

## Accelerator Systems Division Highlights Ending September 12, 2003

### ASD/LANL: Warm Linac

September 5, 2003

#### HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) The 96-hour heat run for DTL klystron S/N 8 has resumed because we now have two converter modulators working. We have about 15 hours remaining. DTL window testing will resume after we finish the klystron heat run. (2) We received an updated schedule from E2V for the remaining three klystrons' factory acceptance tests. S/N 5 is scheduled for Oct. 2003, S/N 11 for Nov. 2003, and S/N 7 for Jan. 2004. (3) We witnessed factory tests and accepted the 9<sup>th</sup> (of 14) SCL transmitter. (4) We are waiting to receive a new bracket for the vac ion pump connector for CPI SCL klystron S/N 31. S/N 32 and 33 are in bakeout at CPI.

Concerns & Actions: The Thales 5-MW klystrons for the CCL remain our most important issue. The Thales klystron engineer is at LANL to help us work through the arcing issues. We achieved 3.25 MW RF output with a 1.35 msec high-voltage pulsewidth and 1.25 RF pulse width, but on the next day observed arcing at 4 MW and short pulse widths. Arcing was observed on the miter flange between the miter and the straight section. We plan to move the Kapton window 18" further away from the klystron, helium leak check the SF<sub>6</sub> circuit, and face off the o-ring groove on the WR975 waveguide side of the taper. We will make this a flat flange and use a Parker seal. After these modifications testing will resume.

#### HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) High-voltage converter modulator (HVCM) production units 14 and 15 (of 17) were delivered to ORNL. Unit nos. 16 and 17 will undergo factory acceptance tests at Dynapower the week of 9/15; LANL personnel are reviewing subsystem performance data and will witness tests. (2) We ran the prototype HVCM with the repaired prototype SCR controller to produce a 135- kV, 70.5-A pulse with a width of 1.35 ms at a rep rate of 60 Hz for over 13 hours without an SCR controller related trip. This implies a peak power of 9.5 MW and an average power of 770 kW. (3) We also ran the production HVCM and SCR controller to produce a 125 kV, 36-A pulse with a width of 1.35 ms at a rep rate of 60 Hz for over 21 hours. This implies a peak power of 4.5 MW and an average power of 365 kW. (4) We continued to revise and add drawings to the HVCM drawing package to properly document how equipment was assembled at Dynapower. (5) We worked with the HVCM control rack vendor (ZTEC) to get source code for DSP voltage regulation routines in the IGBT control chassis to allow us to begin modeling of system with feedback/feedforward. We also continued to work with the LANL EPICS group and ZTEC to attempt to communicate with prototype IGBT control chassis via the computer interface.

Concerns & Actions: The SCR controller repairs reported last week appeared to have held, so we directed Dynapower to resume shipments of the remaining SCR controllers to ORNL. (2) A phase diagonal IGBT pair failed on the LANL production HVCM on 9/5. We suspect that the problem is related to the oil tank internals, *e.g.*, shorted winding or buss work arc. The new the polycarbonate divider sheets prevented the fault from propagating to other switch plates. The physical damage was modest.

#### DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments - Tank-2: Group J magnet installation and cap welding is underway. Stress relief of all units is complete. Waveguide machining is complete and the unit has arrived back in Los Alamos for final leak checking and cleaning.

Tank-4: Final profiling is complete on groups A, B and C and continues for a portion of group D. Numerous failures of drift tube bore plugs were experienced; this prompted an additional cleaning of all tank four PMQ drift tubes. New bore plugs of a simpler, more robust design are being fabricated and will be used during all future machining.

Tank-5: Water channel weld repairs and cap welds at Hanford are on hold due to an e-beam welding machine failure and personnel availability. The component required to repair welding machine arrived and is being installed. Machine check out and resumption of production welding is expected on 9/8.

Tank 6: (1) All drift tubes are ready for weld repairs and cap welds; they are in the queue at Hanford behind tank-5 drift tubes; welding is expected to start 9/15 and finish 9/19. (2) Waveguide is at CMI for final machining

Tank 3: The waveguide is at CMI for final machining.

EMD and BPM DT's: Final profiling of EMD DT 6-12 is complete and EMD DT's 5-13 and 6-18 are in the last stages of final profiling. The parts for the BPM DT's for tanks 2 and 3 arrived; efforts are being made to ensure

these units will be ready for next week's welding campaign at Sciaky. All other units are at Sciaky waiting welding or weld repairs during next week's campaign.

Beam Boxes: Box 3/4 and some associated intertank components have been dispatched to Oak Ridge. All inter tank hardware is accounted for: it exists, is ordered or is being manufactured.

Issues and Concerns: Repair of the Hanford e-beam welder is impacting delivery schedule of DTL tank-4, 5, and 6 PMQ and empty drift tubes. Qualification of ESCO to do the remaining tank-6 drift tubes (as a back-up option to Hanford welding) is underway. (2) Shutdown of stem welding capability due to personnel availability at Scientific Sales next week will require additional efforts later to maintain schedule. CMI indicates that they can regain schedule loss through other operations.

#### COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) J. Stovall and J. Billen are at Accel since 9/1 to oversee tuning activities. The segment tuning plan is complete. Excellent progress with the bridge coupler tuning plan was achieved, but it needs to be written up and approved. Completion of the module-level tuning plan is several weeks away.

Concerns & Actions: ACCEL delivery schedule for Module 1 is being driven by the tuning activities; it is now forecast for early November. More troublesome is the manufacturing schedule for the last module delivery which is now forecast for mid-March. This unit is needed to be delivered to ORNL on 1/31/04 to support the 5/17/04 commissioning start date. A letter requesting a resource loaded plan was sent to ACCEL by the LANL procurement specialist. ACCEL, LANL, and ORNL management had several discussions this week to clarify schedule requirements, and roles and responsibilities.

September 12, 2003

#### HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: Significant improvements were achieved with the 5-MW Thales klystron for the CCL, but performance is still not completely satisfactory yet. The Thales representative remained at LANL for a second week to help us resolve arcing problems. We replaced the copper gasket near the alumina window, replaced all the rings sealing the SF<sub>6</sub> at that joint, helium leak checked the SF<sub>6</sub> circuit, moved the Kapton window 16" farther from the klystron, installed air cooling on the straight section in the lead, faced off the flange between the miter and taper, and installed thermocouples to measure the waveguide surface temperature in the lead. We started re-testing, systematically increasing RF output power and pulsewidth to 4.75-MW and 1.1msec, respectively. The tube ran for 1-2 hours at 5-MW RF output at 60 Hz and 1.1-msec pulsewidth (1.3-msec beam pulse) before arcing started. Decreasing the RF drive did not extinguish the arcing. We took the transition apart and found arc damage at the RF joint between the straight piece that attaches to the klystron alumina window and the mitered bend. From inspection of the flanges, one could infer that there was inadequate quality control by the manufacturer or flatness requirement on the flanges. We will attempt to have both end flanges faced and made flat over the weekend. Our Thales visitor has extended his visit to a third week.

#### HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) Dynapower is ready for acceptance testing of the final two HV converter modulator (HVCM) units starting 9/15. T. Hardek will travel to Dynapower on Sunday to support these tests. We reviewed and approved factory acceptance test results for IGBT assembly S/N # 41. (2) The prototype HVCM at LANL operated without failure to support the full peak and average power testing of the 5-MW Thales klystron.

Concerns & Actions: The production HVCM unit at LANL that lost IGBTs (reported last week) was repaired and brought back into operation. We diagnosed the problem of blown traces on the circuit card for the bias circuit on the IGBT assemblies. We inspected all bias circuit cards for blown traces and replaced traces with wires as necessary. We addressed potential design issues, and performed extensive gate drive testing on IGBT assemblies to identify and correct any wiring errors and poor connections. We inspected all water cooling hoses on the IGBT assemblies and replaced hoses that had restricted flow caused by kinks with insufficient length. We established a safer and more efficient *in situ* gate drive test procedure.

#### DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments - Tank-2: (1) All group J drift tube cap welding is done and profiling is underway. First three K group cap welds are completed; the next five are at cleaning and then will be welded on 9/15. Group L & M body cavities were bored but details are not complete. (2) The waveguide iris was shipped to ORNL.

Tank 4: Welding resumed at Hanford and last members of group D were welded and shipped to CMI for final profiling. Final profiling is complete on groups A, B and C and most of group D. First batch (30 units) of new drift tube bore plugs of a simpler, more robust design were completed and put into service; second batch (55 units) will be complete today. Group A, B, C and some of D will go to stem welding next week – group A and B will likely be done but C and D probably will be “bumped” by tank 2 units (higher priority). Tank-4 shipping dates slipped due to lack of stem welding capability and likely conflict with tank two drift tubes.

Tank 5: (1) Cap welds were finished on group G units. Due to problems with tank 6 end cap fit up, welding will be done next on E and F’s water channel weld repair and end cap welds.

Tank 6: (1) Our original plan was to weld drift tubes after the last tank-4 units were complete but this is on hold due to cap fit-up problem with the tank-6 drift tube end caps; 0.004” gap all way around is observed at the joint. We are now reviewing inspection reports and drawings to locate possible source of the interference causing the gap. (2) Qualification of ESCO to do tank-6 end caps welds was underway, but work was stopped to inspect the unit (showing same gap as units at Hanford) by CMM. Inspection of the parts shows that a corner fillet radius being out of tolerance caused the fit-up problem. Radius will be fixed at Hanford and ESCO with end cap welding to follow. (3) Waveguide iris is at CMI for final machining

EMD and BPM DT’s: EMD drift tubes 6-12, 5-13 and 6-18 were shipped to Albuquerque for final inspection. Welding of EMDs (Tanks 1, 2 and 3) at Sciaky was to be completed and welding of BPMs (Tanks 2 and 3) was started.

Concerns & Actions: (1) EMD 1-55 developed a short circuit between the coil and ground during the next to last welding step. This unit was shipped to LANL for inspection and evaluation of the failure. It will then be sent to ORNL for mapping of the magnet to determine if the unit can be put into temporary service. A spare stem is on hand and the SNS-1 shop is now making body components for a spare unit. A replacement magnet is due to be shipped from Milhous next week. The replacement 1-55 unit could be ready by 9/30 for the first e-beam weld and fully complete perhaps on 10/28. (2) There is a conflict for stem plating resources between tanks (including EMDs and BPMs); we are looking for ways to shorten required time and improve vendor’s response.

#### COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) J. Stovall, J. Billen, and C. Deibele were at ACCEL for a second week to refine the bridge coupler tuning procedure. It is now at the level to transfer to ACCEL. The plan will also be externally reviewed next by L. Kravchuk and Y. Kan.

Concerns & Actions: (1) Commitment and performance by ACCEL staff (a concern over last month) is markedly improved. ACCEL staff is now leading the tuning effort. (2) We remain concerned about the Modules 3 and 4 manufacturing schedule. A resource-loaded schedule is being developed by ACCEL and will be reviewed by LANL at our daily conference calls next week.

#### **ASD/JLAB: Cold Linac**

#### **ASD/BNL: Ring**

Activities for the week ending September 5, 2003

Half-cell #12 was shipped to SNS/OR this week. Half-cell #11 remains at BNL for testing of handling and lifting fixtures.

Installation drawings of the HEFT collimators were reviewed, approved and signed-off. Electronic copies are being sent to ASD.

Engineers traveled to APS (Hicksville, NY) to inspect progress on the extraction kicker PS. Acceptance testing will begin within two weeks.

Our Vacuum Team is coating the last two ceramic chambers for the Injection kicker magnets. Next will be the RF vacuum chamber and the Ring #2 and #3 collimator vacuum chambers.

Field measurements continue at all three test stations. In progress are Chicane #2, 36CDM30 (last two) and 21S26 (~50%).

SDMS is packing vacuum chambers for delivery to BNL. They are the collimator (Ring 2 & 3) chambers and the injection dump septum chambers. The collimator chambers will be TiN coated at BNL, and then returned to SDMS for final assembly.

Tesla reported that three more 21Q40 magnet stands have been completed. We are working with them to arrange special delivery of these stands to SNS/OR in time for HEBT installation.

Alpha Magnets is closing down their 21S26 and their 41CDM30 production lines. Their attention is now on the 26S26 production magnets, the first of which is due to be shipped to BNL on 9/20, followed with a production rate of 2 per month.

Oak Ridge Tool and Engineering expects to receive the steel for the collimator Outer Shielding (HEBT momentum collimator) next week. Delivery of the final product to SNS/OR by ~10/1 is likely.

Preparation is underway to ship an RF cavity, PA and PS to SNS/OR before October 1.

Roger Connolly is preparing a Tech Note on "The SNS IPM Focusing Magnet and Correctors" where he reevaluates the magnet field requirements for the SNS IPM.

Meeting notes from last week's engineering review of the extraction Lambertson magnet were sent to ASD.

Activities for the week ending September 12, 2003

ASD's Tom Shea was at BNL this week to meet with the Diagnostics Group.

RTBT Coll #1 (from SDMS) arrived in port at Georgia and released for overland transport to SNS.

Eight 21Q40 magnets (with box of hoses) were shipped to SNS/OR from BNL (these are the first eight magnets from the Ph II production run).

At the request of ASD, we have authorized Tesla to ship three more stands needed for installation of the 21Q40 magnets. ETA is 20 days.

Jon Sandberg sent a memo to Roy Cutler outlining the BNL cooling requirements and his specific concerns about reduced cooling capacity in the Ring Service Building.

Outer Shielding for the HEBT Momentum Collimator - Oak Ridge Engineering and Tool has all material in house. This job is now in progress. We will work with ASD to arrange for a local inspection during the vendor's assembly process.

We finished measuring the 26Q40 #3 after the pole tip misalignment was repaired. AP reported that the ITF after this repair is almost exactly the same as it was before the repair. The repair did not upset the shimming that had been done in three of the 26Q40's. The repair did, however, improve several of the harmonics that were quite large initially (normal and skew sextupole, normal octupole). So, correcting the misalignment has proved to be very beneficial to the field quality.

Installation drawings of the HEBT collimators were sent to ASD.

The Diagnostics Group continues to refine their list of recommended spare parts (PCR).

Measurements of Chicane #2 are complete and the magnet accepted.

Chicane #3 arrived from NETC; set-up is underway at BNL for magnetic measurements. Chicane #4 was returned to NETC for repairs.

SDMS reportedly shipped Ring collimator #2 & 3 vacuum chambers to BNL for TiN coating. (The chambers for the injection dump septum magnets were shipped too.)

Alpha Magnets shipped their last two 21S26 production magnets to BNL. Work on the 26S26 production magnets is underway (the first production unit is due ~9/18).

## Controls

### 030905 Controls Weekly

After delivery of first beam last week, the controls team was very active this week in operational support. Although the control system is running remarkable well, there are a number of small bugs and annoyances that need attention, and much time was devoted to these this week. This will indeed continue to be our main occupation for the duration of the run.

The largest single issue is operation of the Resonance Cooling Control System which continues to be problematic. A small task force with representatives from Physics, RF and Controls was struck to investigate this problem and propose solutions.

The first maintenance day of this run was used by the controls team to make some minor changes. In response to a channel access security conflict the diagnostics and low-level RF timing function for the front end were separated onto two boards in separate IOCs. Some logic was changed in the vacuum IOC to assure safer operation.

Yury Eidelman extended his visit for a second week to continue work on the Alarm Handling tool. He gave a training talk on the alarm handler to the controls operational support team, correctly noting that the primary reason for its not being useful at present is because of the very large number of anomalous and temporary conditions under which we are operating, which result in a sea of red on the alarm handler screen which in turn make the truly anomalous conditions difficult to find. It was agreed that a very small subset would be created for demonstration purposes. By the end of the week, using part of the vacuum system as an example, that system was ready to demonstrate. This exercise is also helping to ferret out previously undetected database errors.

The ramping algorithm has been used by operator for the MEBT quadrupoles. Progress was made on the implementation of controls for the magnet test stand. The D-Plate magnets have also been operated from the control system power supply screen. The EPICS control system for the magnet test stand has been set up for the next round of mapping. This will provide both ramping and archiving capabilities. The High Voltage power supplies used in the BLM system have a firmware limitation which previously restricted EPICS record processing to 1Hz or less. Working with the vendor (ISEG) a work-around was developed at BNL which allows 10Hz processing (and EDM screen updates) during normal operation, and only reverts to 1Hz updates while recovering from interlock trips. In addition, a new version of the analog front end (AFE) crate digital interface software was developed. This new version increased the screen update rate from 0.5Hz to 10 Hz. Both of these improvements will be incorporated at ORNL after the DTL-1 run is complete.

Initial checkout of the control system for the Central Helium Liquefier (CHL) Facility Purifier system was completed this week and commissioning has started.

### 030912 Controls Weekly

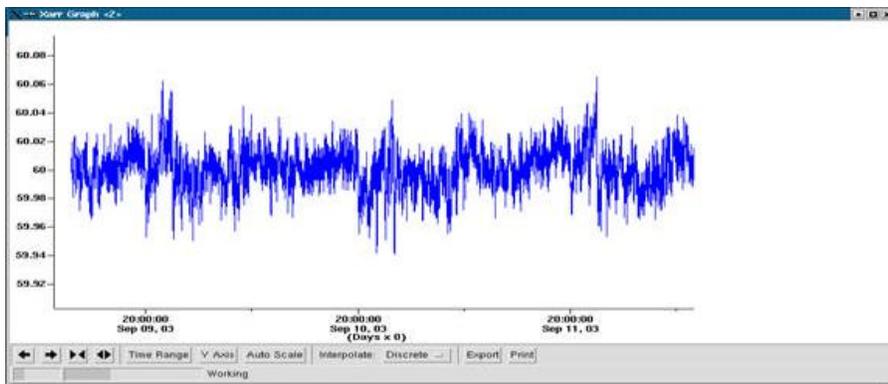
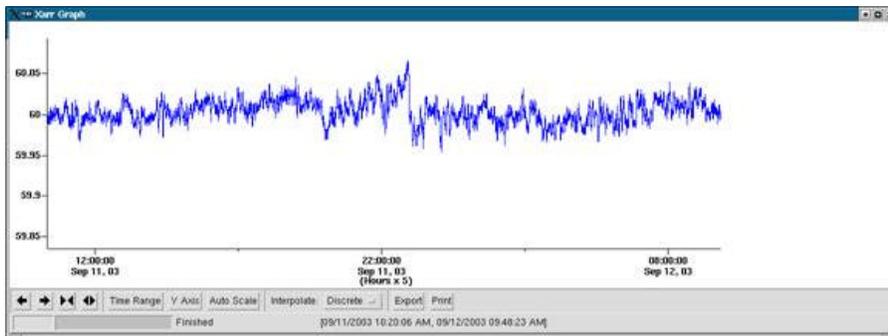
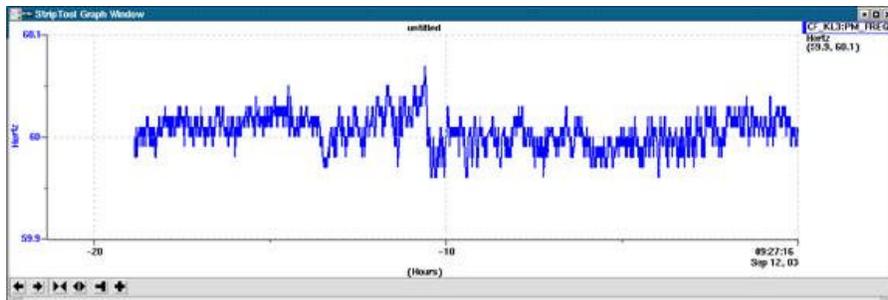
The controls group continued to support the DTL1/D-Plate run this week. On Wednesday, fortunately at a time when the machine was down for other reasons, the control system experienced a catastrophic loss of interprocessor communications. Twelve of 25 IOCs were not communicating with the control room operator servers. There was no evidence of a problem with the communications equipment, and the solipsistic IOCs appeared to be running happily by themselves. Some continued to report to the archiver. Some, but not all, reported that they had exhausted their store of communication buffers. It took a reboot of all twelve IOCs to return the system to normal operation. On the following maintenance day it was possible to reproduce the symptoms, but only by deliberately turning off both redundant backbone core switches – a circumstance that almost certainly did not happen on Wednesday. (In

addition to its improbability, such an event would be detected by the ever-vigilant ORNL communications team that monitors SNS switches.) Analysis continues, but no credible originating root cause has been proposed as yet.

A work order was initiated for installation of communications cabling for the first three SCL rack rows. This is in anticipation of SCL HPRF testing activities to begin in October. Installation of CCL communications cables will continue for another two weeks while other work goes on in the SCL rack area. This work will then shift to the SCL rack area.

An effort is underway to expand our database to support network and IOC maintenance. Tools are being put in place and data from a number of local sources is being uploaded to Oracle.

In response to questions from the ASAC Committee, measurements are being taken on site to characterize the line frequency and line frequency slew rates. The plot below shows the line frequency as measured by conventional facilities power monitor for the front end. The second plot shows the same measurement using the GPS signals and a VME counter module. The third plot shows several days of data and typical daily cycles. The measurements are being taken for Neutron chopper and linac timing studies.



The last of the timing system gate generators was shipped from BNL to ORNL this week.

This was a particularly productive week for the team at LANL. Improvements were made to the Residual Gas Analyzer (RGA) software being developed at LANL for use throughout the entire SNS facility. An RGA test stand has been set up at LANL to validate the EPICS software analysis and compare it with the commercial software provided by the manufacturer. Vacuum system names for the Superconducting Linac (SCL) were modified to conform to the standard. Test boxes have been ordered in preparation for early tests of the SCL vacuum control concept.

Work continues at LANL on support of the new Low-Level RF (LLRF) system. EPICS Channel Access tests on the Field Control Module (FCM) suggest CPU usage problems if there are many clients are accessing waveforms. The resonance error calculation has also been ported to the FCM. The FCM measures the phase of the RF reference line, and uses that information to add offsets to the displayed phases and phase set points for feed-forward and closed-loop operation. This calculation is currently manual, and work is proceeding to determine the best algorithm for automating it.

Superconducting Linac (SCL) High Power RF (HPRF) racks are being assembled and tested at LANL prior to shipment to ORNL. The first two of seven racks are already at SNS – others are being tested with the Tuner (motor-controller) racks. LANL staff will come to ORNL to assist with the first installations. IOC startup files for DTL tanks 4, 5 and 6 were prepared and installed remotely.

Work continued on the power supply application, including ramping, that will be used for both the Linac and Ring. Fiber connections between IOCs and CCL power supplies were verified, and a shunt regulator test was completed at the LANL LEDA facility.

Wire scanner parts are being ordered. The LANL controls team is building the wire scanners and PC boxes for the diagnostic group.

Finally, the LANL team continues to support the application software developments led by the Physics Group at SNS. LANL will explore some performance and memory problems with the existing lattice generator. Many problems stem from the lack of synchronization between the accelerator and the on-line model, which is used in a quasi off-line mode in which a new lattice is built from scratch each time. These problems are compounded by the use of XML as an intermediate representation; the code is slow and consumes large amounts of memory.

### **Installation**

Craft Snapshot 9/9/03

ASD craft workers	60.0
Foremen, ES&H, etc	12.0
Less WBS 1.9 etc	11.0
Less absent	3.0
TOTAL	58.0

The personnel move from RATS I to the 10-Plex was started. A few people and support equipment remain to be moved on September 8, 2003. The plan is for ASD to be completely out of RATS I on or before September 26, 2003.

The second Research Mechanic position was filled. This successfully completes the first phase of the Research Mechanic selection process. The Research Mechanic – Electrical reported for work with ASD on September 2, 2003. The Research Mechanic- Mechanical will report by the end of September.

A review of the management structure for the Davis - Bacon crafts was completed. Discussions on its implementation were initiated with Procurement and the AECM.

### **Accelerator Physics**

The physics group, together with the operations team has been busy with DTL1 commissioning. First beam through DTL tank 1 was achieved Thursday August 28th at 14:00. With a circular aperture placed in the MEBT to reduce

the beam current, a 4mA 30 microsecond beam pulse was transported through tank1 and observed on the energy degrader/faraday cup in the tank 1 beam box. On Sunday August 31, the MEBT aperture was removed and commissioning proceeded with a 15 mA beam transported through tank 1. Comparison of beam current monitors in the MEBT and D-plate show transmission consistent with 100%, that is, measured currents agree within the 5% intercalibration of the BCMs. Acceptance scans using the two Energy Degrader/Faraday Cups in the beam box and D-plate show the expected dependence on phase and amplitude and confirm that the beam is being accelerated.

Much of the commissioning time has been devoted to shakedown of diagnostic systems. At this point nearly all diagnostics in the D-plate are functioning at some level. Emittance scans show RMS emittances which are consistent with expectations, although the emittance data is somewhat noisy.

S. Kim has evaluated the beam pulse length limits on the energy degrader/faraday cups using finite element analysis of thermal stress. He finds the following operational limits. DTL1 ED/FC: 38 mA, 3 Hz, 30 microseconds; D-plate ED: 39 mA, 3 Hz, 100 microseconds.

Applications Programming. The online model has been improved to allow tuning of optical elements with user defined values. The rebuncher phase scan application has been improved to speed up response. A save/restore application has been written and is in heavy use for commissioning.

### **Operations Group**

The main focus for Operations this week continues to be 24/7 Operation, conducting beam commissioning of DTL1.

100% beam transmission (at reduced current) was achieved through the RFQ, MEBT, and DTL 1 to the D-Plate. To support this effort, much work was done successfully commissioning beam diagnostics - Wire Scanners, Beam Position Monitors, Beam Shape Monitor, Faraday Cups, etc. This effort will continue for other diagnostics.

Other systems - MEBT Rebuncher LLRF, RCCS, and Controls - continued to be tested and refined as needed.

During our weekly maintenance day, the CUB PLC software was changed and systems tested, providing a more stable and automatic mode of operation for Tower water and chilled water systems in support of operations.

The response and support received from technical staff, at all hours of the day and during the weekend holiday, was excellent and is much appreciated. It enabled us to maintain progress in commissioning.

### **Ion Source Group**

The 12 kV capacitor bank failed in the QEI amplifier, most likely due to sever external arcs. The entire bank was replaced with the bank from the QEI amplifier on the Hot Spare Stand. The source is running fine again, although the amplifier requires calibration during maintenance day. To improve its robustness we are trying to replace the capacitors with capacitors with a higher rating.

One of us (MPS) visited Dubna to attend the 10<sup>th</sup> International Conference on Ion Sources. The conference was a great success with 217 people attending. We presented two posters, one on the status of the SNS ion source, and one on future developments for the SNS ion source. Both posters received overwhelming interest, preventing the single presenter to visit the other posters shown in the same session. In addition we gave a talk on the self consistent, unbiased, elliptical exclusion analysis for rms emittances, which was received with great interest. We had 40 CDs containing the analysis code, a manual, and a couple of papers. All 40 CD disappeared within less than 2 minutes after they were made available at the front of the podium. Fortunately nobody got hurt. To avoid future stampedes we made the same files available from our website at <http://www.sns.gov/APGroup/Codes/Codes.htm>

### **Survey and Alignment**

## **Mechanical Group**

### Water Systems Installation

Welding of beamline support stands for the HEBT continues.

Installation of SCL-ME1 Piping from TRCC Carts to the first 6 klystrons was completed and pressure tested.

Installation of piping to the CCL-1 HVCM was started.

The RFTF glycol system that provides glycol to the 402.5 loads was drained of water and filled with glycol.

### RING Systems Installation.

Half-Cell #11 was received and staged in the HEBT tunnel.

The RTBT collimator was moved from the RATSII building and staged in the HEBT tunnel.

Cable pulling from in the HEBT tunnel continued.

Cable tray installation in the RING Service Building continued.

Finished welding HEBT diagnostic and beam pipe support stands.

Survey is in the process of surveying HEBT Quads Q20 thru Q30.

We moved a section of pipe around the HEBT momentum collimator in preparation for its installation.

We have finished installing waveguide thru HB-8 with the exception of water loads which will be done on Monday.

## **Magnet Task**

### **Electrical Group**

Started checkout of CCL-ME1. Started cabling work on CCL-ME2. Finished wiring upgrades on safety enclosures through CCL-ME4. Upgraded PLC for security access control and SCR units on DTL-ME1, -ME2, -ME3, and RFTF. Began measurements of switching losses on RFTF-ME and surveyed beamstick radiation. Started testing support for CPI 805 MHz klystron in RFTF. Finished functional design for HVCM cable interlock/bypass scheme, which will be reviewed internally next week.

### **HPRF**

### **LLRF**

#### DTL1 Commissioning

- The LLRF Team has spent much time and energy over the last few weeks supporting commissioning of DTL1. We have been cleaning up user interface issues and continue to make operational improvements.
- The MEBT rebunchers have been receiving attention, both the LLRF systems and the power amplifiers. This week it was determined that the 40 MHz "timing" signal was a significant source of noise. A lab grade frequency synthesizer was installed as a temporary solution.

#### New Hardware Development

- The Rev B VXI motherboards have been received and tested at LANL. The new DFEs and RFOs are due at LANL from production at the beginning of next week. Two systems will be sent to ORNL, one to LBNL, and two retained at LANL.
- One of the prototype FCMs has been installed in the DTL3 RF system. Re-conditioning of the DTL3 tank is in progress using the 2<sup>nd</sup> generation LLRF control chassis. The FCM will be tested with DTL3 after the conditioning is complete early next week. After successful testing of the FCM on DTL3, we plan to perform a test of the FCM on the RFQ with and without beam.
- The Bills of Material for FCM production have been given to ORNL Procurement to be sent out for bids. We plan to order all FCM parts within the next few weeks.

#### Production of 2<sup>nd</sup> Generation Control Chassis for Remainder of DTL

- The remaining DTL chassis are undergoing testing at LBNL. The digital boards were checked out this week. Testing of the PLLs is planned for the coming week.

### **Cryosystem Group**

#### **Beam Diagnostics**

##### LANL Beam Diagnostics Progress Report

BPM pickups: The final weld step underway on the BPM drift tubes. Assuming this is successful; we will install the cables, map the pickups, and complete the documentation for these units, completing all BPM pickup deliverables.

BPM electronics: John Power remained at ORNL for a second week in the hope of seeing operation with beam, but he had to leave before beam through the DTL was achieved on Thursday. Nevertheless, the fixes to the 805-MHz AFEs reported last week are deemed to be successful, and all AFEs are now operating well (the three 402-5-MHz units on the D-Plate had not failed, as the vendor Bergoz had made a design change on these units). Unfortunately we are still seeing failures of the DFE circuits that appear to be related to this last production run of circuit boards. John has brought four units that exhibit this problem back to LANL to be diagnosed and fixed. We will have ORNL ship back the four unused PC chassis to LANL so we can fix and test the entire systems before returning them to ORNL. At present there are two new systems and four old systems installed and operational in the MEBT, along with two new ones in the D-plate. There is one operational old unit as a spare. While at ORNL, John also modified the software on the BPM electronics to fix a startup bug that had required operator intervention during the turn-on phase.

WS pickups: Pete Cameron's evaluation of the beam clearance requirements for a halo scraper mounted on the WS fork in the ring is that we can make things work with the 8" stroke actuator. Therefore, we will proceed with the actuator order as planned. Worst case will be that we fall back to using the wire for the halo measurements.

WS electronics: We completed the front and back panels for 26 (of the 36 remaining) driver chassis. All 36 National Instruments stepper-motor drivers for these chassis are on order. Testing will begin next week on the linac and HEFT WS electronics. We need to confirm with ORNL the proper gain setting for these units from operational requirements. We also need to confirm with ORNL their requirement for wiring diagrams.

Energy degrader/Faraday cups: The five remaining ED/FC assemblies are being assembled at the vendor IMC in Albuquerque. Ninety-five percent of the parts are on hand, and scheduled delivery date to LANL is Sep 30. This should meet the required ORNL delivery dates (see below).

Harps: First articles of the wire crimps were received and tested satisfactorily. The remainder needed have been ordered. We are 50% complete on the harp mechanical drawing package.

Deliverables spreadsheet: Jim Stovall obtained the following "Beam Day" dates from the current commissioning schedule:

DTL-1	28 Aug 03
DTL-3	01 Dec 03 (realistically 31 Jan 04)
CCL	17 May 04
SRF	11 March 05
Ring	01 July 05

Based on these dates, Jim and Craig Deibele developed preliminary "must have" dates for delivery of the BPM electronics. We will integrate these into our schedule at the next update.

#### BNL Beam Diagnostics Progress Report

General: Continuing refinements of the spares PCR

1.5.7.1 BPM: Design of off-board +7V power supply section completed

1.5.7.2 IPM: Design work on the IPM permanent magnet has started. Tech note written on IPM magnet design. Vacuum chamber design continues

1.5.7.3 BLM: Efforts continue on minor revisions to three BNL designed PCBs. Waiting for a designer. First article BLM detector end cap parts have been evaluated and found acceptable from Norpin. Finalizing mechanical drawings to manufacture the AFE chassis enclosure. Updated a version of the detector ATE Lab VIEW VI. This version includes more advanced filtering and data analysis. Sole source paperwork for Ion Chambers is still awaiting approval. The moveable BLM stand was found acceptable by ORNL staff, and we have begun the effort to purchase parts for 18 more units. Preparing sole source justification for Acqiris digitizers.

1.5.7.4 BCM: Stuffing of production quantity of BCM AFE/digitizer board put on hold pending failure analysis. Transient protectors are on order for BCM inputs and power supply lines. Failed BCM boards under-going amplifier replacements will be ready for testing at the beginning of next week. Updating RTBT BCM drawings. Ring BCM design to resume when designer becomes available next week. Delivery of failed BCM PCI interface cards to LANL was delayed until yesterday. This may impact schedule for planned testing of upgraded BCM boards at ORNL. Work continues on calibrator board schematic. Preparing sole source justification for Acqiris digitizers.

1.5.7.5 Tune: Detailed design of dipole and quadrupole kickers and pickups and the damper kickers continues.

1.5.7.6 Wire Scanner: Detailed design of the vacuum chambers for RTBT wire scanners and the HEBT, Injection, and RTBT dump wire scanners continues. We are investigating the possibility of decoupling the Ring Halo/BIG scrapers from the wire scanners, and instead using copies of the HEBT scrapers.

1.5.7.7 BIG/Tune kicker: Submitting kicker drawings to shops for estimate.

1.5.7.8 VFM: We are working with Paul Holik on cable lengths and routing.

Electron Detector: Work continues on shielding upgrades

#### ORNL Beam Diagnostics Progress Report:

DTL Commissioning: All diagnostic systems are functioning well.

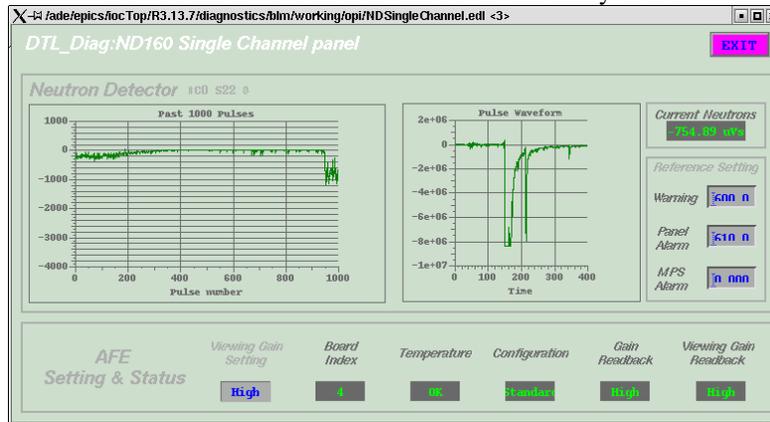
SCL Laser System: The first two phases of installing the transport-line is complete. We are installing optics components in the first box which is inserted in the HEBT ceiling. Slight modifications to the optics box might be necessary to start the HeNe laser vibration test. Initial mechanical vibration test by Dan Stout shows very little 30 Hz signal [ $10^{-8}$  meter] amplitude. This is very encouraging.

D-Box: Picture below shows 3 out of 5 actuators on the D-box. There are two slits, one viewing screen, one aperture limit, and one beam stop. All actuators are working per specifications using Lab View drivers. Wim has written EPICS screens for the remote operation of the motion controller.



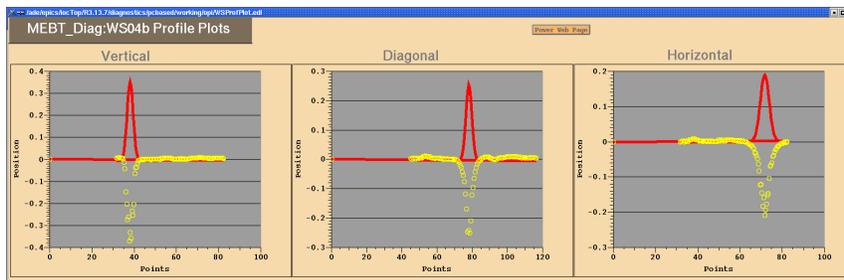
Actuators installed on the Anti-Chopper box.

Loss Monitors: Neutron detectors are extremely useful.



The BML EPICS screen written by BNL is used to display the neutrons generated at 7.5 MeV.

Wire Scanners: During the shutdown on Thursday, we checked the wiring of the D-plate wire scanners. The timing was set by Wim and all are working fine now.



Yellow – Beam Data, Red—the fitted and then inverted Gaussian to calculate the rms beam size.

Emittance Scanner: Again during the shutdown, the AP requested from us to reduce the pre-amp gains. Jim Pogge changed the 80 resistors to reduce the gain by 5.