

# The Spallation Neutron Source Monthly Report

December 2003



SNS 102010000-TR0040-R00



A U.S. Department of Energy Multilaboratory Project

SPALLATION NEUTRON SOURCE  
Argonne National Laboratory • Brookhaven National Laboratory • Lawrence Berkeley National Laboratory • Los Alamos National Laboratory • Oak Ridge National Laboratory • Thomas Jefferson National Accelerator Facility



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Shielding Block installation

**Technical Assessment:** Satisfactory  
**Cost Assessment:** Satisfactory  
**Schedule Assessment:** Satisfactory  
**Overall Assessment:** Satisfactory

  
 Carl N. Strawbridge  
 SNS Deputy Project Director  
 2/9/2004  
 Date

### Highlights:

- Good project performance continues with minor cumulative schedule and cost variances against the March 2006 early finish schedule. Through the end of December 2003, 75.9% of the project is complete. Completion percentages are:
  - ◊ 97 % of R&D
  - ◊ 93 % of design
  - ◊ 71 % of technical hardware (including procurement and fabrication)
  - ◊ 81 % of conventional construction
  - ◊ 45 % of installation
- The available contingency balance of \$44.7M will be reduced to \$30M once the changes identified in the Estimate at Completion are incorporated into the baseline.
- Excellent safety performance continues. As of December 20, 2003, the total Project has worked in excess of 4.6 million hours with 52 recordable injuries (an increase of 2 from last month) and no lost work day (away) cases.

### Assessment and Issues:

**Accelerator Systems Division (ASD):** A 96-hour endurance test of the H<sup>-</sup> ion source was completed satisfactorily. A steady current of 46 mA, more than the baseline value, was achieved with 1-ms pulses at 10 Hz. Drift Tube Linac (DTL) Tank #2 has been assembled, aligned and tuned. One missing drift tube is being repaired at the vendor. At the same time, the DTL-2 tuners are being machined. The Coupled Cavity Linac (CCL) RF module #1 has been installed and vacuum tested. The water cooling and vacuum systems are being completed. CCL-module #2 pre-shipment tuning has been completed and it is undergoing leak testing at the vendor. Six medium-beta cryomodules have been received from JLAB and installed in the tunnel. All of the medium beta cavities were qualified at JLAB; however, the high-beta #7 (HB-07) cavity failed to qualify because of a failure of the high-pressure rinse pump. The pump is being replaced with a spare. Cavities for the medium-beta #10 cryomodule were all processed after HB-07 and are assumed to be contaminated. The string has been disassembled and the cavities will be reprocessed. About 75% of the feedthroughs for the 2K coldbox leak and will be shipped back to the vendor in France for repair. In addition, one compressor ring and its spare were dented when prepared for installation. The vendor does not believe the dents will impair operation. The compressors will be tested after installation and several options are being developed in the event that they do not function as anticipated. Cryomodule testing with 4K helium or dewars is under investigation. All magnet cables for the ring from the HEBT Service Building and Ring Service Building have been pulled, allowing the installation of half-cells. Nineteen ring half-cells have been shipped to ORNL. Assembly continues on half-cells 20 and 21. Work continues on many fronts in preparation for the March 22 Accelerator Readiness Mini-Review to commission DTL Tanks 1-3.

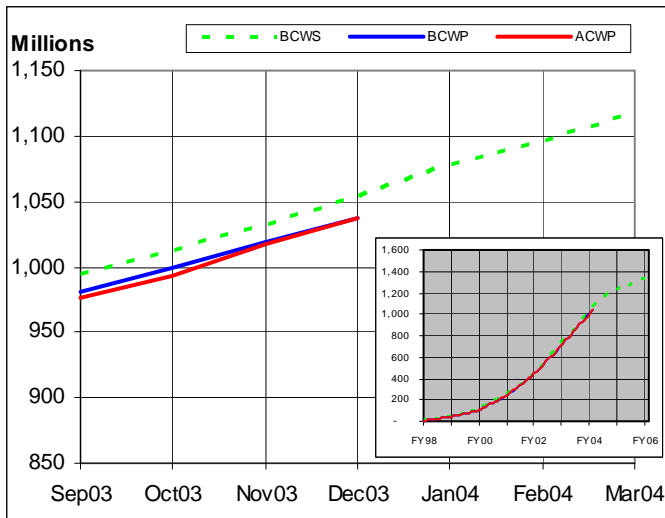
rive. Many of the individual components of the outer reflector plug have been completed by the vendor. Almost all of the individual shield plates and cylindrical shells are complete. The long lead item are the beam tubes and SNS is assisting the vendor in finding additional vendors to allow a parallel machining of the tubes that could expedite the schedule. A promising meeting was held with a potential source to cadmium plate the outer plug beam tubes. A progress review meeting was also held with the manufacturer of the target carriage and transport system. Testing plans were discussed. The instruments team is exploring collaboration with local companies in the development of rugged superconducting magnets and participated in a proposal for development and construction of a compensated high-field magnet for use at SNS and HFIR. Plans for installation of the Backscattering Instrument are on schedule.

**Conventional Facilities (CF):** Construction progress is still on schedule to allow the start of Instrument Systems equipment installation. The Target Building roofing is nearing completion and piping, electrical and block work installation continue throughout the building. Work continues on the north and south walls of the hot cell. Gallery walls are going up with the placement of forming on the north and east walls. The contractor is starting a second shift to ensure that hot cell equipment installation can begin on April 12, 2004. Overall, the Target Building is 75% complete. Mechanical and electrical work is ongoing throughout the Central Lab and Office building. Installation of the curtain wall glass is ongoing, temporary heat has been installed and the skylight is currently being framed. The June 2004 move-in date is still on schedule. Settlement in the RTBT tunnel is being monitored. While it is likely that no remedial measures will be required, a back up plan is in place. Maintenance of the cooling tower and electrical maintenance for the breakers in the Front End and Klystron buildings was completed. Installation and testing of the air blown fiber system is complete.

**Experimental Systems Division (XFD):** The upper support cylinder and the first six chimney shield rings have been installed. The lower half of the water supply and return lines to the core vessel have been welded and radiographed. Interstitial shielding blocks continue to ar-



Project Overview and Assessment (con't)



Total Project	Dec03	Cum-to-Date
BCWS	20,604	1,054,100
BCWP	17,915	1,037,002
ACWP	20,450	1,037,333
CV	-2,535	-331
SV	-2,689	-17,098
CPI	0.88	1.00
SPI	0.87	0.98
Budget at Complete		1,366,963
Contingency		44,737
Total Project Cost		1,411,700

<b>Total Project Cost (TPC)</b>	<b>\$1,411.7 M</b>
Percent planned (cumulative)	77.1%
Percent complete (cumulative)	75.9%
<b>Total Estimated Cost (TEC)</b>	<b>\$1,192.7 M</b>
Cost and Commitments through 12/31/03	\$967.2M
Outstanding Phase Funded Awards	\$50.7M
Budget to Complete	\$180.7M
Contingency	\$44.7M
Estimate at Completion	\$1,162.7M
Remaining Contingency Based on EAC (~20%)	\$30M

**Critical Path:**

Based on the March 30, 2006 completion date, no activities in the project schedule show negative float at this time.

The project's longest path resides in the Target schedule, through Target building construction work supporting the Hot Cell installation. There is no single area in the Target schedule that shows negative float, and there is one month of positive float at the end of this path to the March 30, 2006 early finish date. The schedule is being monitored closely to ensure that there are no delays in the loading of Target Mercury, conducting integrated startup testing of the Target systems and the Target Readiness assessment. Target Systems installation effort has been grouped into "installation packages". Six of the eleven packages have been awarded to the General Construction contractor and a seventh will be awarded imminently. The detailed activities associated with these seven packages are being incorporated into the project's schedule and will be monitored carefully to ensure optimal sequencing. These activities all require that the Hot Cell installation work proceeds on schedule with an April 2004 start date.

**Milestones:**

Description	Milestone Date	Forecast Date
CD-1 Mission Need	Aug-96	Aug-96 ✓
CD-2 Baseline Approved	Dec-97	Dec-97 ✓
CD-3 Begin Construction	Nov-99	Nov-99 ✓
CD-4 Project Complete	Jun-06	Mar-06



## Linac Systems– Los Alamos National Lab



CCL 1 in the Linac tunnel

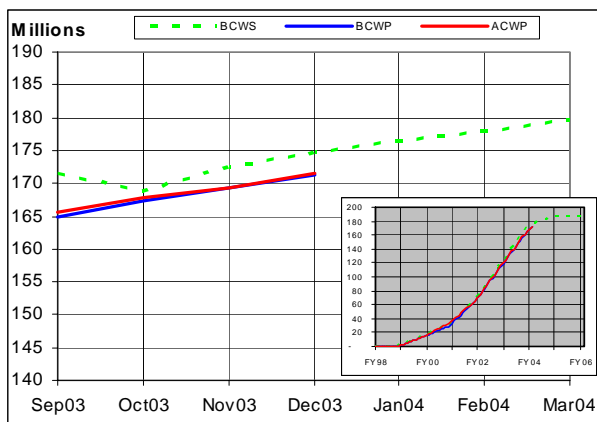
### Highlights:

- Support of installation and testing of RF systems at ORNL continues. The first CCL 5-MW klystron and the first 12 SCL klystrons were installed in their transmitters and made operational. Receiving and testing of klystrons at LANL continues. Site acceptance tests of the second 5-MW klystron at LANL, and the third and fourth 5-MW CCL klystrons were factory accepted at Thales and delivered to LANL. In addition the first four Thales 550-KW SCL klystrons were factory accepted and delivered to LANL, and three more CPI SCL klystrons were accepted and shipped to ORNL.
- Delivery of DTL drift tubes continued. By the end of the month, 208 out of 210 drift tubes had been delivered. At ORNL, DTL Tank-4 drift tubes were installed and aligned.
- The first CCL module was delivered from ACCEL to ORNL in December. The structure was installed in the linac tunnel, aligned, tuned, and is under vacuum. The second module was ready for final tuning at ACCEL at the end of December.
- The electronics for the DTL beam-position monitors, actuators for the DTL wire-scanner pickups, and the remaining five Faraday cup/degraders for the DTL and CCL were shipped to ORNL.

### Assessment/ Issues:

Key issues being worked at this time are the CCL #4 module delivery schedule, repair of the remaining DTL Tank 2 drift tubes and re-work of the non-compliant SCL waveguide.

### Performance and Milestones:



	Dec03	Cum-to-Date
<b>BCWS</b>	2,268	174,662
<b>BCWP</b>	1,999	171,359
<b>ACWP</b>	2,135	171,430
<b>CV</b>	-136	-71
<b>SV</b>	-270	-3,303
<b>Performance Indicators</b>		
<b>CPI</b>	0.94	1.00
<b>SPI</b>	0.88	0.98
<b>Budget at Complete</b>		186,303
<b>Planned % Complete</b>		93.8%
<b>Actual % Complete</b>		92.0%

#### Cost Performance:

*Cause and Impact:* None required

*Corrective Action:* None required

Description	Milestone Date	Forecast Date
Linac Design Complete	Sep-02	Apr-02 ✓

#### Schedule Performance :

*Cause and Impact:* The schedule variance is largely due to delayed delivery of production klystrons as well as RF windows.

*Corrective Action:* Continued vendor liaison will be performed to ensure the schedule and quality of deliverables is maintained. Currently there is no impact on the project's early finish date.



Cryomodule M-4 in the Test Facility

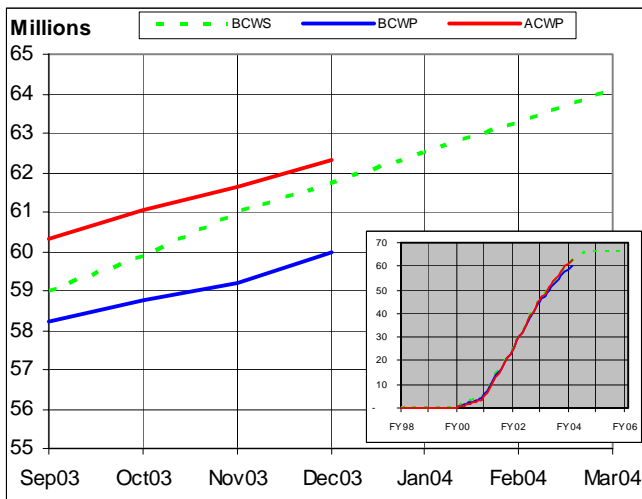
**Highlights:**

- Four additional Medium-β cavities and one additional High-β cavities were qualified in December, leaving only one Medium-β cavity still to be qualified.
- The String Assembly for cryomodule M-9 was completed.
- Assembly of cryomodule M-7 was completed and assembly of cryomodule M-8 was started.
- Testing of cryomodule M-6 was completed. All cavities met specifications for gradient and Q<sub>o</sub>. Testing of cryomodule M-7 was started and suspended due to a leak. Cryomodule M-4 was inserted into the Cryomodule Test Facility, cooled down and testing was completed.

**Assessment/Issues:**

Testing and qualification of cavities has shown significant improvement. An ETC will be performed in March. This will incorporate a revised finish date for the cryomodule production as well as a detailed review for offsets to the cost variance.

**Performance and Milestones:**



	Dec03	Cum-to-Date
BCWS	748	61,731
BCWP	754	59,972
ACWP	687	62,341
CV	66	-2,369
SV	6	-1,759
<b>CPI</b>		
CPI	1.10	0.96
<b>SPI</b>		
SPI	1.01	0.97
<b>Budget at Complete</b>		
Budget at Complete		66,044
<b>Planned % Complete</b>		
Planned % Complete		93.5%
<b>Actual % Complete</b>		
Actual % Complete		90.8%

**Cost Performance:**

*Cause and Impact:* The cumulative cost variance is a result of the additional effort required in the Medium Beta cavity qualification.  
*Corrective Action:* An ETC will be performed in the Spring of 2004 once a specific course of action (incorporating the results of the review and the test program) has been finalized.

**Schedule Performance:**

*Cause and Impact:* The cumulative unfavorable schedule variance results from the difficulty in maintaining a consistent cavity qualification process.  
*Corrective Action:* See above corrective action.

Description	Milestone Date	Forecast Date
Linac Design Complete	Sep-02	Apr-02 ✓
Initiate Testing of Prototype Cryomodule	May-02	Apr-02 ✓



HEFT Collimators

**Highlights:**

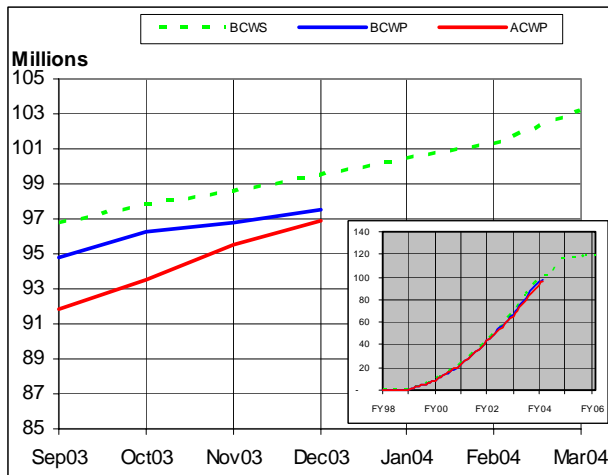
- Ring dipole-quad-corrector (“half-cell”) assemblies #15 and #16 have been completed for delivery to ORNL. This represents 50% of the ring arc assemblies.
- All ring straight section 30-cm ID long quadrupoles (30Q58) have been measured and coil-shimmed. Shimming of the entire magnet coils significantly reduced random multipole errors and improved the field quality. The magnets are subsequently sorted according to their transfer functions to minimize lattice perturbation.
- The low-profile lifting fixture has been fabricated for the installation of ring half-cell assemblies. The lifting fixture is presently under mandated safety and performance tests at BNL before its shipment to ORNL.
- Problems with TiN coating of injection vacuum chamber/bellows were traced to surface contamination. Six injection chambers will be re-cleaned and re-coated with TiN. A proper coating is essential to lower the secondary-emission-yield of electrons from the chamber surface and to control electron-cloud effects.
- The vendor for the 21-cm ID quadrupole (21Q40) magnets has delayed the shipment of the last 8 quadrupoles. Discussions between the vendor and BNL continue over various cost-increase claims. At this time, BNL is approving payment for additional survey holes that were required by the ORNL survey group. The other claims are being denied.
- The first vertical, short injection kicker magnet has been successfully tested.
- The first production pulse-forming network of the extraction system has arrived at BNL. Although engineering aspects are satisfactory, beam coupling-impedance measurements indicate undesired resonance structure. Further investigation is underway.
- At the November DOE review of SNS, a recommendation was made to finalize plans for the earliest possible ramp down of effort at the remaining partner laboratories and transfer of the technical knowledge to SNS at ORNL. Accordingly, SNS and BNL are preparing BNL’s transition/hand off plan.

**Assessment/Issues:**

No issues to report.

**Performance and Milestones:**

	Dec03	Cum-to-Date
BCWS	964	99,552
BCWP	651	97,486
ACWP	1,316	96,852
CV	-665	634
SV	-313	-2,066
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CPI	0.49	1.01
SPI	0.67	0.98
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<b>Budget at Complete</b>		118,504
<hr/>		
<b>Planned % Complete</b>		84.0%
<b>Actual % Complete</b>		82.3%



**Cost Performance :**

*Cause and Impact:* The cumulative cost variance is due to the fact that earned value has been declared for receipt of the pulsed power supplies but the costs have not been incurred in the accounting system. Additional contributors include the fact that the \$1M reduction for reduced BNL overhead has been spread across a year, causing a negative BCWS each month which exacerbates the current month situation.

*Corrective Action:* The possibility of accruing those purchase orders is being investigated.

Description	Milestone Date	Forecast Date
Ring Design Complete	Oct-03	Jul-03

**Schedule Performance :**

*Cause and Impact:* The cumulative schedule variance is due to delay in quadrupole magnet and low power supply deliveries. An additional contributor is an improperly phased BCWS plan that is inconsistent with projected BA allocations.

*Corrective Action:* A PCR was approved in January that will correct the phasing issue.



Mercury pump at ORNL

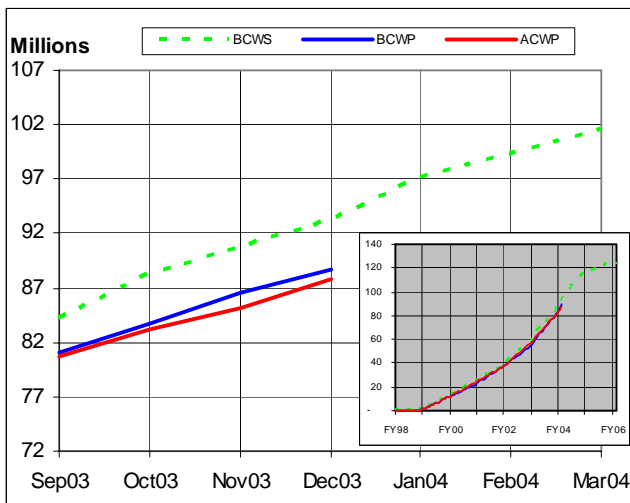
**Highlights:**

- The mercury circulation pump passed final acceptance testing and was delivered.
- Contracts for the Inner Reflector Plug and the Beryllium Reflector Plug were awarded.
- The portable manipulator mobile positioner was shipped from Germany following a successful factory acceptance test. The system will be equipped with the completed manipulator interface package in January.
- The ring injection dump vacuum window and beam stop were transmitted for procurement. Contract documentation is being prepared.
- The remainder of the shield rings in the pan shielding contract was delivered.
- Target Systems personnel participated in the 5<sup>th</sup> International Workshop on High Power Target Development in Tokai, Japan. Substantial progress on understanding cavitation pitting of mercury target containers was reported and future plans were coordinated among the three major parties (SNS, JAERI, FzJ).
- The Proton Beam Window (PBW)/Flight Tube Bellows Assembly was delivered. This assembly connects the proton beam flight tube to the high vacuum inflatable seal of the PBW assembly.

**Assessment/ Issues:**

The installation schedule continues to be monitored closely. The Target Hot Cell Ready for Equipment (RFE) is the next major milestone and is on schedule.

**Performance and Milestones:**



	Dec03	Cum-to-Date
<b>BCWS</b>	2,572	93,375
<b>BCWP</b>	2,183	88,769
<b>ACWP</b>	2,618	87,825
<b>CV</b>	-435	943
<b>SV</b>	-390	-4,607
<b>CPI</b>		
	0.83	1.01
<b>SPI</b>		
	0.85	0.95
<b>Budget at Complete</b>		
		124,682
<b>Planned % Complete</b>		
		74.9%
<b>Actual % Complete</b>		
		71.2%

**Cost Performance:**

*Cause and Impact:* The positive cumulative cost variance was caused by the completion of the shutter gates prior to invoice payment.

*Corrective Action:* None required

**Schedule Performance:**

*Cause and Impact:* The cumulative schedule variance is due to delays in delivery of interstitial blocks and shutter guides as well as procurement and installation in the Target utilities area.

*Corrective Action:* The interstitial blocks are now arriving. Neither the shutter guides nor the interstitial blocks impinge upon the hot cell installation sequence (the project's longest path).

Description	Milestone Date	Forecast Date
Target Design Complete	Jun-03	Jun-03 ✓
Start Target Installation	Jun-03	Apr-03 ✓
Start System Test with Beam	June-06	Mar-06





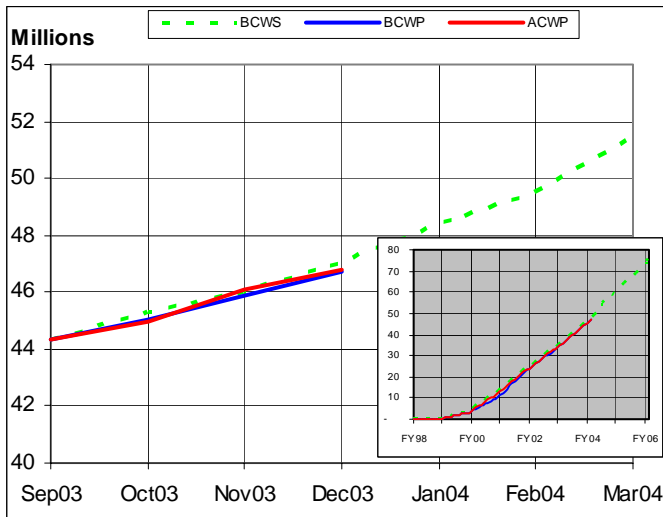
Guide support installation in the 2TU Beamline

**Highlights:**

- The Target Building contractor has completed the initial concrete pours for the guide/shielding supports in the Beamline 2 building between the Target and Spectrometer Buildings.
- Work continues with ORNL High Flux Isotope Reactor (HFIR) personnel to integrate an SNS detector test stand into the HB-2D beamline at the HFIR facility.
- In collaboration with the HFIR technical staff, the first SNS cryofurnace was prepared for commissioning in January 2004. HFIR has supplied resources and accessories such as a cart, and secured an area for testing. Once tested and debugged, the cryofurnace will be used on the HFIR beamlines until SNS is running.
- Results have confirmed that the transmission of the Astrium Chopper disc material meets the specified requirements.

**Assessment/ Issues:** No issues at this time.

**Performance and Milestones:**



	Dec03	Cum-to-Date
<b>BCWS</b>	997	47,048
<b>BCWP</b>	874	46,749
<b>ACWP</b>	672	46,758
<b>CV</b>	202	-9
<b>SV</b>	-123	-300
<b>CPI</b>	1.30	1.00
<b>SPI</b>	0.88	0.99
<b>Budget at Complete</b>		80,036
<b>Planned % Complete</b>		58.8%
<b>Actual % Complete</b>		58.4%

Description	Milestone Date	Forecast Date
Start Instrument Installation	Mar-04	Feb-04
Instrument Design Complete	Oct-04	Aug-04
Complete Subproject Acceptance Tests	June-06	Mar-06

**Cost Performance:**  
*Cause and Impact:* None required  
*Corrective Action:* None required

**Schedule Performance:**  
*Cause and Impact:* None required  
*Corrective Action:* None required



Target Mezzanine construction

**Highlights:**

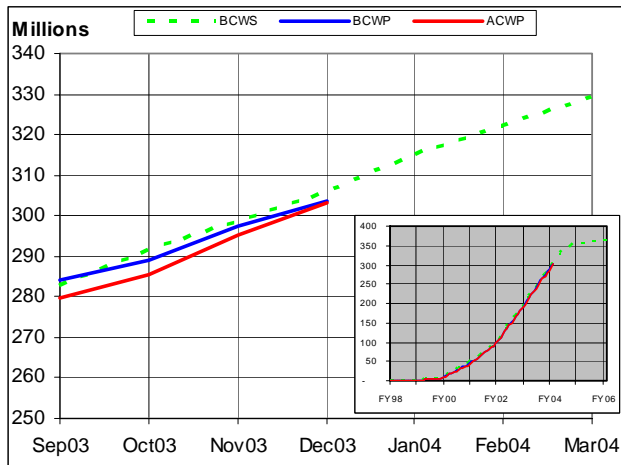
- Construction of the East and West Makeup Air Buildings and Ring Injection Dump is continuing and rough-in work began in the West Makeup Air Building.
- The Diversion Tank Building is awaiting valves and will be completed in early 2004.
- RTBT Tunnel backfill & liner installation is underway.
- Installation of storm drain pipes at the North ellipse road, East CLO parking lot and West CLO parking lot is underway.
- Target Building structural steel is nearing completion and roofing is nearing completion. Motor control centers have arrived on site and are currently being installed. There is a continuing issue regarding the attachment of supports for Target Systems utilities to the overhead structure. The high rebar density in the overhead beams is making it difficult to penetrate the beams with anchors without cutting into rebar. In many instances this may be acceptable, evaluation is underway. The proposal for Target Systems Installation Package 3 has been received and is being reviewed.
- Fireproofing and stud wall installation as well as piping, electrical conduit and cable tray installation is continuing in the CLO.
- Testing and labeling of fiber optic cable is underway and installation of the fiber optic backbone to the Ring Service Building and Booster Pump has begun.

**Assessment/ Issues:**

The critical milestones allowing start of Hot Cell installation in April 2004 and occupancy of the CLO in June 2004 are on schedule.

**Performance and Milestones:**

	Dec03	Cum-to-Date
BCWS	7,197	305,945
BCWP	6,329	303,590
ACWP	8,080	303,395
CV	-1,750	195
SV	-867	-2,355
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CPI	0.78	1.00
SPI	0.88	0.99
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<b>Budget at Complete</b>		367,540
<hr/>		
<b>Planned % Complete</b>		83.2%
<b>Actual % Complete</b>		82.6%



**Cost Performance:**

*Cause and Impact:* The current period cost variance is due to the payment of extended overhead costs to the Site Utility Subcontractor that are not in the baseline.

*Corrective Action:* A project change request to update the baseline is in progress and will be implemented in the January reporting period. The additional cost is reflected in the EAC.

**Schedule Performance:**

*Cause and Impact:* The negative schedule variance is the result of behind schedule progress for Target Building and CLO General Construction effort.

*Corrective Action:* None required

Description	Milestone Date	Forecast Date
Award AECM Contract	Nov-98	Nov-98 ✓
Start Site Work	Mar-00	Mar-00 ✓
BOD Front End Building	Dec-02	Oct-02 ✓
BOD 1000 MeV Linac	Apr-03	Dec-02 ✓
BOD Ring Tunnel	Aug-03	Jun-03 ✓
BOD Target Building	May-05	Feb-05
Construction Complete	Nov-05	Mar-05



## Integrated Control Systems– Oak Ridge National Lab



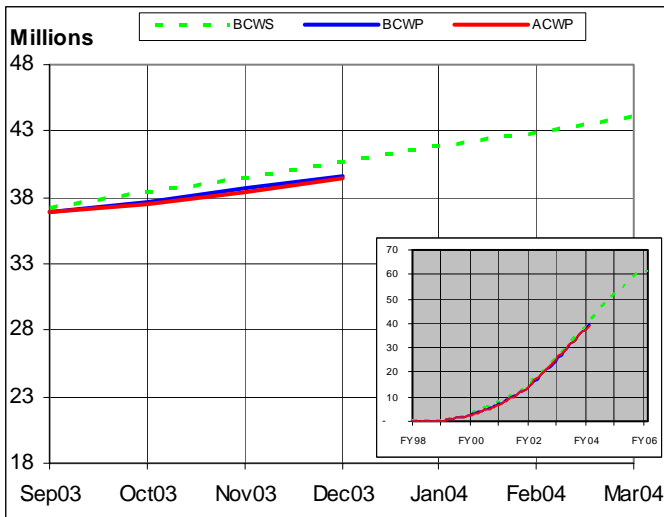
CLO control room

### Highlights:

- All 80 PMC modules for Machine Protection System (MPS) have passed acceptance tests. In response to lessons learned from earlier runs, work began in collaboration with the Operations team on updating the screen specifications document with a view to standardizing on the use of summary process variables and navigation tools.
- Integration testing for phase 0.4a of the Personnel Protection System (PPS) was completed.
- The Resonance Cooling Control System (RCCS), Quadrupole Magnet Cooling System (QMCS), Vacuum, Power Supply, and RF Linac Control Systems are all proceeding on schedule. The QMCS and CCL1 RCCS PLC, database, sequences, and screens are ready for testing and control of SCL RF is ready and has been tested at the SNS site.
- All BNL software development has been converted to EPICS version R3.14.4. This conversion to R3.14.4 allows the support for the reference dipole magnetic field measurement to be migrated from a VMEbus chassis to a LINUX process, simplifying the system configuration by separating the real-time PS software (PSC) from non-real-time software (Hall Probe). It will also allow early deployment of the Hall Probe software, even before there are racks installed in the Ring Service building. This also eliminated some serious obstacles which had been hampering the development and testing of the event-link monitor. Work has resumed on the event-link monitor EPICS software.

**Assessment/Issues:** No issues at this time.

### Performance and Milestones:



	Dec03	Cum-to-Date
BCWS	1,195	40,717
BCWP	891	39,599
ACWP	988	39,429
CV	-97	170
SV	-304	-1,118
<b>CPI</b>		
	0.90	1.00
<b>SPI</b>		
	0.75	0.97
<b>Budget at Complete</b>		
		61,337
<b>Planned % Complete</b>		
		66.4%
<b>Actual % Complete</b>		
		64.6%

### Cost Performance:

*Cause and Impact:* None required

*Corrective Action:* None required

### Schedule Performance:

*Cause and Impact:* The schedule variance is largely due to deliberately delayed ASD diagnostics effort.

*Corrective Action:* The SNS diagnostics plan is being reviewed and will be readjusted based on current BA priorities/allocations.

Description	Milestone Date	Forecast Date
Start Front End Controls Installation	Oct-02	Jun-02 ✓
Global Controls Design Complete	Jan-03	Sep-02 ✓
Global Controls Subproject Test Complete	May-06	Mar-06



Cryomodule Installation

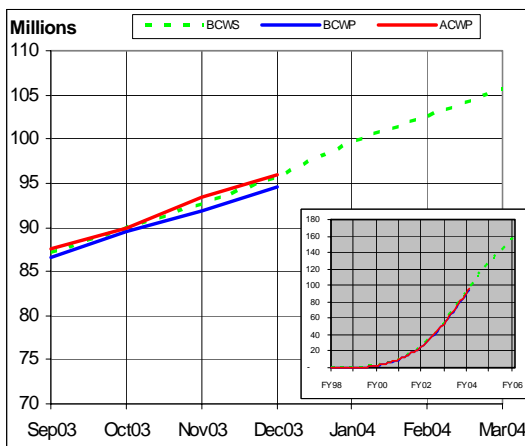
**Highlights:**

- ORNL has received 208 of 210 permanent magnet drift tubes. The “dummy” drift tubes have been removed from DTL-1 and 3 in preparation for the installation of the 4 new EMDs in DTL-1 and DTL-3 as well as the 2 new BPMs in DTL-3. Alignment of the installed DTL-4 drift tubes was completed in preparation for tuning the tank.
- The LANL-ORNL team completed the installation and tuning of CCL Module-1 and it is ready for vacuum pumpdown and leak testing.
- The entire LLRF system (consisting of the HPM, FCM and the timing utility modules) can now be successfully operated in one crate. All the bus contention issues have been successfully resolved. The Analog Front End (AFE) procurement is awaiting DOE approval because it is a foreign purchase. About 120 units will be produced.
- LANL and ORNL personnel successfully completed commissioning of the first two transmitters for the SCL. The first 12-pack of SCL klystrons were successfully operated and commissioned up to 69.5kV, 10.8A and 1.35ms pulsewidth at 20 Hz. RF leaks in the MCI waveguide bellows were found and, after these units were replaced with the MEGA units, the first six klystrons were operated at full output saturated RF power (350 kW) at 1.25 ms RF pulsewidth and 20 Hz. Plans are being made with the vendor to replace the faulty waveguide bellows.
- HEBT-Ring-RTBT installation continues to go well. The installation of the HEBT momentum collimator steel shield plates was completed. The Ring Half-Cell No.15 (Unit C9) was received and staged for installation. Installation of the magnet cables from the Ring Service building to arcs A&D continued. Installation of the cable tray in the RTBT tunnel was started

**Assessment/ Issues:**

Deliveries of CCL components are being closely monitored to determine potential impacts on installation and commissioning activities.

**Performance and Milestones:**



	Dec03	Cum-to-Date
BCWS	3,165	95,740
BCWP	2,750	94,604
ACWP	2,499	95,862
CV	251	-1,258
SV	-415	-1,136
<hr/>		
CPI	1.10	0.99
SPI	0.87	0.99
<hr/>		
<b>Budget at Complete</b>	168,660	
<hr/>		
<b>Planned % Complete</b>	56.8%	
<b>Actual % Complete</b>	56.1%	

**Cost Performance:**

*Cause and Impact:* The cumulative cost variance is due to klystron replumbing, DTL recovery, transfer line leaks, cryomodule production issues, CHL compressor skids manufacturing problems and HEBT dipole stands relocation and regrouting.  
*Corrective Action:* Sources of efficiencies that can offset this overrun are being pursued.

**Schedule Performance:**

*Cause and Impact:* The cumulative schedule variance is, again, a combination of small variances. The largest of these is in the DTL installation area and was caused by the problems with the drift tubes.  
*Corrective Action:* These delays are not expected to impact key commissioning milestones.

Description	Milestone Date	Forecast Date
Start Front End Installation	Sep-02	Jun-02 ✓
Start Linac Installation	Sep-02	Apr-03 ✓
Start Ring Installation	Aug-03	Jul-03 ✓
FE Beam Available to DTL	Mar-03	Dec-02 ✓
Linac Beam Available to HEBT	Aug-05	May-05
HEBT& Ring Beam Available to RTBT and Target	Feb-06	Nov-05



CLO construction

Highlights:

- The East Tennessee Chapter of the National Electrical Contractors’ Association met on January 7, 2004, with SNS as the program topic. About 40 area contractors participated.
- The initial monthly SNS National Pollutant Discharge System (NPDES) report was submitted on time, with no violations reported. A meeting was held with TDEC staff in Nashville to discuss the submittal of the construction permit for the Central Exhaust Facility. The timeliness of the submittal was questioned by EPA during a multi-media audit in June, 2003.
- Revision 1 of the PSAR for the Target Facility was submitted to DOE before December 31,2003, satisfying a project performance milestone. The report from the team that reviewed Revision 1 of the Target Safety Document was received. The team’s findings and recommendations will be evaluated and incorporated as appropriate as the Safety Document is finalized.
- The Blaine and Caddell/Blaine companies celebrated 1,000,000 hours worked without a Lost Work-day (away) Case. The event was well-attended and was a visible example of the functioning safety culture at the SNS Site. A team from Fermi Lab, consisting of both DOE and Contractor staff, visited SNS. They were interested in the SNS Safety Program, and how the Program is implemented by the Construction workforce and during component installation. The team indicated that their trip was worthwhile, and they shared a variety of lessons from the NuMI Project.
- A Quality Assessment was performed at BNL. Many excellent manufacturing and quality practices were observed. A review of the remaining BNL QA work was also conducted.
- A source surveillance was performed at the vendor fabricating the Scattering Tank for the Backscattering Spectrometer. The surveillance observations were positive and no non-conformances issues were noted.

**Assessment/Issues:** Managing within budget. Continuing strong focus on cost control and contingency management. The transition of work from LANL to ORNL (in preparation for the subproject completion in April 2004) is going well. CLO move-in preparation is also on track.

External Review Data:

Progress on External Review Recommendations in the month of December is as follows:

Review	Recommendations	Closed This Month	Open Actions
DOE SC Review (11/03)	24	2	22
DOE End Game Review (7/03)	5	0	2
DOE SC Review (5/03)	29	1	4
DOE SC Review (11/02)	35	1	0

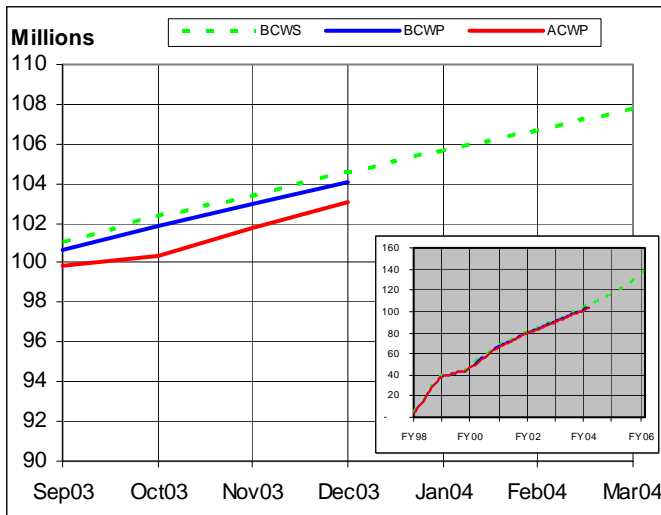
Life of Project Market Experience:

Major Awards (\$M)	Baseline Estimate (\$M)	Baseline Savings (\$M)	Percent savings over baseline
538.7	506	-32.7	-6.5%

Through January 27, 2004: 97% of the major procurements already awarded.



**Performance:**



	Dec03	Cum-to-Date
<b>BCWS</b>	1,179	104,552
<b>BCWP</b>	1,165	104,096
<b>ACWP</b>	1,269	103,049
<b>CV</b>	-104	1,047
<b>SV</b>	-13	-455
<b>CPI</b>		
	0.92	1.01
<b>SPI</b>		
	0.99	1.00
<b>BAC (1.2)</b>		75,603
<b>BAC (1.10.3, 1.1.13, 1.10.5)</b>		71,128
<b>Planned % Complete</b>		71.3%
<b>Actual % Complete</b>		70.9%

**Cost Performance:**

*Cause and Impact:* The cost variance is largely due to improper phasing of move costs. The latter should have been isolated to June 2004 and rather was spread across FY04.

*Corrective Action:* A PCR will be implemented to correct the move plan in the baseline.

**Schedule Performance:**

*Cause and Impact:* None required

*Corrective Action:* None required

**Milestones:**

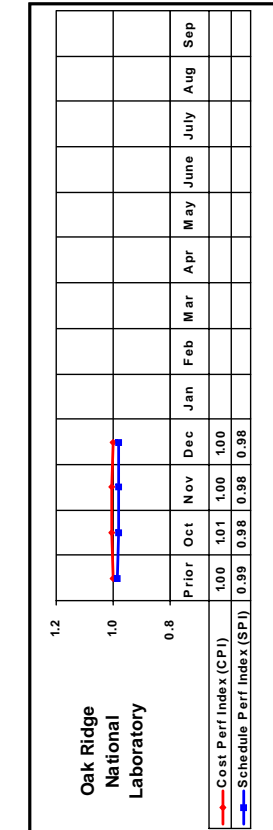
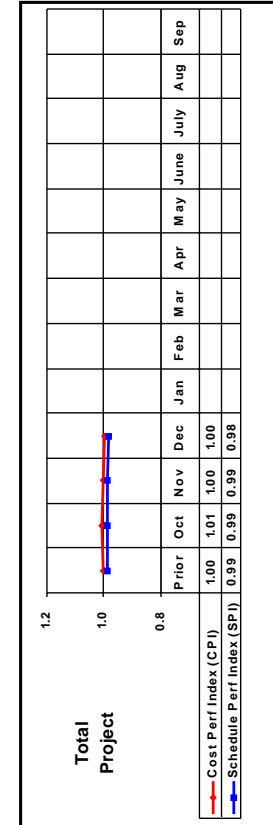
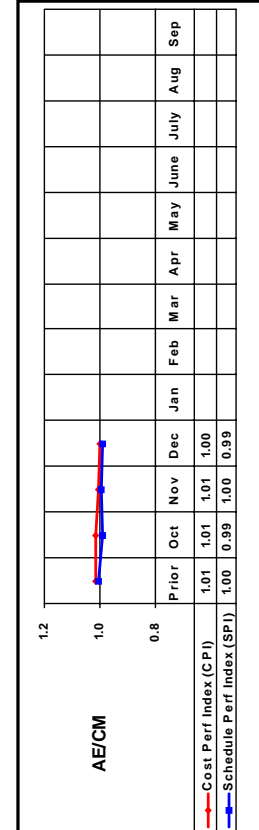
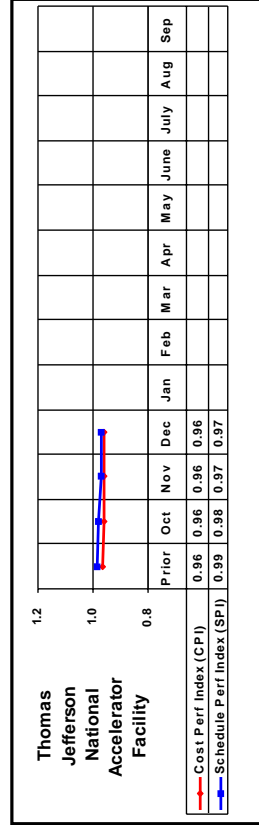
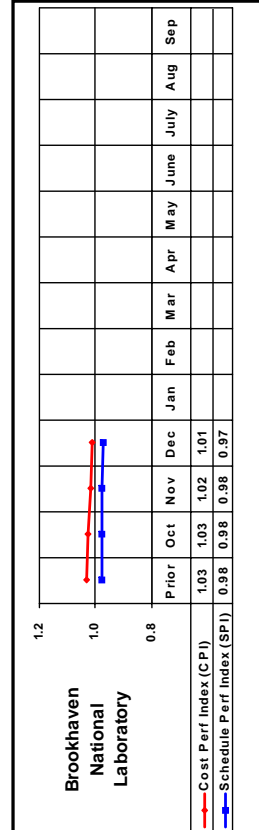
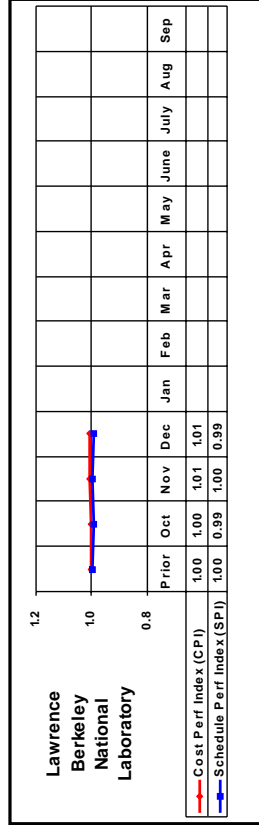
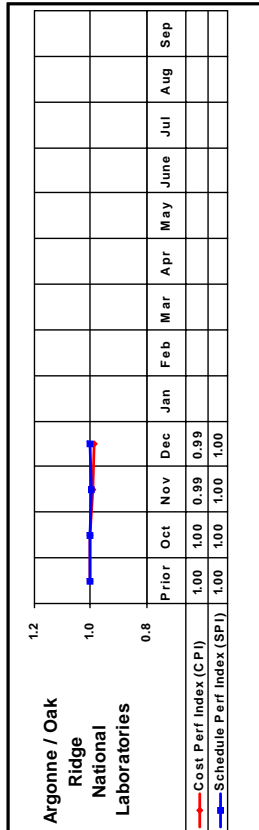
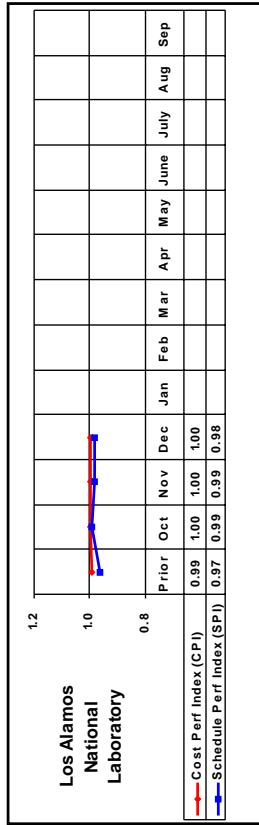
Description	Milestone Date	Forecast Date
EIS ROD	Jun-99	Jun-99 ✓
PSAR Issued for Approval	Dec-99	Dec-99 ✓
Submit PSAR to DOE for Approval	Dec-99	Dec-99 ✓
PSAD issued for Information	Sep-00	Sep-00 ✓
Issue FSAD for approval (Front End and Linac)	Sep-02	Aug-02 ✓
Issue FSAD for approval (Ring and Transfer Lines)	Jun-05	Apr-05
FSAR Issued for Approval	Aug-05	Jun-05
Complete Physical Construction and Project Acceptance Test	Jun-06	Mar-06

CLO first floor offices



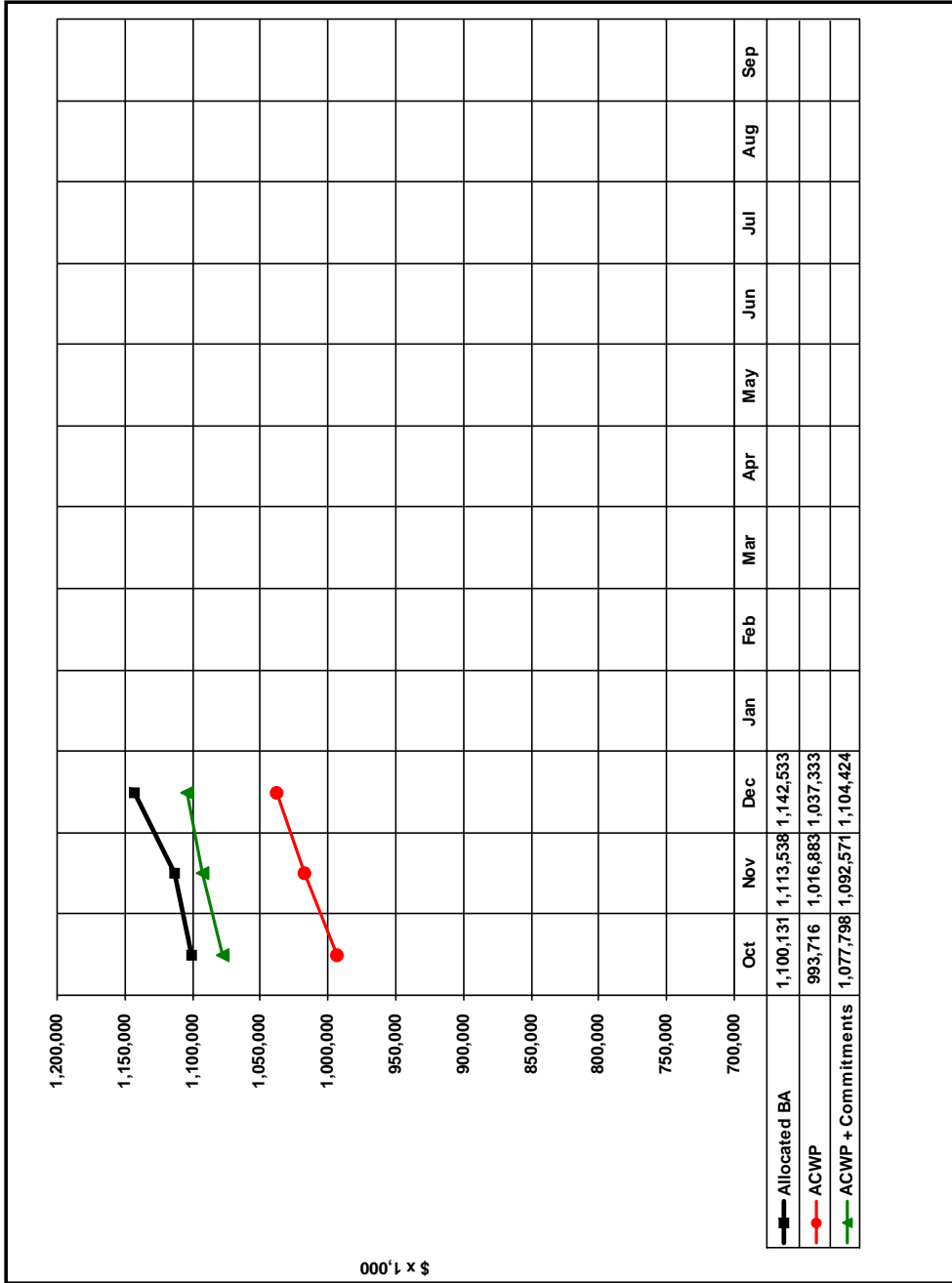


# Overall Project Performance is stable





TPC Obligation Profile against BA



Phase funded procurements at the end of December could obligate an additional \$50.7 M, raising the total obligation potential to \$1,155M





PROJECT TITLE:	REPORTING PERIOD:										PROJECT NUMBER:				
	December 01, 2003 through December 31, 2003										99-E-334				
	December 2003										START DATE: October 1998				
PARTICIPANT NAME AND ADDRESS:	BCWS PLAN DATE:										COMPLETION DATE:				
	December 2003										June 2006				
	Oak Ridge National Laboratory Oak Ridge, TN														
ITEM	CURRENT PERIOD						CUMULATIVE TO DATE						AT COMPLETION		
	BUDGETED COST		ACTUAL COST		VARIANCE		BUDGETED COST		ACTUAL COST		VARIANCE		BUDGET (BAC)	ESTIMATE (EAC)	VARIANCE
	WORK SCHED	WORK PERF	WORK SCHED	WORK PERF	SCHED	COST	WORK SCHED	WORK PERF	WORK SCHED	WORK PERF	SCHED	COST			
1.02 Project Support	765.0	765.0	810.5	810.5	0.0	(45.5)	61,358.1	61,358.1	61,358.1	60,451.6	(0.0)	906.5	75,603	75,103	500
1.03 Front End Systems	0.0	0.0	54.5	54.5	0.0	(54.5)	20,832.0	20,832.0	20,832.0	20,887.8	0.0	(55.8)	20,832	20,832	0
1.04 Linac Systems	4,951.0	4,139.5	4,209.3	4,209.3	(811.5)	(69.8)	273,438.9	266,806.6	270,737.3	270,737.3	(6,632.3)	(3,930.7)	313,266	316,131	-2,865
1.05 Ring & Transfer System	1,423.6	1,242.7	1,552.4	1,552.4	(180.9)	(309.7)	108,229.1	106,597.8	105,695.7	105,695.7	(1,631.2)	902.2	141,241	141,661	-420
1.06 Target Systems	2,572.5	2,182.9	2,617.9	2,617.9	(389.6)	(435.1)	75,220.4	70,613.8	69,670.1	69,670.1	(4,606.6)	943.7	106,527	108,954	-2,427
1.07 Instrument Systems	878.1	731.5	489.9	489.9	(146.6)	241.6	33,546.3	33,234.7	33,092.7	33,092.7	(311.6)	142.0	63,321	63,321	0
1.08 Conventional Facilities	7,196.9	6,329.4	8,079.6	8,079.6	(867.5)	(1,750.2)	305,944.7	303,590.0	303,395.3	303,395.3	(2,354.7)	194.7	367,540	377,087	-9,547
1.09 Integrated Control Systems	1,194.6	891.0	988.4	988.4	(303.6)	(97.4)	39,013.0	37,894.7	37,724.4	37,724.4	(1,118.3)	170.3	59,632	59,632	0
<b>LINE ITEM SUBTOTAL</b>	<b>18,981.7</b>	<b>16,282.0</b>	<b>18,802.7</b>	<b>18,802.7</b>	<b>(2,699.7)</b>	<b>(2,520.7)</b>	<b>917,582.6</b>	<b>900,927.8</b>	<b>901,655.0</b>	<b>901,655.0</b>	<b>(16,654.8)</b>	<b>(727.2)</b>	<b>1,147,963</b>	<b>1,162,722</b>	<b>-14,759</b>
<b>CONTINGENCY</b>													<b>44,737</b>	<b>29,978</b>	<b>14,759</b>
<b>TOTAL LINE ITEM</b>	<b>18,981.7</b>	<b>16,282.0</b>	<b>18,802.7</b>	<b>18,802.7</b>	<b>(2,699.7)</b>	<b>(2,520.7)</b>	<b>917,582.6</b>	<b>900,927.8</b>	<b>901,655.0</b>	<b>901,655.0</b>	<b>(16,654.8)</b>	<b>(727.2)</b>	<b>1,192,700</b>	<b>1,192,700</b>	<b>0</b>
1.01 Research & Development	118.6	142.7	181.8	181.8	24.1	(39.1)	98,660.9	98,672.8	98,897.7	98,897.7	11.9	(224.9)	101,874	101,874	0
1.10 Operations	1,503.4	1,489.9	1,465.4	1,465.4	(13.5)	24.6	37,856.6	37,401.3	36,780.2	36,780.2	(455.3)	621.1	117,126	117,126	0
<b>OTHER PROJECT COSTS SUBTOTAL</b>	<b>1,622.0</b>	<b>1,632.6</b>	<b>1,647.2</b>	<b>1,647.2</b>	<b>10.6</b>	<b>(14.6)</b>	<b>136,517.4</b>	<b>136,074.1</b>	<b>135,677.8</b>	<b>135,677.8</b>	<b>(443.4)</b>	<b>396.3</b>	<b>219,000</b>	<b>219,000</b>	<b>0</b>
<b>TOTAL PROJECT COST</b>	<b>20,603.8</b>	<b>17,914.6</b>	<b>20,449.9</b>	<b>20,449.9</b>	<b>(2,689.1)</b>	<b>(2,535.3)</b>	<b>1,054,100.0</b>	<b>1,037,001.9</b>	<b>1,037,332.8</b>	<b>1,037,332.8</b>	<b>(17,098.1)</b>	<b>(330.9)</b>	<b>1,411,700</b>	<b>1,411,700</b>	<b>0</b>
<b>RECONCILIATION TO CONTRACT BUDGET BASE</b>															
<b>DOLLARS EXPRESSED IN: Thousands</b>															
<b>DATE: January 23, 2004</b>															



PROJECT TITLE:	REPORTING PERIOD:												PROJECT NUMBER:		
	December 01, 2003 through December 31, 2003												99-E-334		
	December 2003												October 1998		
PARTICIPANT NAME AND ADDRESS:	BCWS PLAN DATE:												COMPLETION DATE:		
	December 2003												June 2006		
ITEM	CURRENT PERIOD						CUMULATIVE TO DATE						AT COMPLETION		
	BUDGETED COST			VARIANCE			BUDGETED COST			ACTUAL COST			VARIANCE		
	WORK SCHED	WORK PERF	ACTUAL COST WORK PERF	SCHED	COST	WORK SCHED	WORK PERF	ACTUAL COST WORK PERF	SCHED	COST	BUDGET	ESTIMATE (EAC)	VARIANCE		
AE/CM	7,196.9	6,329.4	8,079.6	-867.5	-1,750.2	305,944.7	303,590.0	303,395.3	-2,354.7	194.7	367,540	377,087	(9,547)		
Argonne National Laboratory / ORNL	896.7	874.2	871.7	-122.5	202.4	47,068.1	46,768.6	46,777.6	-299.5	-9.0	80,056	80,056	0		
Brookhaven National Laboratory	1,207.3	774.0	1,294.9	-433.3	-520.9	106,803.9	104,107.1	102,892.0	-2,696.9	1,215.1	128,710	129,030	(320)		
Thomas Jefferson Laboratory	748.2	754.0	687.5	5.7	66.5	61,731.3	59,972.0	62,340.6	-1,759.3	-2,368.7	66,044	67,199	(1,155)		
Los Alamos National Laboratory	2,518.2	2,284.1	2,361.7	-234.1	-77.6	183,561.2	180,627.3	180,823.7	-2,933.9	-196.4	198,138	199,538	(1,400)		
Lawrence Berkeley National Laboratory	79.0	40.4	38.7	-38.7	1.7	28,476.0	28,322.8	28,168.7	-153.2	154.1	29,663	29,663	0		
Oak Ridge National Laboratory	7,857.5	6,858.6	7,315.7	-998.8	-457.1	320,514.8	313,614.2	312,934.9	-6,900.6	679.3	496,811	499,148	(2,337)		
<b>WBS SUBTOTAL</b>	20,603.7	17,914.6	20,449.9	(2,689.1)	(2,535.3)	1,054,100.0	1,037,001.9	1,037,332.8	(17,098.1)	(330.9)	1,366,963	1,381,722	(14,759)		
<b>CONTINGENCY</b>											44,737	29,978	14,759		
<b>TOTAL PROJECT COST</b>	20,603.7	17,914.6	20,449.9	(2,689.1)	(2,535.3)	1,054,100.0	1,037,001.9	1,037,332.8	(17,098.1)	(330.9)	1,411,700	1,411,700	0		
<b>RECONCILIATION TO CONTRACT BUDGET BASE</b>															
<b>DOLLARS EXPRESSED IN: Thousands</b>												<b>DATE: January 23, 2004</b>			



PROJECT TITLE:	REPORTING PERIOD:		PROJECT NUMBER:														
	December 01, 2003 through December 31, 2003		99-E-334														
PARTICIPANT NAME AND ADDRESS:	BCWS PLAN DATE:		START DATE:														
	December 2003		October 1998														
			COMPLETION DATE:														
			June 2006														
BUDGETED COST FOR WORK SCHEDULED (NON - CUMULATIVE)																	
ITEM	BCWS CUM TO DATE	FISCAL YEAR												FY Total	Out Years	Budget at Completion	
		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep				
<b>PM BASELINE (BEGINNING OF PERIOD)</b>	862,169	23,755	18,636	18,917	22,523	16,673	16,123	18,819	16,123	12,437	19,449	11,524	12,393	10,890	202,139	83,605	1,147,913
1.02 Project Support		-	-	-	-	-	-	-	-	-	-	-	-	-	-	(0)	(0)
1.03 Front End Systems		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.04 Linac Systems		-	-	168	(20)	(19)	(3)	(23)	(3)	(2)	(3)	(3)	(22)	(21)	50	(0)	50
1.05 Ring & Transfer System		-	-	-	-	-	-	-	-	-	-	-	-	-	-	(0)	(0)
1.06 Target Systems		-	-	-	-	-	-	-	-	-	-	-	-	-	-	(0)	(0)
1.07 Instrument Systems		-	-	-	-	-	-	-	-	-	-	-	-	-	-	(0)	(0)
1.08 Conventional Facilities		-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
1.09 Integrated Control Systems		-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0
<b>TOTAL AUTHORIZED CHANGES</b>		-	-	168	(20)	(19)	(3)	(23)	(3)	(2)	(3)	(3)	(22)	(21)	50	(0)	50
<b>PM BASELINE (END OF PERIOD)</b>	862,169	23,755	18,636	19,085	22,503	16,654	16,119	18,796	16,119	12,435	19,445	11,522	12,371	10,869	202,189	83,605	1,147,963
<b>RECONCILIATION TO CONTRACT BUDGET BASE</b>																	
<b>DOLLARS EXPRESSED IN: Thousands</b>																	
<b>DATE: January 23, 2004</b>																	

Project Change Requests implemented in December are as follows:

Revision	PCR Number	Description	Actual Cost Impact
R461	LI-04-006	Implement LANL FY04 WBS 1.4.6 ETC	-
R462	LI-04-007	DTL Support at ORNL from Jan04 - Mar04	50



**Actual Cost of Work Performed (ACWP)**—Actual cost incurred as reported through laboratory cost accounting systems plus any accruals.

**Allocated Budget Authority (BA)**—Cumulative funds currently allocated and authorized by the Department of Energy that may be committed and spent by the contractor for project activities.

**Budget at Completion (BAC)** —The sum of all budgets allocated to the project excluding contingency

**Budget to Complete (BTC)** —The sum of all budgets allocated to the project less commitments and cumulative actual costs.

**Budgeted Cost of Work Performed (BCWP)**—Value of the planned scope of work physically accomplished.

**Budgeted Cost of Work Scheduled (BCWS)**—Cost plan based on the budgeted value of a scope of work, time-phased based on the schedule for the scope of work.

**Commitments**—Funds allocated to subcontractors where the work has been authorized but not yet expended.

**Cost Performance Index**—The ratio of the value of the work performed to actual cost;  $CPI = BCWP/ACWP$ . Values less than 1.0 represent “cost overrun” condition, and values greater than 1.0 represent “cost underrun” condition.

**Cost Variance (CV)**—Difference between the value of the physical work performed and the actual cost expended.  $CV = BCWP - ACWP$ . A negative result is unfavorable and indicates the potential for a cost overrun.

**Estimate at Completion (EAC)**—Forecast final cost of a scope of work based on the current ACWP plus a management assessment of the cost to complete the remaining scope of work.

**Estimate to Complete (ETC)**—A realistic appraisal of the cost to complete the remaining scope of work.

**Forecast Budget Authority**—Future time-phased plan of how the project expects remaining BA to be allocated to the project by DOE. Through the current reporting period Forecast BA will equal Allocated BA.

**Line Item (LI)**—Fund “type” for design, procurement, construction, fabrication, installation, and pre-operational testing of a capital facility.

**Obligation Plan**—Time-phased plan of how each laboratory plans to commit their Allocated BA. Labor and

materials and supplies are typically time-phased as expended, while procurements are typically time-phased at award of contract plus award of any contract options.

**Other Project Cost (OPC)**—Fund “types” (Operating Expense and Capital Equipment) supporting, but not directly contributing to a LI construction project, generally include research and development and pre-operation activities.

**Percent Complete**—The ratio of the Earned value to the Budget at Completion.  $\% \text{ Complete} = BCWP/BAC$

**Percent Contingency remaining**—The ratio of remaining contingency dollars to remaining work calculated as follows. The numerator is equal to the contingency available after consideration of the EAC. The denominator is the EAC less ACWP less commitments (excluding commitment to the AECM that has not been passed through to subcontractors) and outstanding phase funded procurements.

**Percent Planned**—The ratio of the current plan to the budget at completion.  $\% \text{ Planned} = BCWS/BAC$

**Schedule Performance Index**—The ratio of the value of the work performed to work scheduled;  $SPI = BCWP/BCWS$ . Values less than 1.0 represent “behind schedule” condition, and values greater than 1.0 represent “ahead of schedule” condition.

**Schedule Variance (SV)**—Difference between the value of the physical work performed and the value of the work planned (scheduled).  $SV = BCWP - BCWS$ . A negative result is unfavorable and indicates a behind schedule condition.

**Total Estimated Cost (TEC)**—The TEC represents the total capital funds authorized for the project including contingency funds.

**Total Project Cost (TPC)** — $TEC + OPC$