

Accelerator Systems Division Highlights Ending March 5, 2004

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) *402.5-Mhz, 2.5-MW E2V klystrons:* The factory acceptance tests for SN 7 have been delayed three weeks to April 14 because of a vacuum leak. (2) *805-MHz, 5-MW Thales klystrons:* We finished the acceptance test for SN 1 and shipped it to ORNL (see below). We installed SN 5 on the test stand and began conditioning. We also approved the factory acceptance test data for SN 6 this week. (3) *805-MHz, 550-kW Thales klystrons:* We received SN 8, SN 10, and SN 11 at LANL, but the vac-ion connector for SN 10 is damaged. Thales sent LANL directions to replace the broken finger stock and mailed replacement material. Joe Bradley was at Thales this week to witness the factory acceptance test of SN 13. (4) *805-MHz, 550-kW CPI klystrons:* Three klystrons arrived at ORNL this week, SN 48, 49, and 50. (5) *805-MHz, 5-MW AFT circulators:* The vendor has said they would like to go to ORNL to sand all the port 1 and 3 windows. They have not set a date yet. (6) *Shipment:* We loaded a truck for ORNL, which left Los Alamos on Thursday. The shipment includes one Thales 5-MW klystron, magnet, and hardware; one lifting fixture for the 5-MW klystron; one CPI 550-kW klystron; one 5-MW load; two 805-Mhz, 2.5-MW RF windows; five magnets for Thales 550-kW klystrons; several racks for Controls, and a pallet of DTL documentation.

Concerns & Actions: Because of the backlog of 805-Mhz klystrons, we began converting the 402.5-MHz RF test stand to 805-MHz operation, which will be used to test 550-kW Thales klystrons. As of Friday, we had removed all the 402.5-MHz waveguide and were beginning to remove the 402.5-MHz klystron. At the same time, we are working on the 805-MHz waveguide run.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) We finished rebuild of the prototype HVCM and placed it back in operation to support 5-MW klystron testing. Additional diagnostics were added to determine if or when internal arcing occurs in the oil tank, as experienced in the production unit. (2) We continued work on the production HVCM, and it should be operational next week. We fabricated a new filter choke for this unit using amorphous nanocrystalline alloy with 8 AWG HV silicon rubber wire for the conductor. This wire is used in the prototype HVCM but is not suitable for SCL or RFQ/DTL HVCM use because it will not support the 40-A RMS current requirement of these units. We are examining other wire for these units.

Concerns & Actions: We have been examining HVCM design modifications and upgrades to improve reliability and reduce dependence on skilled assembly procedures and personnel. We met with Dave Anderson (ORNL), and went over subtleties of IGBT driver design and timing considerations. We reviewed the benefits of using the "speed-up" networks that reduced the turn-off switching delay and improve slew-rate.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) We completed repair of drift tube, 6-17, leak checked it, and shipped it to ORNL on Monday, Mar 1 (see photos). Final inspection by Jim Billen confirmed that the minor scratches noted earlier would not affect performance. (2) With the completion of this final drift tube, we packaged and shipped all original drift-tube documentation to ORNL. (3) Tank-4 post-couplers were final machined at CMI and shipped to ORNL on Thursday. (4) Pete Smith will travel to ORNL next week to help with the assembly of Tank 6.

COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) CCL Module 3 is now mounted on the stand at ACCEL, and leak testing is expected to be finished by March 12 with the first bead pull now scheduled for March 18 and ready for shipment April 1. (2) Six of the 12 Module-4 segments have now been brazed and leak checked. The first bead pull is scheduled for March 3 and ready for shipment April 12.

Concerns & Actions: Nathan Bultman visited ESCO this week to review their proposed repair plans for the CCL intersegments. They have one unit each from Modules 1 and 2, and four units each from Modules 3 and 4 that require repair. The major issue is positive certification of these units before they leave ESCO again. We need to ensure that the leak testing they will be doing (using our leak-testing equipment from the DTL post-coupler work) is done properly. We assert that these repairs are the responsible of ESCO and that LANL is not responsible for the repair costs. We intend to fast track the one beam box (intersegment #4) that has a body-joint leak because it is needed right away for the Module-1 assembly and magnet testing. This beam box is the only unit from Module-1 needing repairs.



Fig. 1. Repaired drift tube 6-17 (left); Rudy Valdez prepares last drift-tube shipment (right)

PHYSICS & DIAGNOSTICS (WBS 1.4.5)

Accomplishments: (1) *BPM Electronics:* The remaining computers for the SCL and HEBT units have been assembled and we are burning the hard drives with the software. This should be completed by next week. We have received all the electronics boards from Suntron with the exception of 37 motherboards. Those are expected at LANL next week. The entire BPM electronics work at LANL is expected to be completed and the remaining units shipped to ORNL by the end of March. John Power and Matt Stettler were at ORNL Feb 18-23 to help with the installation and commissioning of DTL and CCL units. The problem with the software that prevented the phase locking was fixed on this past Thursday. All of the 2U systems at ORNL were updated with the latest low-level drivers and LabVIEW application software from LANL. The MEBT electronics were replaced with a new 2U system, and the BPM electronics were replaced in the other five units with new current-revision hardware. (2) *Wire-scanner electronics:* All units have been shipped to and received by ORNL. Wynn Christensen and Steve Armijo will travel to ORNL next week to complete the hand over and help with installation and testing. (3) *Wire-scanner pickups:* We received the last of the eight 3-inch (CCL) actuators from Huntington. Following testing, the remaining three units will be shipped to ORNL next week. We continue to experience delays in the delivery of the first units of the 8-inch and 12-inch actuators from Huntington. The current projected delivery date is two weeks from now (several months late). We have asked our procurement office to contact Huntington with the possibility of defaulting them on this contract. (4) *RTBT harp:* We received the aluminum HV planes and signal-plane backing plates from Bogue Machine. They look very good on first inspection. We have just about everything necessary to start assembling the HV planes. (5) *Transition-region beam stop and wire-scanner vacuum box:* Fabrication is proceeding on schedule, and we anticipate a delivery date of end of March.

PROJECT MANAGEMENT (WBS 1.4.5)

Accomplishments: (1) Los Alamos SNS Division will disband in 28 days, and we are working with SNS-ORNL on closeout issues. (2) We increased the number of contracts to be novated from 39 to 44 and completed file transfer and check lists for 38 of the 44. The remaining six are IE Power (power supplies), Alpha (shunts), MCI (waveguides), AFT (5-MW circulators), and the two Thales klystron contracts. (2) We held a LANSCE/SNS Management Transition Review on Wednesday, March 3, with ORNL participating via videoconference and an external review committee chaired by George Coward. We reviewed BAC and ETC for all remaining LANL tasks. The major action item was to complete the HPRF ETC based on ASD's priorities and submit a PCR before the end of March that reflects this agreement.

ASD/JLAB: Cold Linac

Assembly of the M-11 cryomodule has begun. Assembly of the M-10 cryomodule continues. Assembly of cryomodule M-9 is complete.

The M-8 cryomodule is in the test cave, awaiting repair of the 1 MW RF test stand.

Work to resolve the high- β multipactor issue continues.



Cryomodule M-10



Cryomodule M-11

ASD/BNL: Ring

Minutes to last week's Mechanical Systems Review were generated by M. Hechler and distributed to BNL/SNS staff for comments.

Half-cell #24 was shipped to SNS/OR on Tuesday. Work is underway on the first quarter cell (#QC5A) which will be shipped to SNS/OR on March 9th.

Magnetic measurements: Eleven of the twelve 30Q44 magnets are now fully measured. Unit number twelve is on the stand.

Measurements of the chicane #2 and #3 magnets (together) using a long harmonic coil are complete. These magnets were measured individually and together to determine their field coupling. A Hall probe is being prepared to measure B_y and B_z at the target location.

Alpha Magnetics is preparing to ship the last (#9) 26S26 magnet to BNL this week.

36Q85: Design work is underway to support ASD's Technical Issues Forum on the RTBT / Target Interface that is scheduled for March 26th. Twelve of the sixteen quad coils are now fully wound.

A draft of the Diagnostics Production Plan was sent to ASD for review and comments.

Joe Tuozzolo conducted a special meeting this week to review tolerance and tolerance build-up on the RTBT bend magnet (17D244). J. Rank is working on the statement of work.

ASAC presentations were completed this week. Dry run reviews were presented for each talk; all were submitted to the Project Office.

We are in receipt of an invoice from Tesla Engineering covering the shipment of (8) 21Q40 magnets and fifteen magnet stands that were shipped this week from Tesla to SNS/OR. The invoice will be paid upon receipt and inspections of said equipment.

Controls

Checkout continued for control systems required for DTL1/2/3 operations. DTL1 and DTL3 RCCS and power supply control system testing is well along. Checkout of DTL2 control systems should start next week.

Preliminary CCL1 RCCS and vacuum control system testing took place last week. Testing was conducted by a team comprised of both LANL and ORNL personnel. Test activities included the following:

- got the IOCs and PLCs communicating
- Performed initial vacuum system testing using a spool piece in place of the "manifold A" half of CCL1
- Implemented ADE changes to comply with the EPICS R3.13.9 standard
- Submitted revised software to CVS

There were a number of to-do items left afterwards that are being worked. LANL will return Monday, March 15 to continue testing.

LANL shipped the last two Klystron Building "Ctl" control racks. Also shipped were PSCs, PSIs, and VME CPU modules. Serial cables have been fabricated for SCL vacuum controller serial communications. LANL will bring them to the site when they visit in two weeks.

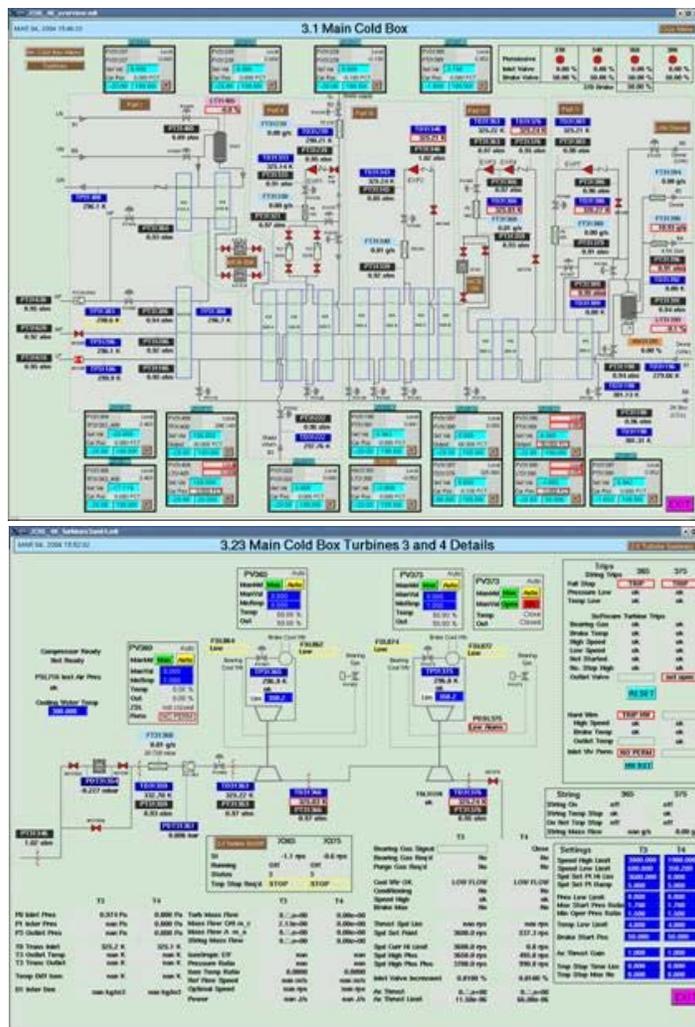
A prototype of the BNL version of the A/C line-sync system, running the PLL algorithm in DSP code, has been demonstrated. The BNL version is based on VME hardware so as to be better integrated with the remainder of the timing system. Communication across the VMEbus has been demonstrated. For demonstration purposes, the input came from a function generator, and the output was measured by an oscilloscope. An interface module with line A/C input, and timing master compatible output signals is being developed.

The event-link monitor software and documentation has been checked into CVS. It will be deployed at ORNL next week.

All 9 of the Central Helium Liquefier Building PLC processors were successfully upgraded to the latest version of the Allen-Bradley PLC firmware and programming software. After the upgrades were completed, several signals were tested from the sensors to the EPICS screens to verify all logic and communication paths still operated properly.

The control and power wiring for the CHL 2.1 K cold box cold compressors was installed in preparation for vendor testing the week of March 8.

EPICS screens and PLC logic documentation for the controls for the CHL 4.1 K cold box were sent to the vendor for their review. Checkout of the 4.1 K cold box field devices is complete except for devices that cannot be checked due to hardware or operational problems.



Example 4.1K Cold Box EPICS Screens

Installation

Craft Snapshot 3/2/04

ASD productive craft workers	58.0
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	67.0
Less WBS 1.9, 1.2 etc	4.0
Less absent	2.0
TOTAL PD BY ASD/ORNL DB WPs	52.0

Accelerator Physics

Analysis of DTL1 output emittance data continues. Jeon and Aleksandrov are analyzing data to understand some observed inconsistencies. For example, the horizontal beam profile width reported by the emittance system is systematically larger by 50% than that reported by a wire scanner at the same location. The profile obtained from the emittance systems are often non-Gaussian, whereas those reported by the wire scanner are Gaussian to about +/- 2 sigma. Taking the emittance results at face value, the horizontal beam core emittances are in the range 0.25-0.35 pi mm mrad (rms, norm) and the vertical are 0.2-0.3 pi mm mrad.

Analysis of a PSR data set for accumulation without ring RF is in progress. ORBIT simulations reproduce the observed persistent linac bunch structure over 1000 turns. The unexpected persistence of the linac bunch structure for many turns in the PSR can be explained by the formation of anti-buckets due to space-charge.

The DTL1-3 commissioning plan is completed and fault study preparations for the ARR review are in progress.

ORBIT simulations of single-turn injection and kicked accumulated beam show that we can expect coherent motion for 50 turns at natural chromaticity and many hundreds of turns at zero chromaticity. This is important for tune and linear optics measurement.

Seven AP group members have prepared presentations for next weeks ASAC review.

Additional simulations of betatron tune measurements, including BPM errors, using both the narrow-band and base-band BPM systems, for both the single-shot and kicked-beam-after-accumulation methods, show that improved tune measurement accuracies can be obtained by adjusting the ring chromaticity toward zero. After 200 turns the beam shows very little decoherence.

Dose rate calculations in the vicinity of the stripper foil indicate higher than expected values. The impact of these calculations is now being evaluated.

Due to the high radiation fields from the activated target and injection beam dump (i.e. radiation fields after the beam has been turned off) we have determined that it is desirable to install simple shutters as close as reasonably possible to the target and injection dump. These shutters would be closed before allowing personnel to enter the area and should significantly attenuate the gamma radiation emitted from the target and dump.

Operations

Preparation for the ARR and ASAC

Working to finalize details of the VC, the on-site visit and the closeout

Readiness Plan of Action Rev 4 should be ready for signature Friday

Accelerator Safety Envelope

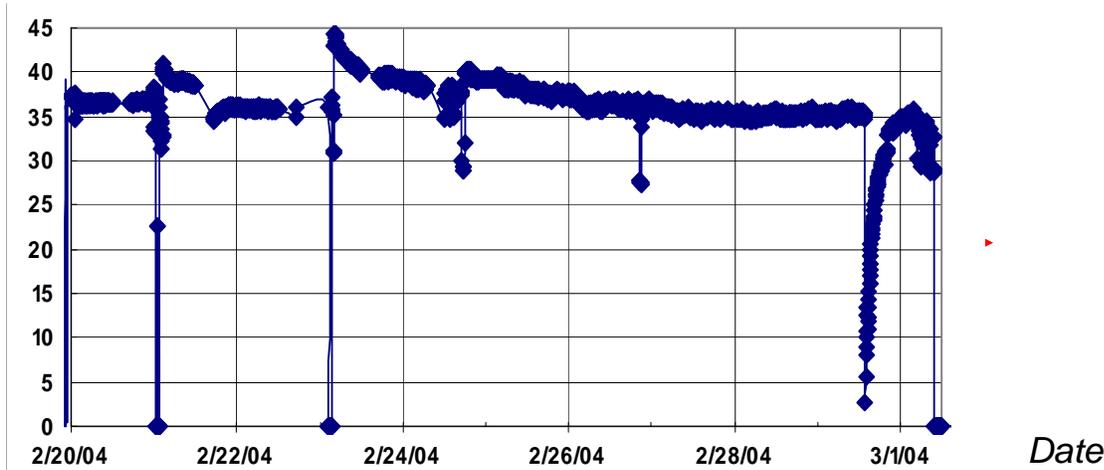
Closing out Action Items

Completing additional Policies and Procedures needed for the ARR

Ion Source Group

Rahul Rauniyar, a former summer student, has returned to help us modeling low energy beam transport and electron dumping, using Simion and PB Guns.

After the equivalent of 21 days at 6% duty-cycle the ion source on the hot spare stand keeps producing 35 mA. The archived Faraday cup data show the cesiations, applied on the 21st, 23rd, 25th, and 27th to slowly loose their effectiveness. On Monday, March 1, 2004, a discharge developed between the ion source and the e-dump, ending an over 6 day long period of high stability. Integrating the 3rd turbo pump into the system seems to have solved this kind of problem.



Survey and Alignment Group

S & A completed preliminary alignment on DTL 1, 2, and 3. Final alignment is scheduled for week of March 22. As a result of mechanical rework, today we will verify/re-align drift tube magnets in Tank Assembly 5.

Magnet fiducialization continued. To date we have completed 36-CCL magnets, 11-21Q40s, and 1-8Q35.

We are also in the process of fiducialization CCL BPMs and wire scanners.

A request was made by the Target Group to mark out the beam line on the floor in the RTBT/Target interface building along with setting a target which represents beam elevation. This line was required so that the site surveyors could use this line to set the flight tube that penetrates the Target Building wall. The only means, at this time, to mark an accurate beam line on the floor of the RTBT/Target interface area was by using reference marks located in the hot cell. The hot cell is located 180 degrees from the RTBT. This task was accomplished by utilizing an optical tooling technique known as collineation (setting two instruments on the same line of sight). With the removal of the target cover plate and the proton beam window cover plate from the core vessel, we were able to collineate an instrument in the RTBT to an instrument located on the reference line in the hot cell. From there, we projected this reference line in to the RTBT/Target interface building.

The adjustment of the Linac re-observation campaign was completed this week, and updated coordinate files were created for the laser tracker and total station instruments.

Review began on the original planned HEBT/Ring/RTBT high-precision network design, to see if it could still be implemented with the existing obstructions in that portion of the tunnels.

S & A is in the process of relocating all men and equipment to Trailer 817. This task will continue for a few more days.

Mechanical Group

Water Systems Installation

- Installation of DI water piping on SCL ME-03 continued.
- Installation of DI water piping on SCL ME-04 continued.
- Installation of DI water piping to DTL2 tank is in progress.
- Installation of DI water piping to CCL1 module was completed and the system flushed.
- Installation of DI water piping to CCL2 RF system components is in progress.

- Fabrication of Linac tunnel QMCS manifold was resumed.

Ring Systems Installation

- The RING Half-Cell #24 was received and staged in the tunnel. We now have 75% of all the RING Half-Cells.
- The RING Half-Cell units # C7 and C9 were installed into their positions.
- The support pads for the Arc B Half-Cells were formed and grouted.
- The HEBT momentum dump was installed.
- The beamline from the HEBT dipole DH14 to the momentum dump was installed.
- The support stands for HEBT quadrupole Q15 and dipole DH15 were installed.
- Installation of the PPS system conduit continued in the HEBT.
- Installation of the electrical grounding straps on all the HEBT magnet stands was started.
- Installation of the AC distribution panels continued in the RING Service Building.

Magnet Task

This week we assembled and installed three CCL Module 1 Magnet intersegments.

Electrical Group

Upgrade and repair work continued on the CCL2 modulator.

DTL ME3 was put back together and is ready for operational checkout.

All electrical and mechanical parts for the HV Interlock/Bypass modification were ordered.

The HV Interlock/Bypass was tested successfully on the RF test facility modulator. This interlock prevents bypass of a klystron that is physically connected to modulator high voltage via its cable by incorporating switches in the cable connectors. It will help prevent klystron damage that could result from mistakes in manually bypassing klystron interlocks.

HPRF

CCL2 – Pipefitter work began on the waveguide components.

SCL – Two tanks and six 550 kW klystrons were prepared and moved to the Klystron Gallery.

MEBT – New circulator water loads were mounted and plumbed. 150' coax cable was run and terminated. Protection function circuitry was tested with good results.

LLRF

Cryosystem Group

The top hat assembly for the 7000 liter Dewar has arrived from JLAB along with some recovery compressor parts and a thermal load for the 4.5K cold box.

The vendor for the cold compressors Air Liquide will be here on Monday to test the performance of the cold compressors that were damaged in shipment. The test will be run on a warm test fixture.

The recovery compressor was stopped to modify the control system to shut down the compressor motor on loss of cooling water. This modification will be available for the next operation.

The first 2 barrels of compressor oil have been processed and will be transferred to the warm helium compressors on Monday.

Work continues to dehydrate the charcoal beds of the 4.5K cold box.

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Work continues on fabricating the transfer lines necessary for the 4.5K cold box acceptance test.

Beam Diagnostics