

## Accelerator Systems Division Highlights Ending March 19 and 26, 2004

### ASD/LANL: Warm Linac

March 19, 2004

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

Accomplishments This Week: (1) *402.5-MHz, 2.5-MW E2V klystrons:* The factory acceptance test for SN 7 has been delayed to April 21-23. (2) *805-MHz, 5-MW Thales klystrons:* We resumed site acceptance tests of SN 5, completing 18 hours at 4 MW, 30 Hz; 10.2 hours at 4-5 MW, 40-60 Hz; and 20.7 hours at 4-5 MW, 60 Hz. This is a total of about 49 hours. The next 5-MW tube is scheduled for factory acceptance tests on March 24. A visit from a Thales engineer is scheduled for Mar 29 to test the new Mega window. (3) *805-MHz, 550-kW Thales klystrons:* SN 13 passed the factory acceptance test on Mar 5, SN 14 passed on March 12, and the next tube is being tested this week, all with a LANL engineer witnessing. The Thales engineer visiting Mar 29 will also fix the vac-ion connector on SN 10. (4) *805-MHz, 550-kW CPI klystrons:* LANL approved the factory test data for SN 51 and SN 52. (5) *805-MHz, 5-MW AFT circulators:* AFT has arranged for a local subcontractor to sand all the port 1 and 3 windows. They have decided not to sand the port 2 windows. We will begin to test circulators today, with an AFT engineer scheduled to be at LANL next week. (6) *Shipment:* A truck is scheduled for next Monday to ship one 402.5-MHz klystron, three 550-kW Thales klystrons, two 2.5-MW, 402-MHz loads, and one 402.5-MHz circulator to ORNL.

Concerns & Actions: (1) To reduce the backlog of 805-MHz klystron testing, we continued conversion of the 402.5-MHz test stand to 805-MHz. Last week we installed the socket, klystron and magnet. This week we completed the waveguide run, lead assembly, and calibrations of the power meter and amplifier. We still need to finish plumbing the RF load and klystron. (2) An MCI rep is at LANL this week to test the new MCI waveguide flex sections. So far the tests are going well—we are running at 2.4-MW traveling wave with no measured RF leakage.

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

Accomplishments: (1) The prototype HVCM is running to support full-power operations (136 kV, 1.35 ms, 60 Hz) for klystron and RF-component testing. (2) We continued rebuild of the production HVCM. We inserted spacers under the boost-transformer secondary bobbins to enhance oil flow in the window region of the transformer. We also finished the harmonic trap assembly, which was tuned for resonance and installed in the HVCM. The production HVCM should be back in service next Monday. (3) We upgraded the designs of the bias-choke and pc-card assemblies to improve system reliability and maintainability. (4) We are adapting the updated and improved IGBT heat-sink mounting techniques for Eupec's 140x130 mm IGBTs to the larger 140x190 mm IGBTs used in the HVCM.

Concerns & Actions: (1) We continued HVCM circuit modeling to determine the cause of IGBT failures. We developed SPICE models of the HVCM systems this month. The previous models used a simple switch to represent the IGBTs and a subroutine that had to be tweaked to produce the waveforms observed in the modulator. Thus it was not well tied to the actual IGBT parameters. (2) Eupec plans to replace the KL2 IGBT that we are currently using with a new version called the KL2-C within a year. The KL2-C will have a softer back diode, so we need to model this change to be sure the new IGBT will work in our systems. We intend to unite the IGBT model with the spec-sheet values so we can do this modeling. (3) We are concerned about electric-field stresses in the production boost-transformer epoxy bobbins. Newer designs we are examining indicate we can reduce field stresses to the 20-kV/cm range vs. the present 90-kV/cm epoxy design. This could be important for future reliability enhancements. The future design should also accommodate increased oil flow in the boost-transformer window region.

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

Accomplishments: (1) Twenty-seven DTL post-coupler replacement stem inner and outer tube-to-tip welds were completed and vacuum leak checked. They were delivered this week to Accurate Tube for bending. (2) CMI started trimming the Tank-5 stems for post coupler final assembly this week, and we anticipate welding these components early next week. (3) Integrated Machine received the Tank-5 slug-tuner data on Tuesday, and they shipped the machined tuners to ORNL on Friday.

Concerns & Actions: It does not appear that final data for the Tank-6 post couplers will be collected until the end of March. Pete Smith will have the fabrication as far along as possible before transferring from SNS on Apr 2.

#### COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) Initial Module-3 bead-pull data from ACCEL look good. Both the field and the tilt sensitivity are close to design goals. Jim Billen and Jim Stovall will travel to ACCEL on Mar 23 for final tuning. Module 3 is still scheduled to be delivered to ORNL on Apr 2. (2) Module 4 is proceeding well, and ACCEL has gained a few days on the schedule. Ten of 12 segments have been brazed, eight are machined to length, six are tuned, and two are mounted on the stand. Module 4 is now scheduled for delivery to ORNL on Apr 23.

Concerns & Actions: (1) CCL inter-segment beam-box 16 repair was completed at ESCO and was shipped to Oak Ridge this week. The leak rate was below the background of the equipment. The leak detector was also checked with a calibrated standard leak of  $5.5E-10$  and read exactly. (2) ESCO plans to work continuously on repairing the remaining CCL components for the next week and a half to two weeks, at which time they believe all repairs will be complete.

#### PHYSICS & DIAGNOSTICS (WBS 1.4.5)

Accomplishments: (1) *BPM Electronics:* We received 12 more BPM PCI card sets for a total of 42. These will be assembled into the chassis next week, the software loaded, and shipped to ORNL. We will assemble four additional chassis with everything but the PCI cards and ship these as well. Four PCI cards already at ORNL will be put into these chassis. That is a total of 46 BPM systems in this upcoming shipment. We have 26 complete systems at ORNL at present, so that will be a total of 70, with 15 more to go to complete the BPM system delivery. (2) *Wire-scanner electronics:* Wynn Christensen and Steve Armijo spent two weeks at ORNL integrating the wire-scanner systems. They finished assembling and testing all 36 electronics chassis and married nine of them to specific actuators. Wynn made one software modification requested by ORNL. Steve also threaded carbon wires onto the wire-scanner actuators. (3) *Wire-scanner pickups:* Huntington has not yet responded to our request to accelerate the schedule for the prototype 8-inch and 12-inch actuators. (4) *RTBT harp:* We completed machining the harp strongback, (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 14 days, and we are working with SNS-ORNL on closeout issues. (2) We are working to novate the remaining contracts, including those with Marconi, CPI, and Titan. The total value of these contracts, including burden, is \$2,698,094. As soon as the vendors return the signed letters we will de-obligate remaining balances and return the budget to ORNL.

March 26, 2004

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

Accomplishments This Week: (1) LANL shipped the following hardware to ORNL: one DTL klystron, one CPI SCL klystron magnet assembly, two DTL loads, one DTL circulator, and three Thales SCL klystrons. (2) The third 5-MW CCL Thales klystron (S/N 5) is performing well and will likely pass site acceptance tests. Two additional tubes are at LANL, while the sixth is in process of passing factory acceptance test. (3) An AFT representative was at LANL to witness 5 MW circulator tests. The first circulator failed and was removed for cleaning and examination. The second passed high-power tests, while a third is experiencing arcing problems. (4) LANL began site acceptance testing of the first Thales 550-kW SCL klystron. The klystron has a window arcing problem that we will work with Thales representatives here next week. Measured klystron efficiency is  $\sim 61\%$ , relative to the reduced specification of  $62\%$ , with a measurement uncertainty is  $\sim 1.4\%$ .

#### HIGH-VOLTAGE CONVERTER MODULATOR (HVCM) (WBS 1.4.1.2)

Accomplishments: (1) The prototype HVCM operated satisfactorily in support of the full power, full duty 5 MW klystron tests. Evaluation of newly installed experimental IGBT bypass capacitors shows no significant improvement in thermal performance at high power as compared to production units. Most units remain in the 60 C range. The experimental capacitor with standard gauge electrode foil and Isopropyl Biphenyl dielectric fluid is running 10 to 15 C hotter. The standard production capacitors with 50-gauge foil are conservatively designed. Capacitor test voltage is 7 kV and operates at  $\sim 2.4$  kV. Capacitors use multiple plastic layers for the dielectric that can slide between each other instead of tearing with thermal cycling. Operation in the 60+ C region should be reliable. ORNL has noted much lower capacitor temperatures at full power running a pair of 2.5-MW, DTL tubes. It is important to monitor capacitor temperatures in the SCL units, as heating may be a function of IGBT commutation current. (2) We completed designs for new PC card assemblies for the IGBT driver and bias choke assembly that will improve reliability and maintainability. The new IGBT driver card provides improved voltage hold-off across the isolation

transformer (now 4 kV RMS vs. old 1.5 kV) and improved switching performance of parameters such as switching delays, slew rate, and source impedance. The layout has been changed to ease diagnostic measurements in place. The bias choke card has been updated with a 1.2 kV rated fuse and a 900-J fault, current-limiting resistor, in addition to a blown fuse indicator. (3) We installed harmonic trap networks and nanocrystalline filter choke in production HVCM. This unit, at least at the 1 MW pulse level runs completely silent. (4) LANL circuit modelers reviewed HVCM design and performance requirements.

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

Accomplishments: (1) Tank-5 slug tuners were finished machined and shipped to ORNL. Tank-6 tuner dimensions were received and finish machining should be completed early next week. (2) Tank-5 post coupler finish machining should be completed early next week. Tank 6 coupler e-beam welding and machining is now underway and should be completed by 4/9/04, well within ORNL installation schedule requirements.

#### COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) J. Billen and J. Stovall returned to ACCEL to supervise tuning of Module 3. Performance to date is excellent. Tuning should be completed early next week. Module-3 will then be readied for shipment to ORNL. (2) The last Module 4 segment should be completed on 3/27/04. This completes CCL manufacturing. Nine (of twelve) segments are on the stand, with the first three passing vacuum leak checks.

Concerns & Actions: Module-3 and 4 shipments have been delayed approximately one week, to April 10 and 23, respectively. ACCEL informed us that the causes of the delays are from unavailability of shipment dates from Lufthansa Cargo and work stoppage around the Easter Holiday. ORNL installation team can accommodate this delay, but their remaining schedule float is essentially exhausted.

#### PROJECT MANAGEMENT (WBS 1.4.5)

Los Alamos SNS Division will disband in 7 days. We are working with SNS-ORNL on closeout issues. Contract novation is almost complete. Of the 44 contracts identified, only 4 remain: the two Thales klystron contracts, warranty transfer of the IE Power power supply contract, and file transfer of the NETC magnet contract. PCR LI 04-011 was submitted to provide budget for the agreed upon HPRF work after the shutdown of the SNS Division. In addition, this PCR transfers \$2,658,094 of LANL budget to ORNL for the open commitment associated with the E2V, CPI, and Titan contract novations.

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

Assembly of the M-10 and -11 cryomodules continues.

The M-8 cryomodule is in the test cave, awaiting repair of the 1 MW RF test stand. The M-7 and M-9 cryomodules are in line for testing.

Two high- $\beta$  cavities have been qualified for string assembly since the last report.

Assembly of the H-1 cavity string is complete.

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

March 19, 2004

Two of the four Ring quarter-cell assemblies have been shipped from BNL to SNS/OR. These magnet assemblies will be installed (one each) into the four Ring arc sectors; work is underway on the last two quarter cells. Assembly of half-cell #25 has begun.

Magnetic measurements:

- All twelve of the 30Q44 magnets are now fully measured and have been assigned lattice positions within the Ring.
- Hall measurements of  $B_y$  and  $B_z$  at the foil (target) location is being measured with chicane #2 and #3 magnets assembled together.
- Production measurements are complete on seven of nine 26S26 sextupole magnets.

We have been informed by Alpha Magnetics that they have shipped the last (#9) 26S26 magnet to BNL.

An AutoCAD drawing of the 36Q85 quad layout was sent to ASD in support of ASD's Technical Issues Forum on the RTBT / Target Interface that is scheduled for March 26<sup>th</sup>.

We are working to develop a series of production, assembly and test plans here at BNL that will address the upcoming short term Project needs. Specifically, to continue with magnet assembly, testing and delivery of the Ring arc half-cells, quarter-cells and doublet magnet assemblies in support of ongoing Ring installation effort; finalize a (BNL) Diagnostics' Production plan that will include schedule, milestones and costs; develop an equipment delivery schedule that supports ASD's plans for the installation of the Ring straight sections starting in July, 2004.

Engineers are at IE Power this week to witness the acceptance testing of the Ring dipole power supply.

March 26, 2004

A plan to create a mock-up assembly of the injection straight section elements (stands, magnets, vacuum chambers, diagnostics, etc.) here at BNL has been developed. Work will begin in April.

Magnet parameters for the Lambertson Extraction Septum (ELS) magnet have been finalized and conveyed to ASD.

A meeting was held to review the dimensional tolerances on the 17D224 RTBT magnet core. A full set of prelim core drawings was sent to ASD.

We had a video-conference with ASD to review our progress on the Diagnostic Production Plan and delivery schedule. Because of Diagnostics' involvement (and travel) with the DTL commissioning plan, BNL was granted an extension on the delivery schedule and ETC.

The BNL/SNS Vacuum Group is setting up a third (NiT) coating station for SNS. This new station will be used to coat the extraction kicker magnets.

Acceptance testing of the Ring's main dipole PS rectifier was terminated last week. Engineers from BNL and OR observed that the rectifier was not ready for full power testing. A punch list of items was given to the vendor (IE Power) and the tests will be rescheduled in about one month.

Installation drawings for the RF straight section were completed this week. Drawings for the Collimation, Injection and Extraction straight sections are next.

Peter Wanderer, et al., reported to our AP Group on completed point measurements of  $B_y$  and  $B_z$  at the injection foil position in chicane magnet #2. There were no surprises.

The magnet measurement test stand is being prepared for the last group of Ring magnets. These include: chicane #4, chicane #1, dump septum, 36Q85 and 36CDR30. Estimates to measure the other three 36Q85 are being prepared.

The first injection kicker magnet assembly and power supply are being prepared for shipment to OR. Included will be a collection of Ring magnet spares (coils, magnets, vacuum chambers, etc.).

The last 26S26 sextupole has arrived from Alpha Magnets.

BNL techs reported that fifteen of the sixteen 36Q85 coils are now fully wound.

RF engineers are reviewing the output stability on one of the RF tune power supplies built by Danfysik.

RF engineers are working on the system integration of the ALE / RF power supplies.

Preparations are underway to ship two complete RF systems; the first in two weeks and the second in four weeks.

Two more PFNs will be ready for testing on April 1<sup>st</sup> at APS. Both will be shipped directly to SNS/OR after acceptance.

IE Power is working on the last three injection kicker power supplies. One of the three will be ready for testing by April 5<sup>th</sup>.

As our vendor prepares to order raw materials, ASD has been asked to decide on the need for a set of spare coils for the extraction septum magnet and the RTBT bend magnet (both magnets use a universal coil).

David Gassner was at SNS/OR this week working on Diagnostics (AFE) for the upcoming DTL commissioning run; Tom Russo and staff will arrive at SNS/OR on Monday to set-up the prototype BPM.

The Linac dump wire scanner chamber, support stand and required hardware were shipped to SNS/OR this week.

The third of four Ring quarter-cell assemblies was shipped to SNS/OR. The fourth unit should be ready in one week. Assembly of half-cell #25 is underway.

## Controls

### 040319 Controls Weekly

Work continued on the standardization effort with more IOCs now running under EPICS v3.14.4. Issues with the Ether/IP Driver under v3.14 were resolved and the "Beckhoff" driver now operates correctly under v3.14. An SNMP protocol is now available and running to assist with the analysis of network traffic. More progress was made on the new archiver, which is running in parallel with the old. (The plan is to run both during the upcoming DTL 1-3 run.) The archiver now exports waveforms.

First priority this week went to preparations for DTL1/2/3 operations. PPS certification was completed (see more below). All requested changes to the RCCS systems were made and integrated system tests of the DTL2 RCCS and vacuum systems were completed. Integrated system tests for the EPICS power supply interface are well along and should be completed early next week. Checkout of the MPS system, trigger control and PLC are all complete; 60% of the inputs have been checked. MEPT power supply controls (including MPS inputs) have been rechecked, and screens are being updated. Test plans are being executed as soon as possible, and should be complete by the middle of next week.

Checkout and start-up of CCL1 RCCS, QMCS, and vacuum control systems were also conducted this week. This effort was led by a team of engineers and technicians from LANL. For RCCS and QMCS, "point-to-point" checkout of PLC I/O and functional testing of EPICS software were completed. (Integrated system testing will be conducted by ASD Controls Group next week). For vacuum, "point-to-point" checkout of PLC I/O was conducted along with initial functional testing. By week's end the CCL1 vacuum system was running and ready for RF conditioning. Having the LANL team here to conduct this testing was a big help since most of our ASD controls group personnel were working on other priorities.

Another start-up activity this week involved installation and testing of control equipment for the first SCL vacuum control rack. The JLAB vacuum control system implementation team installed equipment and cabling with ASD controls personnel participating and learning. A number of minor interface issues were identified; these will be addressed before the next JLAB visit in a few weeks.

Phase 0.4a of the Accelerator PPS for operating beam through DTL3 was certified last Friday. This completes PPS activities for beam operation with DTL3. "Phase 1 lite" to allow RF processing of CCL1 will be certified late next week. Preparations are under way to modify phase 1 of the PPS (beam through CCL4) to add an intermediate gate to separate the warm and cold sections of the LINAC. This gate will allow the operation of the CCLs while accessing the cold section of the LINAC or allow beam operation for the CCLs and RF processing of the SCL cavities.

CF has returned a favorable estimate to install conduit for the outdoor Chipmunks around the RTBT tunnel. Another ASD transmittal has been prepared to have CF provide additional estimates for work around the Ring and HEBT tunnels.

A meeting is scheduled with the chairman of the ARR committee while he is here at the end of this month for the DTL3 ARR to discuss our plans for outdoor Chipmunk locations. If these plans are acceptable, we will have CF start work on the RTBT Chipmunk conduit as soon as possible.

The ODH system for the CHL is complete and the final integration test has been performed. AIMSE crafts will resume work in the LINAC next week to complete installation of the LINAC ODH system. Craft installation is planned to be complete by the end of April with completion of the LINAC ODH system scheduled for the end of May.

We are continuing to meet with Target Operations to revise the PPS design for the transfer cell, the basement utility vaults, and the shutter drive equipment room based on the observations of the external design review committee.

A meeting was held this week with the Instrument Safety committee to discuss the proposed PPS design for beamline 2. The committee has provided some comments. The proposed design will be revised based on these comments and presented at a subsequent meeting.

BNL completed work and documentation on the event-link monitor this week. The software was checked out of CVS at ORNL and successfully run. The LANL designed motion control chassis arrived at BNL and has been installed in a test lab to evaluate with the HEBT charge-exchange foil devices.

A set of drawings and configuration spreadsheets for the Ring vacuum IOCs was sent to ORNL to be included in the document control system. The only remaining IOCs in the 1.9.5 WBS which have not yet been documented in this way are the four RF IOCs.

On the Front End Test Stand, LEPT controllers have been tested and accepted. Work has begun on the Cesium heater controls and the controls for the 65Kv Power Supply. On Friday, a 13 MHz plasma was "lit" and the 2MHz rf was brought online.

#### 040326 Controls Weekly

Support was provided for DTL1/2/3 RF conditioning. Checkout of subsystems required for beam operations continued. Test procedures for a number of DTL1/2/3 control systems (e.g. RCCS, vacuum, timing, power supply, etc.) were completed and submitted to the DCC. The MPS test procedure should be completed by COB Friday.

Checkout of CCL1 RCCS and vacuum control systems continued. Integrated system test procedures are being generated and should be available next week.

Checkout of the Quadrupole Magnet Cooling System (QMCS) continued. Many different groups have pulled together to put this system together quickly. PLC checkout was conducted week-before-last. Electrical installation was finished this week and the water skid was turned on. The water has been circulated through a filter to flush out junk in the piping. All major components appear to operate properly, and there do not appear to be any major roadblocks to completing integrated system testing next week.

Design continued for communications cabling in the vicinity of Klystron Building Comm. room #4. The design package is now ready for final checking.

PPS Phase 0.4a has been certified for operation. PLC programs and wiring are being modified to control RF to CCL1 and Cryo Module MB4. PPS control of DTL5, DTL6 and CCL2-4 have been removed from the system to make PPS Phase 1 "lite." Integration testing is in progress and a Phase 1 "lite" screen has been added to EPICS. A temporary gate dividing the warm and cold Linac has been added to the PPS system design. The gate has been received and will be installed next week. This gate is in preparation for PPS Phase 1.



The front-end ion source and LEBT have been checked out and conditioned to 70 kV on the source and 45 kV on the lenses. Only a few sparks were encountered. After encountering difficulties with the delivery of the non-standard size bottles, we have installed a standard size hydrogen bottle on the high voltage deck.

The aluminum flange that mocks the entrance of the RFQ on the hot spare stand shows discolorations consistent with an off axis beam. To implement the steering capability of lens 2, we have started to assemble the 45 kV deck.

Diagnostics has loaned us a spare current transformer that is being installed between the hot spare LEBT and the Faraday cup that measures the H- beam.

### **Survey and Alignment Group**

Set the elevation on the base plates of the half cells in arc's "A" and "D". This task needs to be completed prior to grouting of the plates to facilitate half cell installation.

Fiducialized the beam stop that will be attached on the down stream end of DTL 3.

We have completed the internal drift tube alignment of Drift Tube Tank Assembly 6. Today barring unforeseen problems, we will fiducialize the exterior tank fiducials.

Mapped the RTBT area ceiling cracks as well as the crane supports with cracks continuing through them.

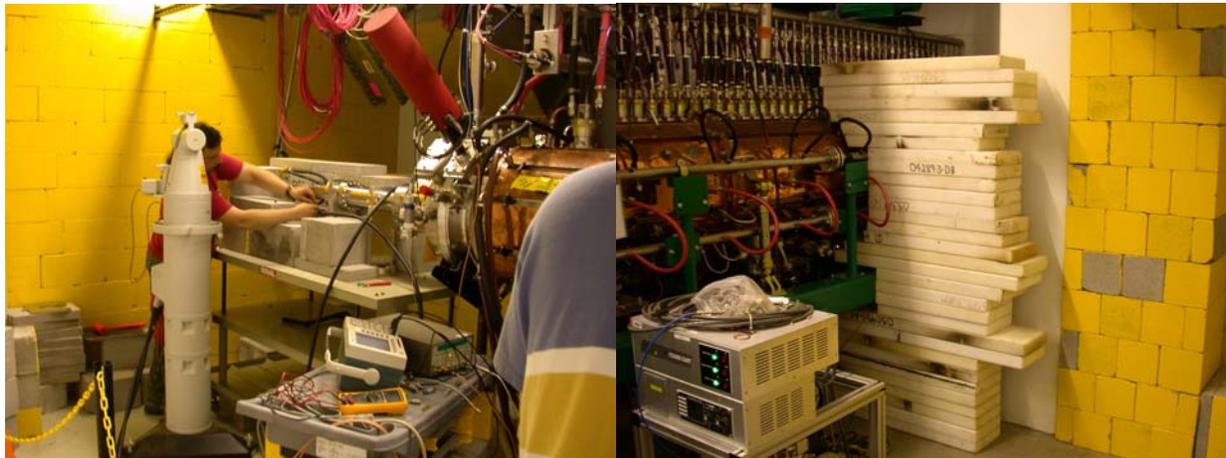
RTBT floor elevations were measured again as part of the ongoing deformation monitoring. The rate of settlement at the RTBT/Target interface has decreased this period. During the past month, only 0.7 mm settlement was observed at the interface.

This week, S&A continued the as-built surveys of the chopper cavities located in the Target Monolith. The majority of the chopper cavities are complete except that we are not able to as-built the bulk shield liner flanges at this time. The reason the bulk shield liner flanges were not as-built was due to tape residue (which was used to protect the flange surfaces) left on the flange surfaces. This tape residue prevents us from mounting our fixture to the flange with any type of accuracy. Once this issue has been rectified, we will complete the remaining.

Completed bolt hole layout needed for the flight tube placement.

### **Mechanical Group**

After some initial struggles we now have the beamstop installed and aligned at the end of DTL 3 for this commissioning run. Shielding of the beamstop has already begun. As well, all 3 DTL tanks are under vacuum and ready for RF power. Diagnostics installation is complete with testing wrapping up. We have placed some additional neutron shielding in the tunnel at the upstream end.



Iris sizing is complete. Tuning checks looked quite good on this tank using the permanent slug tuners and post couplers.

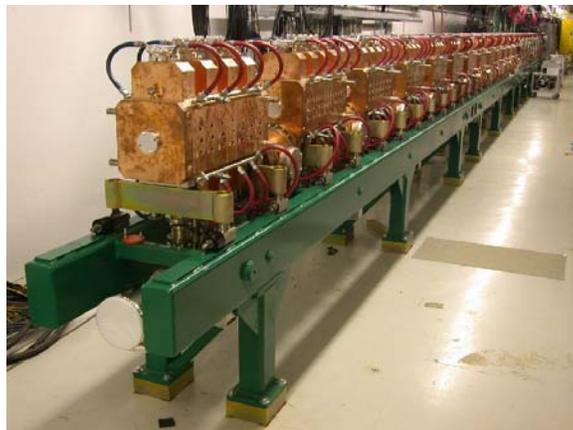
Alignment on the drift tubes went well. Having done this means that all 210 out of 210 drift tubes are installed and aligned in the DTL tanks. Directly afterward we set the tank up for its initial tuning. Our tuning contingent worked through the weekend and as of Monday afternoon the post coupler measurements were sent out for production. This is the last of the DTL tanks which needed this process.

Ten of the 12 CCL-1 inter-segments have been installed. The remaining two will be installed next week.



CCL-1 Inter-Segment 0

CCL-2 BC's were installed this week. Leak testing will begin next week



CCL-2 Segments and Bridge Couplers on Support Frame

#### 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 was completed.
- A walk-down of the Ring Injection Dump construction was performed, comments submitted to CF
- Installation of DI water piping to CCL2 RF klystron was started.
- Installation of DI water piping to CCL3 RF system continued.
- The pump on DTL2 RCCS system was replaced and the system returned to service.
- Modifications to DTL1 RCCS system were started and a new heat exchanger received.
- Installation of Linac Beam Stop chiller was performed and system filling is in progress.

### Ring Systems Installation

- The Arc B Half-Cell assemblies' (6) have been installed into their positions.
- The Arc D Half-Cell support pads have been formed and aligned.
- The Arc A Half-Cell support pads have been formed, aligned and grouted.
- The Arc A Half-Cells base plates have been assembled and staged for installation.
- The south RING crane (#BC8) hoist has been upgraded to 20 Ton capacity, load tested and put back into service.
- Installation of the AC distribution panels was started in the HEBT Service Building.
- Installation of the magnet cables on the magnets was started in the HEBT tunnel.
- Installation of the AC distribution panels continued in the RING Service Building.
- Installation of the PPS system continued in the HEBT.
- The Arc A Half-Cells base plates have been installed and aligned.
- The Arc D Half-Cell support pads have been grouted.
- The Arc D Half-Cells base plates have been assembled and staged for installation.
- The Arc C Quarter-Cell #C5 was received and staged for installation.
- The RTBT BCMs (4x) and the Injection and Extraction Dump BCMs (1 each) were received and staged for installation.
- Installation of the AC distribution panels continued in the HEBT Service Building.
- Installation of the AC distribution panels continued in the RING Service Building.

### Magnet Task

We now have five CCL Module 1 intersegments ready for installation. Module 1 has 12 intersegments plus the intersegment between the DTL. Five have been installed. We are working on intersegment 2 which contains the current monitor. So, of the thirteen necessary, we have eleven accounted for.

We discovered a problem with the 21Q40 measurements system involving one end of the search coil mechanical connection. This problem caused the coil to rotate in a "cone shaped" fashion. We are fixing this problem and will start re-measurement of the 21Q's.

We also started measurement of an 8Q35.

We installed new Klifixons on a HEBT 12Q45 and re-wired the Klifixons ridding the magnet of Teflon coated wire. This will be used as a prototype for the rest of the 12Q45 Klixon re-wire

### Electrical Group

We completed upgrades and checkout of DTL-ME1 and -ME2 this week. The units were turned over to operations on Thursday. DTL-ME3 was upgraded and operated briefly at 125 kV, 60 Hz, 1.35 ms last week during the ASAC review. Commutation cross conduction seems to have been resolved as a result of modifications to the driver electronics. Next week we expect to begin accumulating hours on this unit with the help of the operations group.

We completed installation of CCL-ME2 and CCL-ME1 the past two weeks. CCL-ME1 will go through an abbreviated checkout on Monday, and should be ready for RF conditioning by mid-week. Checkout of CCL-ME4 began, but was hindered by incompleteness of some minor tasks. This should resume sometime next week. Also, we expect to resume installation work on SCL-ME2 next week.

Modulator status:

- DTL-ME1: turned over to operations
- DTL-ME2: turned over to operations
- DTL-ME3: operational at full average power
- CCL-ME1: finishing upgrades, checkout next week
- CCL-ME2: upgrades finished, fully installed
- CCL-ME3: fully installed, not upgraded
- CCL-ME4: nearly installed

SCL-ME1: fully installed, not upgraded  
SCL-ME2: partially installed, upgrades in process

Eight additional ring medium power supplies have been delivered from IE Power, bringing the total to 18(of 77). This delivery includes the first article 700 A supply as well as 7 production 390 A supplies.

Ken Rust and Paul Holik, along with BNL visited IE Power this week for main power supply acceptance tests. Some problems were encountered in the control circuitry and IE Power needs to change the DCCT configuration. A follow up test will be scheduled.

DTL 2 EMD steerer power supplies were connected to the magnets this week and DTL1, 2 and 3 power supplies and EMDs all passed installation testing.

Five additional electrical crafts were added this week, bringing the total to 36.

In the ring, ac cable pulling from the outside transformers continues. This should complete next week and the terminations of these cables will then start.

In the HEBT, ac cable pulling from the outside transformers has started.

In the Linac, work was completed on the final hook-ups of the DTL1,2,3 area, CCL vacuum and diagnostic terminations continued as did work in SCL 1 and 2 areas.

A research mechanic and technician from the Electrical Systems Group changed a water pump motor and variable frequency drive controller for DTL 2 RCCS.

#### **HPRF**

SCL: The tanks were prepared and twelve more klystrons were moved to the gallery in four tanks. There are now enough populated HV tanks in the klystron gallery to support pipefitter work through Modulator 4 (48 klystrons).

CCL: Thales 5 MW klystron (serial #1) was lifted into its magnet on the CCL-2 tank. Framing and lead shielding is being erected to allow the pipefitters to fabricate interface cooling pipes.

RFQ – DTL3 Conditioning support: All relevant rf systems were exercised satisfactorily under EPICS control after upgraded IOC control software was loaded. The RF Group is providing cabling and additional instrumentation for the conditioning effort. We are also repairing the back up generator for the ion source. HPRF and Structures have been signed over to Operations as ready

DTL 5&6: Klystrons running at full power as load for HVCM testing.

CCL-1: Supported measurements of frequency vs. temperature and rf port phase comparison.

CCL-2: AC Power to the transmitter racks completed, klystron cable terminations in progress. Pipefitters working on cooling interface.

SCL3: Electrician work completed, rf terminations to klystrons beginning.

SCL 4-8 (of 14): Klystrons installed in tanks. Forty two 550 kW klystrons are in position for pipefitter work.

Ring RF: The racks and amplifiers associated with the first (of four) systems were moved into the Ring Service Bldg. The power amplifier and cavity will move into the ring tunnel next week.

RFTF: Klystrons will be stored in RATS to provide space for a clean room for cryomodule warm section testing. Three of the first 15 Thales 550 klystrons arrived along with a spare E2V klystron and two water loads. Preparations are being made to support Cryo-coupler testing

**LLRF**

Phase-I production of the HPM and FCM is complete; acceptance testing is in progress. Ten sets of FCM motherboard and DFE daughterboard have passed the digital portion of acceptance testing; the balance will be checked out next week. All RFOs have been tested for basic functionality; approximately 50% failed. Two of these had clear manufacturing errors and were returned to the vendor for rework. The others suffered from damaged or inoperable 50 MHz and/or 805 MHz filters. The assumed cause is a wet wash at the end of the printed circuit board assembly process. Much to our surprise, the filters are not hermetically sealed and must not be subjected to any wet processes. Eight RFOs will be baked at 50 C over the weekend in an attempt to dry the filters and recover functionality. Otherwise the filters will be replaced. In any case, the assembly process will be modified in the future so that the filters are not subjected to a wash cycle. Several HPMs have passed acceptance testing to date; one failed and has been set aside for investigation.

The FCM VXI front panels and enclosures were delivered this week.

The first 25 (of 50) downconversion chassis for the SCL were delivered this week.

Three frequency synthesizers and one oscilloscope were received recently. These complete the set up of the dedicated acceptance test stations in the LLRF lab at RFTF.

The 805 MHz reference line has been installed in the linac tunnel. All couplers have been installed and performance measurements are in progress. Installation of the temperature regulation system will begin depending on craft availability. The first two 755 MHz local oscillator amplifiers are being fabricated now.

John and Irene DeBaca will begin their one-year assignment at ORNL on March 29. Oleg Chernoyarov will begin his one-year assignment in early April. They have been assigned office space in the RFTF and 852T; the IT group delivered and set up used desktop computers for them this week. Acquisition of telephones is in progress.

The LLRF systems for DTL1-3 are ready to support RF conditioning and beam commissioning. Installation work continues on CCL.

**Cryosystem Group**

Cold compressor #1 and its spare motor were tested by the manufacturer and found to be fully functional.

The non code LN2 vessel inside the 2.1K cold box has been removed and a new code vessel ordered. Delivery is expected to take 7 weeks.

The "U" tube that supplies LN2 to the 4.5K cold box has been fabricated and installed.

The first batch of warm compressor oil has been processed and will be transferred into the compressors on Monday.

The Top hat assembly for the helium dewar was set in place along with the test heater for the 4.5K cold box test.

We have started to pipe the relief valves for the 7000 L Dewar.

Two of the seven transfer lines necessary to test the 4.5K cold box have been installed.

The first test of the new Deutsch connector was not successful, it leaked after the first thermal cycle. A new design has been fabricated and will be tested next week.

We have received from JLAB the 4.5K performance test heater and the PLC control cabinet for the 2.1K cold box. This completes all cryogenic system equipment from JLAB.

Plans are being drafted to perform the 4.5K cold box performance test in mid April.

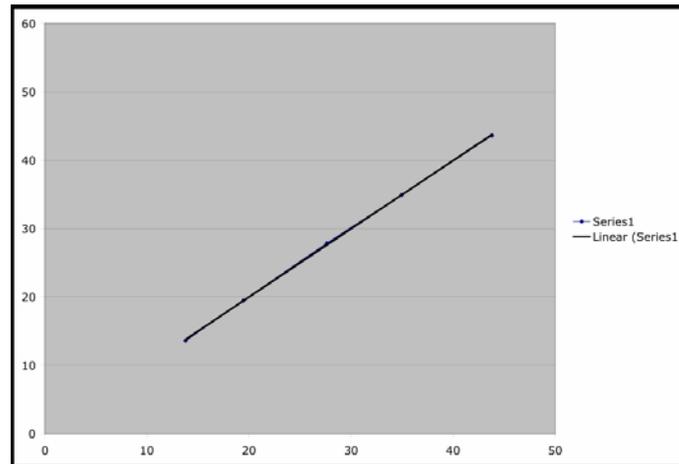
## Beam Diagnostics

03-21-04

Updated IOC version of BPM program to match the results of the LANL ActiveX program. This version with IOC core 3.14 is now ready for deployment.

Hosted two LANL staff members who completed testing of wire scanner electronics for the entire facility. Several bugs were discovered and resolved along the way. Significant progress was made on the actuators for DTL and CCL, but much work remains.

Started on calibration of BCMs. Linearity measurement is shown below:



A webpage has been created to document the LabVIEW/EPICS software that is used for the SNS diagnostic systems:

[http://www.sns.gov/diagnostics/documents/epics/LabVIEW/SNS\\_LabVIEWEPICS.html](http://www.sns.gov/diagnostics/documents/epics/LabVIEW/SNS_LabVIEWEPICS.html)

Installation and test of systems required for DTL3 continues

Diagnostics device tracking table has been implemented in Oracle. A front end has been developed in Access to allow convenient updates to this information that will be use to track installation and testing of all diagnostic systems.

Arranged visit by the BNL BPM team. They will bring Ring BPM electronics to test on site the week of March 29, 2004.

Completed recruitment of a contract technician who will start on Monday.

Reviewing dozens of resumes for the remaining positions

Continued work on BIW04 arrangements.

Reviewing SBIR proposals for DOE

Continued work on DAC report response and Ring diagnostics production plan

03-28-04

At BNL:

The thrust of the work in the group this week has been in the following areas:  
Preparation for the impending trip to Oak Ridge to deliver a BPM system.  
Delivery and installation at Oak Ridge of the near "final" version of the BLM system  
Continuing work on the Diagnostics Production plan.  
Attempting to re-prioritize mechanical work to fit into ORNL installation plan.  
Starting the evaluation of the ETCs for all projects.

#### 1.5.7.1 BPM

The prototype unit is mounted in a rack mount PC and has been operation for several weeks. Rudimentary software has been written with basic functionality tested. The unit will be shipped 3-26-04 to ORNL. BNL engineers will arrive at ORNL 3-30-04 for testing. Additional prototype units are close behind and will be built up as soon as we come back to BNL. More testing will happen when beam is in the machine at ORNL as well as the BNL linac. This device will be impulse tested as well.

We are in the process of resurrecting the BPM mapping fixture.

#### 1.5.7.2 IPM

Production of the vacuum chamber is being scheduled to fit into plan (see above). Also, HV design work continues. Mockups to test geometry and hold off are being fabricated.

#### 1.5.7.3 BLM

Installation of a BLM system is occurring this week at ORNL. Testing continues. Circuit boards for "final" version may need one more rev. Decision next week.

#### 1.5.7.4 BCM

We have two modified units of the original BNL type for test. Modifications include extra protection on perceived weakness of outputs and addition of linear power supplies. Torture testing continues.

For ORNL solution, PCI timing decoder (work also needed in other areas as well) is being developed. Also working on ETCs for both solutions to fully understand budgetary impact.

#### 1.5.7.5 Ring Tune Monitor

Work in secondary systems has been slowed. Vacuum mechanical scheduling and ETCs are as stated as above.

#### 1.5.7.6 Wire Scanner/Profile monitors

All vacuum chambers are being fabricated in the shops. Vacuum mechanical scheduling and ETCs are as stated as above.

#### 1.5.7.7 Ring Beam in Gap Cleaner Monitor

Work in secondary systems has been slowed. Vacuum mechanical scheduling and ETCs are as stated as above.

#### 1.5.7.8 Video Foil Monitor

No progress in this area while engineer at ORNL

At ORNL:

One subcontractor (Jim Diamond) started with the group, received initial training, and has already made rapid progress in CCL installation. Two potential contractors were interviewed.

BCM software was modified for two channel operation. BCM installation was debugged and BCMswere calibrated. Data was taken with different grounding schemes on for the BCM signal cables. Some improvement in noise performance may be possible.

Faraday Cup software was modified to run with just one faraday cup, and analysis routines were updated. Faraday Cups were calibrated and FC334 electronics was reworked.

Wire Scanners were checked out and WS334 was debugged.

Dave Gassner visited from BNL and worked with Andrei to set up new BLM electronics for the upcoming run.

EDM screens were updated to support the upcoming run. Database work was performed to provide connector summaries and reports for upcoming SROs.

Cables were routed and re-pulled in the CCL. Part of this work was to consolidate the BSM systems into one rack and part was to re-pull the WS signal cables that had the wrong cable pulled. The new DB workers were trained on cable terminations. Preparation of the SRO for SCL cable terminations has begun.

Tom visited BNL and reviewed progress on the BPM electronics, discussed data logging and remote access for the upcoming BPM tests at ORNL, identified remaining issues with the production plan, and visited an instrument systems vendor.

Darryl Murphy set up a new Share point server to that allows secure connections via HTTPS (SSL). This allows partner labs and ORNL to share versioned documents, task lists, meeting minutes, and other information via a web browser interface. The secure web interface and WebDAV shared folder mounts were tested from an off-site network.