pulse thru a PA19 amplifier and obtained slightly more than a microsecond rise time. Noise and other testing continues. Four calibrators for delivery April 15th are under construction.
- Additional requirements for the PC motherboards have been received from ORNL. A new PC has been made ready and loaded with BCM software. It has been outfitted with a LANL PCI card and a BCM AFE board, and is presently running for software development efforts.
- The 11 HEBT, Ring and RTBT FCTs have been characterized for transfer function and droop time constant and are ready for installation in vacuum chamber shrouds. Completed drawings for the production HEBT BCMs, working on the support design. Fabricating production HEBT units in the shop.

Incoherent tune:

- Detailed design of resonant dipole and quadrupole circuits continues. Beampipe/ striplines assemblies have been fabricated and delivered to the diagnostics lab for application of this design work. Quadrupole pickup has been resonated with good results. Power amplifiers have been specified. Decision to build the incoherent tune system in a modified BPM IFE was finalized.

WS:

- Received (12) beam box weldments from Key High Vacuum. Machining of bellows and flanges was completed, and they were welded onto the Key chambers and leakchecked.

BIG/Coherent Tune:

- Diversified Technologies has submitted a quote (~$210K) to build the pulser unit. The unit will fill an entire rack, and estimated delivery is 6-8 months from award to system testing. The pulser high voltage unit will move from the instrumentation room to the high voltage room. Dave Purcell (ORNL) will assign a rack for this purpose. An additional vendor was identified for the pulser unit (Polarity Inc. of California). A quote was received for ~$600K. They suggested a preliminary feasibility study be performed first at a cost of $25K. Looked into a suggestion, which arose during the Design Review, to check on tube based switches. This did not pan-out due to costs and placing tubes in the Ring.

Video Foil Monitor:

- Received NI-1409 image acquisition card. We were informed that third camera for electron catcher has been added to the scope.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
7745.2	7857.2	7893.5	111.96	1.4%	(36.3)	-0.5%

Variance Statement: Cum variance is within thresholds. No analysis is required.

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Project Impact: None.

Corrective Action: None.

WBS 1.5.8 – Collimation and Shielding

- Work is continuing on the scrapers for the ring. The ring secondary and tertiary absorber drawings have been completed, with the exception of the flanges. Finally, the outer shielding for the primary collimator is being integrated with the collimator. The design drawings for the primary collimator are being prepared.

- Drawings of the HEBT momentum dump and shielding are being reviewed. Fabrication of the HEBT collimators is continuing. Outer shield arrangements drawings are complete, and a best and final bid is being sought. A pedestal to which the support jacks, and the lateral movement jacks will be attached has been designed and is being manufactured in the BNL shop. Finally, the momentum dump assembly has been designed and a quote is being sought from the BNL shop.

- The as built drawings for the RTBT collimator are complete. The drawings for the remaining RTBT collimator have been completed, and the fabrication of the unit is in progress.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
1880.7	1881.2	1866.5	0.5	0.0%	14.7	0.8%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.5.9 – Extraction System

The checking of the down stream end kicker assembly is complete. The drawings will be signed soon. The drawings of upstream kicker ferrites have been checked too. The requisition of ferrite will be placed in April. The prototype kicker magnet is under vacuum and is ready for more full power testing. This magnet is assembled with CMD5005 ferrite. Due to the limited height in the ring tunnel, two removable lifting beams were added to the extraction kicker so that the kicker assembly can be lifted directly by the tunnel crane.

Manufacturing requirements and planning (machining, forming, acid bath/plating, coating, welding) for the Extraction Lambertson Magnet (ELS); yoke, ring beam shielding, and vacuum chamber, are being developed and process resources are being identified. The design now includes a support member to reinforce the thin septum. The ELS magnet stand has been updated/completed and detailing has begun. Design of the drift pipe, which connects the Extraction Kickers to the Lambertson magnet, has been revised to incorporate a VAT vacuum valve, pump-out port and revised support hardware.

A PCR still needs to be generated by ORNL to identify which special magnets will now be fed by cables instead of water-cooled bus. This change could involve putting cable terminations on eight different high current injection/extraction magnets. The number of cables to be terminated on each magnet type needs to be identified as well by ORNL.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
2618.4	2740.2	2881.2	121.73	4.6%	(141.0)	-5.1%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None

Corrective Action: None.

WBS 1.5.10 – RTBT System

The second 36Q85 radiation resistant quadrupole coil has been successfully wound. The 36Q85 cores from Ranor passed dimensional inspection.

Production of the HEBT/RTBT drift space/instrumentation support castings from Yankee Casting has begun, and a first article is complete. Details for the RTBT 17D224 magnet are being reworked based on revised magnet geometry.

The 17D224 "boxed" vacuum chamber has been redesigned, based on the revised magnet geometry, and permitted the use of the existing coils. An NW320 gate valve and the pump-out port have been incorporated in the design of the drift pipe between kickers and Lambertson. Design of the hardware for the revised support scheme is underway. Planning for the Lambertson vacuum chamber manufacturing procedure (machining, plating, coating and welding) is being developed and process resources are being identified. Production of the HEBT/RTBT vacuum pipe support castings from Yankee Casting has begun.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
4125.2	4168.4	4136.0	43.19	1.0%	32.4	0.8%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.5.12 – Technical Support

The group mainly worked on the following:

- 6 talks were presented in the 8th Accelerator Systems Advisory Committee (ASAC) review on SNS.

- The first article ring sextupole (21S26) was accepted by AP Group.

- Study was complete to move last doublet in the RTBT by 0.6 m upstream.

- Correction of nonlinear resonances for the ring was completed.

- IPM magnet design is in progress to reduce the multiples.

- The subject of magnet interference between quadrupoles and sextupole/correctors is again under discussion between BNL and ORNL AP groups. Plans are made to measure actual assembly on the girder, and computer modeling is underway

- Released the UAL 1.7.2 version including the following new features:
    - Prototype of the APDF (Accelerator Propagator Description Format) parser for building application-oriented modeling engines (e.g. FastTeapot, Tibetan, etc.) from a collection of different algorithms (towards to PAC 03).
    - Integration of XERCES-C++ XML parser and PCRE (Perl Compatible Regular Expression).
    - Upgrade of the SXF (Standard Exchange Format) accelerator builder with aperture parameters for collimation studies (implemented together with Ray Fliller III).

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
13256.3	13121.5	13309.6	(134.75)	-1.0%	(188.1)	-1.4%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

WBS 1.9.5.1 -Ring Controls Integration

The SNS timing system at BNL was distributed to RF and Diagnostic labs in buildings 817 and 911. Power Supply and vacuum development labs already had timing available.

An MPS system was installed and configured at BNL. This system will be used to verify the BLM to MPS interface for the upcoming DTL run. It will also be used to verify the MPS interface with vacuum and beam dump equipment used in later runs.

WBS 1.9.5.2 - Power Supply Controls

Power supply controls consists of "standard" power supply control, using VME-based Power Supply Control (PSC) units, and remote Power Supply Interface (PSI) units, "injection" power supply controls, which adds a waveform generator/readback unit from Yokogawa to control and monitor injection kicker magnets, and "extraction" power supply controls, which adds a Lecroy oscilloscope and timing signals to control and monitor the current in the extraction kicker power supply.

Installation drawings and documentation were completed for all HEBT, Ring, and RTBT power supply IOCs and racks, and sent to ORNL. The HEBT documents have been forwarded to "the rack factory" (DCS) who will build an install the racks in the HEBT service building shortly, and the other locations when needed.

The EPICS device support for the PSC was enhanced to help support conversion from magnet strength to power supply current. For the upcoming DTL run, one D-plate quadrupole will be operated via magnet strength setpoints. Other work on the "standard" power supply controls is nearing completion.

Work continues on improving the EPICS support for the ethernet based LeCroy oscilloscopes used to measure extraction "kicker" magnet waveforms. More fault and load testing is planned for the upcoming month.

The work on EPICS device support for the Yokogawa waveform generator is in early stages. It is expected to be completed by this coming summer so that the remaining Yokogawa units can be purchased before the end of the fiscal year.

WBS 1.9.5.3 – Diagnostics

Much attention is still being paid to the BLM system. The "analog front end" (AFE) chassis being developed by the diagnostic group is falling slightly behind schedule. This schedule slip may compromise integration schedule or delay the ship date until later in May.

The software for the ICS-110B digitizer was successfully redesigned to use direct memory access (DMA) data transfers. The new design uses 21% of the CPU to transfer all data at 60Hz. The previous design required more than 70% of the CPU.

Timing modules (based on the V294 fanout module) were developed to convert two V124S single-ended TTL outputs into one differential TTL gate to control the digitizer acquisition period.

The ISEG control screens, provided by SLAC have been converted from MEDM to EDM, and the ISEG modules have been thoroughly tested via these control screens.

The DTL BLM IOCs are being "built up" at BNL. A full set of EDM control screens are being developed for the timing and utility modules, digitizers, DACs, HVPS modules, and digital interface modules.

A new ion chamber calibration system was put into operation. Labview software was developed to automate the calibration process.

The diagnostic group is developing an AFE module test fixture. The BLM digital interface software is being modified to support automatic testing of AFE modules.

A text fixture is planned for the BLM "comparator module", which provides the MPS signal to inhibit beam. This fixture would likely use spare channels on a DAC to simulate the input from the AFE module.

WBS 1.9.5.4 - Vacuum

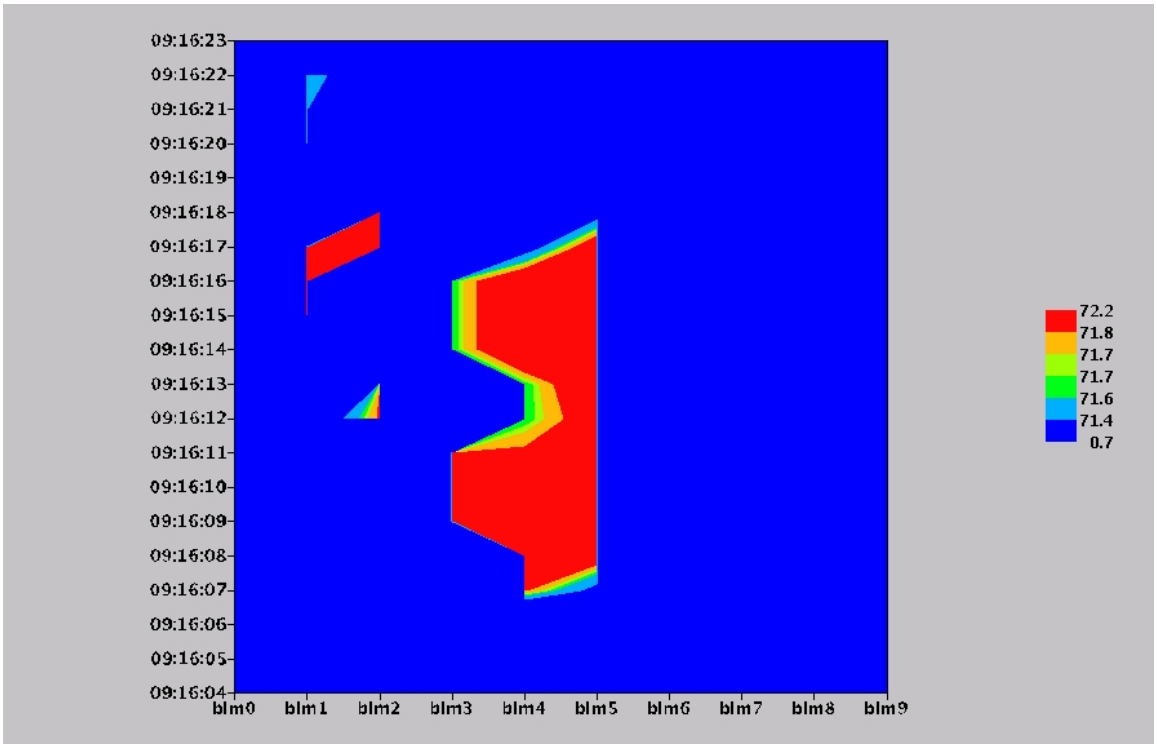
The HEBT, Ring, and RTBT vacuum controls consist of Ion Pump and Gauge Controllers, which are interfaced to EPICS via RS-485 serial link, and Valve Control and inter-lock logic, implemented in a ControlLogix PLC, and interfaced to EPICS via Ethernet. The LINAC and ring use the same make and model of Ion Pump and Gauge Controller, and efforts are under way to standardize on RS-485 interface hardware. Residual Gas Analyzer (RGA) units will be purchased and installed by the ORNL vacuum group. LANL-developed RGA software is expected to support these RGA units.

Xiasong Geng spent time at ORNL to collaborate on development of EPICS software and control screens for the RS-485 based devices, and to demonstrate that the Hytec RS-485 interface module could be used in the LINAC as well as the ring.

EPICS software and control screens for Ion Pumps, Cold Cathode Gauges, and Thermocouple Gauges were developed, demonstrated on DTL tank 3, and checked into CVS.

WBS 1.9.5.5 - Applications Software

The first version of the XAL-based BLM "waterfall" application is complete. It has been checked into CVS and tested by ORNL AP group. Here it is shown being tested against simulated BLM data from an IOC. It is expected to be an important "comfort display" during upcoming DTL commissioning.



A “scope application” is under development at LANL for displaying waveforms at 60Hz, due for release in 2-3 weeks. This application may also have a role in the BLM system for monitoring raw signals from the ion chambers. When this application is available it will be installed and tested at BNL in that role.

WBS 1.9.5.6 – RF

The heart of the Ring low-level RF system is a quad-DSP system. The DSP module uses the PMC form factor, and a PCI interface to the EPICS processor. Feedback algorithms are implemented on the DSP, which has access to analog I/O via custom modules developed by the RF group. The LLRF system also makes use of standard (V124S) timing signals, and a LeCroy oscilloscope for fast signal readback.

The Ring low-level RF DSP system has been interfaced with EPICS. Waveforms that have been configured using the “llrfConfig” application can now be downloaded through the IOC to the LLRF system, as can the DSP application itself. The real-time response of the DSP system can be displayed on MEDM screens.

The performance of the PCI interface was measured, and seems to be adequate even without using DMA. The focus of the RF group is now on developing the DSP algorithms. For that reason further EPICS development is somewhat on hold. Meanwhile, SNS timing has been distributed to the RF development lab, and timing and utility modules have been installed and are being configured. A fast ‘scope was purchased. The EPICS support for this ‘scope will be installed when it is complete.

The heart of high power RF system is a PLC-5, which operates the various power supplies associated with the cavity. In the next month or so efforts will begin to interface the PLC-5 to the more standard ControlLogix PLC, using EDM screens that have already been developed.

Variance Analysis (Cumulative to date) ($K)

BCWS	BCWP	ACWP	SV	%	CV	%
4842.3	5003.6	4872.9	161.27	3.3%	130.7	2.6%

Variance Statement: Cum variance is within thresholds. No analysis is required.

The March current period variance reflects the effects of implementing PCR RI03007, Estimate to Complete (ETC). Reallocation of resources, changes to percent complete and activity closure have biased BCWS and BCWP; and current period variances are not relatable. The cum variance reflects accurate and relatable Cost Performance data.

Project Impact: None.

Corrective Action: None.

IV. Earned Value Reports and Charts

U.S. DEPARTMENT OF ENERGY
COST PERFORMANCE REPORT - WORK BREAKDOWN STRUCTURE (FORMAT 1)

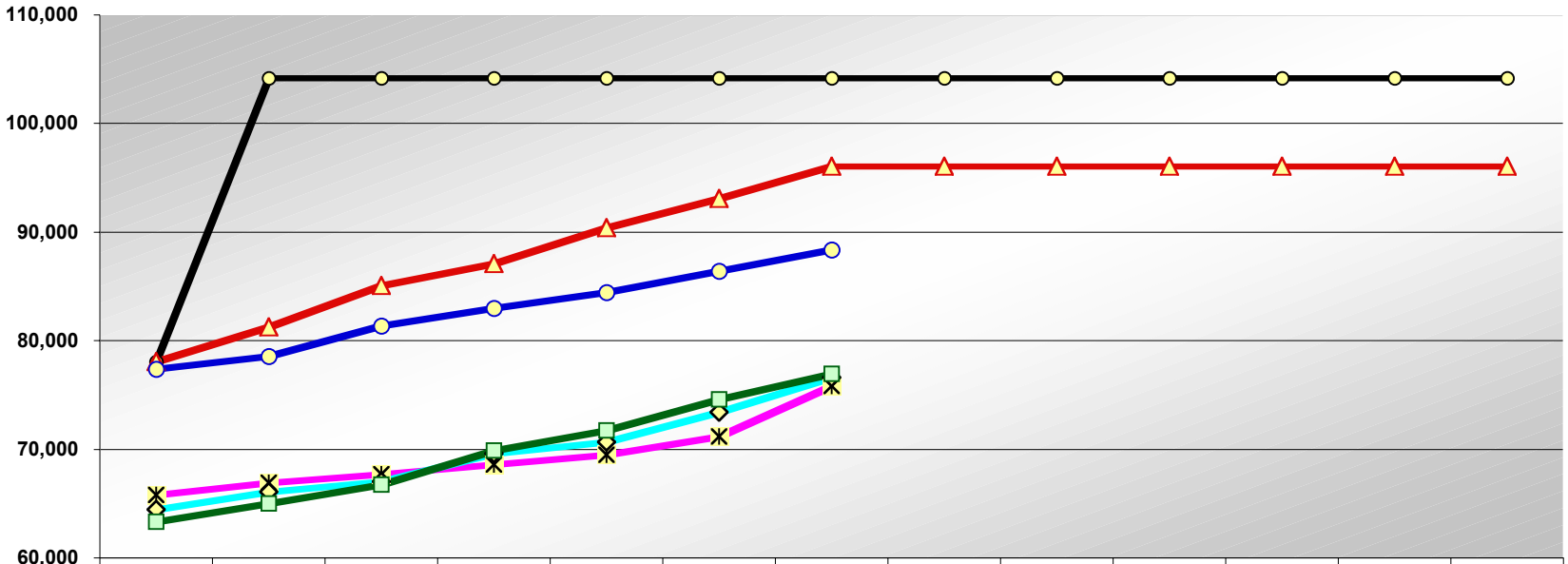
PROJECT TITLE: SPALLATION NEUTRON SOURCE	**REPORTING PERIOD:** 1-Mar-03 thru 31-Mar-03	**PROJECT NUMBER:** 99-E-334
		START DATE: October 1998
PARTICIPANT NAME AND ADDRESS: Brookhaven National Laboratory Brookhaven, NY	**BCWS PLAN DATE:** October 1999	**COMPLETION DATE:** November 2006

WORK BREAKDOWN STRUCTURE	CURRENT PERIOD					CUMULATIVE TO DATE					AT COMPLETION		
	Budgeted Cost		Actual Cost of Work Performed	Variance		Budgeted Cost		Actual Cost of Work Performed	Variance				
	Work Scheduled	Work Performed		Schedule	Cost	Work Scheduled	Work Performed		Schedule	Cost	Budgeted	Revised Estimate	Variance
1.1.3 Rings System Development	0.0	0.0	0.0	0.0	0.0	5,115.0	5,115.0	5,112.9	0.0	2.1	5,115	5,115	0.0
1.5 Ring & Transfer Line System	1,203.0	3,143.3	2,354.3	1,940.3	789.0	70,684.8	71,450.6	71,836.1	765.7	(385.5)	113,323	113,323	0.0
1.5.1 HEBT (High Energy Beam Transport) Systems	33.2	(1,053.9)	128.6	(1,087.2)	(1,182.5)	6,258.9	6,345.0	6,354.3	86.1	(9.3)	8,247	8,247	0.0
1.5.2 Injection Systems	51.1	97.3	175.5	46.2	(78.1)	5,784.7	5,826.0	5,909.1	41.2	(83.1)	9,840	9,840	0.0
1.5.3 Magnet Systems	190.5	1,468.7	253.1	1,278.2	1,215.6	13,014.7	13,121.9	13,077.3	107.2	44.7	18,180	18,180	0.0
1.5.4 Power Supply System	89.4	590.2	170.4	500.8	419.8	1,550.5	1,614.7	1,631.5	64.2	(16.8)	5,141	5,141	0.0
1.5.5 Vacuum System	73.2	157.3	199.6	84.1	(42.3)	5,818.5	5,870.3	5,944.9	51.8	(74.6)	9,454	9,454	0.0
1.5.6 RF System	226.2	819.3	426.9	593.1	392.4	8,630.9	8,903.5	8,831.6	272.6	71.9	12,262	12,262	0.0
1.5.7 Ring Systems Diagnostic Instrumentation	149.2	212.0	297.4	62.8	(85.5)	7,745.2	7,857.2	7,893.5	112.0	(36.3)	13,738	13,738	0.0
1.5.8 Collimation and Shielding	68.7	(56.2)	54.5	(124.9)	(110.7)	1,880.7	1,881.2	1,866.5	0.5	14.7	3,618	3,618	0.0
1.5.9 Extraction System	60.1	553.4	322.8	493.4	230.6	2,618.4	2,740.2	2,881.2	121.7	(141.0)	4,775	4,775	0.0
1.5.10 RTBT (Ring to Target Beam Transport) System	78.1	351.8	88.9	273.7	262.9	4,125.2	4,168.4	4,136.0	43.2	32.4	7,757	7,757	0.0
1.5.11 Cable	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.0	0.0	0.7	0.7	0.0
1.5.12 Technical Support	183.3	3.2	236.6	(180.1)	(233.4)	13,256.263	13,121.516	13,309.6	(134.7)	(188.1)	20,310	20,310	0.0
WBS SUBTOTAL	1,203.0	3,143.3	2,354.3	1,940.3	789.0	75,799.8	76,565.6	76,949.0	765.7	(383.5)	118,438		
UNDISTRIBUTED BUDGET													
SUBTOTAL	1,203.0		2,354.3			75,799.8		76,949.0			118,438		
MANAGEMENT RESERVE													
TOTAL	1,203.0		2,354.3			75,799.8		76,949.0			118,438		

RECONCILIATION TO CONTRACT BUDGET BASE

DOLLARS EXPRESSED IN:	SIGNATURE OF PARTICIPANT'S PROJECT DIRECTOR:	DATE:
THOUSANDS	Jie Wei	April 16, 2003

1.5 & 1.1.3 Performance Measurement Chart



	Prior Yrs	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Cum Planned BA	78,046	104,149	104,149	104,149	104,149	104,149	104,149	104,149	104,149	104,149	104,149	104,149	104,149
Cum Authorized BA	78,046	81,246	85,046	87,046	90,406	93,046	96,046	96,046	96,046	96,046	96,046	96,046	96,046
Cum Actual BA	77,363	78,526	81,359	82,973	84,429	86,405	88,367						
Cum BCWS	65,746	66,896	67,683	68,552	69,464	71,148	75,800						
Cum BCWP	64,446	66,066	67,025	69,566	70,651	73,422	76,566						
Cum ACWP	63,332	65,009	66,719	69,840	71,730	74,595	76,949						

Months