

## Accelerator Systems Division Highlights for the Week Ending February 1, 2002

### ASD/LBNL: Front End Systems

After recording the first beam through the full RFQ on Friday, Jan. 25, the ion source was reconditioned on the second day of beam testing, Jan. 28, and the measured beam current at the end of the RFQ increased from 24 to 33 mA. The exact amount of injected current is unknown, but can be assumed not to have exceeded 36 mA, judging from the operational parameters of ion source and LEPT. Transmitted beam currents were measured for a variety of LEPT and RFQ parameters on the third day, and then the diagnostic beamline was reconfigured for emittance measurements.

Commissioning of the emittance device started on Jan. 31. Sasha Aleksandrov (participated in the RFQ measurements as well), Saeed Assadi, Dave Purcell, and Ernie Williams (from a remote station) of SNS-ASD took part in these efforts. On Feb. 1, a series of emittance scans was performed, but apparently there are some synchronization problems in the data capture sequence that have to be sorted out before actual emittance shapes and sizes will be obtained from the measurement system.

Other visitors from ORNL were Yoon Kang who checked the performance of the MEBT rebuncher amplifiers, Martin Stockli, and Paul Gibson.

By now we have received five MEBT wire scanners from BNL and the two amplifiers for the MEBT chopper system directly from the vendor, after LANL staff accepted them at the vendor's site.

### ASD/LANL: Warm Linac

LANL staff finished a ten-day trip to Marconi to help troubleshoot the 402.5-MHz klystron performance. After they adjusted matching to the output, stable operation of second klystron was obtained at powers up to 2 MW. Optimization of efficiency and gain is still needed. We plan to return to Marconi on Feb 19 for acceptance tests. Before that time, Marconi will perform further studies to gather performance data and to determine whether the acceptance tests will be performed at full or reduced specification. (WBS 1.4.1.1)

Debra Graves coordinated the shipment of an SNS 5-MW 805-MHz circulator from the vendor to JLab for the JLab RF test stand. It should arrive today for customs clearing. (WBS 1.4.1.1)

The first production electrical substation for the high-voltage converter modulator (HVCM) has been delivered to LANL (Fig. 1). Several more units have also been shipped to SNS ORNL, well in advance of installation scheduled to begin in mid-June 2002. (WBS 1.4.1.2)

LANL and ASD staff attended the Preliminary Design Review for the DTL/CCL water skids. The review was held at Avantech's facility in Columbia, SC. It was satisfactory with minimal action items required. (WBS 1.4.2.5 & 1.4.4.5)

We cancelled the procurement RFP for DTL Power Supplies, per ORNL's transmittal notice. A revised RFP will be issued consistent with the new specifications. There will be a schedule impact that will be reported to ASD. (WBS 1.4.2.8)





Fig1: First production HVCN substation from Dynapower. Unit gets shipped as two parts that then get assembled into one when it is installed. The first photo shows both parts, but the transformer is facing the other way. The second photo shows the transformer.

We received the delivery dates for the production HVCN SCR controllers. They will be delivered to ORNL in March 2002, three months before the start of installation in the klystron gallery. (WBS 1.4.1.2)

We conducted the design and manufacturing drawing reviews with the vendor for the HVCN converter modulator. Results were fully satisfactory. The vendor will develop a manufacturing plan this month. (WBS 1.4.1.2)

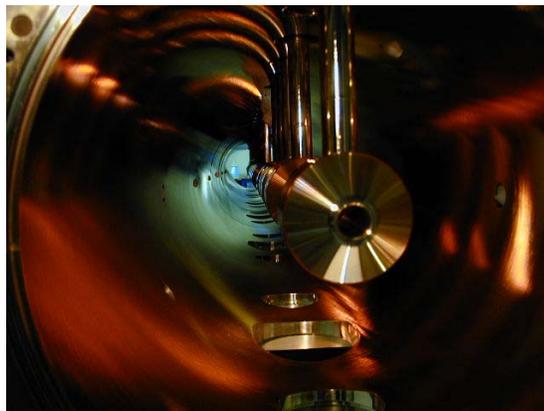


Fig2: DTL Tank #3 assembly

DTL Tank #3 assemble continues (Fig 2). Almost all of the drift tubes are installed. The end plate has been fiducialized. (WBS 1.4.2.7)

We awarded the contract for CCL Quadrupole Magnets to Millhouse Co. (WBS 1.4.4.3)

The physics team is running end-to-end (LEBT-to-foil) simulations using measured LEBT emittance distributions, longitudinal and transverse mismatch, and linac error. (WBS 1.4.5.3)

We provided feedback to the SNS Project Office regarding the proposed BA profile for fiscal years 03-05. (WBS 1.4.6.1)

LANL approved PCRs LI 02 002 and LI 02 003 that capitalizes the CCL hot model. The net effect of these two PCRs is to transfer \$104K from LANL back to Project contingency. (WBS 1.4.6.1)

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

Assembly of the prototype cryomodule cavity string was completed. The string was pumped down overnight, but a large leak in one of the HOM coupler seals was found. The system has been brought back up to atmospheric pressure, and repair is underway.

Mockup assembly of the cryomodule has identified several minor problems and interferences with the tooling. These have been rectified, and final cryomodule assembly will begin next week, after vacuum integrity is certified.

Problems of sticking tuners have been addressed this week, and initial results seem to indicate that drive torque requirements of the cold harmonic drive (7 in-oz) exceed the torque output of the motor (rated at 6 in-oz). A more powerful motor is available, will fit and has been installed. An integrated test is underway.

Assembly and commissioning of the 1 MW RF Test Stand continues. See Figure. Much of the week has been spent diagnosing the cause of erratic crowbar triggering.



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

At this week's STL videoconference, Norbert Holtkamp announced that Jie Wei will succeed Bill Weng as Senior Team Leader of the SNS/BNL Group, effective March 1. We wish Jie the very best in this new role and pledge our full support to help him achieve all technical, cost and schedule goals.

Laser Profile Monitor - a profile was successfully measured at 200MeV on the 100 micro-amp polarized beam. The effort continued with 10ma un-polarized beam in the AGS Linac until yesterday, when the laser failed. Experts are planning for ring access to retrieve the laser for inspection and repair. An expert from Big Sky (our laser vendor) was at BNL last week to determine the reason for the laser power supply failure during our radiation testing.

Preliminary findings pointed to a PS failure, believed to be unrelated to radiation exposure. Tom Shea was at BNL this past weekend to assist with the s/u and testing at 10ma.

Efforts continue to understand the difference between measurement and analysis of the ring dipole integral field transfer function. Bipolar measurements have been taken with no appreciable effect. As experts continue to investigate, our current plan is to complete the testing of all magnets, match, sort, and survey-align to correct for the measured values.

A 2<sup>nd</sup> telephone conference was held with BINP of Novosibirsk to review production issues related to the 30Q44/58 quadrupoles. The ¼ scale model of the BNL wound coil is hung-up in Russia's Customs (we will send an official BNL memo to BINP to help secure its release). A 3-D coil winding video was developed and sent to BINP to show them specifics related to coil winding. A BINP production schedule is now in hand at BNL.

Nick Simos (BNL) is back from his visit to SDMS of France where he traveled to witness a critical point inspection (#2) of the RTBT 1<sup>st</sup> article collimator. Nick gave high grades to SDMS for their progress and quality.

Field measurements of Ring dipole #12 are underway.

Ring half-cell vacuum chamber assembly #9 was completed this week. Four of these chambers have been coated. The VC welding fixture is being modified for the Type "B" chambers.

Magnetic measurements of the 1<sup>st</sup> article 21CO26 Octupole corrector are finished. Offsets between electro/mechanical centers have been eliminated through refined survey alignment in the test stand. Our vendor has been given the go ahead to start production.

#### **Controls:**

Bids are in for the Conventional Facilities installation contractor serving CF Controls, Target Controls, Communication Backbone and whoever else wants to use them. All bidders look technically qualified at first blush.

The MPS test board has arrived and is being built. This board will allow automated testing of the MPS system by driving each input and monitoring all outputs.

At Berkeley, the controls group supported the RFQ beam tests. Emittance motors and electronics were commissioned with beam. The interface box for MEBT Ion Pumps completed

Nearly all the ion source/LEBT control system hardware ordered for the test stand at ORNL has been delivered, and set up of the front end EPICS environment can be started. The file server computer for the operator control station is now in the RATS building and is being set up as an EPICS applications file server.

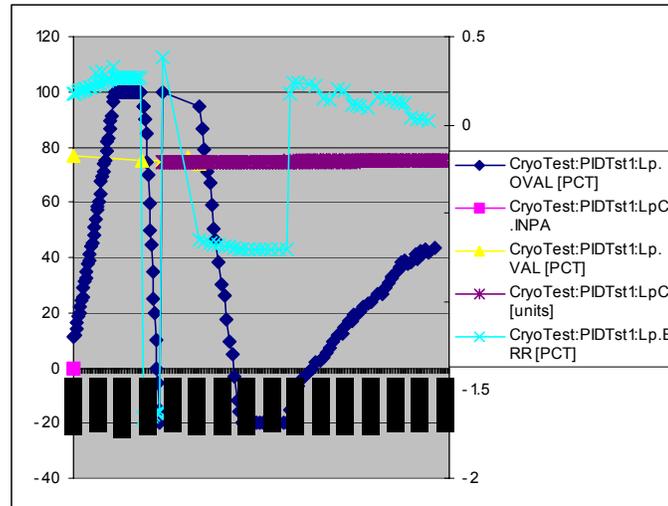
At LANL, work proceeded on interrupt and direct memory access support for the RF low-level control boards.

Drawings and specifications for the Target utility controls and instruments are being finalized for submission as CFC on February 20. Some of these drawings will be included with DCN T5-18 for the Target building General Contractor. The remainder will be submitted as CFC on March 1.

Specification and drawings for the fabrication of the Central Helium Liquefier Gas Management System control racks were completed. A requisition for the procurement of these racks from the Rack Factory (DCS) is being prepared.

Control system installation work has started on the CHL warm compressor skids. The 24-volt power supplies have been mounted in the control panels. Conduit is being routed for power and control connections for the oil pump, oil heaters, and motor heaters. Initial checkout of several instruments has been performed. Development of calibration procedures and data sheets was started.

Checkout of the EPICS control screens for the warm compressor and gas management IOC continued. The channel archiver was configured for several of the PLC test channels. PLC generated data was successfully archived and retrieved. This is another step in the development and implementation of the components for the cryogenic control system. Attached is a plot of the archived data.



### Installation Services

Revision 02 of the Component Delivery Schedule (SNS 104000000-PS0022-R02) was completed. Rev 02 of the CDS will be published on the ASD Home Page under Installation as soon as possible next week. (2/5/02?)

Main items updated in this revision were High Voltage Converter Module components being supplied by Dynapower. A new schedule dated 1/18/02 for Converter Modules, Substation Transformers, SCR Controllers and Equipment Control Racks has been incorporated. Special attention is being paid to the delivery of the 1st and 2nd 140 KV Converter Modules. The CM delivery schedule and Front End Test preparation are being studied to determine the best plan for supporting the Front End Test. Converter Module delivery dates are tight to support the IPS Milestones. CM Unit #1 6/10/02 to LANL. CM Unit #2 9/10/02 to ORNL.

### Accelerator Physics

ASAC commissioning talks for the front-end, the warm linac and ring-systems were prepared and dry-run.

S. Aleksandrov participated in the RFQ commissioning exercise at LBNL.

An Orbit Difference application was prepared for use in MEBT commissioning at LBNL, using the new XAL infrastructure.

### Operations

#### Ion Source Group

Robert Welton completed our emittance analysis system. We now have a system which allows us to calculate unbiased estimates from measured emittances, a problem caused by the offset common in all current preamplifiers. Although the current offset is normally less than 1%, it significantly biases the emittance results because the offset is multiplied with a large range of  $x$  and  $x'$ .

Paul Gibson and Martin Stockli visited LBNL to participate in the commissioning and to gather information needed for transfer of the front end as well as for starting up the hot spare stand. It was very exciting to see the ion source and RFQ to operate very reliably.

Paul met with many LBNL collaborators to gather needed information. In this course Paul identified and received information on changes to the QEI pulse generator that we were completely unaware of.

We had a long discussion with Ken Barat and Dave Rodgers from EHRT regarding safety measures taken and the radiation observed at the integrated test facility. This discussion, a joint site-visit, and our own observations with our radiation alert monitors convinced us that the problem is well addressed.

We met with Alex Ratti, Ron Yourd, and Rod Keller to initiate transferring the scope of acquiring a second 65 kV high voltage supply to ORNL, as previously agreed upon. Unable to locate the performance data obtained during the acceptance test, we agreed that we would use the list of acceptance criteria as our minimum specification for a duplicate or alternate high voltage supply.

We transferred two 60 kV, 75W, 50 Megohm resistors to Alex Ratti to be installed as load resistors on the lens high voltage supplies. Once installed, they allow draining up to 0.8 mA of H- beam without any voltage increase. Such voltage fluctuations were observed during the 7x24 test, especially when the source was not well tuned.

### **RF Group**

We still are having problems with the crowbar circuit we sent to Jlab. Problem now seems to be shorted isolation filament transformer, secondary to shield. Jlab is looking for a replacement. LANL at JLab on the 6th is to begin transmitter check out. We are still waiting for the transmitter cooling cart from LANL and water from Jlab.

Circulator is still in transit from AFT.

Hengjie is at LANL last week continuing LLRF effort. Mark is moving things along at Jlab. Assembly of waveguide pieces in RATS is proceeding.

We've located a flexible microwave cable that can be used for the HOM couplers and the cavity field probes. The original design called for a combination of semi-rigid and flexible cables. It featured 9 cables and 12 RF connections per cavity. The new design features 3 cables and 6 RF connections per cavity. We expect a much lower overall cost, but have not yet obtained vendor quotes. The materials are radiation resistant to  $1E8$  rad. We are planning to implement the new design on the prototype medium-beta cryomodule. The HOM power will be brought out of the cryomodule and dissipated at room temperature.

One of the high voltage isolation transformers in the oil tank of the thyatron crowbar system failed this week during high voltage conditioning of the thyatron tube. The transformer provides 5 VAC, 10 Amp power to the cathode reservoir heater. The bobbin on which the secondary windings are wrapped failed. Apparently the bobbin cannot hold off the voltage between the secondary and the shield of the primary, which is inside the bobbin. The damage to the bobbin is obvious. We are working with the JLab machine shop to repair the transformer by producing and installing a new bobbin. At the same time we are negotiating the purchase of a replacement from industry.

I've talked with Energen this week about magnetostrictive actuators. They have sent me a written proposal for developing an actuator that could be used for Lorentz force detuning compensation.

Champion will be at JLab one more week, returning to Knoxville on Feb. 09. Dale Heidenreich will be coming to JLab next Tuesday and will stay for nearly two weeks to help with the installation and commissioning of the RF test stand.

### **Mechanical Group**

Closed on Request For Quotation (01/31/01) for Residual Gas Analyzers, 4 bids received.

Received notification of shipment of six (6) quadruple vacuum chambers on route from France.

Review and approval of Low Energy Differential Pump station beam stop vacuum design, supporting analysis and leak test procedure submitted by LANL.

Continued gathering of data on electrostatic precipitator and ion pump magnetic fields.

Continuation on setting up vacuum shop in RATS

Capital purchase orders for gas loading and vacuum gauging equipment issued.

### **Magnet Measurement Group**

#### **Cryogenics Group**

#### **Electrical Systems Group**

Visited the Argonne Light Source to visit with John Carwardine (Electrical Engineering Group Leader) and Geoff Pyle (RF Engineering Group Leader) to discuss operational issues.

Calculated radiation yields and activation for DTL 1 commissioning experiment.

Submitted a technical note on radiation safety aspects of hi-potting.

Completed design and specification of a Labview data acquisition system and ordered components. The system is designed for portability and is intended to be part of a stand-alone system for offline operation and testing of the ring rf equipment. The system can also be used for more general test purposes. System software consists of the Labview Full Development Suite. Hardware consists of a National Instruments 8-slot PXI chassis, with a 1.26 GHz embedded PXI controller. The PXI standard will allow simultaneous triggering of modules. Modules for the PXI chassis include a GPIB interface, three dual-channel high-speed digitizers (3 synchronized dual-channel oscilloscopes), an arbitrary waveform generator, and a dual-slot PCMCIA card carrier. One slot is reserved for future upgrades. Purchased separately from NI, a Cisco Aironet 350 wireless PC card inserted into the NI card carrier will allow wireless local-area networking in the RATS building. Peripherals purchased from CDW include a high-resolution 17 in. LCD monitor, a keyboard/touchpad, a printer, and a read/write cd drive. The R/W CD will allow storage of large data arrays.

Completed a review of cable-type requirements for cables extending from the rf stations in the ring service building to the buncher cavities/amplifiers in the ring tunnel. Also completed review of ac input power and cable requirements to each rack of each rf station.

Specified and purchased additional equipment for the ring RF test lab that will be setup in the RATS building in Electrical Systems Group area. Recent procurements included a two-channel arbitrary waveform generator, and an RF survey meter.

Initiated Engineering Change Request concerning rack space and locations to allow implementation of DTL corrector supplies using Danfysik bipolar power supplies.

Accepted 15 Power Supply Interfaces (PSIs) from Brookhaven/vendor.

### **Survey and Alignment Group**

The floor monuments for the first 195 feet of linac and FE are completed. The layout of the floor monuments for the remainder of the linac has been completed and the Davis Bacon labor pool is in the process of drilling and installing.

One of the two global survey monuments that incurred possible damage as a result of an unknowing contractor disassembling the precision mechanism has been cleared for use. The second monument has been taken out of service. A more robust measuring campaign will be required to reestablish the position of this monument.

### **Beam Diagnostics Group**

#### BNL SNS Beam Diagnostics:

1.5.7.3 BLM: We have made a prototype of the new BLM but used G-10 rather than Macor as the insulators. Lab tests (with air as the gas) indicated no leakage for either polarity (within noise of +/- 1 pA) up to the 5 kV limit of PS and feedthroughs. By comparison, the old design started leakage current at 2.5 kV for the "non-preferred" polarity and 1.5 to 2.5 kV for the preferred polarity. With a 1 R/hr source, and air rather than argon fill, the response with either polarity was very flat to the full 3 kV of the test setup. That is, it did not show entry into the proportional region. However, the signal seems noisier than for the old chambers. Data shows a variation of +/- 1 pA. This may match the difference in capacitance between the two detectors. So far, results look promising and the unit will soon be tested with pulsed beam.

1.5.7.4 BCM: All required process variables are now supported by the BCM electronics. A new digital motherboard has been received from LANL and successfully tested with the trigger of the correct polarity. If testing with dual inputs is successful, the MEBT unit can ship next week.

1.5.7.6b Laser Wire Scanner: Profiles were successfully measured at 200 MeV. The beam current was 10 mA, but significant common mode variations the data quality. Data is still taken by eye with an oscilloscope and it is believed that a purpose-built electronics will be required to give the expected performance to 3 sigma. Five failed power supplies caused the failure of the laser during radiation testing. It is believed that this failure was not radiation induced.

#### LANL SNS Beam Diagnostics:

BPM pickups: The DTL tank 3 pickups are now expected back from welding early next week. We will map and test them soon after they arrive. The CCL and SCL prototype pickups are expected to be completed 1/Feb. We should see them next week. We have asked for a quote to fabricate eight more DTL pickups. These will have the redesigned "ridge" on the ends of the electrodes.

WS actuators: Work continues on fabricating prototype forks for the DTL and SCL actuators. The parts to replace the defective ball lead screw assembly for the SCL actuator were picked up this week and assembled. Lifetime tests for both the DTL/CCL and SCL actuators will resume soon.

WS electronics: Five each signal processors, computers, and motor drivers were delivered to LBL this week, on schedule.

D-plate: Final design work continues. The beam stop engineering review will be 6/Feb at 3:00.

ED/FC: The prototype water-cooling lines have been evaluated and deemed successful. The design package should be finished up next week, and then we will fabricate the DTL tank 1 ED/FC unit.

Misc: The final design reviews dates are now firm. Mark your calendars: March 12-14.

#### ORNL SNS Beam Diagnostics:

Craig has written a tech note on the coupled line BPMs. Dave and Saeed helped with the successful integration of the emittance system at Berkeley. They are participating in measurements of the RFQ beam. Tom and Warren participated in the laser tests at BNL. Warren is working on a scheme to remotely locate the laser. Preparations for ASAC continue. At the request of BNL controls, Tom prepared a list of Java applications that could be useful to the diagnostics team.