

## **Accelerator Systems Division Highlights Ending June 11, 2004**

### **ASD/LANL: Warm Linac**

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

- The 5-MW klystron is being used to test the third pair of CCL windows. Tests are proceeding satisfactorily.
- The 550-kW Thales klystron that finished its site acceptance tests last week is being removed from the test stand and replaced with the next one to be tested.

#### **DIAGNOSTICS (WBS 1.4.5.2)**

- Fabrication of the RTBT harp is proceeding on schedule. The electronic circuit boards are being manufactured.
- John Power is spending two weeks at ORNL, and he will continue this at the 50% level for the rest of the fiscal year.

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

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

With \$1.8M remaining, we are still waiting to receive the final installment of \$2.6M of funding for FY04. We will be forced to stop all SNS procurements if we run out of BA (projected to occur by late June).

Half-cell #29 was shipped to SNS/OR this week.

Work on half-cell #30 is nearly complete. Progress continues on our last half cells, #31 and 32.

RF #2 (with magnet chambers, stands, lifting fixture, etc.) will be shipped from BNL next Tuesday.

Measurements taken after TiN coating show that the prototype extraction kicker has a 12k-ohm resistance between the high voltage conductor and the grounded eddy current strips (usually the resistance between these two points can not be measured). AP is investigating.

Vendor bids for the RTBT 17D244 bend magnet cores are being evaluated by our Contracts Department. The bidder response to this RFQ was good. This represents BNL's last magnet procurement.

An ASD progress review of the new Diagnostics Production Plan remains scheduled for Monday, June 14<sup>th</sup>.

Mock-up of the Injection Straight Section line at BNL: chicane #4 has been added to the installation assembly. There is a mechanical interference between the thin-foil chain drive mechanism and its vacuum chamber; BNL Shops are on-call to process minor changes.

Clearance issues (~0.5cm) are being sorted out by AP, Survey and the Design Room on final 3D placement of the Injection Dump Septum magnet assembly.

Field quality measurements on the first of two radiation hardened RTBT corrector magnets were started today.

Chicane #1 is also in the test stand for final measurements that are to be taken next week.

Nine CAD employees were given RIF notices this week. Eight are from the design room.

### **Controls**

On Wednesday evening of this week, it was observed that communication had been lost at approximately the same time between the IOCs and PLCs in the CHL and in the Warm Linac Resonance Cooling Control System (RCCS). On further investigation, it was found in each case that the software driver ("EtherIP Driver") responsible for this

communication had been suspended until the same date in November!! These systems are far apart and operate from different servers. All affected IOCs were running the newest version of the EPICS operating system – v3.14.6. A possible explanation, consistent with most of the observations, is that a bad time stamp was somehow distributed on the Real Time Data Link (RTDL). A modification has been made to the EtherIP Driver to remove the possibility of the same event reoccurring, but a more complete understanding is still required.

Lack of communications services is presently holding up testing of SCL ME2, but work began this week on the installation of communication cables to SCL rack rows 9-12. The design of communications cables for the HEBT service building was completed this week and design of communications cables for the Ring Service Building will start next week. Installation of conduit and cable for the HEBT Beam Shutoff Stations was completed this week. The Conventional Facilities Team this week completed the temporary fiber run of 24 single mode and 24 multimode fibers from the HEBT to the CLO Controls Equipment Room.

Test procedures are being developed for checking out SCL vacuum systems. Draft versions should be ready in time to start testing during the week of June 21.

The low-level RF (LLRF) drivers and sequencers used for the RFQ through DTL6 have been upgraded to support a new version of the controller firmware from LBNL. The operator sequencer code is the same as that used in the newest systems using the LANL Field Control Module (FCM). The engineering screens are still different -- the LBNL boxes support only a subset of the records the FCM driver supports. It all was tested in the lab and looks ok on the target systems but has not yet been thoroughly tested in situ.

A LLRF IOC was set up in the RF Test Cave with two LLRF systems – the configuration planned for all the SCL LLRF IOCs. This will be used to confirm correct operation of this configuration, as well as to investigate some suspected bus errors.

The Machine Protection System drivers have been upgraded to EPICS v3.14.6, and all Front End Applications are similarly being converted to the standard system. The NC HPRF IOCs are also now all booting in EPICS 3.14.6, as are the CHL IOCs. A modification was made to the Display Manager to correct an error that was observed under v3.14.6. The Power Supply Controller (PSC) driver has been upgraded for increased functionality.

Checkout of the controls for MB03 cryomodule continues. Proper operation of silicon diodes, valve position LVDTs, pressure transmitters, and level meters has been verified from the connectors at the cryomodule to the EPICS screen. The cryomodule simulator test box has been used to verify the signals.

The PLC for monitoring and control of the 2.1 K cold box was connected to the control system network. The PLC processor and communication modules were upgraded to the latest version of the firmware. The PLC logic was upgraded to version 12. The initial version of the database was loaded to the IOC. Verification of the PLC interface to the EPICS system and the operator interface screens was started.

The cable diagram for installation of the HEBT service building cryogenic control system trunk cables was completed. These cables go from the Cryo racks in row 1 to the end of the cryogenic transfer line in the Linac tunnel.

Testing of the Personnel Protection System (PPS) Phase 1.1 continued this week in preparation for a planned certification next week. All the EPICS screens have been built, as have the EPICS databases, which may still need some fine tuning of calculation records.

Controls and Operations personnel worked together to develop some high-level operational screens that make use of embedded windows to use valuable screen space more efficiently. A feature allowing operational status from an EDM screen to be sent automatically to the Electronic Log Book has also been implemented.

## Installation

Craft Snapshot 6/8/04

ASD productive craft workers	<b>58.0</b>
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	67.0
Less WBS 1.9, 1.2 etc	<b>6.0</b>
Less absent	<b>3.0</b>
TOTAL PD BY ASD/ORNL DB WPs	<b>49.0</b>

## Accelerator Physics

The list of medium beta cryomodule locations was updated in the following way (CM 4 and 3 will be interchanged:

Cryomodule number	Cavity 1	Cavity 2	Cavity 3	Average	Chosen position
At Qo 5E9	MeV/m	MeV/m	MeV/m	MeV/m	
M01	16.0	16.0	16.4	16.1	5
M02	17.1	15.0	16.0	16.0	7
M03	15.5	13.0	18.0	15.5	4
M04	14.9	17.2	15.5	15.9	3
M05	10.8	10.4	10.2	10.5	1
M06	16.8	12.0	16.5	15.1	2
M07					11
M08	20.0	16.5	15.8	17.4	6
M09					9
M10					10
M11			17.9	-	8

Cryomodule shipment will be as follows:

- M10 will be shipped immediately
- M11 will be placed in storage and possibly tested later in the year, if time permits
- H01 will be shipped after testing and after the piezo tuners will have been fixed
- H03 has a small leak and its fate will be decided once it's repaired

The warm section beam pipe cleaning and installation review has been organized. The Committee is composed of Tsuyoshi Tajima (Chair) LANL, Mike Kelly ANL, Tim Whitlatch JLab, Peter Kneisel JLab, Axel Matheisen DESY. Preliminary video conferences will be held on Wed June 16 and 23 and the final review session will be held on June 30<sup>th</sup>.

The installation of the temporary clean room is almost complete. Test pieces will be cleaned in it next week in order to satisfy the Review Committee requirements.



Coupler processing at SNS is continuing. One set was processed during the week, and one set is in the final stages of baking and it will be RF processed next week.

We now have a conceptual design for the extraction dump vacuum window. It is a 2 mm thick, 8-inch diameter aluminum 5056 window with a 150 mm radius of curvature. A primary design concern was multiple scattering. An Inconel window would have to be 0.5 mm thick to limit the multiple scattering, but the 2 mm thick aluminum window actually produces less multiple scattering than a 0.5 mm thick Inconel window.

The RTBT radiation modeling calculations are on hold until the modeling effort in the linac tunnel is complete. The linac dump and the ring injection area modeling effort will continue but at a low (10 to 15% FTE) level. The delay in the RTBT effort may not allow the shielding around the last quadrupoles to be optimized before for procurement must begin.

### **Operations**

Working on the ARR Post Start Action Item list. A list of items was sent out to responders.

Working on integrating the SCL schedule for Installation/Cooldown/RF Processing/Testing

Discovered that the Equipment Tracking System, Equipment data were entered (barcoded) but not tracked, many systems are installed but we have no idea where. Ben Sanchez will be assisting in correlating the installed equipment location with the barcode numbers.

Working with the Radiation Calculation Group, Radiation Design Working Group meeting Thursday at 2:00

Coordinating the ASD move to the CLO. People moving into the Second floor, move next week 14-17 RTW in the CLO on Monday the 21<sup>st</sup> and the people moving into the First floor the week after, pack 21-24, move 25-26 and RTW on the 28<sup>th</sup>.

Working with Controls on the Certification of the PPS

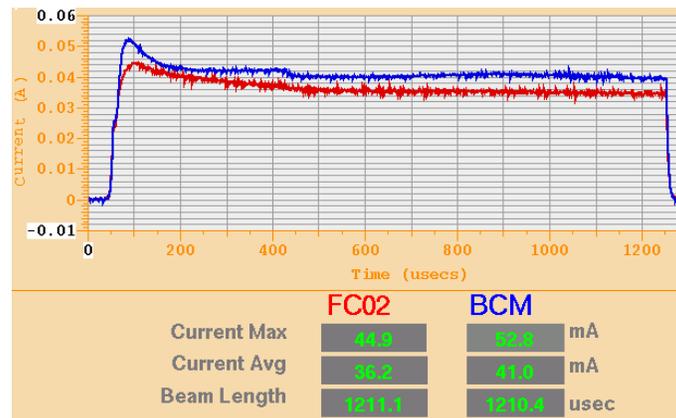
We Deferred RTW date for FY 05 reports consistent with David Olsen's request

FAST Team from Tennessee State, here will assist Ops with testing/certification.

## Ion Source Group

After experiencing apparently inconsistent noise levels, Wim, Craig, and Martin remeasured the noise levels. Consistent with the last measurement, BCM02 shows some 13 MHz, where BCM200 shows excessive 2 MHz noise, both originating from the Front End. Only very small levels originating from the ion source hot spare stand were detected. This clears the path for implementing suggested emission reduction measures.

Being able to finely control the RF power level has allowed us to push the ion source to the performance levels that will be required for the 1.4 MW operations: 1.23 ms long beam pulses with the beam current never less than 40 mA when measured at the end of the LEBT. This involved nominal RF power up to 60 kW generating antenna currents up to 350A. Inadequate cooling of the extractor limited the rep rate to 20 or 30 Hz. A more efficient cooling loop has been installed today.



However, over the course of the week, the performance slowly degraded and cesiations became ineffective, limiting the average pulse current in the lower thirties. The last two cesiations actually decreased the beam current but increased the extractor current. Increasing the gas flow by roughly 50% slowly returned the current to the previous values that were maintained after returning the gas flow to the nominal level.

## Survey and Alignment

### Mechanical Group

All RF windows are loaded on the DTL tanks. We will trial fit the waveguide connections since they appeared to be slightly off from the initial plan. All RCCS are operating and flowing water. Testing of them is underway. Having the water systems running has allowed our Magnet Group to begin their final testing of the EMD drift tubes. Vacuum system cable connections and pump installation is progressing rapidly.

CCL-2 vacuum terminations were completed.

CCL-3 cooling manifold installation is complete.

CCL-4 bridge coupler leak testing is completed. No leaks were found.

CCL-4 orbital welding is complete.



CCL-4 Orbital Welding

### Ring Systems

- Holes for the RF cavities and Quarter cells have been marked by survey.
- Drilled and installed anchors for the first RF cavity.
- Installed collimator shielding for ring collimators 1 & 2.
- Installed collimator 2 collimator support.
- Moved half cell C7 from the C6 location to C7.
- Received half cell A6.

### Water Systems

- CCL-3 installation for the Linac has been completed and system filtering has begun.
- Installation work on the CCL-4 klystron began this week. Still awaiting installation of the water load and circulator in order to complete the piping to that equipment.
- The feed piping to TRCC carts # 9-12 in SCL-ME5 & SCL-ME6 has been completed.
- The lift plan for the RF hoist is awaiting approval. Once approved, the SCL-ME 5 klystrons will be tied into the piping for the TRCC skid.
- The first six klystrons have been installed in SCL-ME6.
- The requisition for the software program, Fathom 6.0 has been placed and should arrive early next week. Shaun Gilliam, our summer intern is off and running getting the data base set up for the geometry of the RCCS-DTL3 for the program.
- The kick-off meeting for the CCWS (collimator) skids was held this Thursday and AVANTech is much further along than expected. The flow diagram and layout drawings are already in fairly good shape. Have made some minor changes and may change position of the some equipment to make it easier to maintain. I believe we can eliminate the PDR and just have a FDR in July. The longest lead items are the pumps which is 10 weeks and the conductivity probes that are 6 weeks.
- The design of adding instrument air to the PFN room in the RSB has been completed and SRO has been generated.
- The design of the DI water system for the Cryo vacuum tubes clean room has been modified to add a drain line back to the pump room.
- The layout design of the RSB power supply distribution piping has begun and will take several weeks to complete. We are sharing Jeff's time with some other drafting tasks.

### **Magnet Task**

This week we mapped more CCL Quads and assembled five more CCL Tank three intersegments.

We removed CCL Module 1 intersegment two and replaced a grounded current monitor.

We are studying repeatability issues concerning the SRF 8Q35 measurement system.

We received a permanent magnet dipole from Fermi Lab. We got this magnet free of charge only paying shipping. This magnet will be used as a reference magnet for the 8Q35 system.

### **Electrical Group**

Began check out of DTL 4, 5, and 6 corrector power supplies and magnets.

Started vacuum cabling in HEBT

Ongoing electrical installation in DTL, CCL and SCL 1, 2, and 3

### **HPRF**

Six CPI klystrons are in final position in the ME6 area. Six Thales klystrons will be positioned in the ME5 area next week.

CCL3 is just about ready for HV and RF.

Work continues on the reference line and the CCL 3 LLRF system

SCL-ME2 transmitters require arc detectors for 6 tubes before RF can be applied into shorted waveguide.

### **LLRF**

Installation: We're focused on wrapping up the DTL4-6 and CCL1-3 installation. There are a few details to be cleaned up in the tunnel and klystron gallery. This work will be complete in time to support RF conditioning of the RF structures in early July.

Procurements: HPM and FCM motherboard production is complete (all boards have been received.) Phase II production of the RFO and DFE daughterboards is underway with first deliveries of the RFO due June 11, and first deliveries of the DFE due June 18. Completion of the RFO and DFE production is planned for the end of June. The first nine AFE daughterboards shipped June 11 from Europe and will arrive at SNS in approximately one week. Completion of AFE production is planned for early July. The FCM ground shields have shipped and will be received at SNS within the next few days.

Development/Upgrades: 1) Several of the 2<sup>nd</sup> generation systems (RFQ & DTL) have been upgraded to the latest FPGA code from Berkeley; the remaining systems will be upgraded over the next few days. 2) A dual-system has been set up in the lab and performs as expected. This is the prototype for the SCL installation, where we will serve two RF systems per LLRF VXI crate. 3) The sequencer has been upgraded to provide a smoother transition between closed-loop and open-loop modes of operation. 4) Kay Kasemir and Carl Lionberger have been working together to ensure a smooth transition upon Carl's return to Berkeley at the end of June.

Ring RF: Chip Piller and Mark Champion will visit Brookhaven next week to begin the process of taking ownership of the ring RF systems.

### **Cryo-Group**

## **Beam Diagnostics**

### **Wire scanners:**

A video conference to discuss 8 and 12 inch actuator production was held Wednesday, June 9. LANL participated along with members of the Diagnostics and Mechanical groups. A plan was developed to procure these devices.

### **Faraday Cups:**

The Vacuum team has come up with a fix for the leaking seals and components are being fabricated.

### **BLM:**

A video conference was held to summarize progress toward the final wire scanner acquisition system. Another will be held in two weeks. Work on the BLM calibration facility continues with a concentration on the ion chamber holder and motion control details.

### **BCM:**

Current monitors for the ion source test stand were developed and have been running reliably. With help from the magnet team, magnetic field measurements were performed in the vicinity of a CCL BCM toroid. Results are being analyzed.

### **BPM:**

We are working with BNL to obtain the balance of the design documents for the BPM electronics. These will be reviewed along with the materials presented participated in the pre-production review. We have completed installation and fusion splicing of the RF reference fiber for the upcoming run. John Power from LANL visited to help ready the linac BPM electronics for the CCL run.

### **Timing:**

Quotes for the PCI card fabrication have been received. Nearly all components have been received.

### **Administrative and Misc:**

The contract has been awarded for the second contract electronics technician. Interviewer summaries for the staff Technician position are being reviewed. Interviews for the staff engineer position are now being arranged.