

## Accelerator Systems Division Highlights for the Week Ending June 14, 2002

### ASD/LBNL: Front End Systems

- Ongoing efforts continue to be focused on disassembly, crating, shipping and documentation activities.
- Truck number 2 was offloaded and uncrated at the FEB on Monday of this week. Mike Hechler reported that an inspection of the items by him and his staff indicated that everything arrived in good condition.
- This week in Berkeley, the MEBT and RFQ assemblies were weighed and rigged for lifting by our building crane. On Wednesday both assemblies were lifted out of the building and set and secured onto specially designed metal skids. A forklift was used to set both units onto the truck. Final securing to the truck was completed on Thursday and the equipment left Berkeley Lab on Thursday night. This is shipment number 3 and is expected to arrive in Oak Ridge early next week. LBNL mechanical engineer, Daryl Oshatz, will be on-site in Oak Ridge next week to assist during receiving and offloading operations.
- Disassembly work on the electronic racks continues and is making excellent progress. The racks inside the high voltage enclosure (*a.k.a.* the big blue box) were removed on Friday.
- All activities related to shipping the FES equipment from Berkeley to Oak Ridge are going well and remain on schedule. Many thanks to the Oak Ridge team who has been here working very hard during the past 3 weeks helping to get this job done.

### ASD/LANL: Warm Linac

- Two more 402.5-MHz transmitters arrived at ORNL. (WBS 1.4.1.1)
- The first pair of CCL windows was conditioned up to 2.5 MW traveling wave, at 1.3 ms, 60 Hz. We are preparing for a four-hour heat run and 10-MW equivalent standing-wave test at short pulse (100  $\mu$ s). (WBS 1.4.1.1)
- The *Thales* 5-MW tube could not pass acceptance tests. Primary problems were magnet power, DC leakage current across the ceramic during high pot, and very high body power (6% of RF output.) They also broke their test load. Their test equipment doesn't appear reliable at our operating conditions. (WBS 1.4.1.1)
- Gary Anderson from ORNL came out for a visit and reviewed the operation of the high-voltage converter-modulator (HVCM). He could not install his *Rogowski* current diagnostics as hoped directly on the IGBT's because there was not enough space for a probe; instead he decided to install the *Rogowski* loop at the transformer primary winding (in oil tank), the only location with sufficient room. He will do an in-depth transient analysis of IGBT losses and temperature rise. (WBS 1.4.1.2)
- The HVCM was switched to operate the CPI 805-MHz klystron at 2.5 MW, about 400 kW average. This is about half of the design power. (WBS 1.4.1.2)
- The *NWL SCR* controller had electrical failure of a thermal interlock which could have placed 2400 VAC (1 MVA) on the control panels. All thermal interlocks have now been removed for safety reasons. After making a physical review of equipment, we determined that no other similar situation is possible. (WBS 1.4.1.2)
- The HVCM design is now "frozen." (WBS 1.4.1.2)

- LLRF control integration continues to make progress. We started testing Rev B of the HPM. We had some initial problems but can now program the logic PLD through the JTAG connector. The VXI interface is fine. The RF channels on the first unit have all been calibrated. (WBS 1.4.1.3)
- We continued to define the DSP code. We had a number of good meetings between interested parties at LANL and ORNL furthering the specification and definition. (WBS 1.4.1.3)
- Schematics are completely into ECAD for Rev B of the FRCM. They will be working on the layout next week. (WBS 1.4.1.3)
- Matt Stettler completed additions to the RF board (rev C), and turned them over to ECAD as well. They are busy with the FRCM motherboard revision, but this will be next. This accommodates some new detectors and serial PROM interface, which allows a serial number/revision number to be read from the back plane. (WBS 1.4.1.3)
- Rev B of the clock distribution module works. One minor problem was found, but it will not affect operations. (WBS 1.4.1.3)
- The first reference-line heater chassis is built. We have contacted a company in Albuquerque to send a quote to build all twelve that we need. (WBS 1.4.1.3)
- Roy Lopez has been working with Taylor Davidson at ORNL to transfer experience on the exact layout of the RF-control racks. (WBS 1.4.1.3)
- *Votaw* has suffered a delay in the fabrication of the remaining DTL tanks due to a gear failure on their horizontal mill. The impact of this delay is approximately 3 weeks, which moves the final shipping date to October 18, 2002. (WBS 1.4.2.2)
- The vacuum and flow rate tests on the downstream end wall for Tank 1 were successful, and this end wall has been accepted. The test results compared reasonably well with *Major Tools* data, and vacuum concerns did not appear to be a problem. (WBS 1.4.2.2)
- Several of the PMQ drift tubes for Tank 1 are nearing completion, and the first batch of drift tubes is expected to ship by June 17. The remaining PMQ drift tubes will continue to ship to ORNL in small batches, with the last batch shipping before July 15. The EMD drift tubes should also ship by July 15. (WBS 1.4.2.3)
- We are still working to repair the EMD for Tank 3, and the delivery date for this drift tube hinges on activities occurring over the weekend. Our goal is still to deliver it with the post couplers. (WBS 1.4.2.3)
- The support stand for Tank 2 should be delivered by July 2. (WBS 1.4.2.6)
- The finished post couplers for Tank 3 are progressing as planned and should ship on or before June 24. The finished slug tuners should ship on June 18. (WBS 1.4.2.7)
- LANL mechanical engineering and physics staff left this week to make three stops in Europe on CCL issues. The first stop, at RAL, is for discussion of CCL manufacturing and installation. The second stop, at *ACCEL*, is to review the CCL cavity production schedule and components in process. They expect to inspect brazing samples and the bridge-coupler first article. The final stop, at CERN, is for discussion of CCL furnace brazing issues. (WBS 1.4.4)
- Repairs on two DTL BPMs are underway at *ISYS*. The process of welding the feedthrough to the electrode is being fine tuned using coupons. Once the process is refined, the BPM electrodes will be re-welded. (WBS 1.4.5.3)

- The BPM destined for the D-plate (the one that was rejected for DTL-3 due to a chunk taken out of one electrode during the feedthrough weld) has a shorted feedthrough to ground. It will be returned to the vendor for repairs. (WBS 1.4.5.3)
- Design modifications to the SCL BPM-mapper fixture drawing are complete. (WBS 1.4.5.3)
- We are preparing to loan a BPM electronics chassis to *Bergoz* to allow them to test and characterize the BPM analog front end and the future modifications to it. ECAD modifications are in progress on the digital front-end design. Modifications for the PCI motherboard have been delivered to the ECAD designer. Testing and characterization of the 402.5-MHz electronics continues. (WBS 1.4.5.3)
- Work continues at JLAB to test the SCL wire-scanner actuator. Fabrication continues at *Huntington* on the prototype and D-plate WS actuators. (WBS 1.4.5.3)
- Work began in earnest on the electronics design for the D-plate halo scraper and beam stop. Fabrication continues on many D-plate components. (WBS 1.4.5.3)
- The order was placed this week for three current transformers for the CCL and TR. Two are needed for operations, and one will be a spare. This is the final current monitor order. (WBS 1.4.5.3)
- Work began in earnest on the electronics design for the ED/FC system. Fabrication continues on the first prototype unit. (WBS 1.4.5.3)
- At ORNL, the first pumpdown of the DTL-3 tank was performed this week and preliminary leak testing has begun. Two small o-ring leaks have been found and repaired. This effort will continue next week.
- The slug tuners and post couplers, set in the tuned configuration, are being fabricated at Coronado Machine and Integrated Machine, both in Albuquerque. They are scheduled to be delivered to RATS by June 25.



### DTL-3 Vacuum Leak Testing in RATS

#### ASD/JLAB: Cold Linac

- Testing of the prototype cryomodule continues.
- The measured static Lorentz detuning coefficient for cavity #2 is  $-3.8 \text{ Hz}/(\text{MV}/\text{m})^2$ , consistent with predictions based on finite element analysis of the cavity.
- The measured range of the slow mechanical tuner is 478 kHz, well above the 200 kHz specification. The resolution of 2 Hz is also better than specification.
- A preliminary measurement of  $Q_0$  yields a value of  $10^{10}$  at the nominal operating gradient, comfortably greater than specification.

#### ASD/BNL: Ring

- Paul Holik was at BNL this week to discuss electrical/safety issues.
- Bids for the Ring dipole high field power supply were opened on June 6<sup>th</sup>. A technical and cost evaluation of the three responsive bidders is in progress.

- Another iteration of the SNS magnet parameters was circulated this week for staff review. A final copy will go to ASD for before it is sent to our power supply vendor, IE Power.
- An ICD between Controls and Collimation is being prepared for submittal to ASD via DCC.
- PSSRs, APPs and P3 Milestones are being reviewed for the balance of FY02.
- A PCR is being negotiated with ASD for the budget and scope transfer of the linac and ring extraction dump window beam pipe assemblies from BNL to ORNL.
- A PCR for six spare vacuum chambers (Ring, straight sections) is under development for approval by ASD.
- Laser Monitor – AGS/Linac machine access is scheduled for later today to inspect the laser hardware and set-up. Efforts continue to observe laser/beam interactions.
- Chicane #4 (injection) arrived at BNL this week from New England Techni-Coil. Incoming inspection is IP.
- Testing of the Bunker (BINP) quadrupole is complete. We have been advised that this first article will be shipped to BNL later today.
- We have been advised that SDMS will ship the 1<sup>st</sup> article (RTBT#2) collimator, with its inner box, to SNS/OR this week.
- We are working with ASD on improved methods for brazing stainless steel water fittings to copper conductor. Some of our vendors have experienced difficulty with this spec requirement.
- An internal review was conducted on open issues related to the WBS 1.5 Collimation Systems.

### **Controls**

- All data required for the revised WBS 1.9 plan were received from the partner labs, and processing of the PCR is underway.
- Racks to be installed the vicinity of the FE building temporary control room are being stuffed with hardware at the RATS Building and will be shipped to the site next week.
- Checkout of the safety train on the ion source hot spare in the RATS Building has begun, using ladder logic based upon the Berkeley PLC-5 implementation, but converted to the SNS-standard ControlLogix platform. Implemented logic is for doors, fans, heat detectors, and some power supplies. High Voltage power supplies will follow.
- Requirements for the D-Plate imaging system have been defined at LANL. The LANL Data correlator was published. Beta testers so far are KEK and PSI.
- The second Linac LLRF HPM module has been implemented in EPICS. Only minor software changes were required. EPICS can now “talk” to the complex FRCM module in the VXI crate, however the conversation thus far is still not going well. EPICS is in use for temperature monitoring on the second HPRF transmitter.
- The RFP for Phase 1 PPS equipment was issued. This procurement is for all of the PLC equipment required for the Linac. Development of PLC programs and EPICS screens for Phase 0 PPS is continuing.

- Conventional Facilities Control valves for the FE building and tunnel to 600 Mev were delivered to the site. FE software was factory tested and is ready for delivery.
- A task order with DCS (Rack Factory contractor) was placed for RCCS racks.
- All workarounds needed to avoid fabrication in the field are in place and fabrication is underway. System block diagrams for the CCL were finished and a block diagram structure to use in planning the SCL was completed.
- A bug in the timing master module was fixed and new firmware sent to ORNL. New timing decoder firmware was sent to ORNL that corrected the output pulse width.
- New Beam Loss Monitor electronics were tested at BNL using a 16-bit digitizer instead of the 24-bit digitizer that had been previously planned. The output of this analysis is still being studied. It has the potential to simplify the BLM hardware configuration.
- A SUN Ultra-5 was sent from BNL to ORNL to be used as a platform to run HP OpenView network monitoring software. A PLC-5 and 1771 rack is being sent to help the effort to migrate Front End vacuum software from a PLC-5 to the ControlLogix platform.

### Installation

- Installation of the roof beams for the DTL shielding tomb was completed this week. The attached photo shows the second beam being placed above the LBNL Bevatron blocks.



### Accelerator Physics

- Six members of the AP group were in EPAC last week. Galambos, Henderson and Olsen visited the ISIS facility at Rutherford Lab in England to discuss machine operation and their Ion Source and RFQ development work with local experts.
- The ORBIT space-charge code has been enhanced with the addition of higher-order maps supplied by Fermilab collaborators. Parallelization of the ORBIT code continues in anticipation of the arrival of a new parallel computing cluster in the next two weeks.
- Carbon-carbon composite material for use in scrapers or slits in the front-end has been ordered. A. Feschenko is visiting from INR, Russia, to discuss design and fabrication of bunch-space monitors for the DTL and CCL commissioning. These monitors will provide the capability of longitudinal phase-space matching in the linac.
- AP group members are working with LANL colleagues to establish the procedures and variables to be used in automated DTL RF conditioning. A summer student is working with Eugene Tanke and Leonid Kravchuk to develop software to do the automated conditioning.

### Operations Group

- Met with NEXTEL on cell phone tower on site, Hicks memo
- Worked with preparation of Electronic Logbook
- Preparing Commissioning Program Plan
- Commissioning Plan of Action being signed
- Preliminary discussions of the who should be on the ARR Committee
- Worked on requirements for the Operator Interface to EPICS Control Screens.
- Continued discussions of an improved Document Management System.
- Operations Windows software
- Starting a discussion with CF over testing and operation of utilities

### Ion Source Group

- John Munro has successfully completed the check out of all HV ground-based interlocks on the Big Blue Box for the Hot Spare Stand.
- Paul Gibson spent another week at LBNL directing the ORNL efforts to enhance documentation while the FE is disassembled.
- The high power, 2 MHz, 80 kW amplifier was tested in conjunction with the capacitive matching network. Initially operation at modest power levels (<25kW) resulted in a severely damaged Oakland, thin-coated antenna (many burn spots between antenna and plasma chamber). Inspection of the network circuit

revealed the presence of an undocumented 1000 pF capacitor, which allowed the entire antenna to float electrically with respect to the plasma chamber. We believe this allowed the antenna to charge to high voltage with respect to the plasma chamber, which resulted in the antenna damage. This problem was corrected by insuring a good ground of the antenna to the plasma chamber. The system now runs stability to 60 kW with ~4x the plasma density with antenna currents as high as 560A. Tuning parameter maps of the network were determined and documented. Comparisons in plasma density will be made with the standard inductive matcher, which will be retrofit in several days to the source. Sonali Shukla and Yoon Kang participated in these investigations.

- Rahul Rauniyar is implementing the 'user programing' advanced feature of SIMION to allow full control over ion starting conditions. This will initially be used to fly ions through a full 3D map of the dumping magnetic field but may ultimately be employed for fundamental studies of negative ion extraction.

## **RF Group**

### **Mechanical Group**

#### **Magnet Systems**

- HEBT Dipole #4 has been successfully measured
- #5 Buss has been manufactured and assembled
- The HEBT 12Q45 has been sent back to Danfysik for repairs To the water cooling system.

### **Vacuum Task**

#### **Cryogenics Group**

- CHL: The contractor has started to install the building siding on the west end of the CHL beginning at column line 1. The roof paneling is covering 1/2 of the RF section of the building.
- Transfer lines: Work is 30% completed on supply modules S-HB6/HB7 and S-HB8/HB9. We have completed the first return module R-MB3/MB4.
- Tunnel: The chases between the CHL and the tunnel have been condensing water and we have covered the ends of the chases to prevent them from breathing and further condensing water. A protective curtain has been installed in the tunnel area around the CHL chases. This will allow us to install the "T" sections of transfer line in a somewhat controlled environment. We anticipate beginning the installation of the return "T" section this next week.
- Personnel: We continue to interview for the vacant technical positions at JLAB.

### **Electrical Systems Group**

- The klystron building has been surveyed for equipment lay out (thanks go also to Joe and Julius)
- Teresa Toomey resumed directing tunnel and klystron building tray installation
- Ken Rust visited IE Power with Jack Gioia to review CCL power supply bids

- Paul Holik visited BNL to participate in BNL-SNS electrical meeting, review BNL safety and interlock policies of large power supplies with Jon Sandberg and Bob Lambiase.

## Survey and Alignment Group

### Beam Diagnostics

#### LANL Beam Diagnostics Progress Report:

- **BPM pickups:** Repairs on 2 ea. DTL BPMs are underway at ISYS. The process of welding the feed-through to the electrode is being finely tuned using coupons. Once the process is refined the BPM electrodes will be re-welded. The BPM destined for the D-plate (the one that was rejected for DTL-3 due to a chunk taken out of one electrode end during the feed-through weld) has a shorted feed-through to ground. It will be returned to the vendor for repairs. Design modifications to the SCL BPM mapper fixture drawing are complete.
- **BPM electronics:** We are preparing to loan a BPM electronics chassis to Bergoz to allow them to test and characterize the BPM analog front end and the future modifications to it. ECAD modifications are in progress on the digital front-end design. Modifications for the PCI motherboard have been delivered to the ECAD designer. Testing and characterization of the 402.5 MHz electronics continues.
- **WS actuators:** Work continues at JLab to test the SCL wire scanner actuator. Fabrication continues at Huntington on the prototype and D-plate actuators.
- **D-plate:** Work began in earnest on the electronics design for the D-plate halo scraper and beam stop. Fabrication continues on many D-plate components.
- **Current monitors:** The order was placed this week for three current transformers for the CCL and TR. Two are needed for operations one will be as spare. This is the final current monitor order.
- **ED/FC:** Work began in earnest on the electronics design for this system. Fabrication continues on the first prototype unit.
- **Cabling:** Work continues on cable specifications, rack layouts, wiring lists, and block diagrams.

#### BNL Beam Diagnostics Progress Report:

- **1.5.7.1 BPM:** Danny Mangra of ORNL requested BPM drawing information. This was passed to the mechanical engineer. Work continues on a tech note for the upcoming review. Bergoz reports that they are focusing on a design. They claim compatibility with the present configuration, requiring only a number of additional pins to be defined for gain control. A request was made for a block diagram.
- **IPM:** Six of the eight channels are working on the luminescence gas profile monitor. With pressure about  $3E-7$  Torr we see clear single bunch signals. Single bunch profiles have been measured using the six good channels.
- **1.5.7.3 BLM:** Continue to work with vendors to develop pricing for the new BLM design. Modifications to the AFE electronics to improve response for the RTBT region are being tested.
- **BCM:** All parts except for inductors are now in house for stuffing the new AFE circuit board. When the inductors come in, the board will be stuffed. The shop has delivered the test mock-up of the Ring BCM. Tests to start next week. Drawing details has started for the RTBT BCM mock-up. Work continues on testing the new transformers.

- **Tune:** Work progresses on preparing a new PLL configuration.
- **1.5.7.6a Carbon Wire Scanner:** Preparations continue for refurbishment of the MEBT wire scanners.
- **1.5.7.6b Laser Wire Scanner:** An eight-hour shift with the laser wire showed no indication of laser/beam interaction. We will have a vacuum access to do a full test on all components and then a final run with beam early next week.

**ORNL Beam Diagnostics Progress Report:**

- Craig continues work on DTL tank-3 tuning. Work continues on integrating the diagnostics with the EPICS. Controls and diagnostic people are identified to work on Embedded XP, EPICS time-stamp needs, and running EPICS 3.14 on Win32 devices. Work continues on the LabView template to unify all SNS diagnostic systems. Laser wire data analysis continues. Summer interns are making excellent progress on their projects. We had a meeting with the Physics group and the Russian collaborators on installation and integration of the BSMs. We concluded that the first BSM would be available around April-2003. We are investigating the impact of the diagnostic engineers that are reassigned to help the LLRF group. We will prepare a new installation schedule.