

## Accelerator Systems Division Highlights for the Week Ending March 8, 2002

### ASD/LBNL: Front End Systems

#### ASD/LANL: Warm Linac

The first 402-MHz SNS klystron was shipped from Marconi to LANL. (WBS 1.4.1.1)

The first 402.5-MHz transmitter system from Titan-Beta arrived at LANL. Installation is underway. (WBS 1.4.1.1)

We continued to support JLab staff testing of prototype SRF fundamental power couplers. Our RF test stand worked exceptionally well. The tenth and final JLab campaign concluded this week. LANL personnel aided JLab visitors with the disassembly and shipping of their equipment. (WBS 1.4.1.1)

We started high-power acceptance tests on the 550-kW SRF circulators. Leaders from the manufacturer (AFT) were at LANL to witness tests. Initial results are excellent – satisfactory performance at up to 900 kW. The first four circulators tested passed their acceptance tests. (WBS 1.4.1.1)

LANL and ASD personnel were at Dynapower this week to conduct acceptance tests on the first production SCR controller for the SNS high-voltage converter modulator (HVCM). Although nearly all tests conducted resulted in satisfactory results, excessive noise, believed to be generated by the output chokes, was deemed to be unacceptable by both LANL/ASD and Dynapower and resulted in non-acceptance of the unit. Dynapower made a strong commitment to remedy the problem and to be ready to recommence testing within the next two to three weeks. Dynapower continues to plan on delivering at least three SCR Controller units by the end of March 2002 which is well ahead of their contractual obligation. Dynapower also agreed to revise the SCR Controller Test Plan to incorporate those additional tests requested by LANL and ASD and to resubmit the test plan to both parties prior to retesting the SCR controller. (WBS 1.4.1.2)

Dynapower had shipped eleven of the seventeen production HVCM substations. One unit was shipped to LANL and ten units to ORNL. Dynapower plans to ship five of the remaining six units to ORNL by the end of March 2002. Dynapower will retain the final unit to be used to support SCR Controller and HVCM acceptance testing. Our assessment of the work accomplished on these remaining units supports the ability for Dynapower to deliver according to their aggressive plan that is well ahead of contractual requirements. (WBS 1.4.1.2)

LANL/ASD and Dynapower met to review the status of the HVCM converter modulator contract. Dynapower continues to support their ability to delivery the first four HVCM production units in June 2002. At this time all their suppliers who have responded indicate the ability to provide required components within the necessary timeframe to support this plan; however, not all suppliers have responded to Dynapower yet. (WBS 1.4.1.2)

The stem repairs on the two BPM drift tubes have been successfully completed (Fig. 1) Coronado is planning to ship the first drift tube on 3/12 and the second on 3/15. Both drift tubes will undergo testing once they arrive at LANL. (WBS 1.4.2.3)



Fig. 1: DTL Tank #3 BPMs after stem repair

The two vertical EMD drift tubes failed QA vacuum tests performed by the vendor. They will require a weld repair. The anticipated delivery date is now 3/22. The two horizontal EMDs are still scheduled to ship on 3/29. (WBS 1.4.2.3)

Manufacture of drift tubes for DTL Tank 1 (Fig. 2) are currently on schedule. (WBS 1.4.2.3)



Fig. 2: DTL Tank 1 drift tubes prior to welding.

The tank sections for DTL Tanks 1 and 2 are currently on schedule. Three tank sections will ship to Germany for plating on March 25. The remaining two sections are scheduled to ship on April 1. (WBS 1.4.2.2)

The end walls for the remaining DTL tanks are nearing completion and should ship to ORNL in early April. (WBS 1.4.2.2)

We started to automate and document the DTL structure-tuning algorithm for ORNL, who take over DTL tuning starting with DTL Tank 1. (WBS 1.4.5.3)

Options are being added to the PARMILA code to have simulation capabilities emulating FWHM values from the measured wire-scanner data. (WBS 1.4.5.3)

In support of the ASD SRF linac-commissioning plan, we have started generating self-consistent quad laws for transporting variable energy (200 – 1000 MeV) beams through the entire SRF section, the HEBT, and into the low-power "straight-ahead" dump. (WBS 1.4.5.3)

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

Prototype cryomodule assembly continues. Installation of multi-layer insulation and inner magnetic shield is complete.

The first-article return end can was returned from the vendor and leak checked. No leaks were detected and the unit is available for cryomodule assembly.

Effort on the 1 MW test stand focused on addressing reliability issues, specifically spurious crowbar trips. Problems with some of the interlocks were repaired, and further rf tests today have demonstrated a marked improvement in reliability.

The fundamental power couplers being processed at LANL were operated, over all phases; into a short circuit at 600 kW input power essentially without incident. This satisfies the prerequisites for the completion of the Final Design Review.

The CHL Compressor Room Piping Design Package is complete and is being sent out today for SNS comments before final release.

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

Sixteen dipole magnets have been measured and two of these were shimmed to determine acceptability of the proposed shimming fix. From these initial results, it was determined that the shimming corrections exactly follow calculated predictions; thus, we have since tightened our tolerance goal to achieve +/- 1 part in ten thousand for the acceptable range of the integral field transfer functions. Using the new tolerance, we have determined that of the 16 magnets tested to date (50% of total) 5 are ok as is and 11 will need shimming. Of the 11 that need shimming, 3 have already been successfully shimmed to the new tolerance and are now considered complete. Our production goal is to correct and measure two magnets per week. Manpower will be added to help achieve this goal.

An RFQ for the 36Q85 magnet cores was released for bid this week by our Contracts Department.

The design package for the 36CDM85 correctors was also released for vendor bids.

The laser for the MEBT beam profile monitor is fixed (Big Sky) and being shipped to Berkeley this week.

Testing of the extraction PFN continues at 35kv and 60Hz using the prototype kicker magnet. For the upcoming RFQ, we are working on a parts list, specification and statement of work. See photo, below.

Zaltsman, Owens and Cutler are developing a spares list for the Ring RF systems as per the request of Dave Olsen.

Quotations for the RTBT Collimators' "inner box" are due later this week.

Danfysik shipped the HEBT 1<sup>st</sup> article quad and corrector assembly on Feb. 28 to SNS/OR. ETA is mid March.

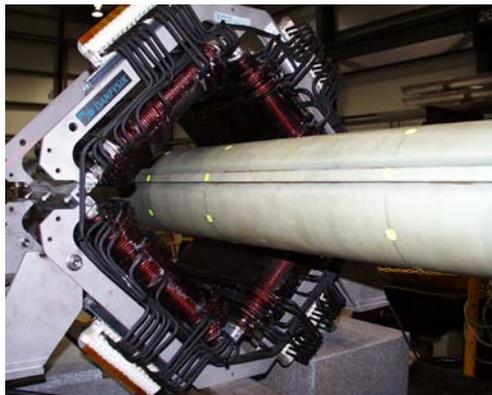
Our Mechanical Group conducted an internal production workshop this week for the Ring half-cell assemblies. Requests are being made of our vendors to provide updated delivery schedules.

The BNL/SNS Controls Group (J. Smith, et al.) conducted an internal Controls Group Workshop to review issues that included: scope displays, testing ADC boards for diagnostics, Java status, Labview, status of RF/Collimator ICDs, power supply IOC, PSI/PSC spares, V124 board software, timing signals, temperature monitoring, database status, EDM problems, Linux system testing.

Bill Foyt was at BNL last week to review property management issues with John Hauser and staff.

Ioannis Marnaris returned from Danfysik where he participated in the acceptance testing of the 1st articles for the low field power supply.

Acceptance testing continues on the 27CDM30 corrector magnet from Danfysik. See attached photo.





### Controls:

The Site Utilities CFC package for conventional facilities controls was posted. A meeting was held with ASD operations to review the design for power monitoring. A number of action items were taken.

At ORNL, the NIS Server for Centralized Account management is installed and running. All user accounts have been migrated over to the new Linux server. Installation of the Network Management Console is also complete. Migration of CAPFAST (a graphical tool used to develop the EPICS databases for the cryogenic control systems) from Solaris to Linux is complete and under test. Integration of another graphical database configuration tool, VDCT, on the new EPICS Linux server will begin next week.

At LANL, rack drawings were completed for the water-cooling system, vacuum system and magnet systems. IOC racks are complete for all but the LLRF and diagnostics. Wire databases for the vacuum and cooling are complete and under review; for magnets and controls they are started.

Modulator software is ready to support the vendor test at Ztec in Albuquerque. A server, IOC and PLC are set up and operational at the vendor site. A transmitter has been received at LANL and is being assembled. The PLC and IOC are set up and communicating - ready for integration test. The 24-hour test at Titan was completed and the control system was used to archive the results.

An ion gauge controller arrived at LANL, and the driver is started. The signal list is being verified. New P&ID drawings are available. The prototype cooling system from the LANL ESA Division has been received and we are reviewing the PLC programming and verifying the wiring. New P&ID drawings have been received. Modifications have been made to the LLRF software to support design changes in the hardware Protect module.

The video diagnostic for the Diagnostic Plate ("D-Plate") to be used for testing of beam through DTL Tank 1 is working into the IOC, through the database and up to a channel access client, assembled and displayed.

The third Utility board has been tested at LANL. Boards will be shipped this week to BNL and ORNL. A fourth board will be assembled and retained at LANL.

At Berkeley, work proceeds on preparations for the upcoming MEBT run. EPICS interface software for the LLRF controls is under development, and enhancements are being made to the automated RFQ conditioner. The MEBT vacuum interface and EPICS are in checkout. The third (and last) IOC will be converted to the SNS standard PowerPC next week.

The Matlab interface has been tested at ORNL against the Accelerator Model Channel Access Server provided by the Physics Group.

A PLC programming workstation has been set up for the "hot spare" control system in the RATS building. PLC programming (including linking to EPICS database) should start this week.

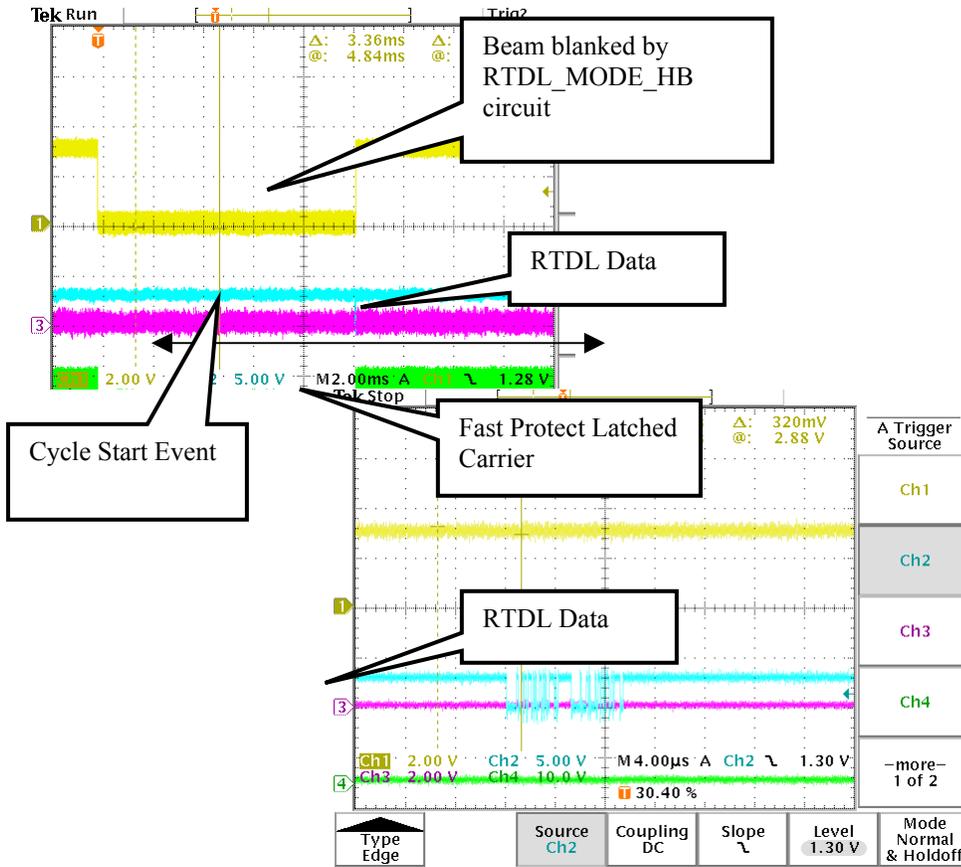
The six The Central Helium Liquefier (CHL) warm compressors PLCs are now communicating properly with the Integrated Control System (ICS) CHL Gas Management PLC via ControlNet in the RATS building. (All PLC components used are the ones that will be installed in the CHL facility.) Network set-up parameters were changed to correct communication errors that were encountered last week. Testing was performed to determine how changing a failed module in one of the warm compressor PLCs affected the operation of the other PLCs. It was found that maintenance work could be performed on one PLC without affecting the other PLCs. Since the CHL must operate around the clock, it is important to provide system and PLC module status information to the operator. A means for providing module status information for the warm compressor PLC modules was tested and found to be satisfactory. It does require making modifications to the vendor's PLC logic and the changes will be coordinated with the vendor. The EPICS database for the warm compressor and gas management system is complete and is being installed in the IOC. Checkout and verification of the communication from each compressor skid to the EPICS operator interface screen will begin next week.



SNS Integrated Control System  
Gas Management System PLC and PanelView Terminal

All known bugs in the Machine Protection System (MPS) Hardware are fixed. The MPS Driver board helped to uncover a couple of timing system problems not previously seen (see below). We added several test functions to the Timing Master software to simulate timing system bugs. We can change the mode sent on the RTDL and Event link, and verify beam blanking when they are different. We can also change the RTDL data sent out, and verify blanking when the mode data is inconsistent.

It was discovered that the RTDL transmitter board (V105) would occasionally send only a small subset of the RTDL Frames. This allowed us to verify and debug operation of the RTDL heartbeat circuit. Originally we described this circuit as monitoring the RTDL time, and blanking a pulse if we did not get the time, however the above condition shows we need a heartbeat on the RTDL MODE Frame received signal.



The picture above shows the decoded RTDL data stream with two frames instead of the desired four being transmitted. The problem is under investigation.

First articles for the fiber optic single mode and multi mode timing system transmitters and receivers are in test. Some additional parts needed to complete acceptance testing are expected next week.

**Installation Services**

**Accelerator Physics**

LANL and ORNL have agreed to support the RF conditioning of DTL tank 3 in November 2002. A draft schedule to reach this goal has been made up and discussed with the different groups involved at ORNL and will be sent out essentially to groups at ORNL and LANL in the week of March 11.

Fault analysis are being done for the RTBT line to help formulate a strategy of ensuring reliable beam on target performance without incorporation of a high QA monitoring system.

J. Holmes visited FNL to assist efforts in a RCS proton driver study. In particular, space charge calculations were performed to help identify attractive injection scenarios. This trip was sponsored by FNL.

A new ORBIT code repository was created. This is to assist development of a new code version, using the standard python module as a scripting driver. This is a collaborative effort with FNL. Presently, the ORBIT code is used in several high intensity proton accelerator projects.

**Operations**

## **Ion Source Group**

A 2-hour safety meeting was held on Tuesday afternoon to watch Madia's safety video and to discuss upcoming schedule and associated hazards.

The electric wiring progresses rapidly. Isolation transformers have been wired and the transformer rack has been put in place. Interlock relays, surge suppressors and fuse panels are being wired.

The remaining vacuum equipment has been ordered.

The bid package for H- Faraday cup has been released.

On March 6, Vadim Dudnikov presented a seminar "High Brightness Negative Ion Sources with High Emission Current Density" for ASD. It was interesting to hear about the compact surface plasma source (CSPS) with negative ion current densities in excess of 1 A/cm<sup>2</sup>. In addition we learned that our meniscus should be noiseless if his results obtained with his magnetron source can be applied to our RF-source. His investigation for different slit geometries was another very interesting point. His result agrees with our understanding that relatively narrow thin slit should give the highest currents for Cs enhanced discharges. The seminar was preceded and followed by long and interesting discussions.

## **RF Group**

### **Mechanical Group**

Analysis of pump-down time and base pressure of the SCL inter module cryo section with sector gate valves closed following a pressure burst was completed. This was an action item from the design review of the SCL warm section held the previous week. The impact on pump size with the use of elastomer sealed sector gate valves was also investigated.

O-ring degassing tests are currently being prepared, and the degassing procedure being finalized.

The soft wall clean room acquired from Y-12 has now been delivered to RATS. An assessment has been completed and an SNS service request order placed for refurbishment and assembly of the unit by DB personnel issued.

Parts for the re-circulation system (filters and pumps) for the vacuum cleaning station have been received; the balance of equipment is scheduled for delivery next week.

Vacuum instrumentation for the RATS vacuum test stands was received and is now being installed.

Survey of the second HEBT chamber originally planned for this week was delayed due to other priorities. This survey is now tentatively scheduled for next week.

Accelerator equipment received this week included 10 ion pumps and 6 MDC gate valves for the CCL installation.

The first shipment from RATS to LANL for rack population of DTL tank No. 3 was received.

The vacuum technician hired for a probationary period in a temporary position has now been offered and accepted a permanent position in the vacuum group.

The required GO-Train training module on compress gas was completed.

Three approved and signed off JHA's covering vacuum operations in RATS and an MSD binder have been posted and a lock out tag out board installed in the vacuum equipment receiving area.

## **Cryogenics Group**

## Electrical Systems Group

### Survey and Alignment Group

### Beam Diagnostics Group

LANL Beam Diagnostics Report:

BPM pickups: The DTL BPMs have suffered another setback. During drift tube stem repairs a plug was inserted into the BPM, which deformed the electrodes. The consequences are now being evaluated. Fabrication on the remaining eight DTL pickups has begun. JLab has evaluated the prototype SCL pickup and declared it to be good. The prototype CCL BPM has now been mapped and the results look good. During the weekly diagnostics videoconference on 4/Mar it was decided to make an attempt to modify the CCL electrodes to improve their performance at higher frequencies. Cost and schedule impact are now being evaluated.

BPM electronics: Work continues on LabView programming. A firmware bug was also identified and corrected.

WS actuators: Quotes for the next generation DTL and CCL actuators were received. We received prototype forks for the DTL/CCL and SCL actuators, complete with the collets for the carbon wire mounts. The carbon wires were mounted without incident. They look great.

WS electronics: Work continued on linking the LabView and EPICS software.

ED/FC: Steve Ellis completed a tech note on the ED/FC mechanical design.

D-plate: Final design work continued.

CM: A solid core, Kapton insulated wire was vacuum tested and found to perform well. A CM transformer will be now shipped back to Bergoz to change over to this type of cable.

Misc: Preparations continued for the final design reviews next week.

BNL Beam Diagnostics 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: Delivered 8 more 21cm Ring BPMs to the vacuum group. 12cm and the 26 cm BPMs machined parts are on schedule. 5 more 21 cm Ring BPMs have been sent out for brazing. Running total of delivery: 21 cm Ring - 28; 21 cm HEBT - 2.

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. Conceptual design of a 'nestled' IPM is in progress. This design promises to greatly reduce problems with background due to beam loss and image currents

1.5.7.3 BLM: New prototype BLM ion chamber parts have been received from the shop. Preliminary sub-assembly high voltage testing indicates it will hold-off +/- 5KV. Testing with a Cesium source, 1 rad/hr, using a complete air filled assembly resulted in a fairly flat response up to 3KV (tests stop at 3KV). Testing with Argon showed an increasing current with voltage. Additional testing will be performed with Argon to determine the critical points, and appropriate modifications will be made to improve signal flatness. The prototype electronics circuit board has been stuffed and installed in an enclosure. Initial tests show good linearity. Thermal stability is being tested now. The controls group will be given the the equipment to test simulated loss signals with the ICS110B 24-bit ADC.

1.5.7.4 BCM: The prototype BCM electronics that was delivered to LBNL was integrated with their control system. This work went relatively easily. The unit has been connected to the MEBT transformers and will be tested with the transformers soon. Work has begun on the mechanical design of the BCM pipe assemblies. The controls group is testing the BCM AFE electronics to determine all parameters of interest; ie: gain, offset, noise, repeatability, drift

parameters, etc, as well as assisting us with the evaluation of our algorithms, and trying to "tune" them to operate faster. A tech. note has been prepared, and is now in the approval cycle, on the design of the BCM electronics. Preparing for Final Design Review at LANL on 3/13/02.

1.5.7.5 Tune: Work continues on UAL script for modeling beam transfer function measurements.

1.5.7.6b Laser Wire Scanner: Awaiting shipment of the 200mJ Beam-in Gap laser and power supply/controller from LANL to resume measurements at 200MeV at the AGS Linac. Spectrum measurements were taken at the LINAC to evaluate the effect of amplitude variations on the 100MHz mode locked laser scheme. Preliminary results are quite promising. Big Sky Laser completed the 50mJ MEBT laser repair and shipped it to Berkeley.

ORNL Beam Diagnostics Report: Wim wrote a LabView program to analyze the Laser wire data taken on the BNL 200 MeV. It is hard to extract small signals from the data. Sasha has prepared an analytical Tech note to calculate the laser/H minus interaction. We are comparing his effort with Shafer's program. Warren has begun analysis of optical windows and design of an optical transport line. New components for the fast faraday cup have been machined. Electromagnetic modeling of the revised CCL and SCL BPM electrodes continues. Work continues to identify the number and location of beam shape monitors. We attended meetings on the ring-target interface – it appears that CD-4 and early operations might be possible without the proposed hi-rel MPS system and its attendant diagnostic inputs. A mandatory safety meeting was held to view Bill Madia's video and discuss safety strategy for the group. Position descriptions for two technicians were written and several resumes were reviewed. Planning activities continue, including: installation estimates, rack layouts, and database entry.