

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

### ASD/LBNL: Front End Systems

Upon inspection of the LEBT, a mechanical problem was identified (improper installation of the LEBT-RFQ gate valve) that had caused the excessive sparking from LEBT Lens #2 during the last period of operation. The problem is now corrected, and the LEBT has been re-installed in its tank.

After conditioning the RFQ to full 6% duty factor at nominal 640 kW power, we are now continuing at a power level of 736 kW and reduced duty factor, to accommodate anticipated beam-loading effects.

The full first unit of our LLRF system has successfully operated on the RFQ hot-model cavity in closed-loop mode, utilizing the analog and digital parts.

MEBT installation is continuing at fast pace; the fixed tuners have been installed in the four rebuncher cavities, and their resonant frequencies were verified to be on the nominal value of 402.5 MHz. The platform of the diagnostic beamline (accommodating a full-power beam stop and a rotatable, single-channel transverse emittance device) has been installed behind the MEBT.

A team of LANL and SNS-ORNL specialists has debugged the electronics systems for the Beam-Position-Monitors and Fast Current Transformers. Work on the Wire Scanner electronics is underway.

We have received a laser from BNL, designated for the Laser Profile Monitor system.

On 3/22, we shipped a set of devices (2/13-MHz rf matcher, rf load, directional coupler, and starter filament) to the SNS Ion Source group to facilitate creating plasma at ORNL earlier than possible with the latest anticipated receiving dates for these items from vendors.

Detailed planning for the full Front-End commissioning effort at Berkley has started, in close collaboration with A. Aleksandrov of ASD-SNS.

### ASD/LANL: Warm Linac

The first 402.5-MHz klystron arrived safely at LANL. It was unpacked, inspected, and installation is well underway (Fig. 1). Socket and tube are in place in the transmitter (Fig. 2). Ion pump is energized and initial pressure is satisfactory. (WBS 1.4.1.1)

The prototype SNS high-voltage converter modulator (HVCM) was back "on the air" this week. The NWL engineer returned to LANL all week to bring the prototype SCR controller to within specification. Some progress is being made (e.g., SCR controller is no longer "motor-boating"), but the SCR controller may not regulate well from no-load to full load or more importantly, unloading of the system - if the klystron stop pulsing, the voltage may climb to dangerous levels. Other HVCM highlights include satisfactory core flux offset measurements and junk-box voltage divider performance. There remains a concern that we have not solved noise trip-outs. We also need to pull unused equipment and control cables, and examine grounding. The modulator ran in support of the 805-MHz circulator heat runs. Approximately two hours before the end of the run an arcing event was believed to occur, which caused shoot-through faults on some IGBTs. That event is being analyzed. (WBS 1.4.1.2)

LANL staff was at JLab this week to participate in the fundamental power coupler final design review. (WBS 1.4.1.1)

The last BPM drift tube for DTL Tank 3 successfully passed the vacuum test. Coronado will now weld on the stems, plate, and finish fabrication. Delivery is expected on or before April 1. (WBS 1.4.2.3)

All four EMDs are back at Coronado. Two have successfully passed the vacuum test and the remaining two should be done by week's end. Forecast delivery for two vertical EMDs is April 3, with the two horizontal EMDs coming by April 8. (WBS 1.4.2.3)



Fig. 1: Moving 402.5-MHz klystron to the transmitter.



Fig. 2: Klystron inserted in transmitter oil tank.

The first 550-kW, 805-MHz klystron unit is under vacuum at the manufacturer. It is presently at the bake temperature. Pinch-off is forecast within a week. (WBS 1.4.1.1)

The PMQ drift tubes for Tank 1 are currently on schedule to ship by the end of April. The EMD drift tubes for Tank 1 are now expected to ship by May 30. (WBS 1.4.2.3)

Three of the five tank sections for DTL Tanks 1 and 2 are in transit and expected to arrive in Germany on March 25. The remaining two sections will be inspected by a LANL next week and should ship on April 1. (WBS 1.4.2.2)

LANL staff was at ACCEL this week to review progress on CCL fabrication, and to perform site visits to their subcontractors. (WBS 1.4.4.2).

LANL staff was at LBNL this week to support initial operation of MEFT wire scanner and BPMs. (WBS 1.4.5.2)

Code work to put a new option into PARMILA was completed. This option will provide simulated FWHM values for comparison to measured wire-scanner data during commissioning. (WBS 1.4.5.3)

Formalism and code work to generate predefined quad laws for transporting 200-MeV beams through the entire SRF section was completed. This is necessary for tuning the SRF linac during commissioning. (WBS 1.4.5.3)

Two PCRs are approved by LANL and are awaiting ASD approval. PCR LI 02 018 (resubmitted) realigns BCWS and transfers LANL budget to ORNL, as requested by ASD. PCR LI 02 019 returns HVCM procurement savings to ORNL. These PCRs return \$666K of LANL funding back to Project contingency. (WBS 1.4.6.1)

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

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

Extraction kickers are being repositioned within the existing lattice to optimize performance while improving specific PFN parameters such as reduced operating voltage, which in turn will provide added design margin and reliability. Currently, all operation points can be realized with an operating voltage of less than 35kv on the PFNs.

Bid evaluations for the RTBT collimator "inner box" are complete. SDMS is the low bidder and the contract will be awarded to them. Since they also have the beam pipe and absorber, SDMS will furnish and deliver a complete collimator assembly to ORNL.

Bids for the 36CDM30 were opened last Friday. New England Techni Coil was the successful low bidder and will likely be awarded this contract for eight magnets.

Acceptance testing of the 27CDM30 was finished last week. The data was evaluated and this magnet accepted. Danfysik has been given the green light to complete the production order for the remaining magnets.

Three special HEBT dipole "Y" chambers arrived at BNL earlier this week. They are in our queue for QA acceptance measurements.

Ted Hunter and Graeme Murdoch were at BNL this week to review specific mechanical systems. These include: collimation, linac vacuum window analysis, stripped electron heating, status of dipole measurements, review ring sextupole and RTBT quad designs, review lattice drawings, magnet parameters and installation drawings.

Released BNL/SNS Technical Note #104, "Considerations for the Design of the Beam Current Monitor System for the Spallation Neutron Source (SNS)" by M. Kesselman.

The BNL/SNS AP Group is working on optimized placement of the RTBT collimators and adjacent correctors.

Participated in a videoconference with ASD on issues related to the half-cell buss design for interconnect and straight sections.

Ioannis Papaphilippou returned to Greece to satisfy his military commitment.

Mel van Essendelft has accepted a new position within BNL's Environmental, Safety, Health and Quality Division. Richard (Dick) Savage has assumed Mel's responsibilities as BNL/SNS' QA representative.

Vendor updates:

- The 21Q40 quads have arrived in NY harbor (Tesla)
- The 12Q45 + corrector assemblies arrived at SNS/OR (Danfysik)

### Controls

A list of control racks required for DTL3 RF conditioning was forwarded to the controls team leader at LANL. The LANL controls group is evaluating whether or not there are any delivery problems.

Thirteen racks for the FE communications room are now mostly ready for handover to the FE contractor. (The only work remaining is labeling).

A requisition was issued to the "rack factory" to get ~12 racks in the FE temporary control room area fabricated.

The installation contract was awarded for conventional facilities I&C equipment and cabling. (Most of this installation is funded under conventional facilities, but there is some WBS 1.9 work included as well).

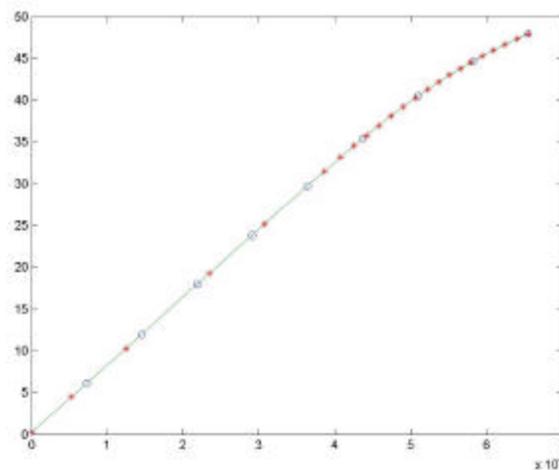
All production DM2K screens are under CVS control at SNS/ORNL

EPICS was configured for MEBT Quad and Steering power supplies (waiting only for cabling for full test)

EPICS was configured for all BCM, BPM, and WS devices

Initial tests of Beam Position Monitor and Wire Scanner PC servers with LANL and BNL staff and Dave Purcell show first calibration/test data. Some additional work was advised before beam tests on 1 April.

All quads for the MEBT have been curve fitted (using spline in MATLAB) and converted to EPICS breakpoint tables. The error from the fits to the linear conversion in EPICS should be less than 0.01% of the full scale setting in TESLA.



The circles are the original data point from the field map, solid line is the spline fit, and the stars are the EPICS breakpoint values.

Work on the spare ion source at Oak Ridge included the following:

The ControlLogix 5555 PLC to be used for the protection and safety functions is configured and communicating with the Remote I/O adapters. The PLC programming workstation (Compaq Evo W6000 with Windows 2000) is now set up and in use. The next step is to set up the EPICS database and application for the high level monitoring and control.

The references in the PSAD to the HQA MPS system were deleted. All references were updated to indicate the current design. The front end PLC that was in the previous design is still required and is referred to as the front end MPS PLC.

For Conventional Facilities controls, the computer and mounting brackets for a field deployable OPI system (to be used in equipment racks) finally arrived. This system will be set up for testing. If tests are successful, this system will be used for all CF field deployable OPIs.

### **Installation**

The ring tunnel cross section drawings were approved. Differences between the ASD drawings and the conventional facilities design package will be captured in a transmittal. The design for the permanent shielding around DTL tanks 1 and 2 (except for the DTL/MEBT interface) was completed this week. Fabrication will take place in the RATS building.

The ASD Division Director held the fifth of ten (10) planned System Installation Estimates Reviews at @1:00 on Friday 3/22/02. The SCL Installation estimates were reviewed.

- The presentation by Dan Stout went well. Action Items: Don Richied is to initiate work on two (2) heater loads which will simulate the cryomodules for cryogenic system testing. This de couples the receipt of cryomodules and cryogenic systems tests.
- Dan Stout/Mark Champion are to revisit rf conditioning input to the estimate. This is in addition to cavity qualification and cryomodule tests.
- An action item from the 3/15/02 meeting was to review the Integration and Conditioning estimates from both DTL and CCL with personnel who have recent experience in these tasks. That issue will be addressed at a meeting at 1:00 on 2/25/02 in Room 329.

The IPS-ASD Installation Integration Links were completed for the through the HEBT/Ring/RTBT. The HEBT links will be completed on 3/18/02. They were explained to Project Controls, Barbara Thibadeau, on 3/22/02.

David Olsen, George Dodson and Tom Mann met on 3/20/02 to interface the IPS-ASD Installation and Commissioning Links with the ASD Division Detailed Schedule. Operations, Dodson, provided Commissioning Links on 3/22/02.

Diagnostics provided delivery dates for diagnostic devices being provided by LANL and BNL

### **Accelerator Physics**

J. Galambos attended the Global Accelerator Network workshop at Cornell. The purpose of the workshop was to help define a structure in which future large scale accelerators can be built and operated in a collaborative fashion, with multiple control rooms. There was interest in the SNS collaboration experience.

A java program was written to help set up the accelerator configuration from the global database. This is part of the application programming effort to have applications initialized from a common database.

The modeling of ring injection painting, extraction and transport to the target is being set up. Aperture limitations are included to evaluate possible beam losses. This is all being done in the context of the ORBIT code.

Work in preparation of conditioning and fully integrated testing of DTL tank 3 in November 2002 is well underway. Both LANL and ORNL are supporting this effort. A schedule has been made up, showing in which order the different systems and subsystems are to be installed and tested. Most of the tasks at hand will be concentrated in the klystron gallery, which should be ready for equipment up to the 40 MeV point as soon as early May 2002. Preparations for cable orders and pulling, rack installation, PPS, waveguide installation, to name a few, are in full swing. At present, meetings with representatives of the different groups on the DTL tank 3 planning are being held on a biweekly basis, the frequency of which will need to be increased as installation approaches.

### **Operations**

Integrating the XFD ICOP with the ASD CPP for DOE

Integrating XFD Commissioning into the project commissioning timeline.

Implemented the ORNL Radiation Generating Devices Policy. Obtained and distributed appropriate forms and set registration process in motion

Updated and evaluated ASD Spares list

Worked with PPS on ODH procedure

Worked on DTL Tank 3 safety and processing systems. Worked on PPS safety for Front End processing and commissioning

Documenting operating procedures for Front End Systems

Proceeding with obtaining ASD Technical Review documentation and storing it in IMAN as required for the Accelerator Readiness Review Process

### **Ion Source Group**

In an effort to help us expediting the start-up of the hot spare stand, LBNL has agreed to send us a number of components that hold us up at this time. We were delighted to learn that Rainer has shipped a matching network, a directional coupler, an RF load, and the filament.

In anticipation of its startup, the hot spare stand has been registered as an RGD. Initially Martin Stockli will serve as custodian.

The 80 kW, 2 MHz RF-amplifier voltages do not exceed 12 kV, and therefore no RGD registration is required.

The 80 kW, 2 MHz amplifier has arrived with a few minor dents and bents. A closer look, however, revealed substantial internal damage. Early next week the amplifier will be returned QEI, which has agreed to expedite the necessary repairs.

In discussion with Sam Mackenzie, we developed a plan to integrate an area X-ray monitor as interlocked safety device of our hot spare stand.

### **RF Group**

We are working on cable lists, schedule, and other documentation. Chase assemblies are rolling out and we continue to assemble manageable sections of waveguide. People are in New Mexico for design reviews for HVCM control rack. People are at Jlab for the FDR of the couplers and Piezo tuners. By the end of the month we will have a updated schedule on HVCM deliverables, when equipment arrives. A Marconi klystron arrived at LANL on Thursday, it should be ready for power testing next week. This tube will be shipped to ORNL and used to power the RFQ in time. LANL has a better schedule for klystron deliver ability. Hengjie will be at LANL next week for more LLRF work. We are again moving forward on the LLRF system.

## **Mechanical Group**

Review and updating of the labor estimates for site installation and that needed to support vacuum activities at RAT continued.

A videoconference to define the communication protocol to be used between the SNS local controllers and the RGAs was held with participation from BNL, LANL, ORNL and the RGA supplier VTI.

Delivery inspection checklists for vacuum hardware were received from LANL, and these have been reviewed and comments forwarded for incorporation. The need for these check lists has arisen due to the problem that has been experienced with incorrect and short shipments from suppliers, as was previously reported.

Survey of the second HEBT dipole chamber was completed. The survey's conducted by ASD Survey and Alignment Group on chambers 002 and 006 compare favorably with those recorded in the travelers received from the vendor. This would indicate that no damage occurred to the chambers during shipment (the crate's as received condition had shown minor damage), and BNL has been advised of these findings.

Due to the high level of out-gassing and the significant high mole peaks recorded at the end of last week during testing of the injection beam dump flight tube it was decided to pump over the weekend and then take a further RGA scan. This later scan showed even greater levels of contamination of indefinable origin. As a result the test was suspended and release of the flight tube was held pending further investigation. Proper operation of the RGA has been confirmed and the problem is thought to be due to the quality of the pipe and standard of fabrication (possible contamination by cutting oils) used in the manufacture of the flight tube embedment assembly. The flight tube will be abrasively cleaned (sand blasted and glass beaded) prior to a final washing and retesting. This is targeted for completion by the end of next week. Technical support provided by VTI staff in support of this activity has been first rate and they will support the retest activity supplying two further RGA's.

The first article support brackets for the HEBT dipole chamber have been dimensionally inspected and found to be within tolerance. The trial fit-up with the dipole magnet and chamber will now proceed.

Accelerator equipment received this week included eight, 300 l/s, ion pumps for the DTL installation. The RAT's vacuum test racks are currently being assembled and populated with accelerator specific pump and gauge controllers this will allow the future efficient testing of accelerator vacuum components.

Capital and consumable purchases received this week included, the mobile turbo pumping station needed for testing of accelerator equipment at RAT, the vacuum heat-sealing unit together with the poly bags for the storage of vacuum components, and PPE needed for vacuum group activities at RAT's and site.

## **Magnet Group**

The First article 12Q45/16CD20 has been received and we are starting field measurements of the Quadrupole. We are also preparing for installation of a beam tube into the HEBT 8D533.

## **Cryogenics Group**

The delay of the steel for the CHL has left an opportunity to begin the installation of the CHL equipment. We are developing a plan to install the transfer line from the CHL to the tunnel the first week of April.

We continue to develop the Medium Bata supply transfer lines and install the tooling for the return segments.

We have developed an acceptable weld joint for the buss and have set up the manufacturing tooling.

The piping for the next 2 beam stops is on order and should arrive here this week.

We continue to interview for the technical openings

## Electrical Systems Group

### Survey and Alignment Group

The SNS Survey & Alignment Group is involved primarily at this time in the Global Network Measuring campaign. Last week, despite bad weather, we were able to complete the exterior network elevation measurements. The necessary survey equipment utilized in this campaign has been re-calibrated. The on-going measuring campaign is expected to continue for the next several weeks.

### Beam Diagnostics Group

LANL Beam Diagnostics Progress Report:

BPM pickups: We received the first DTL BPM installed in a drift tube. Mapping is now in progress. Initial results indicate a sensitivity of 2.15 dB/mm, to be compared with the theoretical value of about 2.6 dB/mm. The other DTL BPM has a vacuum leak and repairs are in progress. Work continues on the fabrication of eight more DTL BPMs. Work has begun to modify the CCL BPMs to improve their high frequency performance.

BPM electronics: John Power and Matt Stettler are spending the week at LBL for initial installation and checkout of the BPM electronics needed for the FES tests.

WS actuators: The purchase order for the next version of the DTL/CCL WS actuators will be placed in the next couple of days. Estimates for DTL/CCL forks and collets are in progress at several vendors. The SCL fork was shipped to JLab for vacuum, cleaning, and particulate checks. Work has resumed to estimate the cost for LANL to deliver the HEBT, ring, and RTBT WS actuators.

WS electronics: Chris Rose and Lisa Day are now at LBL for initial installation and checkout of the WS electronics needed for the FES tests.

D-plate: Design detailing work continues. As the drawings complete the checking process the various components will be fabricated.

ORNL Beam Diagnostics Progress Report:

Warren Grice completed the tech note about laser damage. He began design work on the laser transport line. At this point, just gathering information and opinions until the Mechanical Group identifies a suitable location in the Klystron Gallery. Craig has concluded his analysis of the CCL BPM and has written a paper describing the changes to the CCL BPM electrode as tech note #42. He started on the SCL electrode analysis. A prototype Faraday cup was destroyed at INFN from a machining malfunction. A new Faraday Cup was made and sent to Italy on Thursday afternoon. Wim Blokland worked on a Gaussian fit analysis in LabVIEW. He continues work on Wire Scanner data analysis programs and traveled to Berkeley to join the LANL Engineers to integrate the profile monitors. Dave spent the week at LBNL helping with the installation of software for the MEBT diagnostics. Also, he updated the rack profiles on the web to show the exact configuration of the 3 LBNL racks. Coles and Saeed visited a local manufacturer (Ametek, Inc) to learn about their neutron detection instrument proposal. Tom has been revising our installation and integrations plans with information collected from partner labs and past projects.

BNL Beam Diagnostics Progress Report:

#### 1.5.7.1 BPM:

- Continued wire cutting the striplines for the 12cm BPMs. Six units are done so far.
- Machining the mounting flanges for the 30cm BPMs.
- Running total of delivery this week; 21cm Ring BPMs=28, 21 cm HEBT BPMs=2.

#### 1.5.7.3 BLM:

- After making several relatively small but effective modifications to the prototype chamber, we are getting good response curves up to 3KV. For ease of disassembly & testing, the chamber was configured to flow Argon..

- In a parallel effort with TroyOnics, to improve the RHIC style chamber performance, we have received 5 modified chambers all of which also demonstrated very good response curves.
- It appears we will soon have to choose from two very good performing SNS BLM detector designs.
- A pulse current source has been designed and built to simulate loss signals into our front end electronics.

#### 1.5.7.4 BCM:

- A preliminary sketch for the BCM design is finished and being reviewed.
- A design of a prototype outer shell, based upon the current test fixture design is underway to evaluate frequency response and resonance.
- The BCM Final Design Review was held at LANL.
- Tech. Note 104 has been published, "Considerations for the design of the Beam Current Monitor System for the Spallation Neutron Source"; M. Kesselman.
- The second generation AFE board artwork is under review.

#### 1.5.7.5 Tune

- Continuing BTF modeling, analyzing kicker requirements

#### 1.5.7.6b Laser Wire Scanner:

- The 50mJ laser for the MEBT laser scanner has been repaired and is at LBNL.
- We received the 200mJ laser from LANL and it is installed in the BNL HEBT line of the Linac. It was noticed that the spot on the vacuum window where the laser beam had been passing has turned milky. Probably the light is being scattered and the intensity in the focused beam passing through the ion beam is greatly reduced. The suspected reason for the spot is burned organics on the vacuum side of the window. We are trying to get an access to change the window and inspect the optics inside the chamber.