

Accelerator Systems Division Highlights Ending February 6, 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:* SN 11 shipped to ORNL on Jan 26, and SN 5 is scheduled to ship this week. The factory acceptance tests for SN 7 are still scheduled for March 8-12. (2) *805-MHz, 5-MW Thales klystrons:* We are still in the process of conditioning SN 1 at LANL. The next 5-MW klystron is scheduled for factory acceptance tests the week of Feb 23. (3) *805-MHz, 550-kW Thales klystrons:* SN 8 passed the factory acceptance tests last week. The next 550-kW klystron, SN 10, is scheduled for factory acceptance tests on Feb 5. (4) *805-MHz, 550-kW CPI klystrons:* SN 43 and SN 47 shipped to ORNL on Friday Jan 30. (5) *805-MHz, 2.5-MW Thales windows:* We completed high-power testing of two 805-MHz windows, SN 7 and SN 10. (6) *Transmitters:* We reviewed and approved the acceptance test results for SC transmitter number 14. This is the last transmitter to be delivered.

Concerns & Actions: A MCI representative was at LANL this week to test the repaired flex sections for RF leakage. The repaired section did not meet specifications for leakage. MCI has agreed to a plan to provide a combination of brazed or soldered flexes and straight sections that supports the ORNL installation schedule. ORNL will likely not need to buy any additional waveguide. We will send the details out next week after MCI sends us a written form of the verbal agreement.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) We continued HVCM circuit modeling to determine the cause of IGBT failures. (2) We continued rebuild of the prototype HVCM with the primary focus on completing the boost transformer assemblies. Changes were also made to the oil distribution system to increase oil flow to the transformers.

Concerns & Actions: We have been examining IGBT driver-card performance as a possible cause of recent system failures. The Dynapower fabricated IGBT driver cards have a significantly longer turn-off delay (450 ns) than called for in the design. Since the system is "zero-voltage-switching," the turn on delay is not that important of a parameter. However, turn-off delay is important, and excessive turn-off time can lead to IGBT "shoot through" and failure. We will now catalog IGBT timing parameters *in-situ* when performing gate-drive tests and evaluate completed IGBT and driver assemblies for compatibility before assembly.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) Pete Smith was at ESCO this week to oversee welding of post couplers. Twenty of 23 Tank-2 post couplers were welded and sent back to CMI for final machining. The final three post couplers were shipped to ESCO on Friday and will be welded next week. (2) ORNL baked and vacuum tested partially repaired drift tube 6-17, and it shows no measurable signs of a leak. Both 6-17 and 2-02 are now at GAR for additional electroforming. They should be shipped to CMI next Monday or Tuesday for final machining.

COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) Nathan Bultman remained at ACCEL this week supporting completion of CCL Module 2. They successfully sealed the vacuum leaks on all segment/bridge coupler flanges by polishing the sealing surfaces. The final leak test of Module 2 was completed, and shipment should proceed as planned for Feb 13. (2) ACCEL completed brazing of all Module-3 segments, and five segments have now been placed on the stand for mapping with the laser tracker. Vacuum tests are projected to begin Feb 12 and module-level tuning Feb 23.

Concerns & Actions: ACCEL was able to overcome the technical and schedule setbacks reported last week. At our management conference call this week, they reported that brazing of Module 4 would start Feb 10, and there is no change in the forecasted delivery of Module 4 (the final CCL module), which is scheduled for April 8, 2004.



Fig. 1. CCL Module 2 (right) nearing completion and Module 3 (left) being mounted in assembly hall at ACCEL

PHYSICS & DIAGNOSTICS (WBS 1.4.5)

Accomplishments: (1) *BPM electronics:* Thirty-five more BPM chassis were assembled and are ready for software download. Ten of the new PC board risers to correct the timing problem were installed, and these 10 chassis were shipped to ORNL this week. (2) *Wire-scanner electronics:* Assembly of the RTBT chassis continues with projected finish date at the end of February. (3) *Wire-scanner pickups:* We have now received four of the eight CCL actuators, and they are undergoing tests. The vendor will ship the remaining four CCL actuators next week, along with the prototype 8-inch (HEBT, Ring) and 12-inch (RTBT) actuators. (5) *RTBT harp:* Machining is underway on the strong back and HV planes. We received two quotes for the ceramic signal cards and will place an order with the successful bidder next week. (6) *Transition-region beam stop and wire-scanner vacuum boxes:* We received final approval from an ORNL review team this week and released the production order for the TR beam stop (the TR beam box was released last week). We documented proper mounting and cycle life of the formed bellows for this beam stop.

PROJECT MANAGEMENT (WBS 1.4.5)

Accomplishments: (1) Los Alamos SNS Division will disband in 56 days, and we are working with SNS-ORNL on closeout issues. This week we completed contract novation for the Dynapower HVCMs and the ACCEL CCL cavities. We continue to work on novating the contracts for E2V klystrons, Dynapower SCR controllers and substations, and ZTec HVCM controllers. (2) The ORNL-LANL memorandum of agreement (MOA) has now been approved by both SNS and LANSCE and is pending final signatures by the two Lab directors. (3) We briefed LANSCE group leaders this week on commissioning support for SNS and are working on a list of proposed personnel to submit to ASD. (4) We scheduled a handoff review by ASD and LANSCE for March 3.

ASD/JLAB: Cold Linac

Processing cavities has resumed. HB-07, -09 and -10 have all been processed. HB-09 and -10 are under test at 2.1 K. Both have substantial field emission, but it appears that they will process up to meet specification. Based on this result, assembly of the M-10 string is scheduled for next week.

The M-8 cryomodule is ready for installation in the cryomodule test facility vault.

The M-9 cryomodule assembly has progressed to the point of insertion into the space frame.

In light of vendor bankruptcy and QC problems, an end can qualification/repair facility will be put into operation in the Test Lab next week.

The follow-up close-out of the October cavity production review was successfully completed.

ASD/BNL: Ring

Half-cell #20 was shipped to SNS/OR this week. Work continues on the assembly of HC units #21 and 22.

Talks were presented to the Diagnostics Advisory Committee (DAC) Review held at BNL on Feb. 5 and 6. The focus of the review was on systems status and equipment handoff. Tom Shea, Norbert Holtkamp and Mike Plum were at BNL.

Equipment that has been packaged for shipment to an outside paint shop (while en-route to SNS/OR) includes: 30Q stands, assembly equipment for IP mounts on the 21Q40/27CD30 assemblies, grout plates for three Ring collimators, support assemblies for R2 and R3 collimators. The momentum collimator assembly, which is also ready for shipment, will be sent directly to SNS/OR since it does not require any painting.

IE Power (PS vendor) has three (3) 185A power supplies and two (2) 390A power supplies that are ready for shipment to SNS/OR. The plan is to deliver these magnets with the injection bump power supply after its heat run (now in progress) has been approved. ETA for all six units is ~ 2 weeks.

Digitizer cards (placed via an emergency order) were received at Oak Ridge.

Testing of BCM electronics in the A10 house (AGS) continues.

Vendor bids for the Lambertson magnet are being evaluated. BNL and OR engineers have made arrangements for a pre-award meeting with the low bidder.

Preparations are underway to begin tuning of the first production PFN. ASD's Ken Rust will witness and assist the BNL team.

Jim Alduino (BNL/SNS) is working with the Project Office to facilitate a second transfer of "mature" electronic files to Oak Ridge.

The 30Q test station (for magnetic measurements) is again available for quad testing. Plans are underway to initiate testing of the 30Q44 magnets next week.

Controls

The controls Group this week hosted an EPICS Training Course presented by Bob Dalesio and Kay Kasemir of the LANL Team. The course was attended by sixteen participants representing several different ASD Groups. Feedback was very favorable.

At the conclusion of the EPICS course, and to a larger audience of stakeholders, Kay Kasemir demonstrated the current status of the new Channel Archiver which will be put in service at SNS – probably for the CCL Run. This tool is scheduled for delivery to SNS on March 1. IT was announced at the beginning of this discussion that Kay Kasemir would be joining the SNS team at Oak Ridge on June 1.

Meetings were held with the management of the controls team at LANL to prepare for a March 3 review of SNS controls work remaining at LANL after the closure of the LANL SNS Division on March 31. The ETC was updated and a revised and updated list of deliverables was agreed at this meeting.

Numerous discussions were held to decide on the most appropriate flooring material for the CLO Central Control Room and computer equipment rooms. Compromises satisfactory to all parties have been reached. Estimates were obtained for two types of control room consoles. The preferred design somewhat exceeds the current estimate available in the WBS 1.9 budget.

A re-analysis of Davis-Bacon costs for installation and termination of controls communication cables confirmed current experience that costs will be 50% over MPM estimates. This analysis was presented at the weekly Division Director's Installation Meeting. A strategy of reducing this cost by purchasing pre-terminated cables is under

discussion, but will not by itself yield adequate savings to compensate for anticipated overruns. The possible effect of other approaches will be evaluated.

An advertisement for a Field Programmable Gate Array (FPGA) programmer was placed this week. This person will be in the Controls Group, but work on the approximately 50 different gate array designs in use by the Controls, RF and Beam Instrumentation systems.

Interfacing of the Front End Test Stand to the control system is approximately 80% complete. The LEBT remains to be done. The Ion Source operated using the control system for approximately 41 hours without a problem. Almost 24 hours of that time was at 3 percent duty factor - the rest of the run was at 2 percent. The availability of the archiver proved valuable for diagnosing the cause when the plasma died. The principle Ion Source engineer appreciated and benefited from his new capability to monitor the status of the source from home.

Separate video conferences were held with partner lab collaborators to discuss requirements for sector gate valve control and the standardization and configuration of power supply interfaces. At the latter meeting BNL agreed to convert the magnet ramping/cycling software to EPICS R3.14.4.

A two day review of BNL beam diagnostic group status and schedule was held at BNL. Larry Hoff presented status of BLM controls, and of controls support for NAD-based systems. The preliminary review committee report indicates little no impact for controls. The issue of fiber optic vs. copper for timing distribution (currently not in scope) was discussed as a critical path item for development of BCM and BPM electronics. Two Beam Loss Monitor (BLM) IOCs were shipped to ORNL. One is the second DTL BLM IOC (DTL-2). The second is for use by the Diagnostic Group for laboratory tests and ion chamber calibration.

Installation

Craft Snapshot 2/3/04

ASD productive craft workers	56.0
Foremen (Pd by 15% OH)	7.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	63.0
Less WBS 1.9, 1.2 etc	7.0
Less absent	4.0
TOTAL PD BY ASD/ORNL DB WPs	45.0

Operations Group

Received Test Plans from

HVCM

Ion Source

LLRF

Magnet Power Supplies

Anxiously awaiting the rest.... Eg. Diagnostics, HPRF, vacuum,

Participated in the investigation of the RF incident last week

Working with Stuart and Ricky on CM testing in the tunnel in June and looking at different scenarios for enclosures for CCL Commissioning with lower impact on SCL installation and testing.

Working with Irina on radiation calculations for commissioning.

DTL 3

CCL

Full Linac.

Working on a seemingly endless list of issues related to the CLO:

Office/Cubicle assignments

DI in the CLO
Flooring in Control/Target control/Equipment/IT Rooms

Working on Action Items from last ARR.

Completed the Update of PPS Phase 0.4a certification, sweep, access procedures and did a test certification

Working on the implementation of the CMMS

Procedure for trending beam loss and radiation survey data.

Reviewing and validating Operation Procedures, assuring that they can be performed as written.

Fine tuning the Web Based Interlock Bypass database system

Accelerator Physics

Analysis of scenarios to test cryomodule(s) (at least one) in the tunnel in the April-May time frame is continuing. A preliminary schedule has been prepared with all the activities which would lead to the decision to proceed with preparation for the test. One such activity is the testing at 4.2K of one of the cavities of MB08, which will be cooled down next week. A draft test plan is ready which addresses the issues of testing the cryomodule at JLab in the second half of February. All of the integration issues of testing a cryomodule can be addressed during the 4.2 K test, except for the Q_0 , which will be about $7.5 E8$. A moderately sized pump could bring the temperature down to 2.6 K, where the Q becomes equal to the design value of $5 E9$. The maximum field performance should be independent of temperature, as long as nonlinear heating effects within the pulse length become significant. The test at JLab will clarify which pulse length and repetition rate are adequate to reach the nominal field of 10.5 MV/m.

I don't know if it is premature to report about the SRF facility. In any case, we have a blueprint of a Proposal which is based on a minimalist approach focused on cavity performance and not on elaborate facilities. Use of surplus components for the cryogenic system will limit the costs. If you need more details, please let me know.

15 EPAC abstracts were submitted from the AP group

The HEBT database entry for beamline devices is nearly complete. The connection between the database and online model is working, producing beamline optics that agree with MAD output. Likewise, a MAD output file has been written from the database and agrees with design.

Magnet hookup information was specified for the HEBT and provided to the electrical group to allow power supply hookup to proceed.

Two PSR benchmarking studies show good agreement with observation: i) longitudinal instability due to the PSR inductive insert and ii) single turn linac bunch decoherence/recoherence in the ring.

V. Danilov is working on HEBT optics knobs and software

Ion Source Group

Since Friday morning, the ion source on the hot spare stand is running with a 6% duty cycle, delivering an averaged pulse current in excess of 40 mA. The full duty cycle was reached after running 2 days at 4%, 2 days at 3%, two days at 2%, and 4 days at 1%, although not consecutively. The ramp up period included prolonged downtime to allow for the installation, testing, and shake down of controls equipments. The ramp up period also includes the previously reported 4-day run with a duty cycle up to 2% without a single random trip.

We assist in the analysis of FNAL front end emittance data as an extension of the emittance analysis taught at USPAS.

We have submitted 2 abstracts to EPAC-04.

Two ASD staff members (1 from controls and 1 from ion source) underwent total hip replacements. The hardware upgrade became necessary after the lifetime of the original part expired prematurely. The installation went as planned, the shakedown is a little more painful, and the full commissioning will take a little longer, just as we experienced with the front end. An unintentional side effect is the increased rank of minorities, as the ASD division now has a minimum of three bionic Americans, well, partly bionic Americans.

Survey and Alignment Group

Processing continued on the Linac tunnel re-observation campaign (data consistency checks). Work began on establishing best-fit horizontal and vertical datum.

Leveled the Warm Section Stand Base Plates. Additionally, we leveled several Cryo module base plates which were postponed from our initial campaign.

Completed the calculations for the layout of 100 additional floor bolt holes in the upper and lower straight section of the ring.

Received from BNL data for eight additional half cells. We are in the process of analyzing the data and translating it into the ideal coordinates for the actual setting of the half cell assemblies into the Ring.

Completed the fiducialization of two additional CCL Magnets bringing the total fiducialized to twenty-eight. Additionally fiducialized one additional 21Q40 Magnet bringing the total fiducialized to nine.

S & A "as-built" the chopper cavity and bulk shield liner flange for instrument beam line 11. We also located some points on beam line 11 that the beam line scientist/engineer requested.

Completed alignment of DT5. We are presently in the process of re-observing the alignment of DT3.

Mechanical Group

Water Systems Installation

- Installation of DI water piping on SCL ME-03 continued.
- Installation of DI water piping from the facility to the SCL ME-04 TRCC7 cart was completed.
- Installation of DI water piping from the facility to the SCL ME-04 TRCC8 cart was started.
- Installation of DI water piping to the CCL-2 RF loads and circulators was started.
- Fabrication and installation of the QMCS manifold in the Linac tunnel continued.

Ring Systems Installation

- The RING Half-Cell #19 was received and staged in the tunnel.
- The RING Half-Cell #20 was received and staged in the tunnel.
- The Half-Cell lifting fixture was received and trial connection to the crane.
- Installation of the Arc C Half-Cell support stands was started.
- The RING Collimators #2 & 3 exterior shielding was received.
- A mockup connection of the DC cable to 12Q45 magnet buss was installed.
- Final flushing of the RING Systems' DI cooling loops by the installation contractor continued.

CCL-1 vacuum system installation is progressing and is expected to be complete in ~2 weeks.

CCL-2 module leak testing at ACCEL is complete. Shipping will begin on February 13 the module will be delivered to ORNL on February 16.

CCL-3 segments have all been stack brazed and are being set on the support stand. Delivery at ORNL is still planned for mid March.

Magnet Task

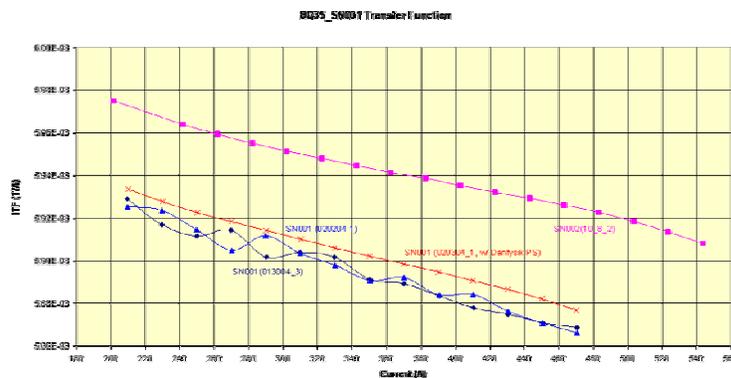
Attached are photographs of the CCL Intersegment assembly and lifting fixture. These parts were provided from LANL last week and assembled here this week. The fixture will be used to assemble CCL intersegments into the CCL Quadrupoles. We have assembled one Quad into the fixture, and added magnet "feet". The 47 intersegments also arrived from LANL and will be leak checked by the Vacuum group and then loaded into magnet assemblies prior to installation into the CCL.



We also mapped three CCL Quads this week.

We also mapped another 21Q40 and now have three that match within 0.1% and two that match within 0.1%. We need two sets of four each for the HEBT.

We also finished mapping the 1st article SCL 8Q35. We tried using an SCL 8Q35 power supply which didn't work well. The power supply was too noisy (0.2%). So we had to switch to another supply.



Electrical Group

Power supplies for the DTL 3 EMDs were connected to the magnets and checked out and are now operational. The power supplies have been turned over to the Controls Group for integration into EPICS. These EMDs, unlike those in DTL 1, have the correct thermal protection interlocks installed.

Work on rebuilding SCL-ME1 and DTL-ME1 modulators has been the primary activity this week. Reapplication of heat sink compound to the switch plate assemblies and modification of the driver card to reduce the driver turn-on and turn-off delays are in process. We have investigated the DTL-ME1 transformer assemblies for evidence of melted spacers between the primary and core (as experienced at LANL), and found none. However, the assembly is

such that this problem is likely to occur at higher average power operation. We are calculating plenum oil flow rates and will modify the design to ensure adequate cooling around the transformer. We expect to have the unit ready for operation by the end of next week.

We continue to take data on the DTL-ME3 modulator to investigate IGBT recovery phenomenon, a possible contributing factor to the SCL-ME1 failure of a few weeks ago.

HPRF

LLRF

Irene DeBaca, Mark Crofford and Mark Champion will travel to Suntron next week to perform first-article inspection on Friday, Feb. 13.

The cross talk between the FCM motherboard and the RFO daughterboard has been eliminated by means of a shield, essentially a ground plane, installed between them. This has been tested on the bench on two FCMs; one of these will be re-installed in CCL1 next week.

We performed phase noise measurements on an FCM at ORNL this week with remote assistance from Larry Doolittle. The results confirm the measurements he made recently at LBNL. The data is under analysis.

Hengjie Ma will attend a Verilog training course next week in San Jose. He will spend two days working with Larry Doolittle at LBNL the following week.

Craig Swanson will be working with Larry Doolittle at LBNL next week.

We are scheduled for LLRF testing at JLab beginning Feb. 25 (one day earlier than stated last week).

Cryosystem Group

The purifier has been operating on gas storage tanks 6, 7 & 8. Tanks 6&7 have been cleaned and tank #8 is in the purification process. The purifier had to be shut down for this weekend due to power outages on the 480Volt supply to the CHL.

Work has started installing the piping to the cold compressors. A leaking connector and a spare connector from the cold compressors have been sent to JLAB for analysis.

The oil purifier processing station that was purchased from PHPK arrived and is being installed.

Work continues on installing the instrument tubing on the warm gas piping in the tunnel. The final pressure test of the transfer line was accomplished today.

The remaining parts for the cold box "U" tubes have been ordered. The craft people assembling cryomodule "U" tubes have been temporarily re-assigned to installing the cold compressor piping in the 2.1K cold box

Beam Diagnostics

The Diagnostics Review Committee met at BNL this week to review progress on the Ring diagnostics.