

## **Accelerator Systems Division Highlights for the Week Ending June 21, 2002**

### **ASD/LBNL: Front End Systems**

Progress on shipping and documentation efforts continues at an excellent pace. The RFQ and MEBT subsystems arrived safely on site at SNS on Monday of this week, and both units have now been set by Oak Ridge staff into position in the FEB, awaiting final precision alignment.

A fourth truck left LBNL Thursday evening containing a large number of ancillary parts associated with the RFQ and MEBT systems. These items were shipped ahead of schedule, which will ensure that these parts will not be the pacing item for reinstallation activities at Oak Ridge.

The High Voltage Enclosure (a.k.a. the big blue box) has been prepared for lifting by crane out of Building 71 on Monday. It will then be loaded along with MEBT racks and other equipment onto the next truck in preparation for departure from Berkeley next Wednesday.

Documentation efforts are substantially complete for the mechanical systems. Final documentation for electrical systems is progressing well. This effort consists primarily of updating existing drawings to reflect as-built configurations. All documentation efforts are expected to be concluded by July 15.

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

We completed acceptance test on the first pair of CCL windows. The final test was a 10 MW standing wave (with variable phase) at 60 Hz, 100 microsecond pulses. (WBS 1.4.1.1)

We completed the 4-hour heat run on an 805-MHz, 550-kW load. The second one should be completed by COB 6-21-02. (WBS 1.4.1.1)

We started acceptance tests on the fifth 402.5 MHz transmitter system at Titan. (WBS 1.4.1.1)

CPI started the vacuum bakeout of the repaired 550 kW klystron. (WBS 1.4.1.1)

LANL staff were at Dynapower this week to status progress on the production high-voltage converter modulator (HVCM) order. Dynapower has made significant progress over the last month. There is a lot of activity on the shop floor with a variety of electronic and hardware assemblies actively being worked on. We observed approximately 15 Dynapower technical staff members actively engaged in SNS HVCM specific work and were informed that there were some additional staff on vacation at the time of the shop tour. We spent time with the production manager discussing potential changes to the Dynapower production schedule. The net impact of these changes was to pull the schedule back such that all first four HVCMs are now scheduled to be completed in August 2002. (WBS 1.4.1.2)

LANL staff also went to Sorrento and National Arnold for acceptance tests and status of the HVCM GFE capacitors and transformer cores being supplied to Dynapower.

We continue to test the first Rev B High-Power RF Protect Module for the LLRF system. So far, there have been no showstoppers, although we cannot get FLASH to work. We're working with Altera to define the problem and solution. We can program from JTAG and have decided to move on with further board testing. (WBS 1.4.1.3)

We continue to define and specify the LLRF DSP code. (WBS 1.4.1.3)

We identified the proper LLRF PROM chip to allow for EPICS readable version and revision number for the RF board and DSP board. This will get incorporated on the next revisions of each. A TTL backplane driver was built and just needs to be tested for aiding in FRCM testing. We were having trouble with the JTAG chain, which allows one to program all of the programmable chips on the board from a single connector. We identified the problem and added few pull-up resistors which seem to have done the trick. (WBS 1.4.1.3)

We sent ECAD schematic updates of LLRF Clock Distribution Module Rev C to ASD for review. These changes fix rev B's inability to talk to EPICS. (WBS 1.4.1.3)

We wrote the resonance control algorithm based on SRF data taken from a JLAB report plot. Simulations of the algorithm are underway. (WBS 1.4.1.3)

We received the LLRF reference line air dryer in and mocked it up in the rack to be sure we have all of the right length plumbing parts etc. The last two items required have been ordered. (WBS 1.4.1.3)

We have the top entry panels labeled for the LLRF system and after a final check will be ready to send to ORNL for the RFQ rack. (WBS 1.4.1.3)

Rad hard connectors have been ordered for all LLRF non-Heliox connectors in the tunnel. A second supplier has shown interest in bidding on Heliox connectors as well, which we will pursue. A second vendor has provided a quote that is under evaluation. (WBS 1.4.1.3)

We had daily interactions with ASD this week to support DTL Tank 3 installation issues and testing such as drift tube stem centering and vacuum leak checking. (WBS 1.4.2)

LANL staff were at ACCEL this week to perform a preliminary tunability check on the first article CCL bridge coupler. The tests were satisfactory. (WBS 1.4.4)

LANL visitors conducting work at ORNL this week included Mike Lynch (RF system delivery and installation planning).

LANL visitors conducting work at ORNL next week include: Jim Billen (tuning DTL Tank 3); Amy Regan (LLRF delivery and integration planning); and Kirk Christensen and Rick Martineau (DTL-3 testing and acceptance criteria).

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

Testing of cavity #2 in the prototype cryomodule continues. Further measurements of  $Q_0$  confirm a value greater than  $1 \times 10^{10}$  for gradients less than 12 MV/m, dropping to  $7 \times 10^9$  at the limiting gradient at 16 V/m. The cavity specification is  $Q_0 = 5 \times 10^9$  at the operating gradient of 10.2 MV/m (corresponding to a peak surface field of 27.5 MV/m). Measurement of dynamic Lorentz detuning at the operating gradient and with a standard SNS pulse waveform yields a total frequency excursion of 400 Hz, meeting specification (<470 Hz). In addition, preliminary tests with the piezo-electric tuner have demonstrated that the excursion can be substantially reduced with only a very simple pulse timing/shape algorithm. These are very encouraging results.

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

Technical and cost evaluations of the Ring dipole high field power supply continue. A request for additional info went out to two of the bidders. We are working with ASD on specific issues.

The SNS magnet parameter list is being finalized to include sextupole design changes. A final copy of the magnet parameters will go to ASD for review before it is sent to our vendor, IE Power.

An Interface Controls Document (ICD) between Controls and Collimation is being prepared for submittal to ASD via DCC.

Two more corrector sextupoles arrived from NE Techni-Coil. We now have 5 of 9 in house. Also, all nine of the corrector octupoles have arrived from NE Techni-Coil.

The 1<sup>st</sup> article Injection Kicker PS arrived at BNL from IE Power. We plan to test this unit with the 1<sup>st</sup> article injection kicker magnet this summer.

Chicane #4 (injection) arrived at BNL last week from New England Techni-Coil. See attached photo.



Laser Monitor – Laser profiles were obtained last Sunday. The Diagnostics group worked over the Father’s Day weekend and recorded several laser profile scans. In addition, the horizontal profiles were calibrated with carbon wire data. As of this week, the AGS and Linac are “down” for scheduled summer maintenance.

The Bunker (BINP) quadrupole is complete. At this week’s teleconference they reported that it has been air shipped to BNL for acceptance testing.

An RFQ is being prepared for the procurement of (8) 26S26 sextupole magnets. We expect to release an RFQ in July.

An RFQ is being prepared for the 27CD30 (19+1) correctors. Expect to release in July.

An internal review was conducted to review open issues related to the WBS 1.5 Collimation Systems.

At this week’s AP meeting, A. Jain reported on the measurement results from the first 17 Ring dipole magnets. The measuring station is being changed over for the type B magnets. We expect to resume measurements on magnet #18 this week.

We had an internal design review of the Ring/RTBT Extraction Area with a specific look at the extraction septum magnet, beam dynamics and optics.

### **Controls**

The timing link fanout box is out for bids as of Thursday 6/20/02. This makes it likely that the procurement contract will be issued in two weeks.

The V124S timing decoder module driver and device support software was updated in accordance with the software review held in Brookhaven last January. Also, we are beginning to get a set of standardized timing signal names.

A complete (but limited) timing system (6 events, 4 RTDL frames) was installed at RATS.

A new PROM for the V123S event link generator modules was received from Brookhaven. This PROM corrects the problem we were having with the V123S not passing IACK and blocking interrupts from any upstream modules. We are now testing interrupts from the V123S itself.

Racks to be installed in the temporary control room area were stuffed and shipped to the site. FE communications cabling documentation was revised and a "Service Request Order" (SRO) for installation of these cables was submitted to the ASD Electrical Group.

This week BNL hosted an EPICS training course for most of their controls staff.

Conventional Facilities Controls drawings for the CUB were issued CFC. The next focus will be the Target Building.

## **Installation**

### **Accelerator Physics**

The AP group has been working with Operations to identify manpower needs for commissioning the front-end in November and December. A few AP group members will be trained as operators to provide sufficient operator coverage during commissioning. We will make use of ALL AP group members for staffing shifts.

S. Kim and M. Doleans visited Jlab this week to discuss prototype cryomodule test with the Jlab team. They will visit Jlab a few more times this summer to participate in Lorentz-force detuning measurements.

The first version of the electronic logbook has been put together by T. Pelaia, and will be in use in a few weeks.

J. Holmes has put the higher-order maps provided by FNAL collaborators into the ORBIT code. Benchmarking and timing is underway.

Applications programming group is preparing software needed for front-end commissioning in November. Several applications which were not available for Berkeley commissioning were identified: beam-based alignment, general purpose histogramming, X-Y correlator, RF-scan, automated trajectory correction and scripting capabilities.

Mario Giannella and Eugène Tanke attended the Confirmation Team meeting for the FE-DTL-CCL Work Smart Standard organized by Rosa Murr (ORNL). Overall, the meeting went very well: The ID Team is being asked to reword the report in a couple of places and review one item. A revision will be sent out soon for concurrence.

A summer student, Eric Snow has started to work on a computer program to assist in DTL RF conditioning.

Sasha Feschenko (INR) is visiting until 25-Jun-02 to discuss Bunch Shape Monitors for the CCL, in particular with AP and diagnostics group members.

### **Operations Group**

The Commissioning Plan of Action was signed and submitted – This is the first SNS Commissioning Document submitted to DOE.

Preparing Commissioning Program Plan for signature.

Front End Training Manual – Outline done –preparing text.

Preliminary discussions of the who should be on the ARR Committee.

Starting a discussion with CF over testing and operation of utilities.

Continued discussions with NEXTEL and ORO on cell phone tower on SNS site.

### **Ion Source Group**

Paul Gibson and Robert Morton continue to participate in the installation of the front end.

The delivery of the cooling plates for the matching network transformer has been delayed, which will set us back for 1-2 weeks.

This setback provides Robert Welton and Sonali Shukla with the opportunity to continue mapping the ion source plasma with 2 MHz RF fed through the capacitive matcher.

In the afternoon of June 21, 2002, a loud bang announced the beginning of the ORNL based ion source equipment shake down. A closer inspection of the 2 MHz, 80 kW RF amplifier revealed an inductor that self-destructed. QEI, the manufacturer, believes that operations can continue until a replacement arrives.

### **RF Group**

RF group preparing for installation, transmitter scheduled to go in the gallery July 15th, interconnecting and checkout begins July 24th. All equipment is on hand will either be in final position or in staging area. We will have 2- klystrons.

RF group cold model measurements and tuning techniques with our equipment are finished and will be evaluated next week when LANL folks are here.

Modifications to klystron water pipes are in progress and we are rearranging the water metering circuits on several of the klystron cooling carts to accommodate collector flows for 2 tubes.

### **Mechanical Group**

#### **Magnet Systems**

The "Short" DEBT 8D406 is being mapped.

#6 of 9 Buss assemblies is under construction.

#### **Vacuum Task**

The specification for the Mass Spectrometer Leak Detectors needed to support site installation was completed and is currently being reviewed prior to release planned for early next week.

A minimum change design to improve the mechanical drift tube (DT) support and alignment system was completed and released for fabrication.

The design of a test chamber to allow DT's to be individually vacuum leak tested with the water cooling channels pressurized with helium was completed and released for manufacture. Delivery is promised by the end of next week.

The MEBT was placed in position and the RFQ aligned for mating. Preparation (installing and conditioning portable clean room) is now underway to allow installation of the interconnecting bellows.

First article acceptance of the RGA commenced with calibration using the multi-gas calibrated leaks.

Leak testing of DTL 3 continued intermittently and a number of gross leaks resulting from incorrectly installed O-rings, flakes of copper plating in O-ring grooves, rusting of the seal closure end flange were corrected. A long-term fix to the rusting problem needs to be established to prevent the potential long-term erosion of the seal surface. A brushed plating treatment may prove suitable but need to be evaluated for vacuum compatibility. Leaks have been found in two DT's and these are being differentially pumped to allow leak testing to continue. However, vacuum integrity needs to be improved significantly to allow leak testing at an adequate level of sensitivity.

Procurement of assorted vacuum hardware and equipment continued to support FE vacuum installation and vacuum activities at RATS. Fabrication of the seal test rig commenced and delivery is scheduled for early next week. Instrumentation required for the seal test rig was ordered and received.

Accelerator equipment received this week included 6 gate valves for the DTL/ CCL installation.

### **Cryogenics Group**

#### **Electrical Systems Group**

Ken Rust visited IE Power and Alpha Power Supplies to attend design reviews for the CCL quadrupole magnet power supplies.

Paul Holik visited BNL to discuss ring power supply cabling requirements and to review bids received for the ring main dipole supplies. Four companies responded to the bid request. We are awaiting answers on bid clarification questions from some vendors.

Tom Owens and Eddie Tapp visited BNL to review ring RF systems progress.

About one-half of the cable trays in the RFE klystron gallery is installed. All of the RFE linac tunnel cable trays are installed, except for a short 3 foot section. Magnet cable installation is scheduled to begin next week.

#### **Survey and Alignment Group**

Heavily involved in the location of the 78 Target Anchor bolts. This includes data analysis as well as fieldwork.

We are in the process of positioning MEBT in the DE building.

Have located the 1st/last magnet, and waveguide center on each structure, as well as all DTL foot locations in the linac tunnel.

Have completed layout of over 200 transfer line stands boltholes. We are now in the process of identifying bayonet center locations.

Assisting in a number of alignment and vacuum tests associated with DTL-3.

#### **Beam Diagnostics**

LANL Beam Diagnostics Progress Report:

BPM pickups: The two repaired DTL BPMs came back from ISYS. All the feed-through-to-electrode welds are now good. Two electrodes are still twisted, and we are in the process of evaluating this. The order for the CCL and SCL BPMs was finally placed 14/Jun. We expect the prototypes in 4 weeks and the balance of the CCL BPMs in 6 weeks. The short to ground on the D-plate BPM electrode has been repaired.

BPM electronics. Design modifications continue on the Digital Front End.

WS actuators: Work continues at JLab to test the SCL wire scanner actuator. Fabrication continues at Huntington on the prototype and D-plate actuators.

WS electronics: An estimate of the beam loss caused by the ring wire scanner, compared to the background radiation, indicates that we may need a wire larger than 6 micron diameter, or another method of reading the wire signal.

ED/FC: An off-the-shelf USB binary controller is now on hand for evaluation. Fabrication continues on the first ED/FC head.

D-plate: Fabrication continues on many D-plate components. The last drawing for the last D-plate component was finished this week (although the water manifold drawing is in checking). Drawings left are the assembly drawings and various details related to the actuators. We have met several times with LANL/Controls to make progress on D-plate wiring and software issues.

Cabling: Work continues on cable specifications, rack layouts, wiring lists, and block diagrams.

Misc: A tech note has been completed on the effect of wire scanner actuator and electronics errors on the accuracy of the measured beam size and position.

#### BNL Beam Diagnostics Progress Report:

1.5.7.1 BPM: Work continues on tech-note and preparations for design review. Continue to explore details of PCI interface. Continue fabricating the assembly fixture for the 26 cm, 30 cm and 36 cm bpms. Vendor is finishing up wire cutting the striplines for the 36 cm bpms. Expected to receive them in around a week.

1.5.7.2 IPM: Work continues on ICD and preparations for design review. Analysis of prototype luminescence gas profile monitor data continues.

1.5.7.3 BLM: Reviewed the ion chamber assembly labor estimate from the vendor. Tests of the new chamber design were completed at the BNL Linac. Expected improved rise times were observed, data is being examined.

1.5.7.4 BCM: Parts have been delivered to instrumentation. Board stuffing to start next week. Testing of mock-up has started. Work continues on testing the new transformers. Details of RTBT BCM mock-up are underway.

1.5.7.5 Tune: UAL modeling continues.

1.5.7.6a Carbon Wire Scanner: Preparations continue for refurbishment of the MEBT wire scanners.

1.5.7.6b Laser Wire Scanner: We were able to obtain a beam profile on Sunday (Father's day). Laser intensities were erratic, perhaps as a result of radiation damage. Motion control problems persisted, and ultimately it was necessary to gather the data by hand. A comparison profile was obtained with a carbon wire scanner.

1.5.7.7 Beam in Gap: UAL simulations underway. Vendor discussion regarding pulsers is underway.

#### ORNL Beam Diagnostics Progress Report:

We prepared a laser wire proposal for the superconducting linac. We are preparing the detail of 400 MeV laser studies at Fermilab. Work continues on embedded NT-EPICS integration. We have started discussion with Lisa Day and Matt Stettler to write diagnostic device drivers. We are still assessing the loss of diagnostic engineers to support the LLRF. Craig Swanson, contract digital engineer from Alpha CAD has joined the diagnostic group to design and build the timing decoder. He has started translating the SNS RTDL Receiver altera schematics written by Paul Stein to VHDL. Craig checked the MEBT BCMs. BCM11 has a bad SMA connector. Per Sasha's request, we would not remove the BCM for repair but will try to repair it in place. Students are progressing very well on their projects.