

## **Accelerator Systems Division Highlights for the Week Ending February 22, 2002**

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

After completing the characterization of the RFQ beam under various conditions the Diagnostic Beamline was removed from the MEBT support frame, and Rafts # 1 and 2 were installed in its place. All three MEBT rafts were precisely aligned to the last RFQ module by members of the LBNL-ALS survey and alignment group with support by J. Fazekas, ASD, using a Laser Tracker device. All vacuum connections of the MEBT beamline segments are made up.

The MEBT infrastructure installation work is preceding; all wireways and cable trays are completed, and power and signal cables are being placed.

D. Purcell and an ASD coworker checked out the Fast Current Transformer electronics systems. T. Shea paid a visit to coordinate diagnostics installation and checkout issues.

All five Low-Level RF system units have been fabricated and checked out, and operational tests are ongoing with the first unit.

The conditioning of the RFQ rf system towards full duty factor is progressing well, currently it is being operated at 40 Hz, 165 microsecond, 650 kW pulse peak power.

The LEBT chopper system is being tested without beam to eliminate sparking inside one of the summation boxes.

The Front-End Systems were visited by J. Marburger, Science Advisor to the President, on Feb. 22.

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

LANL staff was at Marconi this week. The 402-MHz klystron for the SNS RFQ was accepted at 1.9 MW. Delivery at LANL is expected by mid March. (WBS 1.4.1.1)

While at Marconi, we also started retesting the klystron for DTL #3. Operation at 2.6 MW with good efficiency was achieved, albeit with unacceptable regions of instability. We were able to adjust the configuration to reduce the unstable regions but not completely eliminate them. Work will continue, and we plan to return to Marconi to accept this tube on April 8. (WBS 1.4.1.1)

LANL staff was at Thales this week. The first two CCL RF windows passed their factory acceptance tests. (WBS 1.4.1.1)

We have factory accepted the final five 5-MW circulators and have authorized delivery at ORNL and LANL. (WBS 1.4.1.1)

LANL staff was at Titan-Beta this week to resume klystron transmitter acceptance tests. Approximately 90% of the tests on the first unit are complete (WBS 1.4.1.1)

JLab staff returned for their tenth visit to LANL. They will be at LANL for three weeks to test prototype SRF fundamental power couplers. LANL staff helped unload and setup for the baking this week. The upgraded prototype high-voltage converter modulator (HVCN) is back in operation and ready to power RF for the JLab tests scheduled to begin on February 25. (WBS 1.4.1.1)

LANL personnel were at JLab this week to help turn on the modulator and klystron for the JLab high-power RF test stand. (WBS 1.4.1.1)

Dynapower has delivered the detailed test plan for the production HVCM SCR controllers. It is under evaluation. Dynapower's current delivery schedule forecasts the shipping of all 17 production units over a 10-week period beginning next month. (WBS 1.4.1.2)

LANL staff were in California this week to inspect manufacturing of HVCM high-voltage capacitors and amorphous nanocrystalline transformer cores. These parts are being furnished by LANL to Dynapower for the HVCM converter modulator manufacturing. (WBS 1.4.1.2)

DTL Tank 3 drift tubes numbers 7 and 9, which had to have plating repairs done to them, have been received at Los Alamos and have been magnetically mapped by LANSCE-1. Drift tube 9 had the extra e-beam welding performed on it. Neither drift tube showed any indication of damage from any of the repair processes. A vacuum test was performed on drift tube 7 and it also showed no change caused by the post fabrication plating. (WBS 1.4.2.3)

The final hardware pieces for DTL Tank 3 are nearing completion. The EMD drift tubes are pacing these last deliveries with an estimated delivery of March 15. Post coupler fabrication is on-track and will support the tuning process when it begins after the final drift tube installation. (WBS 1.4.2.7)

The CCL structures contract with Accel is being modified to reflect changes agreed to at the January manufacturing review. The next visit to Accel is being planned for the week of March 18 to support the first intermediate milestone. (WBS 1.4.4.2)

Vendor visits were made this week to three potential fabricators for the CCL segment support stands. Because of the critical nature of the alignment requirements of the CCL segments special fabrication/alignment capabilities are being investigated. (WBS 1.4.4.6)

The physics team used the LTRACE code to study effects from the superimposition of systematic error on the random DTL quad rotation error. (WBS 1.4.5.3)

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

Tuner installation on the cavity string has been completed. Process piping and cavity turnbuckles have been installed. Problems with integrity of titanium/stainless steel transitions are being resolved.

A leak developed in the process helium piping in the return end can. Specifications, shipping supports and procedures are being reviewed, since the unit passed acceptance tests at the vendor. The vendor has agreed to carry out the repair and has promised a door-to-door turnaround time for the repair of four weeks, which will not impact the overall cryomodule assembly schedule.

Repairs and modifications to the high voltage power supply, crowbar unit and PLC code are complete. The power supply and crowbar passed acceptance tests, including a foil test, and are now considered to be commissioned.

Commissioning of the klystron and modulator has begun, but quickly had to be terminated due to the discovery of water in the modulator oil tank. The klystron and oil have been removed and the system is being dried out. It is thought that the water entered the tank after the oil tank was filled, as the result of accidental spillage during the flushing of anti-freeze from the cooling lines of the klystron. Cleanup is not expected to take more than a couple of days.

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

The Diagnostics Group processed a web req. for a new Mode Lock Laser to further develop the Laser Profile Monitor for SNS.

Bob Lambiase traveled to IE Power (Canada) for a design review of the Medium Range Power Supplies (Type A, of which there are six models), and an engineering review of the regulator circuit for the #1 Injection Power Supply.

The first results from the Ring dipole split/assembly test indicate that field repeatability is within  $1.6E-04$  at all five measured locations at 1.0 GeV. More tests are planned for confirmation.

A plan was formulated to “fix” the Ring dipoles. The aim is to correct the integral transfer functions so that they are within an acceptable tolerance of  $\pm 3.0 E-04$  of the central value.

Joe Tuozzolo conducted a technical review of the HEBT Momentum Collimator. The drawings for the shielding box are complete. Design work on the HEBT Collimators is in progress. Equipment floor plan layouts are underway. Design of the window/collimator interface is under review.

PFN testing: Jain-Lin Mi reported that PFN have been run for a total of 100 hours at 35kv (2.5ka) at 60Hz (80 hours continuous operation). Plan is to push the testing levels to determine margins and reliability. A special test to measure generated noise is being implemented.

Ring dipole #14 was tested this week.

Assembly of half-cell vacuum chamber type “B” is underway. Three have been completed to date.

Injection kicker magnets – the first magnet is assembled and the second one is in progress.

A videoconference design review of the linac vacuum window is being scheduled for early March.

BPM: signed-off on Engineering Change Notice (ECN) to update the assembly drawings of all Ring BPMs (allowing for differential movement during 400 degree firing) and all the outer shells (allowing easier installation of the copper wires).

IPM: work continues on the optical IPM prototype for installation in the HEBT line of the BNL Linac next to the Laser profile monitor test.

Laser Wire Scanner: the MEBT laser platform as sent to LBNL. The 50mJ laser that will mount on the platform has been shipped to Big Sky for repairs. The vendor will send it directly to LBNL once it is fixed.

Our vendor, Tesla engineering, is fabricating the second HEBT dipole magnet. They aim to direct ship to SNS/OR in early March.

The lifting fixture for the ring half-cell assembly is being fabricated.

27CDM30: the first seven production units have been received from Danfysik.

BNIP: Our progress with BINP is still painful and slow. A major effort is now underway to set in place an inspection service contract to have SGS Vostok, Ltd. perform equipment inspections at Budker Institute of Nuclear Physics in Siberia. Per recent negotiations, money transfers will be made from BNL to a specific US bank, where a US business affiliate has been appointed as sales representative to execute final funding transfers to Vostok for inspection services performed at BINP. In addition, the BNL engineering staff is spending much time and effort to procure magnet materials that are not readily available in Russia. This includes all assembly and clamping hardware (all threaded fasteners), and all epoxy needed for potting the quadrupole coils. We are still awaiting delivery of BINP's production schedule (1<sup>st</sup> article schedule is in hand). After four weeks, the  $\frac{1}{4}$  scale model coil is still being held-up Russia's Dept. of Customs.

An RFQ for the 36CDM30 corrector magnets went to Contracts this week. A duplicate procurement package was sent (Fed-Exp) to Ted Hunter for review.

An RFQ went out for the inner box fabrication of the RTBT collimator. Quotes are due back by early March.

Detailed drawings for the rad hard 36Q85 quadrupole magnets are complete and in final review. Also, core drawings for the 36CD30 correctors have been completed.

Charlie Pearson traveled to SNS/OR to participate in a workshop on RTBT/Target interface issues.

John Smith, and others from the BNL/SNS Controls Group, traveled to LANL for a design review of Controls Software and Hardware.

Among other issues, the AP Group continued with their efforts to resolve issues related to global coordinates and Ring collimator beam pipe profiles.

**Controls:**

A software design review was held at LANL on February 19-21. Highlights will be provided in next week's report.

Derrick Williams traveled to LANL to attend an installation workshop, to gather design information, and to resolve some interface issues.

A review of the PPS "Phase 0" control racks design was held on Wednesday (2/13/2002).

Ring penetration data has been input to the cabling database. We now have all known penetration data in the database.

Conventional Facilities Controls sensor "Requests For Proposals" are on the street to equipment suppliers.

**Installation Services**

The ASD Division Director has initiated an internal review of all Groups' Installation Estimates. Group Leaders will meet with the Division Director to explain the basis for their installation man-hour estimates. The goal is to further refine the estimates prepared for the Nov 01 SAR and to achieve additional efficiencies and cost reductions. The schedule for these group reviews is attached. The Cryogenics Group and the Building Pre estimates will be conducted first at 1:00 PM on Friday, March 1, 2002. All group review will be completed by April 26, 2002.

Project Controls (Barbara Thibadeau) and ASD (David Olsen/Tom Mann) met on 2/23/02 to establish the basis for linking the ASD Detailed Schedule milestones with the IPS. The approach is to extract an appropriate subset of milestones from the ASD Installation Schedule and add them to the Division Detailed Schedule. This schedule is linked on a monthly basis to the IPS details (SNS-9). A plan to define the process for this linkage will be completed next week (2/26/02). The hard schedule date for implementing this linkage in the ASD Detailed Schedule is 3/18/02. This date is necessary for Project Controls to perform a verification check that the two schedules interface.

LANL is discussing with Dynapower to formalize the new, aggressive delivery schedule that supports the Front End Test milestone. If this schedule cannot be firmed up, it raises the possibility again of diverting the first HVCM delivery from LANL to ORNL.

Near term equipment deliveries are: Kinney Vacuum Pumps (2) JLAB, HVCM Transformers (4 more for 12) LANL/Dynapower, HEBT Dipole (1 more for 2) BNL/TESLA, 12Q45/16CD20 Magnet (1 for 1) BNL/Danfysik, and HEBT Beam Pipes (6 more for 7) BNL/SDMS.

The first three rows of the DTL shielding block were installed yesterday and today, in order to identify the openings for waveguide and utilities. The remaining blocks and custom pieces will be installed in April/May. (See photos)



Monuments have been installed in the RATS DTL/CCL assembly area, and the dust barrier curtain enclosing the area was ordered and should arrive in two weeks.

### **Accelerator Physics**

Changes to medium range power supply order are approved. Additional linac dump power supplies are still under discussion.

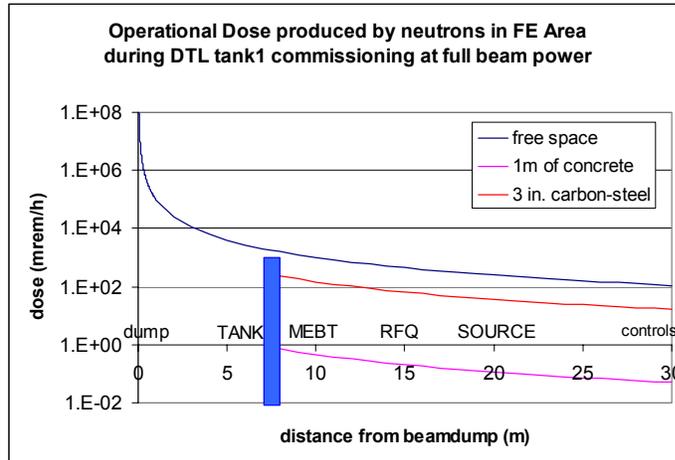
Graeme Murdoch is near completion on the linac dump window design. Design review is imminent.

Charlie Pearson from BNL visited ORNL to discuss the many RTBT interface issues with ASD, Target and CF. It is proposed to move the target harp out of the proton beam window box, and place it after the last RTBT quadrupole. The details for this are being worked out between ORNL ASD, Target and BNL. Ideas for a remote vacuum clamp were discussed, but many details remain.

Sarah Cousineau and Danielle Davino have specified the ring collimator vacuum chamber dimensions. They find that constant cross-section elliptical pipes are sufficient. They find no need to manufacture tapered elliptical chambers for the collimator assemblies.

In the video of this week, radiation issues related to running beam at full average power possible (11.7 kW) with the DTL tank 1 D-plate were discussed. It was shown that the dose rate at the control position in the FE building, as a consequence of neutrons coming off the beam stop on the beam axis in the opposite direction of the beam, would be of the order of 100 mrem/h (see slide). This will need shielding. Franz Gallmeier gave a more detailed presentation on the subject, showing that the residual dose on the beam stop after a decay of 1 week would be 0.01 Curie. The beam stop will have to be shielded (Irina Popova has already made preliminary calculations) in order to avoid activation of components on the DTL tank 1 in particular.

The length of time that one should be testing with beam at full average power was discussed. To come to closure on this, one will first need radiation and activation estimates for a shielded beam stop. Rod Keller explained that it is trivial to make a gap change in the beam extraction region of the source (could be done during a standard maintenance cycle); the consequence to beam emittance out of the RFQ would be minor. This may be useful during commissioning.



## Operations

Before ASAC, participated in Accelerator Reliability Workshop, at Grenoble

Participating in the ORNL SBMS Committee on Accelerator Safety. Participating in the ORNL SBMS Committee on Work Management. Participating in the ORNL SBMS Committee on Work Planning.

Working with SNS DCC on Design Review and Documentation folder organizational structure

PPS-TPS-MPS Interface Issues. PPS – RF Shutdown Mechanism. ODH Policy

SNS – IT Advisory Committee

Continuing work on documenting ASD Design Reviews

## Ion Source Group

### RF Group

As of yesterday the power supply and crowbar we sent to Jlab was working fine, it passed the foil test at 90KV. Water was found in the Jlab transmitter oil tank and its source is being investigated. We hired our 1st LLRF technician (Taylor Davidson). The deadline for receiving 402.5 MHz klystron proposals has been extended to Feb. 26th. Thalys requested the one-week extension. We are working on the schedule to include the RF for DTL3. I think it is doable if equipment in here and functional, no major problems. We are looking into the way the PPS turns of the RF to the front end and the Transmitters, we need to make sure it's done in a manner that will not destroy RF amplifier front ends.

### Mechanical Group

We are doing refinements to the HEBT dipole measurement program in preparation for production measurements of these dipoles. The next dipole is scheduled to be shipped the 28th of this month. I have been interacting with Tesla regarding fiducial hole placement on the dipoles. We are also developing a coil-lifting fixture that will help facilitate installation of the beam pipe into the HEBT dipoles.

Similarly, we are continuing to develop the HEBT 12Q45 measurement system and the Linac Warm Section 8Q35 measurement systems. The first 12Q45 is scheduled to be shipped from Danfysik the 28th of this month.

We are also assisting with development of the power bus assemblies that will provide magnet currents from power supplies to the beam tunnel.

### **Cryogenics Group**

The CHL walls have been poured in the cold room. The electrical conduits for the compressor skids are set in concrete. It is anticipated that the piping trenches will be excavated next week.

Warm compressors leak checking continues. Parts have been ordered that will connect all the compressors to a common gas source. We will then have the ability to monitor the combined leak rates of all the compressors in parallel.

We are developing a welding technique for the buss bar welds. Several coupons have been cut and shaped. A sample of shrink wrapping has been made and is being fitted to the standoff spacers.

The 20" and 14" pipes have arrived for the beam dump. The 14" pipe has been cut to length and weld prepped. The main head assembly arrived here from the vendor and is being aligned for welding of the 14" inner pipe.

We continue to interview selected candidates for the technical and engineering openings.

### **Electrical Systems Group**

Job offer extended and accepted for a power supply technician, scheduled to start 4/1/02.

Roy Cutler assisted The ORNL Holifield Radioactive Ion Beam Facility in the design of an electron linac driven radioactive ion source.

Attended a final design review at IE Power for 6 of the 12 medium power supply types. Also witnessed first operation at full power for the injection kicker power supply, which is also being produced by IE Power.

We received a production schedule and spares list for these power supplies from IE Power.

2nd. Engineering Change Notice for DTL Power Supply Racks has been distributed.

The Insulators for copper water-cooled buss arrived for evaluation.

The first 10 tons of water-cooled copper buss were delivered

The Power Supply Test Stand Instrumentation for current monitoring was installed.

We Received hardware necessary for the Power Supply Test Stand data acquisition.

Devised a plan to facilitate development of a relevant LABVIEW data acquisition and control system for offline tests of the ring RF system. The plan also allows substantially real-world simulations of rf stimuli and responses in the ring rf system, including effects of feedback.

Designed the x-ray shielding enclosure for high-voltage testing of the TH558 Tetrode. Since these high-voltage tests will be done infrequently, the design philosophy was to build an enclosure that satisfied requirements without a great deal of expense or complexity. This was not a trivial problem because of the need to satisfy multiple requirements, including:

- a. Maintaining a clear, unobstructed view completely around the tube during tests to determine the location and nature of atmospheric arcs, if they occur.
- b. Attenuating worst-case x-ray fluxes completely around the tube to achieve personnel protection levels at or below background.
- c. Testing the TH558 anode at 50 kV above ground potential.

Completed general testing of the 4395A Network/Spectrum/Impedance Analyzer that will be required in the Ring RF Test Lab. Verified performance of essential functions, and instrument accuracy. Particularly noteworthy was the ease with which the three functions (Network, Spectrum, and Impedance) could be switched and utilized in the instrument. No sacrifice of performance or utility was found in combining functions into one instrument, yet many thousands of dollars were saved compared to the price of separate network, spectrum, and impedance analyzers.

### **Survey and Alignment Group**

The installation, measuring process and adjustment is now completed of the localized RATS Network that will be utilized for DTL alignment.

Measure HEBT Dipole Chamber

Instrument Calibration

Continued site-wide verification measurements of global monuments that may have changed resulting from site construction.

Installed wall monuments for future measuring campaign.

### **Beam Diagnostics Group**

BNL SNS Beam Diagnostics Weekly Report:

General: The move of Technician offices and labs continues, with considerable effort is being devoted to packing and unpacking.

1.5.7.1 BPM: Shop is working on outer shells of the 12cm, 26cm, 30cm, and 36cm BPMs; the mounting flange of the 36cm BPM and the tool to wire EDM the strip-lines of 12cm and 21cm BPMs. The brazing shop finished 8 more 21cm BPMs on 2/18/02. Expect to receive them 2/22/02. Signed-off ECN to update the assembly drawings of all Ring BPMs. This allows differential movement during 400 degree firing and the outer shells (allowing easier installation of the copper wires). Running total of delivery this week: 21cm Ring-20, 21cm HEBT-2. Continuing the investigation of using a modified Bergoz Linac AFE for Ring BPM electronics

1.5.7.2 IPM: Work continues on the optical IPM prototype for installation in the HEBT line of the BNL Linac next to the Laser profile monitor test.

1.5.7.3 BLM: All ordered material is received. Continued machining parts for the two prototype units.

1.5.7.4 BCM: Initial tests of the DAC2902 indicate it works as advertised. It has a very fast rise-time (near 1ns), and can deliver 20ma. A scaled current (5ma) has been used to simulate a 50 mA beam pulse. We have been investigating various termination schemes to achieve a 50 Ohm termination for the calibration winding, while introducing no errors in the current pulse to the winding. One method seems to have promise and is being tested further. Preparing for final design review 3/13/02.

1.5.7.5 Tune: Investigating details of tune spread measurements using the Quadrupole Moment Monitor. Work continues on UAL script for modeling beam transfer function measurements.

1.5.7.6b Laser Wire Scanner: The MEBT laser platform is at LBNL and appears to fit. The 50mJ Laser that will mount on the platform has been shipped to Big Sky for repairs. They will send it directly to LBNL. An order has been approved for an 11W, 100MHz mode-locked Laser, pending acceptance of the sole-source statement. Awaiting shipment of the 200mJ Beam-in Gap laser and power supply/controller from LANL to resume measurements at 200MeV at the AGS Linac.

ORNL SNS Beam Diagnostics Weekly Report:

The ORNL staff integrated the beam current monitor with the LBNL control system. The simulated BCM data made available via EPICS channel access. We observed some connection recovery issues between PCAS and dm2k that will require further work.

We have continued work on the Laser profile monitor. An ORNL group is put together to provide calculation and design support to the BNL diagnostic team. Tom visited SLAC to discuss their participation in laser system design. Handoff issues were discussed with LBNL staff. Arrangements for the Linac Diagnostics final design review continue. Wim Blokland started work with our group and has already contributed significantly to integration activities.