

Accelerator Systems Division Highlights for the Two Weeks Ending June 27, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) An E2V representative was at LANL to tune DTL klystron S/N 10. The bandwidth is good but we are about 70 kW short of obtaining the 2.5 MW. We tuned the input cavity, output cavity, 2nd cavity, 2nd harmonic cavity and magnets. We installed a second tuning post in transition. E2V is going to send us some larger tuning posts to try in the transition. If we obtain the 2.5 MW with the larger tuning post, we will do the high power acceptance tests. If the high power acceptance tests are unsuccessful, E2V has agreed to send someone to LANL to re-tune and examine the problem. (2) CPI provided test data from a klystron tested on the new test set which we compared to data on the old test set. After this comparison, we authorized CPI to begin using the new test set. S/N 26 is the first tube schedule to be tested on the new test set. S/Ns 23, 24, and 25 are scheduled to ship today. (3) Three Thales representatives are at LANL this, and, if needed, next week to tune our 1st article SCL klystron. We still have not authorized the shipment of S/Ns 005 and 006, the two that were factory tested last week. We are waiting on the calibration information on the voltage measurements. (4) We began factory acceptance testing of SCL transmitter S/N 6 at Titan. (5) Two DTL windows, S/Ns 8 and 1 (rebuilt) are being installed on our bake out stand; processing begins next week.

Concerns & Actions: (1) Thales further delayed the factory acceptance tests of CCL klystron S/N 5 to 7/16, and S/N 3 to 7/18, and S/N 1 to 7/24. Delays were due to leaks in the SF₆ section of the waveguide. These dates still support the integrated project schedule.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) The LANL prototype high-voltage converter modulator (HVCM) with the Dynapower SCR unit is also running well and supporting HPRF klystron testing. Wiring is nearly complete on the LANL production unit. Checkout of the control rack was initiated. (2) We worked with Dynapower to revise and complete the Integrated Acceptance Test Plan for the first production unit 80-kV HVCM. Dynapower indicated that they will be ready to test the final 140-kV unit upon Dave Anderson's arrival at Dynapower 7/1. They also expect to be ready to test the first 80-kV HVCM unit upon Bill Reass' arrival at on 7/8. Dave Anderson will perform a preliminary inspection of the 80-kV sub-assemblies while he is at Dynapower next week.

Concerns & Actions: (1) Dynapower was notified about output resistors that broke loose during a recent shipment. We should be able to repair and reuse, and recommended that on all future shipments that this subassembly be removed and packaged in a separate box.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: Billen and Stovall completed final tuning of Tanks 1 and 3 at the SNS site. Tank-1 resonant frequencies and Q problems reported last week were solved, and the system is under vacuum.

EMD DT's: Tank 3 & 4 body/stem brazing is done and leak checked (Fig. 1). All are within dimensional tolerances.



Fig. 1: EMD drift tubes for Tanks 3 and 4.

Concerns & Actions: (1) The first three Milhous produced DTL drift tubes EMD magnet as received at Los Alamos has numerous physical and documentation deficiencies which increase the risks of damage during EMD drift tube fabrication and malfunction later during machine operation. They included excess resin in bore; locating pin location is out of position, excess resin at leads to magnet body interface, and crooked leads. They are being sent back to the vendor for repairs. Schedule impact is under evaluation.

COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: The first half-module was fitted on the support stand at ACCEL (Fig. 2).



Fig. 2: Half of CCL Module-1

PROJECT MANAGEMENT (WBS 1.4.6)

(1) John Bretzke has been appointed Acting Supply Chain Management Division Leader for LANL, effective this week. John will lead the procurement, property & materials management, and the small business office groups. We are grateful to John for his contributions as SNS Deputy Division Leader over the past 4 months. During his tenure, he was instrumental in streamlining and updating our scope baseline, establishing quantitative assessments of risk for the project, improving our QA practices, and initiating our project closeout strategies. Please join us in congratulating John, and in recognizing the importance of his new assignment for the future of the Laboratory. (2) Next week John Tapia begins his new position as Senior Staff Advisor to the Physics Division Director. Dan Jones has been appointed as the new SNS Division Chief of Staff. We thank John for his significant contributions to SNS business functions over the years, and welcome Dan into his new position of added responsibility.

ASD/JLAB: Cold Linac

Cavity #2 in cryomodule M-2 has exceeded specifications, achieving $E_{acc}(\max) > 18 \text{ MV/m}$ and Q_0 at $10.2 \text{ MV/m} > 5 \times 10^9$ (see figure). Attachment of end cans on module M-4 continues and the cold mass for M-5 has been inserted into its space frame (see photos). Assembly of the M-6 cavity string continues to be delayed by the slow cleanup of the repaired High Pressure Rinse system. System cleanup requires uninterrupted operation, presently not possible because of concurrent upgrading of the rinse wand and repair of table support bearings.

U-tube parts were shipped to SNS on Friday, June 20 and arrived on site on Monday, June 23. Temperature sensor installation in the 2 K cold box is complete. Welders have completed two weld passes on "valve shelf" to lower vacuum shell b



M-4 Cryomodule



M-5 Cryomodule



ASD/BNL: Ring

Graeme Murdoch and Kerry Potter were at BNL this week to review status of BNL's "Design Complete" milestone and obtain updates on various mechanical systems, that included: collimation, ring mechanical, extraction Lambertson, half-cell lifting, and 36Q85 doublet assembly.

Additional HEBT installation drawings were given to Graeme Murdoch for delivery to M. Hechler in support of ASD's installation efforts.

Dennis Klein of Alpha Magnetics was at BNL this week inspect and repair two of the production 41CDM30 magnet assemblies. Two others will be returned to Alpha for factory repairs.

Recommended spare parts for Diagnostic Systems has been sent to ASD for review, comments and approval. (Systems include: BPM, IPM, BLM, BCM, Tune, BIG, VFM, electron detectors, electronics, and DAQ)

Now that all 1st article magnets have been received, our magnet resistance parameter list is being updated to include actual measured resistance in place of the original calculated values. In addition, the revised power requirements are being matched against power supply ratings.

A meeting was held with BNL's manager of Contracts and Procurement to resolve issues related to the timely procurement of new ion chambers needed for ASD's upcoming commissioning schedule.

Magnetic testing of 26Q40 production quads is underway.

Acceptance testing of the first article 30Q44 production magnet is underway.

An RFQ for the Momentum Collimator Outer Shielding has been extended one week, to 7/02/03.

The shipment of eight 21Q40 quads from Tesla to SNS/OR has been rescheduled from 6/30 to 7/11/03.





HEBT Shielding

Controls

Four specifications for ring controls racks were updated to show the latest design information. Fabrication of ring controls racks for the HEBT SB was completed.

Additional chipmunk EPICS screen testing was completed and the PPS has been restored to “Certified for Operation” status.

Progress was made in setting up the Hot Spare Ion Source for EPICS control.

The procedure for calibration of the sensors and devices connected to the ICS Cryogenic Control System was approved. Calibration of the sensors for the CHL main compressor system was started.

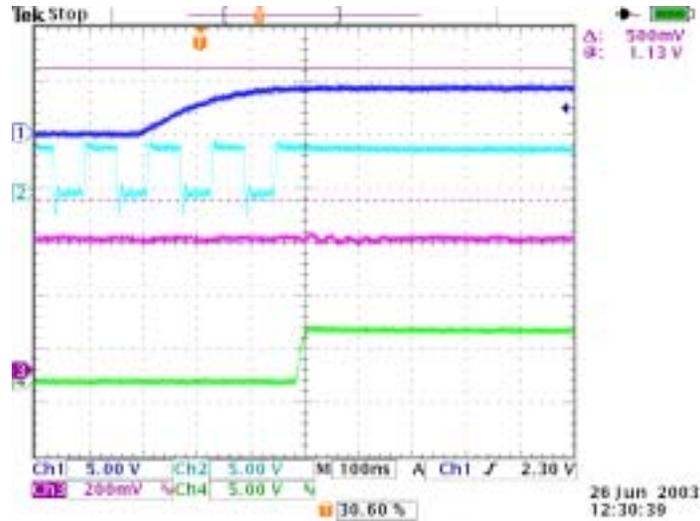
Retesting of the D-Plate magnet power supply system was completed this week. The recalcitrant D-Plate collision avoidance system was finally whipped into shape this week.

Xiaosong Geng traveled from BNL to ORNL to assist with DTL vacuum efforts. Yongbin Leng also traveled to ORNL to assist with BLM commissioning. Despite a bureaucratic obstacle, he was able to complete much of his planned work by providing phone support from his hotel room.

MPS configuration files, startup command files, and database substitution files can now be configured from the Oracle Database. This is being tested in the LAB before being installed in the run time database.

Inputs to the Machine Protection System (MPS) are being verified as equipment is installed. Inputs from the D-Box and D-Plate diagnostics will be verified when testing and installation is complete. The prototype Beam Loss Monitor (BLM) electronics and MPS interface are also being tested. The Neutron Detectors are tested using an LED test signal. The MPS response is shown below. The response time from the threshold detector to MPS trip is ~300 nsec, consistent with previous measurements in the lab. This verifies the drive circuit in the BLM-MPS interface is within specifications.

Some BLM test results are shown below. The top trace is input to the MPS from the BLM comparator chassis, 2nd trace is Fast Protect Auto Reset (FPAR) clock, 3rd is output from lossy integrator stage of the Analog Front End (AFE) stage and the bottom trace is the status output from the MPS chassis, showing a 300nsec response.



Installation

Craft Snapshot 6/25/03

ASD craft workers	78.0
Foremen, ES&H, etc	12.0
Less WBS 1.9 etc	6.0
Less absent	3.0
TOTAL	81.0

ASD provided input to the Project Office on the IPS revision to be proposed with the End Game Plan.

Planning began to identify craft allocation associated with the reduced Davis Bacon resources anticipated in FY04.

Preparations were completed for two important milestones which will occur next week:

PEP 2-12 Start Ring Installation which will occur on Tuesday.

CCL 353 Begin Cryomodule Installation - Heavy cabling associated with the two warm sections adjacent to the Medium Beta #2 location was completed to allow the cryomodule to be installed.

Eight of 9 HEBT Dipole magnets and 6 of 32 - HEBT 12Q45 magnets were installed.

DTL #1 tuning was sufficiently completed to allow conditioning and commissioning.

HVCM ME #2 ripple problem was resolved.

CHL transfer lines are complete.

The decision was made by SNS Management to replace the trailers in the ASD 10-Plex due to the mold present. Efforts to clean up the mold were not successful. It is now planned to have the bulk of ASD personnel move to the site from RATS I in mid Sept, 03.

An inventory of High Beta Wave Components was completed. All but a few pieces are on hand. HB wave guide installation will resume on July 9, 03.

Accelerator Physics

Operations Group

The Front End Control Room is being staffed by Operations for day shifts only until DTL1 is ready for RF Processing.

ARR

The current dates are:

- DTL Tank 1, August 12-14, 2003
- DTL Tanks 2-6 Jan 13-15, 2004
- CCL Still May 3-6, 2004.

Preparation

- PPS 0.4 Certification completed. We are beginning to look at PPS Version 1.0 for the Linac Tunnel.
- PPS Version 0.4 is "all or nothing". If the Front end is operated for beam studies, the DTL enclosure must be searched and secured
- RS Holds must be applied to systems so that people can work.
- Neutron Shielding issues are being investigated.
- Fire and Building Emergency Plans are being reviewed

Test Plans

Operations need hard copies of signed, completed test plans for the committee. Very few have been submitted.

The last Chief Operator hire for FY 03 has accepted.

Ion Source Group

The Hot Spare Stand equipped with Ion Source #2 produced routinely 28 mA when operated with 30 kW. The highest current was 33 mA when operated with 42 kW. Work continues towards reaching the nominal current.

We have ordered critical spare parts for the ion source, namely Cs-collars, e-dumps, outlet aperture, and insulators for the LEBT ground. All these parts are critical because they have long lead times and can fail as we learned during front end recommissioning.

We propose a simple modification to the safety chain in the Big Blue Box that would split the safety chain into a high voltage safety chain and into an RF safety chain.

The modified RF safety chain would allow for leaving the RF amplifier running when entering the Blue Box, but it would remove the AC power from the RF amplifiers when accessing the ion source cage or the matching network. The modified safety chain would guard all exposed RF connections since Yoon Kang eliminated the RF hazard in the Big Blue Box with his new 2 MHz connection.

Accessing the Big Blue Box with the RF amplifier running would improve the stability of the ion source and allow for tuning the RF amplifier without having to bypass interlocks or override the safety chain.

Survey and Alignment Group

Mechanical Group

Water Systems Installation

- Began piping installation from the CF headers to the TRCC skids at SCL_ME1.
- Continued piping from the CF headers to the RCCS and TRCC skids at CCL 3
- Began piping installation from the CF headers to the HVCM at DTL_ME-3.
- Began checkout/dry run of the D-plate RCCS cooling system.
- RF-Reference line work has been completed.

- Newly dimensioned orifice plates have been installed on DTL-1

RING Systems Installation

- 8 of 9 HEBT Dipole magnets were installed.
- 6 of 32 HEBT 12Q45 Magnets were installed.
- Installation of RING Half-Cell #C1 was started.
- All the 21Q40 magnets stands were received and staged for installation.
- Cable pulling in the HEBT is continuing.
- Grouting of the HEBT magnet stands is continuing.
- All the lateral RING buss bars were installed.
- Cable tray installation in the RING is continuing.





We have begun clearing space and preparing for DTL work in the Front End Building. The area is now clear and we will begin moving cabinets today and tanks (hopefully) next week provided that the support can be organized.

Magnet Task

Electrical Group

Ring main dipole DC bus - tunnel has been completed

Ring cable tray is 60-65% completed

HEBT SB has been vacated and D/B electricians moved to ring SB

SCL magnet pulls are in progress

HPRF

DTL tank1 tuning has been completed with the final copper slug tuners and post couplers for the design field distribution and the quality factor. The field error was measured less than $\pm 1.5\%$. The non-vacuum resonance frequency is 402.35 MHz. Iris matching is temporarily completed for the initial conditioning and commissioning.

Tank3 resonance frequency has been lowered by ~ 70 kHz to 402.40 MHz for 402.5 MHz operation under vacuum. Three slug tuners were modified to have minimal effect on the field distribution and stability while lowering the frequency. The field distribution error is measured less than $\pm 1.0\%$.

The RF Group completed Readiness Tests for RFQ, DTL1 and DTL3 HPRF Stations. These three systems are ready to drive cavities when waveguide shorting plates are removed. Completed wiring terminations of DTL 5 & 6 HPRF Stations. We brought both transmitters to "Ready for High Voltage" mode under test conditions.

LLRF

New Hardware Development

The initial prototype of the field control module has been at LBNL for two weeks. It will be shipped to ORNL today and will be tested on the bench next week prior to being installed in the RFQ system at ORNL. Meanwhile the additional prototype hardware is being checked out at LANL. Kay Kasemir will visit ORNL next week to assist with the hardware and software integration.

Reference System

All four temperature zones are under regulation at 100 deg F, and the line is now pressure regulated with the pressure regulation unit mounted in its final location in the klystron gallery. The reference system rack was cut over to permanent power; the UPS power supply has been turned on.

MEBT Rebunchers

Operational studies are in progress. One of the primary goals is to configure the systems for reliable and robust operation of the cavity tuning system. New operator screens are under development. The spare MEBT control chassis was returned to ORNL from LBNL.

Installation

Cable lists were completed and turned in for the first equipment group on the superconducting linac.

LLRF Lab

The LLRF lab has been established in the RF Test Facility at the SNS site. It now has network service and is becoming more usable each day. As of today, two VXI crates and one 2nd generation RF control chassis were operating and accessible via a Linux console. The control chassis was used to operate a benchtop coaxial resonator at 805 MHz.

Cryo Systems Group

CHL: We are still purging the charcoal bed with dry nitrogen and we now have the purifier mole-sieve beds also under nitrogen purge. The motor coupling on the #3 first stages is aligned. King, the mechanical contractor installing the purifier piping, is approximately 50% completed.

Tunnel: The 12" outer jacket of the down stream modules is installed and we are pumping on the insulating vacuum space. The 1 1/2 ball valves are installed on the down stream section of the transfer line. All the valves are installed in medium beta position #2 in anticipation of setting this Cryomodule Monday 6/30/03.

Rats: Medium Bets #1 is loaded onto the truck in anticipation of installing into the tunnel on Monday 6/30/03. Parts and tooling are ready to begin assembly of the Cryomodule "U" tubes.

Beam Diagnostics

LANL Beam Diagnostics Progress Report:

DTL BPM pickups: Eight completed units (with weld flanges) are due to be delivered to LANL any day now from ESCO; #9 had the dimensional error and is being re-worked -- it should be complete by next week. The feedthroughs have arrived to repair #10, and this work is going on at CMI and ESCO.

CCL BPM pickups: We shipped 12 units to ESCO for installation into the inter-segment beam tubes. We also shipped a prototype that they can use to test their weld set up.

BPM mapping: We completed and distributed reports on the CCL BPM mapping and electrode testing. We also completed a note on systematic errors associated with the SCL and CCL mapping and corrected the SCL BPM mapping report regarding these errors.

BPM electronics: Troubleshooting continued at LANL this week on the faulty boards brought back from ORNL. However, the work was negatively impacted by higher priority LLRF work. We received updated quotes from GMW (Bergoz) for the BPM AFEs. We have decided to order 25 BPM units now, 12 of the 805-MHz (DTL) type and 13 of the 402.5-MHz (CCL) ones. With a delivery date of 60 days ARO, this will (barely) allow us to meet the target date of Sept. 15 for the DTL units. The total for 25 AFEs will be \$32,800.

WS actuators: We are expecting the prototype 6-inch (DTL) and 3-inch (CCL) actuators from Huntington by mid July. Assuming two weeks for checkout, we should be able to finalize the order for the production units by the end of July, allowing us to meet the target date for these units of Oct. 15.

WS electronics: Work continues on fabricating the chassis for the remaining DTL and CCL units.

ORNL Beam Diagnostics Progress Report:

D-plate: All Actuators including the air-actuators were tested this week. The collision avoidance system was checked with all actuators. It performed fine. The damaged cables were repaired. We need to rearrange the cables after the D-plate is set in the final position. Johnny Tang, Coles Sibley and Saeed signed off the fast valve functionality with the MPS. The key to the Vat-valve was handed to the operations group. The system went through the checklist and performed per spec.

D-Box: We have a new beam-stop design. The new Carbon-Carbon cone shaped beam stop will be installed by July-15th. The Fifth actuator will also be installed at the same time. Tom Roseberry (the D-box designer) is working on the inline HARP beam-box. We will use 16 horizontal wires and 16 vertical wires on two actuators to complete the project.

SCL Laser System: The laser room in the HEBT service building is under construction. Next phase is to install the Laser transport-line in the HEBT ceiling. We further tested the Fused silica vacuum windows at 50 times the operation limits. The window did not suffer any visible damage. To go to higher power test of windows, we need either to sound proof the room or perform the studies at nights. We will perform the tests at night (the laser blasts are un-acceptable for an occupied building during the day). The load sound only occurs when we focus the laser beam to get about 100 times the operational condition.

Kerry Potter and Dan Stout installed the first article laser-optics-box on the warm section at RATS. Figure below shows the cryo-station and the warm section.



Figure 1. First article SCL laser optics box and warm section is shown at RATS.

BAS: Beam Accounting System (differential current measurement) circuit design is complete. Jim Pogge modified the schematics this week. We expect to receive the V-3 boards soon. We expect to have two systems ready by July-7th. The MEBT BCMs are being moved to the klystron Gallery to accommodate the BAS.

Software: Wim successfully tested the new LabView code for the D-plate Faraday cup.

BLM: The neutron detectors were tested with the BNL electronics. They are ready for operations.

Timing: Quotes were received for the first run of the embedded timing circuit. Purchase orders should be out next week for a 5-day turn on the PC boards. We have decided to limit the initial run to 10 units and follow this with a cost reduced version.

Misc: Three test stations are being designed/prepared and installed (BPM, BLM and an automated three dimensional magnet mapper). The Cs-137 source will be housed in a remotely controlled lead shielded box. The Mechanical Engineering group is designing the box. A preliminary model is shown in figure 2.

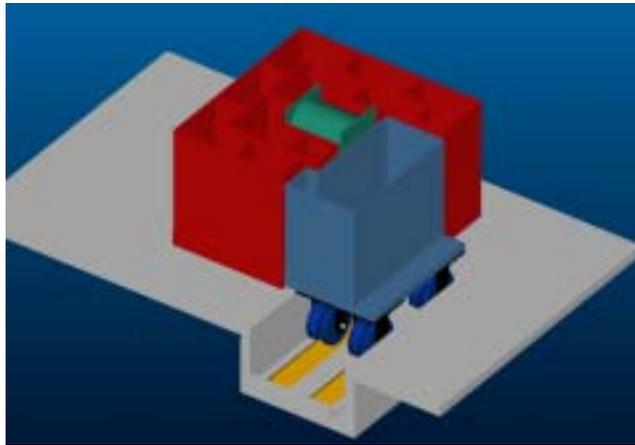


Figure 2-- Cs-137 lead shielded box (the top lead-hat is not shown). The blue section operates remotely to expose the source. The exposure solid angle is 20 degrees. The green box houses the Cs-137.