Accelerator Systems Division Highlights Ending January 16 and 23, 2004

ASD/LANL: Warm Linac

January 16, 2004

HIGH-POWER RF (WBS 1.4.1.1)
Accomplishments This Week: (1) We dc conditioned the second CCL 5 MW klystron up to 134 kV at the full 1.2-ms pulsewidth and 60-Hz repetition rate. This is 1 kV below the nominal 5-MW operating voltage. (2) We completed setup of the CCL RF window bakeout system and began baking two windows. (3) We sent a spare ion pump bracket to ORNL for repair of CPI 550 kW klystron until replacement part is available from CPI. (4) We received outer o-rings for the 5 MW SureBeam loads. They will be installed on LANL units. ORNL will perform replacement on remaining units.
Concerns & Actions: We are in daily contact the president of Micro Communications Inc (MCI), manufacturer of the flexible 805-MHz flexible waveguide that was found to leak RF last month. MCI is pursuing two options in parallel: (1) an absorptive seal; and (2) brazing the corrugated sheets. MCI is convinced option #1 will work and will treat a pair of defective waveguide and then sent them to LANL for testing at high power. The sealant is reported to have 60 to 80 dB suppression capability (we need a 16 dB or less), with a greater than 20-year lifetime. Option #2 seems more permanent, but development is needed. MCI has a local brazing company lined up to do a sample pair of corrugated sheets (not full flex section) and expects to know whether this is a viable manufacturing solution before the high power tests on the sealant-reworked units at LANL.

HIGH-VOLTAGE CONVETER MODULATOR (HVCM) (WBS 1.4.1.2)
Concerns & Actions: (1) Rebuild and testing of production HVCM has been unsatisfactory. After inspections, improved assembly procedures, and diagnostics, we continue to observe IGBT failure and have not yet determined the root cause. We will disassemble the A-phase boost transformer and make a more thorough analysis. (2) Rebuild of prototype HVCM was also unsatisfactory. When we performed the single-phase test, A phase showed a noisy output, indicative of a poor connection. The prototype HVCM was also recently underwent a routine maintenance inspection and no problems were found. Although the problems may suggest QA issues, we need to determine whether control electronics are the cause. When the prototype HVCM failed, our external gate coincidence detectors indicated a shoot through fault condition as generated by the control electronics. This was the only time we have seen this indication. We will examine the fault log for the production HVCM.

DRIFT-TUBE LINAC (WBS 1.4.2)
Accomplishments: (1) Pete Smith is at ORNL all week to participate in Tank-2 drift tube installation and alignment. All 47 drift tubes are installed and alignment will be completed by 1/20. Tank-5 drift tube installation is beginning. (2) All 210 drift tubes have been delivered to ORNL, fiducialized and leak checked. Two drift tubes required some stem straightening. LANL completed the rework and shipped them back to ORNL. Work is underway in repairing two drift tubes that require vacuum leak repair (see below). (3) Coronado Machining and Integrated Machine have begun making final cuts on the Tank-4 post couplers and slug tuners, respectively. We will be at ESCO to supervise e-beam welding operations on the T-4 post couplers next week.
Concerns & Actions: At this time, only drift tubes 6-17 and 2-02 require some leak repair work. DT 2-02 passed final vacuum leak test at LANL and first test at ORNL. Leak rate in ORNL test, while satisfactory, was somewhat higher than usual when compared with background, so ORNL baked hotter and longer, and then tested again. It was in this second test that the DT leak rate exceeded the acceptance criterion. LANL pulled the travelers for 2-02 and found that it passed final leak checks at LANL following the approved baking/He pressurization procedures. However, earlier on, during the final cosmetic e-beam welding at ESCO, we recorded that this DT experienced leaks and eruptions; six e-beam passes were needed before it became leak tight. Eruptions were likely due to contamination either on the surface or from inside. Had it been from the inside, one can speculate that a longer-than-normal baking time would be needed to completely evaporate contaminant through a low-conductance path from the water channel weld joint. LANL pulled all tank-2 travelers and reviewed the ESCO e-beam weld reports to look for multiple pass e-beam welds. None were found to be as problematic as with DT 2-02. We reported to ORNL which DTs received extra rework and recommend that they retest three of them at the more stringent bake/leak retest procedure. We started repair of DT 6-17. We are implementing a machine prep followed by electroforming and final machining. This should take ~ 2 weeks. We should have it back and tested before Tank-2 bead pulls are complete. If leaks are still detected, we believe we will need to do a cosmetic e-beam weld pass or perhaps a ring weld repair

on this unit before repeating electroforming. This will add ~ one month since we need to cut stems, ship tooling back to ESCO, and prepare rings. This remains well within the installation schedule at ORNL. While 6-17 is being repaired, all tank-2 DTs are being installed, aligned, and tank will be tuned. This will take ~ two weeks. DT 2-02 will then be removed and repaired during the same two-week period when tank-2 post couplers and slug tuners are getting their final welds/cuts.
Bottom line: We should be able to meet the 3/29/04 ARR date provided we don't have to implement the e-beam weld repair of DT 2-02. If e-beam welding is necessary, we would envision DT 2-02 delivery in March, which would probably cause a ~ 2-week delay. To minimize delay, if weld repair is needed, we will consider TIG as a substitute for e-beam. Daily communications and interactions between LANL, ASD, & suppliers are excellent will continue. Tank-2 is our top priority.

COUPLED CAVITY LINAC (WBS 1.4.4)
Accomplishments: (1) Billen and Stovall continue their work at ACCEL. Module-2 is aligned. The RF drive irises should be sized today. (2) All the vacuum flanges should also be in place today. ACCEL staff will work Saturday to prepare for leak checking early next week, (on schedule). (3) Module 3 production continues. Seven of twelve segments have been stacked brazed. Tuning should begin on Feb 5. We will return to ACCEL in mid Feb for the bead pull measurements. (4) We supported ORNL leak check efforts on Module-1 by implementing a design modification that will enable rapid diffusion of the leak check He through the flange connections outside the vacuum seals.
Concerns & Actions: ACCEL lost time due to some rework of three half cell assemblies by their supplier in Erlangen. Current working schedule shows a negative 2-week variance in the Module-4 delivery to ORNL (4/21 delivery). ACCEL management believes that this forecast is incorrectly pessimistic and is rechecking its validity.

PHYSICS & DIAGNOSTICS (WBS 1.4.5)
Accomplishments: (1) We shipped 48 of the programmed 85 FPGAs to Suntron for the PCI card production. They will do a split production run on the SMT line for us to speed up the delivery of at least 10 units for CCL next week. Suntron has also shipped 30 clock multipliers to LANL. We are still programming the remaining 48 FPGAs and expect to be done with the entire run early next week. We have 10 computer chassis assembled for the CCL delivery and parts for the remaining chassis have mostly arrived and are awaiting assembly. (2) *Wire-scanner electronics:* All of the boards for the new electronics design that SMT has been populating have been received as of today. We have not had a chance to do detail testing of the boards but from a general glance they look good. The chassis machining is in process and the estimated return is early next week. We should be able to begin assembling scanner chassis as soon as the machined parts are delivered. We found one dead-on-arrival stepper motor control chassis. National Instruments will replace it next week. (3) *Wire-scanner pickups:* We have received the following deliver schedule from Huntington: the last 6" next week, 3" actuators one a day next week and the week after (8 total), and the first of 8" and 12" actuators the first week of February. (4) *ED/FC electronics:* The two controllers have been shipped to ORNL and should be on site next week. (5) *RTBT harp*: We have narrowed down our choices to 2 possible vendors for the metallized harp cards: Macro-metallic and Coorstek. We are in the process of obtaining quotes for the machine tool work on the strong back and other backing plates. We are also working on ordering the piece parts. (6) *Harp electronics:* Simulations of the basic harp circuit operation are mostly done, with no unexpected results observed. We have been doing some preliminary work on the design of a 32-channel harp AFE and we will also continue looking for alternative commercial products. *(6) Transition region beam stop and wire scanner vacuum boxe*s: The drawings have been completed and reviewed internally. Review modifications should be completed early next week. LANL and BNL engineers have reached an agreement on mounting the Ring wire scanner onto BNL's rectangular beam box by adding an adapter, which basically is a rectangular flange and a half-nipple.

January 23, 2004

HIGH-POWER RF (WBS 1.4.1.1)
Accomplishments This Week: (1) *402.5-Mhz, 2.5-MW E2V klystrons:* We received the final test data for SN 5 and SN 11 and authorized shipment of these two klystrons to ORNL. SN 5 is scheduled to ship the week of Jan 26 and SN 11 is scheduled to ship the week of Feb 2. The vacuum leak in SN 7 is being repaired, and the factory acceptance tests are scheduled for Mar 8-12. (2) *805-MHz, 5-MW Thales klystrons:* We are still in the process of conditioning SN 1, but have not made any progress because of problems with the HVCM (see below). The next 5-MW klystron is scheduled for factory acceptance tests the week of Feb 23. (3) *805-MHz, 550-kW Thales klystrons:* The next 550-

kW klystron, SN 6, is scheduled for factory acceptance tests on Jan 29-30. (4) *805-MHz, 550-kW CPI klystrons:* We received and approved the test data for SN 43. SN 47 and SN 48 completed the bake out, and SN 47 is now under test. (5) *805-MHz, 2.5-MW Thales windows:* We completed the bake out of two 805-MHz windows. (6) *Transmitters:* We started testing the last SC transmitter at Titan.
Concerns & Actions: Testing is delayed pending repairs to the HVCMs. We are experiencing quite a backlog of HPRF equipment to test.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)
Accomplishments: (1) We continued rewinding the prototype HVCM boost transformers. The A phase is the only transformer that had melted poly spacer sticks. (2) We completed switch-plate repairs of the production HVCM and will perform a phase-balance test tomorrow to determine the status of HVCM internals. If all appears well, operation at reduced voltage could be initiated for window testing. (3) We are working with ORNL on the SCL-ME1 failure analysis. The IGBT clearly did not have sufficient cooling paste between the IGBT and water-cooled base plate. Also, the FR3 oil is forming stalactites and spider-webs in the oil. The spider-webs and stalactites seem to form along some field stress lines. These may be detrimental to long-term operation and require further investigation.
Concerns & Actions: With failure of both LANL HVCMs, we are unable to adequately support the HPRF test program. Intense efforts are underway to rebuild both of these units.

DRIFT-TUBE LINAC (WBS 1.4.2)
Accomplishments: (1) Jim Billen provided physics support to Craig Deibele at SNS to tune DTL Tanks 2 and 4. After mechanical measurements at SNS, the final machining on the post couplers and slug tuners for these two tanks can be completed. (2) Drift-tube 6-17 (with .020" thick copper deposit) is scheduled to ship from GAR Electroforming to Oak Ridge next Wednesday, Jan 28. (3) The DTL Tank-2 bead pull is complete, and leaking drift-tube 2-2 is being shipped to CMI in Albuquerque for machining preparation for the copper-electroforming repair. We decided to do a post-machining vacuum leak check at LANL before dispatching it to GAR for electroforming. (4) Pete Smith was at ESCO this week to supervise e-beam welding on the Tank-4 post couplers. We finished the production welding of the boss-to-body welds. They all passed leak testing at less than 1x10E-, were packaged with certificates of conformance and weld-schedule documentation, and were shipped to CMI for machining. (5) Jim Billen completed a more accurate calculation of the frequency response of DTL Tanks 1 through 6 to changes in the temperature of the copper drift tubes and the steel tank wall. The calculation involved two Superfish runs on every cell in each tank with geometrical changes that correspond to a 10 C temperature rise of the metal components. These data can be compared with measurements of the tank frequency under controlled conditions.
Concerns & Actions: Following up on our review of the fabrication history of all Tank-2 drift tubes, ORNL reviewed the results of all the leak tests carried out there. Although nothing stands out as being suspect, ORNL will follow our recommendations and re-test 2-4 after baking. If it is found to leak, they will pull 2-5 and 2-7 and bake and check them.

COUPLED CAVITY LINAC (WBS 1.4.4)
Accomplishments: (1) We completed CCL Module-2 pre-shipment tuning at ACCEL with good results. The field distribution is with +/- 2% of design, to be adjusted to better than +/-1% in the SNS tunnel. The tilt sensitivity has an end-to-end rise of 2%/MHz in the tilt sensitivity curve. We would like to reduce this by about a factor of two. Therefore, as we did for Module 1, we will retune the odd-numbered coupling cells by about 140 kHz as the segments are unpacked at Oak Ridge. (2) The two irises at bridge couplers 3 and 9 on Module 2 were enlarged to give ~95% of the target coupling prior to pump down for vacuum leak testing. After leak testing, ACCEL staff will round and smooth the edges of the slots, which we expect will increase the coupling to the target value. (3) Leak checking and packing are underway, and Module 2 is scheduled to ship Feb 6 with arrival at ORNL on Feb 9. Nathan Bultman and Gary Johnson are scheduled to be at ACCEL next week to witness the packaging and shipment. (4) Module-3 fabrication is back on schedule after solutions were found to the manufacturing rework and some flow-test failures. Module-level tuning is now scheduled for Feb 19 and shipping for Mar 16. (5) The detailed schedule now has Module 4 shipping on Apr 8.
Concerns & Actions: (1) The management conference calls on Thursday of each week continue to be effective in resolving schedule and payment issues. ACCEL provided a highly credible plan for completing the remaining work on Module 3 and for the manufacture, assembly and tuning of Module 4.
PHYSICS & DIAGNOSTICS (WBS 1.4.5)

Accomplishments: (1) *BPM electronics:* We finished burning the remaining Quick Logic FPGAs, and they have been shipped to Suntron. The balance of the BPM PC parts has been received, and we now have everything but the CPUs. (2) *Wire-scanner electronics:* We prepared parts of the assembly so they will be ready when the front and rear panels arrive. We assembled all the Lab jack cards, put pluggable ground leads on the HV power supplies, and soldered the 68-pin connectors onto the boards. We also started to test the motion control chassis that were completed last week. The front-panel PC boards have been received at LANL. (3) *Wire-scanner pickups:* We received the last 6-inch (DTL) actuator from Huntington; the wiring was perfect with no need for modifications. Huntington has also started shipping the 3-inch (CCL) actuators, and the entire set of eight should be received by the end of next week. The first-article 8-inch (HEBT, ring) and 12-inch (RTBT) actuators are expected the first week of February. (4) *ED/FC electronics:* The two dual controllers were shipped to ORNL and should have been received by now. (5) *RTBT harp:* We placed the machine tool work for the support/backing plates and HV plates with Bogue Machine and the strongback machining with the LANSCE-1 shop. We still have not received a bid from Macro-Metallic for the ceramic cards. We contacted them, and they are still waiting to hear from their ceramic supplier. We continued ordering and receiving other non-critical materials. (6) *Harp electronics:* We continued looking for commercial sources for the harp electronics and have found nothing suitable. The commercial system used at LANSCE for the 1-L target has a dynamic range of only 4000:1, over a factor of 100 too low for the SNS specification. LANSCE has a new VME-based design being used on the IPF line; however, it would need a new AFE to be usable. The system is flexible and full-featured, but the cost would be high; the system would cost $60 K for the modules, probably another $5 K for the crate and controller, plus the cost of the AFE design and test. Based on this latest research, we conclude that the original plan for PC-based electronics is still the most economical way to go. (6) *Transition-region beam stop and wire-scanner vacuum boxes:* The drawings have been completed and reviewed internally. Review modifications were incorporated, and the final set of drawings were shipped to ORNL. We will have a review during next Monday's diagnostics videoconference. The W/S box, beam stop, and the support feet drawing packages were sent to a local shop in Los Alamos, and we received a favorable quote ($4 K below previous estimate) and a delivery estimate of four weeks.

ASD/JLAB: Cold Linac

The M-4 cryomodule was shipped to ORNL

Assembly of the M-9 cryomodule has begun.

Cavity HB-07 failed to qualify. Investigation revealed another failure of the high-pressure rinse pump. The pump is being replaced with a spare and we expect to be back in operation next week. We now have enough data to estimate the pump lifetime under current processing protocols as between 75 and 100 hours of operation. A preventive maintenance program to replace the pump after 75 hours (~4 weeks) has been put in place and additional spare pumps have been purchased. Failure is always associated with overheating. A life test program with one spare pump assembly will investigate techniques for life extension through improved cooling.

Cavities for the M-10 string were all processed after HB-07 and are assumed to be contaminated. The string has been disassembled. All cavities will be reprocessed.

The M-7 cryomodule developed another helium-insulating vacuum leak late in cooldown (all cavities were below 50 K). The leak is much smaller than the earlier leak, but is still too large to allow continued testing. The cryomodule has been warmed and removed from the test cave for repair.

Assembly of the M-8 cryomodule continues.

JLab SNS Cryomodule Production Status Report
For Period Ending January 23, 2004

	Cum. To Date		Previous 4 Wk Running Average		Next 4 Wk Rate (To Complete by Jan. 05)
	Plan	Actual	Plan	Actual	
Cavities Produced	34	37	3	1	4

Cryomodules Produced	7	7	0	0	1

Major Accomplishments

- The M-6 cryomodule has been shipped to ORNL.
- All primary piping on the M-9 cryomodule is complete. Tuners and instrumentation are being installed.

Key Issues & Actions Being Taken

- The M-7 cryomodule is being repaired.
- The replacement high-pressure rinse pump failed (same mode) 16 h into a 24 h conditioning run, with clear indications of an alignment instability. The local expert representative of the pump manufacturer was present when the failure was detected, examined the installation and made several recommendations for improvement. All these improvements have been implemented with the replacement of the pump and the conditioning run is under way.

  Results are starting to come in from the life extension test stand, which has been assembled and started up. The initial focus is on reducing operating temperatures by improving alignment, better pump support and decoupling the mechanical alignment of the pump from that of the motor using a flexible coupler.

  For the long term we are switching to a Lewa pump, which is significantly larger than the present pump. There is no room inside the Test Lab suitable to house the pump, so construction of a small and simple extension to the building is required. An integrated planning team has begun preparations to accommodate the larger pump. Our present understanding is that pump delivery (13 weeks ARO) will be the pacing item on this activity, implying that switchover to the new pump cannot take place before May. Maintenance of the SNS schedule is therefore dependent on a successful outcome of the existing pump life extension program.

Management Items

- Management continues to closely monitor progress on resolution of the high-pressure rinse pump problems.
- The follow-up close-out to the October 15, 2003 review of JLab's SNS cavity processing procedures and facilities will take place by videoconference February 2, 2004.

ASD/BNL: Ring

We shipped half-cell #17 to SNS/OR this week. Assembly work continues on HC units #18 and 19.

The half-cell lifting fixture has been final approved by Safety. The lift points have been determined for alternate configurations. Remaining work includes the addition of counter-balance weights and safety labeling.

Alpha Magnetics - 26S26 (8) sextupole units #4 and 5 were received at BNL this week. These two magnets will be added to our short list of production magnets that need to be measured.

Chicane #2 & 3: these magnets are set-up on a common stand for magnet measurements. Alignment fiducials were added for testing and installation.

Peter Cameron called an internal meeting to review the BCM failure history and to develop a list of planned efforts to resolve these problems. In addition, a BCM unit is being tested in the A-10 house of the AGS.

Diagnostics: our Procurement Department reported that the digitizer cards ordered by BNL are a "catalog item", typically available within 3 weeks. Fortunately, the vendor currently has 5 in stock. Our Buyer will request that the vendor hold these 5 until we receive procurement approval from Chicago DOE.

Another round of telecom meetings was held with the Project Office in an effort to bridge the gap between cost risk contingency and offsets.

Joe Tuozzolo conducted a Mechanical Review of the SNS Ring and RTBT Diagnostic Instrumentation. The presentation was made by C.J. Liaw.

An inventory and delivery schedule for BNL supplied racks and rack mounted equipment are being prepared at the request of ASD.

We shipped half-cell #18 to SNS/OR this week. Assembly continues on HC units #19 and 20.

The half-cell lifting fixture has been assembled, tested, Safety approved and painted. We expect to ship to SNS/OR within a week.

We completed a material inventory for the HEBT scrapers. Component assembly is underway.

Mike Skonicki, SNS QA Manager, and Jon Mashburn, SNS QA Supervisor, were at BNL this week to discuss QA scope transfers (from BNL to SNS/OR) with BNL's Richard Savage, QA Inspector for SNS.

BNL staff continues to work with Contracts personnel to obtain DOE approval for the Diagnostic's digitizer order.

The Tesla contract (21Q40 magnets) has been turned over to BNL's Procurement & Legal Departments to help resolve open contract issues.

A (remaining) work list is being generated for the 36Q85 doublet magnets in the RTBT line.

Bids for the Lambertson magnet are due today; they will likely be opened on Monday.

Work continues to close the gap between risk contingency and budget for FY04 and 05.

Acceptance of the Chicane #1 injection magnet is underway.

One BCM is being tested in the A10 house of the AGS. A second unit is being installed in the Booster RF area of building 930A.

SDMS has shipped the top plate assembly (lifting plate) to SNS/OR. ETA is February 9.

Controls

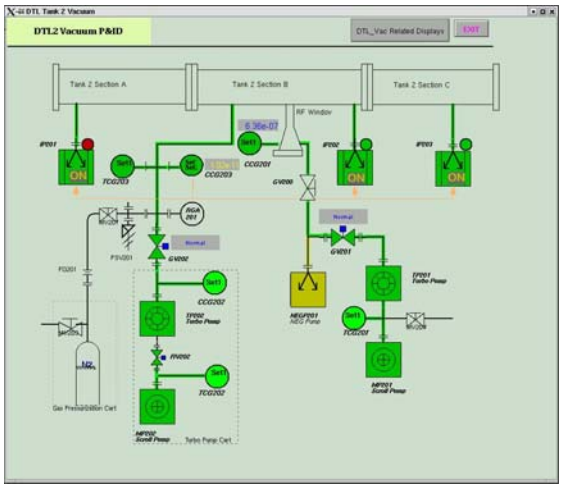
January 16, 2004

Work continued on preparations for the upcoming DTL 1-3 run. The software team is upgrading all IOC software to EPICS v3.14 which was developed in the SNS community specifically to meet SNS requirements. At the same time the IOC software "make" procedure is being standardized. This will in due course facilitate use of the SNS technical database automate production of IOC software as well as archive and alarm handler files.

In collaboration with the operations team, the existing Human-Machine Interface (HMI) standard was updated with a view to standardizing operational screens and screen navigation. This in response to lessons learned from earlier runs. The primary addition is a definition of summary process variables (PVs) which will facilitate the development of overview and summary screens.

Also in response to lessons learned, the handling of latched machine protection (MPS) faults was re-evaluated. The present implementation requires as many as ten (!!) button pushes to re-establish beam after an MPS fault. A new design, requiring only small coding changes in the MPS modules, will remove latches in the MPS system itself and reduce the number of required button pushes to three on two screens.

Using a test cart, vacuum control wiring and software function were verified for DTL2 and DTL5. At the same time, D-Plate vacuum and RCCS signals were decommissioned.



Fiber Optic cabling between controllers and interface modules was completed for the DTL power supply system. Testing of DTL1 will begin the week of 26 January, with testing for DTL3 to follow and DTL2 last. Testing will be coordinated with LANL.

January 23, 2004

Controls Group software developers met in a series of four meetings to discuss strategies for moving the system to EPICS v3.14, standardizing the IOC "make" process in such a way as to facilitate better use of the site technical database and formalizing a "release" process that strengthens configuration management without making change too difficult. The issues are complex and opinions varied.

All software under development at BNL is now running under EPICS v3.14. A LINUX-based IOC application that supports field measurement of the ring reference dipole magnet and the interface to devices used to provide the fine timing needed for the extraction kicker Pulse Forming Networks (PFNs) have been created, tested, and submitted to CVS at ORNL by the BNL team. This application can be deployed at ORNL at any time to support reference dipole field measurements as soon as the magnet is energized, even if racks are not yet installed in the Ring Service Building.

A BLM test IOC has been assembled and tested at BNL using EPICS R3.14.4. This IOC will be shipped to ORNL next week to provide the Beam Diagnostic Group with a system that can be used to test BLM signal conditioning electronics.

Machine Protection System (MPS) cable design documentation is being updated. Drawings have been red-lined to show changes required to move FE MPS inputs from the "CCL Beam Stop" link to the "Source" link. MPS inputs required for DTL1/2/3 operations have been identified and MPS configuration data will be revised accordingly. The new FPGA code that will change the latching mechanism for latched MPS inputs, reducing the effort required to clear them has been implemented and is under laboratory test.

CCL communications cable installation is complete except for 4 cables. Controls Group techs have tested the field cabling. Installation of jumpers and functional tests are next.

SCL Vacuum System cable block diagrams for 12 more cryomodules were completed. The SCL vacuum test box shipped to JLab.

PLC code and EPICS databases for the DTL Resonance Control Cooling Systems have been modified to allow on line modification of engineering parameters. This greatly simplifies the PLC download process.

Considerable progress was made on integrating the Front End Test Stand to an EPICS-based control system. By week's end it was felt that long term running of the test stand under EPICS control and with full archiving capability could begin next week.

Installation of cryogenic control system cables from the Klystron Building to the Linac tunnel was started this week. The cable tray for routing the cables and mounting the terminal strips was installed for one cryomodule (See photo below.) This tray will be shared with other groups. Field junction boxes for the cryomodules will no longer be used. The terminal strips will be removed from the boxes and attached to the side of the cable tray. This seems to be the best solution for installing the numerous cables for each cryomodule.

All the silicon diode and thermocouple cables were pulled from the Klystron building to the tunnel for the first cryomodule.

DCS completed fabrication of the cryogenic control system racks for the High Beta cryomodules. Checkout will be performed next week.

Calibration and checkout of the sensors for the 4.5 K cold box continues and is approximately 50% complete. Fabrication of the cryogenic control system HEBT service building racks is 30% complete.

Personnel Protection System (PPS) hardware and software for Phase 0.4a (DTL 1, 2 and 3) is ready for certification. The drawings are being as-built to reflect the changes from phase 0.4.

Field hardware for PPS "Phase 1 Lite" (CCL RF processing) has been completed, including:

- LINAC/HEBT gate and associated hardware
- Emergency exit door
- Beam shutdown stations in tunnel

PPS interfaces to the CCL RF equipment (RF amplifiers and SCL controllers) are 90% complete, as is integration testing.

Field installation of the ODH system in the CHL is complete. Integration testing will start this week. Installation of LINAC ODH field devices and conduit in the LINAC tunnel is 50% complete.

A design review was held this week to review the Target PPS design. It was decided that an external design review of the PPS functionality will be desirable. Several issues arose that need to be resolved before this external design review.

Installation

Craft Snapshot 1/20/04

ASD productive craft workers	53.0
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	62.0
Less WBS 1.9, 1.2 etc	8.0
Less absent	1.0
TOTAL PD BY ASD/ORNL DB WPs	44.0

Operations Group

Working on Action Items from last ARR. Sent out a list of not-closed items on Tuesday, some are long term items, may not be closable out but there must be a reply.

Updated the SNS-OPM Development Matrix.

Completed the Update of PPS Phase 0.4a certification, sweep, access procedures and documentation. Started Phase 1 lite documentation

Updated the equipment organization tables for the CMMS

ARR Reminder that Group/System Test plans are due Monday February 2.

Working with Controls on Screen issues and Chipmunk issues.

Worked on a procedure for trending beam loss and radiation survey data.

We are reviewing and validating Operation Procedures, assuring that they can be performed as written.

Populating and checking out report generating for Access Data base for operator training
Reviewing training lectures and changing from recorded lectures to narrated PowerPoint lectures.

Contacting potential candidate HBCU professors for the Summer Research Project

Web based automation of the startup/shutdown procedures

Working on the new navigation screens

Accelerator Physics

Benchmarking of PSR longitudinal instability measurements with the ORBIT code shows good agreement.

Convergence studies were performed to ensure convergence with number of macroparticles. This work helps to address an ASAC recommendation for further benchmarking studies.

S. Kim is performing thermal analyses of i) energy degrader/faraday cups for DTL3-6, ii) DTL3 commissioning beamstop and iii) copper damage due to beam faults in preparation for DTL1-3 commissioning.

Beamline device information for the ring has been gathered and entered into the global database. This will allow writing lattice input files from the global database, and extension of the online model toward the ring.

Work continues on ring commissioning applications. The HEBT on-line model is now almost fully functional. There is just a 1% discrepancy in some magnet currents to resolve. Once this is done we will be in a position to generate the phase advance information needed by the Java code for the HEBT emittance measurement stations. Work is also

underway to create single knobs to adjust parameters like the HEBT arc phase advance, which is needed to tune the HEBT achromatic section.

We received magnet multipole information from BNL on the 26Q40 and 30Q58 magnets. This is needed to realistically model the expected performance of the ring using the ORBIT code.

Work continues to model the radiation levels due to back scatter from the injection dump.

Work continues on the ring commissioning applications, in particular on the application that computes the injected position and angle at the stripper foil based on time-mode data from a single BPM with single-shot injection.

Work continues on a temporary phosphor screen to be mounted on the target for commission. The concept continues to look good. There is about 8 mm of space available all around the target nose cone to install a fiber optic viewing system.

Preparations are underway for the Feb. 5-6 diagnostics meeting at BNL.

AP group is working with D. Stout to define beampipe apertures in the CCL/SCL transition region

J. Holmes completed calculations and simulations of the evolution of the injected linac bunch in the ring. He finds that the linac debunching occurs in 6-10 turns and therefore that the expected 402.5 MHz signal on the ring BPMs will decay in this time. Predictions of debunching in the PSR are consistent with observations.

M. Plum presented a dry-run on ring commissioning and diagnostic needs during commissioning for the upcoming diagnostics review at BNL.

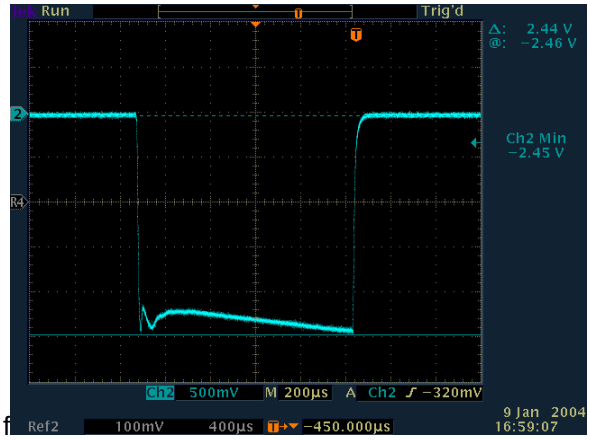
Ion Source Group

The controls group continues their effort to computer control the hot spare ion source stand. They have now succeeded to control the e-dump supply, which is very important. It will allow us to better optimize the source, as the extracted ion beam current is rather sensitive to the e-dump voltage.

The low level RF group found a loose screw in our 2 MHz RF pulse generator. After it was tighten, the generator ran normal without the intermittent problems previously experienced. The screw was a part of the ground path for a capacitor.

LBNL reports the successful startup of the startup source with an extracted current of up to 46 mA. This is an excellent result as we were never able to extract so much current from the startup source when it was at ORNL.

The hot spare ion source was switched off Monday morning in preparation for the planned shutdown of the cooling water system. This terminated a 96 hour endurance test that started on Thursday morning. The 1 ms long pulses started with a current of 48 mA, which then dropped to 46 mA, where it stayed all weekend. The one and only trip occurred Friday morning when the cooling water system was shut off early. It took about one hour to restore the cooling water service and to get the source back in operation. The short time period did not allow us to safely raise the rep rate above 10 Hz.



Computer control for most of the ion source functions has been successfully implemented and tested. The problems experienced with the timing fiber optic box should be resolved with another modification that will be tested next week.

A very active class made the first course on "ion injectors for accelerators" at USPAS a success. The class went over 491 power point slides describing the different disciplines that interplay in typical injectors. In addition we looked through two safety presentations provided by Lloyd Gordon from LANL. The diagnostics presentation benefited substantially from Saeed Assadi's contributed slides. Almost eight hours were spent on the topic of emittance. The fist hour looked at the various definitions for emittance, acceptance, and brightness, which were illustrated with simple models for ion source emittances. Half an hour were needed to discuss the various measurement methods. Another hour was dedicated to methods of emittance analysis, and one more hour to methods of rms-emittance analysis. This was followed by four hours in the computer lab, where the students used the SNS emittance analysis code to analyze five very different sets of emittance data. Each of the five sets of home work included about 5 problems that had be solved and turned in next day. The presentation will be made available on the web.

Survey and Alignment Group

Magnet Fiducialization

- Preliminary set up study for the 8Q35 magnet fiducialization.
- Completed alignment of DT Tank 2 on Monday and we are presently aligning #20 on DT Tank 3.
- Fiducialized one additional 21Q40 magnet.
- Fiducialized one additional CCL Quad.

The network re-observation campaign is in its second week of an estimated 3 – 4. Once completed, these updated global coordinates will allow for the precise "final" alignment of drift tube tank assemblies #1, 2, & 3 as well as other linac components.

Checking, analysis, and adjustment of recorded network data are continuing. Preliminary results demonstrate that our revised procedures are successful. Adjusted data from laser tracker measurements resulted in elevation datum transfer (from a monument in the Front End, to a monument at the Linac Dump) with an uncertainty of about 300 microns (2-sigma).

Based upon new information provided by ASD Physic's the S & A Group is presently updating their data bases and drawings. The new coordinate information provides us with valuable needed information for the precise placement of components into

We have received new coordinate information for the ring which is now being updated into our drawings and data files.

Mechanical Group

All drift tubes are installed as well as adjustable tuners in DTL2 and we have begun the beadpull. So far it is progressing rapidly. Alignment of the 47 drift tubes was done at a record pace to help maintain the already tight installation schedule.

Tuning verification of DTL1 showed that the field flatness was great but the tank was off tune a small bit. We are arranging to do a test of temperature vs. resonant frequency in the next few days to decide if we want to compensate for the change by a slightly warmer operating temperature.

An alignment check is under way on this DTL 3. Six drift tubes were replaced with the final EMD and BPM tubes and we have chosen to re-shoot all of them to be certain.

DTL 5 has all the drift tubes installed and will be ready for alignment as soon as resources are available.

We have finished initial prep work and begun assembling the main tank sections of DTL-6 on its stand.

CCL-1 initial vacuum leak checking is complete. The installation and connection of the total vacuum system is in progress.

CCL-1 Vacuum Leak Testing (Bagged Assembly)

CCL-1 orbital welding of cooling pipes to the segments is about half complete. This will be completed next week. Cooling manifold installation will begin next week.

CCL-1 Segment Cooling Line Orbital Welding

Water Systems Installation activities

- Installation of DI water piping on the second half of SCL ME-02 (SCL-TRCC4) continued and is roughly 50% complete.
- Installation of DI water piping on the CCL-01 Klystron was completed.
- Installation of DI water piping on the CCL-03 HVCM/SCR was completed.
- Re-routing of the RING magnet cooling headers around the HEBT momentum collimator was started.
- Installation of additional drains in the HEBT magnet cooling headers was started.
- Installation of DI water piping on the second half of SCL ME-02 (SCL-TRCC4) continued and is now roughly 80% complete.
- Klystron floor areas SCL ME-03 and ME-04 were cleared of staged materials and ME-04 deionized water carts SCL-TRCC7 & 8 moved into position.
- Installation of DI water piping on the CCL-04 HVCM/SCR was completed.
- Re-routing of the RING magnet cooling headers around the HEBT momentum collimator was completed.
- Installation of additional drains/vents in the HEBT magnet cooling headers was completed.

Ring Systems Installation

- Painting preparation on the HEBT momentum collimator shield block was completed.
- RING Half-Cell assembly #17 was received and staged in the tunnel.
- RING Half-Cell assembly #18 was received and staged in the tunnel.
- Installation of the magnet cables from the Ring Service building to RTBT continued.

Magnet Task

Since the 5000 amp supply is not useful to us, we have disconnected it and removed it from the area. We are installing an SRF 8Q35 power supply in preparation for measuring 8Q35's.

DTL measurements are complete except for #6-17 which will be mapped as soon as repairs to the drift tube are completed.

We completed measurements on four CCL Quads.

We completed measurements on two 21Q40 and installed the eighth one on the mapping stand.
The first SCL 8Q35 arrived from Milhous and checkout has started on it.

Electrical Group

Received delivery of 4 of the ring medium power supplies (2 -185A, 27V, 1-4000A, 18V, and 1-390A, 24V). This brings the total of medium power supplies delivered to 5.

Tested 2 SCL quadrupole magnet power supplies and installed in the SCL. (7 of 41)

Tested 6 Corrector power supplies (233 of 356)

CCL-ME3 work complete, with checkout expected to begin next week. Checkout of SCL-ME2 basket assembly completed, with insertion into tank expected later today. We removed all switch plate assemblies from DTL-ME1 to replace Mitsubishi IGBTs with the Eupec devices. We will also take the opportunity to open up the tank and inspect the electrical components, since the unit has been operating off and on for over 1 year now. We expect to start resumption of SCL-ME1 testing today or first thing next week. We visited Baron Industries for 1 day to acceptance test and train on the operation of a 300 gph oil press.

Klystron SCL rack row 7 AC distribution panel wiring completed
SCL tunnel tray first module complete

Ring to RTBT 535MCM cables pulled

HPRF

SCL HV tanks were moved outside and placed under tarps to make room in the gallery for the accelerated plumbing installation schedule. Tank preparation continues so they will be available when required by the installation crew. Our request to have the water flanges on the klystron body circuits moved closer to the maintenance aisle was accepted and should make the replacement of klystrons much easier during operations.

CCL The final check on the CCL-1 phase measurement was performed with good results. The waveguide sections were replaced and torqued to specification. The final RF grounding to the HV tank was installed. The CCL-1 transmitter was brought to the "Ready for HV" mode. The 5MW Thales tube was brought slowly to 135kV, 70A with a 1ms pulse width and 15Hz duty cycle. We will complete the diode mode operation next week when Karen Young from LANL arrives to oversee the first RF operation at the site. She will also be instructing the RF crew on the procedure for handling SF6 gas necessary in the klystron output waveguide and circulator. In preparation for RF, we temporarily ran an air hose to the CCL-1 klystron waveguide for cooling purposes. After testing, a permanent PVC pipe will duct the cooling air to the waveguide

LLRF

16 January 2004

The subcontract for production of the High-Power Protection Module (HPM) and Field Control Module (FCM) was awarded to the vendor that produced the prototypes during the development of these systems. The deliverables for this subcontract are 500 fully assembled printed circuit boards. The parts kit is being assembled at ORNL and will be delivered to the vendor near the end of next week.

The subcontract for production of the SCL downconversion/distribution chassis was issued this week, and fabrication of the first article is underway. The deliverables for this subcontract are 50 dual-station fully assembled chassis.

Irene DeBaca and Monica Salazar of LANL will visit ORNL next week to assist with preparation of the HPM & FCM parts kits.

Our primary installation activity is preparation for the testing of the RF system for CCL1. In preparation for this, two 805 MHz FCMs have been prepared. One will be used in CCL1; the other will be used in a test at JLab. This test was planned for January, but may be delayed until February due to schedule changes at JLab.

23 January 2004

Preparation of the parts kits for production of the HPMs and FCMs is nearly complete, and we plan to ship the kits to the vendor (Suntron) on Monday, Jan. 26. Thanks to Irene and Monica for all their help this week.

The 805 MHz reference line drive amplifiers (200 W) arrived at ORNL this week. The reference line itself is due at the end of February; the vendor confirmed this date this week. The reference line hanger installation is complete. The LO cables (755 MHz) were installed in the klystron gallery.

We held a teleconference with LANL and LBNL to discuss the FCM performance measurements made at LBNL. We plan to make the same measurements at ORNL to verify the results.

The CCL1 LLRF system is ready to support klystron testing next week.

The funding was put into place via PCR for solenoid replacement on the LANSCE klystron at Jefferson Lab. The replacement solenoid will probably ship to JLab next week.

Cryosystem Group

The purifier was cooled down and the purified gas was passed though all 6 warm helium compressors to remove the nitrogen and other gasses from the process streams. Then the purifier was turned off for the weekend.

Work continues on orbital welding the ¼" instrument tubing on the warm gas header.

Work continues on assembling the Cryomodule "U" tubes

While unpacking the cold compressors for installation it was noticed that the #1 compressor motor suffered shipping damage to the outer jacket of the nitrogen reservoir. It was decided not to install the compressor but remove the spare from storage. When we unpacked the spare it was discovered that the spare also suffered from the same type of damage. A representative from the vendor will be here on Monday to install the other 3 cold compressors and assess the damage to the #1 compressor motor and the spare. The attached picture shows the damage to the nitrogen jacket.

A purchase order has been placed with PHPK to purchase their warm compressor oil processor. The processor should arrive next week.

The return line has been prepared for the high pressure test of the primary piping. The test will occur some time next week.

It was noted that the drawings from JLAB for the cold box room "U" tubes were not complete. We are ordering some parts but awaiting the final approved drawings from JLAB to complete the purchase.

Cryomodule M-06 was installed in the tunnel this week

Long haul cabling between the klystron gallery and tunnel has been started. In support of this, the cryomodules in slots 2-4 were moved downstream to aid cable pulling and infrastructure installation. The photo below shows the cabling to date in slot 1.

Beam Diagnostics