



Brookhaven National Laboratory

SNS

Ring and Transfer Lines Systems

DECEMBER

MONTHLY REPORT

01 December – 31 December 2002

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
December 2002
Ring and Transfer Lines Systems

I. Senior Team Leader Assessment

1. TECHNICAL PROGRESS AND ACCOMPLISHMENTS

- Anticipating the completion of our SNS efforts in about two years, a de-staffing plan was developed based on the estimate-to-complete of each group, and submitted to DOE.
- Continuing our support to the SNS front end commissioning, the Control's group participated the commissioning at ORNL, and the Diagnostics group repairing beam-current-monitor electronic boards damaged during commissioning.
- More than 40 abstracts were submitted by BNL/SNS to the 2003 Particle Accelerator Conference including 3 invited talks and more contributed talks.
- The injection kicker magnet was measured with satisfactory results for time response and field uniformity. The time response meets required 200 μ s, and the vacuum chamber was found to have negligible effect to the field variation.
- One of the power-supply vendors found that 35 V instead of 50 V capacitors were mistakenly used in some corrector power supplies. The vendor will go to ORNL to correct.
- Sorting was completed for all the ring dipole magnets and HEBT transport line dipole magnets. With sorting, minimum corrector strength is needed to realize an ideal beam orbit.
- K. Mirabella will take over M. Nekulak's task for BNL/SNS project control after Mike's retirement.
- Colleagues from KEK (I. Yamane) visited BNL for collaboration of laser-stripping experiments at AGS linac.
- N. Catalan-Lasheras, Y. Papaphilippou, D. Davino visited BNL for continued collaboration on SNS.
- Unified Accelerator Library (UAL) User Guide was completed and published as a BNL report. Prof. R. Talman completed his sabbatical at BNL.

2. ISSUES AND ACTIONS

- ASAC Recommendations, supported by the recent DOE Review, needs to be authorized, funded and implemented. Awaiting Project direction.

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)

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
5115.0	5115.0	5112.9	0.00	0.0%	2.1	0.0%

Variance Statement: Cum variances are within thresholds. No analysis required.
No current period activity.

Project Impact: None.

Corrective Action: None.

WBS 1.5 Ring and Transfer Lines

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
63437.2	64450.8	64727.0	1013.56	1.6%	(276.2)	-0.4%

Variance Statement: Cum variances are within thresholds. No analysis required.
Current period SV \$1627.1K (192.5%) is driven by WBS 1.5.1, 1.5.9, & 1.5.10.

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
FY02	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	98
Missed	0	0	0	0	13
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 variances are 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 dipole magnet. The HEBT dipole magnet order is complete. They are maintaining the scheduled delivery of the first HEBT/RTBT 21Q40 magnets for March 2003. The stands for the 12Q45/16CD20 were assembled, shrink wrapped, and shipped to ORNL. New England Technicoil has started fabrication of the 27CD30 corrector magnet.

Design of the 12cm quadrupole chamber welding fixture is complete, and the drawings released. The RFQ to fabricate the fixture has been submitted. All eight 21cm quadrupole chambers were vacuum degassed and leak checked. One chamber leaked and was repaired. One 21cm chamber is being set-up for vacuum instrumentation mock-up prior to the shipment of all 21cm chambers to SNS. The design of Linac dump line vacuum is almost complete pending the information on Harp from project office. The design of the momentum dump vacuum has been started.

Drawings of the HEBT momentum dump are being reviewed. Fabrication of the HEBT collimators has started. Outer shield arrangements have also been designed, and the drawings are in checking. A pedestal to which the support jacks, and the lateral movement jacks will be attached has been designed.

Variance Analysis (Cumulative to date) (\$K)

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
5806.8	7273.5	5512.1	1466.75	25.3%	1761.4	24.2%

Variance Statement: Cum SV \$1466.8K (25.3%) & CV \$1761.4K (24.2%) are material driven by 1.5.1.1 HEBT 8D533, 16CD20 & 12Q45 Magnets, whereas most magnets were received ahead of schedule. Also ACWP is understated and does not reflect final payment to magnet suppliers. After final payment ACWP will be accrued in a subsequent current period and a material change to the CV will be reported. BCWS and current SV will be readdressed and adjusted during the ETC. Current period SV \$948.6K (192.8%) and CV \$470.9K (47.3%) are driven by the same magnet deliveries as described in cum variances.

Project Impact: None.

Corrective Action: None.

WBS 1.5.2 – Injection Systems

Full power test with wedge shaped clamps installed to reduce vibration was successfully done. The total vibration amplitude is significantly reduced to a reasonable level for operation. The vibration displacements in the straight part of coil calculated from accelerometer readings are listed below for reference.

Without wedges					With wedges		
Vibration displacement					Vibration displacement		
Current	+ mm	- mm	Total		+ mm	- mm	Total
1.0 Gev	1050	0.088	-0.092	0.179	0.062	-0.046	0.108
1.3 Gev	1250	0.170	-0.125	0.295	0.101	-0.058	0.160

An ECN will follow to implement the wedge clamps into kicker assembly.

An Opera magnetic field calculation was performed to have a coil model that is closer to the as built coil, which has a gap (.5cm) between top (and bottom) of coil and ferrite core but less gap (ground insulation) in the centerline between two coils.

	<u>Previous calculation</u>	<u>New calculation</u>
1. The center field	790.2 gauss	784.9 gauss
2. Integral field	664670 gauss-cm	65720 gauss-cm
3. Integral field quality	.78%	1.0%

The field strength and integral field quality of the magnet meet the requirements. Rich Thomas has performed the full power magnetic field measurements with and without the coated ceramic beam tube. The magnetic field measurements were made by recording the voltages of the dipole windings of a stationary tangential coil placed in the magnet. BNL-SNS machine physics group is reviewing the results.

The first delivery of the short magnet ferrites from Ceramic Magnetics Inc. has been checked and they are in compliance with the drawings. CMI is working on the production ferrites. More parts finished by Central shop are being cleaned and inspected in Bldg. 919.

The first set of measurements on the number 4 injection chicane magnet has been completed. The results show that the magnet needs “Z bumps” as were installed on the ring dipole magnets. The configuration of the bumps has been defined and the bumps are being fabricated in the shops. The drawings for the number 1 chicane magnet are being checked. A PCR for a spare injection dump septum magnet has been submitted.

Variance Analysis (Cumulative to date) (\$K)

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
4864.5	5335.9	5258.2	471.33	9.7%	77.7	1.5%

Variance Statement: Cum variances are within thresholds. No analysis required.

Current period SV \$122.4K (251.5%) is driven by BCWP for Ring Injection 24D64 Dipole magnets and Injection Stripping Foil, whereas the SV computation reflects current period BCWP of \$125.8K and no BCWS. BCWS was recorded in a prior period.

Project Impact: None.

Corrective Action: None.

WBS 1.5.3 – Magnet Systems

The second half-cell is being assembled in the 902 assembly area.

There are still 23 - 21Q40's now at BNL. The last batch of magnets was shipped and are now in New Jersey. Production measurements of the 21Q40 will resume in the beginning of January. Replacement of the fittings is continuing. 9 more magnets have been repaired and the repair pace can stay ahead of the measurement pace.

Stangenes Inc. and their subcontractor Quest Machine were visited during the month to check progress on the 26Q40. The coils for the production magnets are nearly complete but assembly of the cores has come to a stop. BNL is awaiting an inspection report of the machining tolerances of the core pieces from Quest before they can proceed.

The BINP held only two phone conferences during the month because of vacations and holidays. They have sent photos of their progress. There were extensive delays in them getting the hardware parts that were purchased by BNL. "Air" shipment took almost three weeks. They are still scheduling shipment from their facility in March via ground transport.

This time eighteen 27CDM30's have been measured and accepted. The measurement effort for these magnets has been stopped to start measurement of the 21Q40's again.

On the 21S26, Alpha was visited during the month. Upon inspection it was found that the delivery time for "first article" of 12-21-02 was unrealistic. They have since provided a shipping date of 1/17/03 that will also be tight based on their progress to date. Bids for the 26S26 high field sextupole were received and reviewed. Alpha magnetics was the low bidder and has been awarded the contract.

New England TechniCoil shipped a reworked 36CDM30 corrector magnet. The magnet is being acceptance tested. It looks significantly better than the first magnet they shipped.

On the 41CDM30, Alpha Magnetics was visited. Though they had all the materials in house, no progress has been made on machining the cores or winding the coils. They have to provide a revised delivery schedule.

Variance Analysis (Cumulative to date) (\$K)

BCWS	BCWP	ACWP	SV	%	CV	%
11376.3	11208.2	11864.4	(168.15)	-1.5%	(656.2)	-5.9%

Variance Statement: Cum variances are within thresholds. No analysis required.

Current period CV -\$185.9K (-172.5%) is driven by WBS 1.5.3.1 High Field Magnets whereas an accounting accrual for direct & trade labor, small & special purchases exceeded BCWP by \$131.6K.

Project Impact: None.

Corrective Action: None.

WBS 1.5.4 – Power Supply Systems

- First article testing of the first model of the medium range power supplies took place. The unit tested fell short of meeting specifications. A plan was made to fix the problems, and the unit will be re-tested in February '03.
- A capacitor in a Low Field Corrector failed during factory tests. This revealed insufficient ratings on this part and two transistors. The manufacturer is going to send a technician to ORNL to remove the capacitor and replace two transistors in each delivered unit. New deliveries will include the change.

Variance Analysis (Cumulative to date) (\$K)

BCWS	BCWP	ACWP	SV	%	CV	%
1249.7	987.7	1233.1	(261.96)	-21.0%	(245.4)	-24.8%

Variance Statement: Cum SV of -\$261.96K (-21.0%) & CV -\$245.4K (-24.8%) are driven by Ring Quad PS & Ring Low Field PS deliveries. Current period CV -\$60K (-644.8%) is driven by WBS 1.5.4.2 Main Ring PS material whereas an accounting accrual for vendor Apogee (Controllers) was not offset by current period BCWP.

Project Impact: None.

Corrective Action: None.

WBS 1.5.5 – Ring Vacuum System

The welding fixture for type D halfcell chambers was setup and surveyed. Three type D chambers have been assembled and leak checked. The welding fixture for the 30cm doublet chambers is being designed and fabricated. The chamber components for the injection and rf straight section doublet chambers have arrived and are being leak checked. Helicoflex delta seals were tested in the 14” aperture Evac flanges with chain clamps with excellent results. A seal retainer was fabricated and Evac flanges were modified with a 14” aperture so that an Al seal retainer can be used in conjunction with a Helicoflex delta seal. Testing with this setup is scheduled for January. Aluminum diamond seals with an outside retainer ring for the 14” aperture flanges were ordered from EVAC for evaluation.

The vacuum device list and the valve interlock layout have been updated to reflect the changes in the vacuum hardware. Scope and cost transfer for residual gas analyzers has been submitted. The SNS HEBT installation schedule is being reviewed to identify critical vacuum components for delivery to SNS. The out-year manpower projection was generated for review by BNL management.

Variance Analysis (Cumulative to date) (\$K)

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
5291.5	5282.3	5528.0	(9.20)	-0.2%	(245.6)	-4.7%

Variance Statement: Cum variances are within thresholds. No analysis required.

Current period CV -\$61.1K (-40.1%) is material driven by 1.5.5.2 Ring Vacuum Pumps; whereas an accounting accrual for purchased material was not offset by current period BCWP. BCWP is understated and will be adjusted in a subsequent current period. Current period SV \$85.8K (129.1%) is material driven by 1.5.5.1 Ring Vacuum Chambers; whereas the SV computation reflects current period BCWP of ~\$65.7K and no BCWS. BCWS is in a subsequent current period.

Project Impact: None.

Corrective Action: None.

WBS 1.5.6 – RF System

- Work on electron cloud instabilities continued with a more detailed attempt at understanding the effect of nonlinear space charge forces on instability thresholds. For a 1-D model, simulations are in fair agreement with the analytic theory. A code for two dimensional simulations is under development. Working under the supposition that 2-D simulations can be well modeled using the analytic model, a pseudo-analytic bunched beam theory incorporating nonlinear space charge is being developed.
- Fabrication of cavities and PA's continuing
- Work on WCM started by mechanical engineer.

Variance Analysis (Cumulative to date) (\$K)

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
7679.4	7414.5	7722.2	(264.89)	-3.4%	(307.6)	-4.1%

Variance Statement: Cum variances are within thresholds. No analysis required.

Current period CV -\$230.9K (-169.7%) is material driven by High (WBS 1.5.6.1) & Low (WBS 1.5.6.2) level RF; whereas an accounting accrual was not offset by same current period BCWP. BCWP is understated and will be adjusted in a subsequent current period.

Project Impact: None.

Corrective Action: None.

WBS 1.5.7 – Ring Diagnostics

- Preparations are underway for the upcoming design review, planned for March.
- Delivered 4 more 26cm BPMs to the vacuum group. Assembling more 12cm BPMs for brazing. Shop fabrication of 30cm BPMs for the spare vacuum chambers is underway. BPM base-band PCB is being stuffed. RF/mixer section design continues. PCI interface cards needed for this system were requested from LANL. None are available, but BNL has the artwork and will make appropriate modifications and manufacture the boards. A rackmount PC for the BPM system has been located after an extensive search. One of the many complicating factors is the non-standard size of the PCI interface card. Project-wide commonality on rackmount PCs is a desirable goal, which has not yet been reached.
- Detailed design of IPM detector and vacuum chamber continues. Burle Electron Generator array calibration source was ordered. This is a microchannel plate in which the input channels are doped for greatly decreased work function. A modest bias voltage causes the MCP to emit a very uniform cold electron beam which illuminates the detector MCP, giving us the capability to calibrate and monitor MCP accurately with no moving parts. Design work continues on the IPM detectors, primarily in the area of MCP selection. Beam tests with the rebuilt RHIC IPMs using the Laird ElectroVent panels for RF isolation show that this material prevents measurable RF coupling from the beam while allowing electrons to pass. This technique will be applied to the SNS IPM.
- Considerable thought has been given to the BLM single/dual path question. Present plan is to provide single path electronics. Continue with 8 channel AFE module PCB design. Ordered parts for AFE chassis, and selected Euro-card module and internal chassis components. Ten LND ION chambers and 15 end-cap RC network PCBs for testing and DTL were received. The purchase order for all Rexolite cable ends and bulkhead connectors has been submitted. We have agreed to use the Times Microwave cable for the HV bias distribution; a compatible cable end was suggested by ORNL. Discussions continue with our Russian colleagues regarding processing the neutron detector signals through our AFE chassis.
- Failed MEBT BCM electronics was received, failed components were identified, repairs were completed, a report has been written and submitted, some RF protection was added, and the equipment was shipped overnite delivery to ORNL. Cause of failure was determined to be the application of over-voltage to the signal input. It remains a puzzle how this happened. Expected levels from the transformer are of the order of 10's of millivolts. Several orders of magnitude more would have been required to cause the observed damage. Moving ahead with completion and testing of boards earmarked for DTL commissioning to provide MEBT spares. Tests have been made on the BCM software to determine the time required to process a single channel including calibration and time constant calculations for each analysis. Placed order for the ceramic breaks and flanges for the HEBT BCMs.
- Detailed design of tune kickers is proceeding. Received quotes from Meggitt Systems and Ceramaseal for the HVN feedthroughs. Additional manpower has been assigned to

accelerator physics oversight and detailed design of timing and control. Possibility of incorporating tune systems into modified BPM IFEs (following the successful development path pioneered in the RHIC tune system) is being evaluated.

- Finished updating drawings for the MEBT wire scanner. Placed the order of the WS beam boxes and associated flanges in the HEBT line.
- Worked with vacuum group to claim space for the BIG and the Tune Kicker at the extraction and collimator area in the Ring, modifying the preliminary layout according to comments of the vacuum group, contacted AP to confirm the beam pipe apertures at the Ring straight sections.

Variance Analysis (Cumulative to date) (\$K)

BCWS	BCWP	ACWP	SV	%	CV	%
7472.5	7126.7	7138.5	(345.80)	-4.6%	(11.8)	-0.2%

Variance Statement: Variances are within thresholds. No analysis required.

Project Impact: None.

Corrective Action: None.

WBS 1.5.8 – Collimation and Shielding

Work is continuing on the first scraper for the Ring. The ring secondary and tertiary absorber drawings have been completed, with the exception of the flanges. Finally, the vacuum chambers before and after the primary collimator are being integrated with the collimator.

Drawings of the modified shield are complete. A review with project office staff was carried out, and the drawings are now in checking.

Variance Analysis (Cumulative to date) (\$K)

BCWS	BCWP	ACWP	SV	%	CV	%
1863.4	1667.4	1748.7	(196.1)	-10.5%	(81.3)	-4.9%

Variance Statement: Cum schedule variance (SV) of -\$196.1K (-10.5%) is material driven by 1.5.8.1 Ring Collimator 1st delivery; whereas 1st delivery will be in March `03 thus reducing the SV. Current period variances are within thresholds.

Project Impact: None.

Corrective Action: None.

WBS 1.5.9 – Extraction System

The checking of the downstream end kicker assembly is nearly complete. A kicker exit aperture dimension and bellow diameter were double checked with J. Rank and N. Tsoupas. The upstream kicker assembly design is moving along and will be ready for checking by the end of January. The prototype kicker was reassembled again with CMD 5005 ferrite. H. Hahn is doing the impedance measurements.

Detailed design of Extraction Lambertson magnet from 3-D layout using revised geometry has resumed. A test sample of the large cross-section copper conductor matching the main coil design is being ordered to verify the compound bend radii needed to fit this magnet into its lattice location.

Variance Analysis (Cumulative to date) (\$K)

BCWS	BCWP	ACWP	SV	%	CV	%
1834.5	2009.4	2177.4	174.87	9.5%	(168.0)	-8.4%

Variance Statement: Cum variances are within thresholds. No analysis required.

Current period SV \$184.6K (382.3%) is labor driven by Extraction Kicker PS (WBS 1.5.9.2); whereas the SV computation reflects current period BCWP of \$216.9K and no BCWS. BCWS is in a subsequent current period. Current period CV -\$99.9K (-42.9%) is material driven by Extraction Kicker PS (WBS 1.5.9.2); whereas an accounting accrual for purchased material was not offset by current period BCWP. BCWP is understated and will be adjusted in a subsequent current period.

Project Impact: None

Corrective Action: None.

WBS 1.5.10 – RTBT System

Large quad (30Q48 and 30Q55) stands have been detailed and are being checked. Procurement of vacuum components for magnet chambers and drift spaces continues. Detail design of specialty chambers at extraction and target building is on-going. Winding of the coil for the radiation resistant corrector magnet has begun.

Orders are being placed for commercial components for RTBT magnet and drift space vacuum chambers. Designs of specialty chambers and components, such as those at Extraction and upstream of the Target Building are being completed.

The as built drawings for the RTBT collimator are being prepared, they will be used as a basis for the second RTBT collimator.

Variance Analysis (Cumulative to date) (\$K)

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
3223.2	3369.8	3892.4	146.68	4.6%	(522.6)	-15.5%

Variance Statement: Cum schedule variance (CV) of -\$522.6K (-15.5%) is material driven by 1.5.10.5 Collimator & Shielding; whereas an accounting accrual for purchased material (~\$593.6K) was not offset by current period BCWP. BCWP is understated and will be adjusted in a subsequent current period. Current period SV \$375.5K (626.5%) is material driven by 1.5.10.5 Collimator & Shielding; whereas the SV computation reflects current period BCWP of ~\$266K for material and no offsetting BCWS. BCWS is in a subsequent current period. Current period CV of -\$309.7K (-71.1%) is also driven by WBS 1.5.10.5; whereas an accounting accrual for purchased material was not offset by adequate current period BCWP. BCWP is understated and will be adjusted in a subsequent current period.

Project Impact: None.

Corrective Action: None.

WBS 1.5.12 – Technical Support

- Unified Accelerator Library (UAL) User Guide was completed and published as a BNL formal report.
- Dipole sorting for the ring was completed.
- Dipole sorting for the HEBT was completed.
- Lambertson magnet physics design was completed.
- Global coordinates for the injection were completed.
- Chicane #4 physics design was optimized and its effects on the injection dump line were studied.
- Studies continue for (1) octupole correctors and damping of instabilities, (2) effect of fringe fields in damping of instabilities, (3) correction of nonlinear resonances.

Variance Analysis (Cumulative to date) (\$K)

<u>BCWS</u>	<u>BCWP</u>	<u>ACWP</u>	<u>SV</u>	<u>%</u>	<u>CV</u>	<u>%</u>
12774.5	12774.5	12651.2	0.00	0.0%	123.3	1.0%

Variance Statement: Cum variances are within thresholds. No analysis required.

Current period CV of -\$78.6K (-46%) is labor driven WBS 1.5.12.1.

Project Impact: None.

Corrective Action: None.

WBS 1.9.5.1 -Ring Controls Integration

Larry Hoff traveled to ORNL to meet with Controls personnel to discuss plans for the upcoming ETC, and to observe control system configuration and performance during MEBT commissioning.

A system disk failure in our LINUX server and the subsequent recovery efforts hampered productivity for nearly a week. By applying lessons learned from this experience we are now in a better position to weather any future server failures.

WBS 1.9.5.2 - Power Supply Controls

The EPICS device support for the LeCroy oscilloscope is being enhanced to better support the function of viewing extraction kicker magnet waveforms. Improved support includes “zoom” (sampling rate and waveform size) control. Remaining work includes supporting “asynchronous mode”, so that EPICS record processing is not blocked while receiving large data arrays.

IOC configuration files have been generated for all 9 PS IOCs planned for installation in the HEBT, Ring and RTBT areas.

LANL personnel have checked out the PS IOC application from ORNL CVS for control system/power supply integration tests at LANL.

BNL has shipped 62 PSIs to the ORNL power supply group for power supply testing.

WBS 1.9.5.3 – Diagnostics

Work continues to improve the software performance of the BLM IOC application. Software optimization has increased performance somewhat, but not enough to meet the requirement of 32 channels at 60 Hz. Using a processor with 25% higher clock speed resulted in only marginal improvement in throughput. The next planned test involves the DMA engine on the processor board to copy data from digitizer memory to processor memory over the VMEbus.

All digital and analog modules needed for DTL commissioning have been received. A driver and EPICS device support for the VMIC 2510B digital I/O module were developed, tested, and submitted to CVS in ORNL. “Pin outs” for the I/O modules were provided to the diagnostic group for use in designing the BLM signal conditioning and MPS-comparator modules.

ISEG shipped 12 2-channel High Voltage power supply modules to BNL for use in biasing RHIC electron cloud detectors. Before being used at RHIC, these modules were tested with SNS

MVME2100 processors to verify that the previous VMEbus bug had been fixed. The ISEG modules for the SNS BLM system can now be safely ordered.

The only remaining VMEbus module required for the BLM IOC is a timing module to translate V124 pulse outputs into a differential-TTL gate for the digitizer. This module is being built as a special form of the SNS standard V294 timing fanout module.

WBS 1.9.5.4 - Vacuum

Xiaosong Geng traveled to ORNL to meet with Controls personnel to discuss global vacuum standards, and hand-off issues.

The HEBT valve control application was submitted to CVS in ORNL. The application was then checked out and demonstrated into the ORNL development environment.

WBS 1.9.5.5 - Applications Software

The alarm handler configuration application “confFileEditor” was presented at the last EPICS collaboration meeting, and to EPICS experts at Argonne National Lab. Feedback from those two meetings is being incorporated into the application prior to its deployment at ORNL later this month.

WBS 1.9.5.6 – RF

Preliminary HPRF “engineering” EDM screens have been developed and tested using “soft” EPICS records. These records will be interfaced to the RF PLC 5/60 via a ControlLogix PLC as the plan for that interface is developed.

FAULTS														
FILAMENTS	ATTEN WATER	TUBE WATER	TUBE OT	CABLES	FLUSHING AIR	TUBE AIR	CRASH							
HV READY	VACUUM	CAVITY WATER LEFT	CAVITY WATER RIGHT	CAVITY OT LEFT	CAVITY OT RIGHT	ROSS RELAY	GRID UV	FILUV						
ANODE PS	OL	WATER LEAK	WATER MAT	CONTROL BOX OT	CRASH	DOOR INTLK	PLC I/L TRIP	#1303 WATER	#1303 OVER VOLTAGE	#1303 INTERLOCK	#1303 OL	#1303 ARC	#1303 PWRFLT	#1303 COOLANT
								#2303 WATER	#2303 OVER VOLTAGE	#2303 INTERLOCK	#2303 OL	#2303 ARC	#2303 PWRFLT	#2303 COOLANT
CAP BANK	CRBR INTLI	CRBR FUSE	OC	AIR FLOW	DOOR	PS SHORTING BAR	CRBR OT	LOAD FAULT	CUBICAL OT	HEAT LAMP				
SCREEN PS	OL	OVER VOLTAGE	INTER LOCK											
TUNING PS	INPUT OC	INPUT OV	INPUT PHASE LOSS	INPUT PHASE ROTATION	OUTPUT OC	OUTPUT OV	OVER TEMP	WATER	FUSE	DOOR INTLK	LOAD FAULT	EXTERNAL INTLK	GND FLT	
DRIVER	OC	WATER												

AUTO	OFF	STBY	ON
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MANUAL	AUX ON	FILAMENT CURRENT	GRID ON	VARIAC HIGH LIMIT	HV READY	ANODE ON	VACUUM CONTACTOR	SCREEN ON	QEI ON	SW ON	TUNER ON	PHASE LOOP	TUNER UPPER LIMIT
	AUX OFF	FILAMENT CONTACTOR	GRID OFF	VARIAC LOW LIMIT	IN PROCESS	ANODE OFF	ROSS RELAY	SCREEN OFF	QEI OFF	SW OFF	TUNER OFF	POSITION LOOP	TUNER LOWER LIMIT

Variance Analysis (Cumulative to date) (\$K)

BCWS	BCWP	ACWP	SV	%	CV	%
4805.1	4494.1	4510.6	(311.07)	-6.5%	(16.6)	-0.4%

Variance Statement: Cum variances are within thresholds. No analysis required.

Current period SV of -\$88.4K (-38.5%) is driven by 1.9.5.3 Diagnostics, (SV -\$59.9K); whereas Diagnostic & Collimator Controls material delivery and fabrication are delayed.

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-Dec-02 thru 30-Dec-02	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		Budgeted	Revised Estimate	Variance
	Work Scheduled	Work Performed		Schedule	Cost	Work Scheduled	Work Performed		Schedule	Cost			
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	868.8	2,540.9	3,120.8	1,672.1	(579.9)	63,437.2	64,450.8	64,727.0	1,013.6	(276.2)	112,438	112,438	0.0
1.5.1 HEBT (High Energy Beam Transport) Systems	47.8	996.4	525.5	948.6	470.9	5,806.8	7,273.5	5,512.1	1,466.8	1,761.4	9,886	9,886	0.0
1.5.2 Injection Systems	48.7	171.1	168.8	122.4	2.3	4,864.5	5,335.9	5,258.2	471.3	77.7	9,350	9,350	0.0
1.5.3 Magnet Systems	131.4	107.8	293.7	(23.6)	(185.9)	11,376.3	11,208.2	11,864.4	(168.1)	(656.2)	16,935	16,935	0.0
1.5.4 Power Supply System	11.5	9.3	69.3	(2.2)	(60.0)	1,249.7	987.7	1,233.1	(262.0)	(245.4)	3,746	3,746	0.0
1.5.5 Vacuum System	66.4	152.2	213.3	85.8	(61.1)	5,291.5	5,282.3	5,528.0	(9.2)	(245.6)	9,758	9,758	0.0
1.5.6 RF System	135.5	136.1	367.0	0.6	(230.9)	7,679.4	7,414.5	7,722.2	(264.9)	(307.6)	12,009	12,009	0.0
1.5.7 Ring Systems Diagnostic Instrumentation	124.2	112.6	120.2	(11.6)	(7.6)	7,472.5	7,126.7	7,138.5	(345.8)	(11.8)	13,584	13,584	0.0
1.5.8 Collimation and Shielding	24.0	15.9	35.4	(8.0)	(19.4)	1,863.4	1,667.4	1,748.7	(196.1)	(81.3)	3,437	3,437	0.0
1.5.9 Extraction System	48.3	232.9	332.7	184.6	(99.9)	1,834.5	2,009.4	2,177.4	174.9	(168.0)	6,165	6,165	0.0
1.5.10 RTBT (Ring to Target Beam Transport) System	59.9	435.5	745.2	375.5	(309.7)	3,223.2	3,369.8	3,892.4	146.7	(522.6)	7,280	7,280	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	171.1	171.1	249.7	0.0	(78.6)	12,774.5	12,774.5	12,651.2	0.0	123.3	20,287	20,287	0.0
WBS SUBTOTAL	868.8	2,540.9	3,120.8	1,672.1	(579.9)	68,552.2	69,565.8	69,839.9	1,013.6	(274.2)	117,553		
UNDISTRIBUTED BUDGET													
SUBTOTAL	868.8		3,120.8			68,552.2		69,839.9			117,553		
MANAGEMENT RESERVE													
TOTAL	868.8		3,120.8			68,552.2		69,839.9			117,553		

RECONCILIATION TO CONTRACT BUDGET BASE

DOLLARS EXPRESSED IN: THOUSANDS	SIGNATURE OF PARTICIPANT'S PROJECT DIRECTOR: Jie Wei	DATE: January 16, 2003
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1.5 & 1.1.3 Performance Measurement Chart

