

## Accelerator Systems Division Highlights for the Week Ending January 25, 2002

### ASD/LBNL: Front End Systems

The SNS RFQ successfully accelerated its first beam to full energy at 4:30 p.m. Friday afternoon, the 25th of January 2002. Beam appeared at the Faraday cup on the first pulse, increasing in minutes to 24 mA, with a fresh source that had not yet developed its full cesiation. The beam operation was very stable with an excellent pulse shape of the 2.5 MeV beam. The duty factor was low, with a 100-microsecond pulse at 10 Hz, which will be increased as we gain confidence in the system.

### ASD/LANL: Warm Linac

The final item that LANL is preparing to ship to JLAB for the klystron test stand is the water manifold and interlocks. The unistrut support structure is completed (see photo), and shipment should occur by the end of this week. (WBS 1.4.1.1)



Fig. 1: Water manifold for JLAB test stand.

The work-package manager (Dan Rees), STL (Don Rej), and buyer (Dennis Mack) were at *Titan-Beta* this week for the second attempt on the transmitter acceptance test. LANL controls personnel have been at the vendor all week finishing the EPICS interface, and the good news is that this part is working. Although we are close to acceptance of the solid-state amplifier, issues remain on the sequencing and ladder logic in the vendor's software. Don Rej got a firm commitment from the vendor's vice president to focus attention on completion of this critical-path software. (WBWS 1.4.1.1)

The rebuild/upgrade of the converter-modulator is proceeding well. Most of the replacement parts have been fabricated, and reassembly of the unit has begun. The photo Fig. 2 below shows the new rectifier stacks and step-up transformers being placed on the 'basket' platform in preparation for interconnection. Shown in the top of the photo is an ORNL engineer (David Anderson) who is assisting us in the rework. (WBS 1.4.1.2)

We have halted procurement of the DTL steering-magnet power supplies pending a final decision by ASD on the specifications. We have developed budgetary estimates for all of the options under discussion to help expedite this decision. (WBS 1.4.2.3)

The *DEI* pulsers for the MEBT chopper were shipped to LBNL on Thursday, and they arrived on Friday. Two bound copies of the operations manual accompanied the units, and electronic copies are being sent to both LANL and ORNL. (WBS 1.4.5.1)



Fig. 2: Rework of the prototype converter-modulator.

Drift-tube fiducial problems have been resolved and the DTs are again being installed. Several adjustments to the installation procedure have been made that make the insertion of the DT stem (with alcohol-lubricated o-rings) slide more easily into the top hat. An external band was added to help hold the RF seal, and it works well. A new DT support stand was fabricated and is positioned inside the tank to help support the DTs during mounting. (WBS 1.4.2.7)



Fig. 3: Support stand to assist in mounting drift tubes

After mounting a DT, the vent port between the o-rings is roughed down to remove excess alcohol. A leak detector is then attached, and the o-rings are leak checked. On the first seven DTs, the total leak rate of the o-rings was  $<5 \times 10^{-10}$  m-bar l/second. (WBS 1.4.2.7)

The SNS CCL copper material is in receiving at *ACCEL*. The receiving process involves gauging of each item for size and shape and permanent marking with a serial number for complete traceability on each item. The picture below shows the material for Module 2 in the receiving area awaiting measurement. (WBS 1.4.4.2)

ORNL re-design if the SCL inter-segment region calls for no beam-line flanges on the BPMs or beam box, no vacuum port on the beam box, and no support feet on the beam box. Post-prototype modifications will be necessary. Plans are firming up for the final design reviews scheduled for March 12-14. (WBS 1.4.5.2)

A contract was placed with *New England Technicoil* for the SCL magnets. (WBS 1.4.9.2)



Fig. 4: A portion of the SNS copper material in the receiving area at *ACCEL Instruments*, Cologne Germany, awaiting measurement and marking.

Following last week's successful review of the manufacturing process, we approved the first progress payment invoice from *ACCEL*. (WBS 1.4.4.2)

Assembly-level layout is complete for the HEBT cavities, and we are working with BNL on the interfaces. When the detailed drawings are complete, we anticipate a modification to the *ACCEL* contract to add these extra segments. Issues with the water-cooling and resonance-control for these units are being worked. (WBS 1.4.4.9)

The DTL Tank-3 BPM pickups are expected back next week after being welded into the drift tubes. Each one needed to be repaired following the welding operation. One had a leaky weld joint, and the other had a hole burned into the side. The BPM mapper modifications are complete and ready to go. The CCL and SCL prototype pickups are scheduled to arrive next week. (WBS 1.4.5.2)

Tests of the prototype wire-scanner actuator from BNL showed acceptable noise levels on the signal wires during simulated profile scans. Integration issues were minimal. (WBS 1.4.5.2)

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

Replacement of a CEBAF cryomodule Joule-Thomson valve was demonstrated to SNS staff to illustrate the process anticipated for SNS cryomodules.

Mockup assembly of the cavity string has identified several minor problems and interferences with the string assembly tooling. The mockup assembly is now complete, the problems have been rectified, and final assembly will begin next week.

Repair of the high-pressure rinse unit is complete.

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**

All five carbon wire scanners have been sent to LBL. We are waiting for the prototype to be returned to BNL for retrofitting.

Laser Profile Monitor - a beam profile was successfully measured at 200MeV on the 100 micro-amp polarized beam. P. Cameron, R. Connelly and/or T. Shea will provide details to ASD.

An expert from Big Sky (our laser vendor) was at BNL this week to determine the reason for the laser power supply failure during our radiation testing.

Efforts continued to understand the difference between measurement and analysis of the Ring dipole Integral Transfer Function. Bipolar measurements will be made on two magnets to see if remnant magnetization from their production is a contributing cause.

Efforts also continued on the Extraction Kicker Rise Time and Impedance Matching. Jon Sandberg noted: "...Jian-Lin has spent the week tuning the extraction kicker and adding the saturable reactor. He has substantially reduced the rise time to where it will probably meet the new requirements. He will show his results at the physics meeting today. The next step is to put the kicker in the oil and run at 60 hertz."

Ted Hunter and Stuart Henderson were visitors at BNL this week. Specific reviews included:

- Injection Chicane Magnets
- 36Q85 Quads
- 36CDM30 Correctors
- Review of Magnetic Measurements (Ring dipoles)
- Injection Stripping e- Catcher
- Linac Vacuum Window Analysis

Dave Gurd and his review team were at BNL this week to conduct reviews that included:

- EPICS
- PS Software (including PSI/PSC hardware)
- Timing System
- Interface Control Document – Power Supplies to Integrated Controls System

Tom Shea is at BNL to review Diagnostic's issues with Cameron and Connolly. In particular, to review the recent results from the Laser Profile Monitor tests.

A telephone conference was held with BNIP of Novosibirsk to review production issues related to the 30Q44/58 quadrupoles. During this review, we agreed to send BNIP a specially generated 3-D coil drawing that will show specific details of each turn, for each layer, with each transition. This, hopefully, will show them the manufacturing steps required for this type of coil. Youri Shatunov will be at BNL on February 25<sup>th</sup>.

Nick Simos (BNL) and Graeme Murdoch (OR) traveled to SDMS of France this week to witness a critical point inspection (#2) of the RTBT 1<sup>st</sup> article collimator.

A contract was awarded to Alpha Magnetics (California) to manufacture the 41CDM30 corrector magnets.

A contract was awarded to Stangenes, Inc. (California) to manufacture the 36CDM30 corrector magnets.

Field measurements of Ring dipole #11 are underway.

Ring half-cell vacuum chamber assembly #7 was completed this week. Four of these chambers have been coated.

We continued with our preparations for the ASAC Review.

We are awaiting direction from ASD on how to proceed with the radiation hardened designs for the (4) 36Q85 quads and the (2) 36CDM30 correctors.

We are awaiting direction from ASD on how to proceed with WBS 1.5 spare parts and special materials.

### **Controls:**

A review of the low level software for the power supply and timing system modules was held at Brookhaven this week. A number of suggestions were made, and will be documented. This work has advanced very well.

An interview was held at Brookhaven for a possible successor to John Smith, retiring Level 3 leader for WBS 1.9.5 (Ring Controls).

WBS 1.9.2.2 Timing System: The "first article" fiber optic converter chassis has been received at BNL. It will be tested there before the supplier is authorized to send the rest. (These chassis are part of a system for converting timing system and MPS links from/to optical signals).

WBS 1.9.6 Target Controls: We met with Sverdrup and Knight this week to resolve issues for the Target building substructures construction for the Target building General Contractor, and for the Ring Injection Dump construction. Most of the issues for construction were wall and floor penetrations for cables and for tubing needed for instrumentation and controls. A schedule for submitting drawings for each of the construction projects was developed.

WBS 1.9.8 Conventional Facilities Controls: The conventional facilities CUB 90% Title II instrumentation and controls package was issued for comment.

WBS 1.9.10 Cryogenic Controls: Three of the six warm compressor motors and compressors were rotated in accordance with information obtained from the original equipment manufacturer. The motor manufacturer recommended that we connect power to the motor heaters to keep the motor windings dry. We have yet to receive data from the warm compressor skid vendor, PHPK, and are having to contact the original equipment manufacturer directly to obtain instructions and documentation.

WBS 1.9.3 Front End

-- The controls group supported RFQ commissioning at full gradient, 10Hz, 100usec, 11ma  
 -- Emittance gear was made ready for beam: Control of slit and harp motors was implemented via a scan application. ADC triggering was set up and data read. Data was forwarded in the proper format for MATLAB analysis.

### **ASD/ORNL: Integration and Installation Support**

We have taken occupancy of building 7039 on the ORNL site, it's a 10,000 sq ft sprinkled building with no HVAC. We started moving in the week of Jan 7.

Linac chase assemblies are being fabricated now with plans to install all chase conduit, piping and waveguide in RATS.

The ASD installation trailers now have power and by next week will be secure for ASD Survey to store their equipment on site.

We continue to grout Survey's floor monuments in the Linac tunnel when able, rain has held us up quite a bit the last week.

### **Accelerator Physics**

S. Cousineau participated in the USPAS at Los Angeles, S. Henderson visited BNL for updates on ring activities and Sasha Aleksandrov visited LBNL to participate in the RFQ testing and commissioning.

A transmittal was completed to reduce the RF reference line stability requirements. With the reduced phase control requirements, the beam dynamics are acceptable and the rf reference line temperature control is alleviated.

A decision was made on a plan to procure DTL corrector power supplies within budget, after the cost for the specified power supplies came in higher than expected. Smaller supplies (as used in the rest of the accelerator) will be used and stacked as needed.

### **Operations**

Began the revision of the Commissioning Program Plan to include the Target and instruments per DOE's request

Began the revision of the Accelerator Safety Envelope.

Turned over Review Documentation monitoring to Shane Passmore.

Participated for 2 days in the PSAD Review

Worked with the MIS group on operational software acquisition

### **Ion Source Group**

Advanced Machine Services in Coalfield expects to have the LEBT parts completed by February 8.

Paul Gibson visited TTI and brought many LEBT vacuum components with him. It includes a aluminum vacuum vessel which leaks which will be partially re-welded in Oak Ridge. TTI agreed to a \$2000 price reduction to cover our repair costs.

Electrical conduit is being installed in our big blue box.

The 70 kV isolation transformers have been mounted on the transformer stand.

Syd Murray has established and organized his work space in the RATS building. Currently he is cleaning the leaking vacuum vessel to prepare it for re-welding.

### **RF Group**

Mark is at Jlab, he had another Piezo tuner Video this week, Jlab is doing bench testing with these devices. The HVPS we sent to Jlab developed some problems, and these have been fixed and testing is continuing. David was at LANL for design reviews of the HVCM control rack. Jim Hicks was at LANL assisting in rebuilding the 20 KHz, 3-phase inverter transformer. Discussions concerning LLRF are ongoing and a transmittal is being prepared for the reference line new specifications, the physics group is writing them. People are discussing with Amy on ways to improve the overall LLRF. Chip Piller suggested a way to eliminate the reference line in the tunnel and generate the clock signal needed at each LLRF station. This option may have been acceptable months ago but time may have run out, we will continue to discuss his idea.

The installation and commissioning of the 1.25 MW RF test stand at Jlab continues. We started the recommissioning of the ORNL high voltage power supply and crowbar system at the end of last week. We've corrected a few wiring problems and are presently using a hi-pot power supply to condition the thyatron tube. The conditioning appears to be successful in that the number of thyatron "prefires" is decreasing and we can operate at higher and higher voltages. Presently we are at 110 kV.

### **Mechanical Group**

#### **Magnet Measurement Group**

#### **Cryogenics Group**

Work continues on the "T" sections of the transfer line. Tooling for the "Transfer line module sections" is being assembled.

A plan to rotate the motor and warm helium compressor shafts periodically has been developed and implemented.

Oil processing continues at the vendors.

The surplus Dewar is found to have a substantial leak from the inner vessel to the outer vacuum vessel, and we are in the process of analyzing options.

We attended the weekly meeting at the contractors trailer. Work is in progress setting the footings for the basement.

A coordination meeting was held between the building contractor, some of the sub contractors and the rigging company. A timely installation plan for the warm compressors and helium gas tanks was established. The installation schedule will be modified to reflect the new component deliveries.

### **Electrical Systems Group**

### **Survey and Alignment Group**

### **Beam Diagnostics Group**

BNL SNS Beam Diagnostics Weekly Report:

1.5.7.1 BPM: Delivered 6 more (a total of 12) 21cm Ring BPMs to the vacuum group Shipped out eight additional 21cm Ring BPMs for brazing. Finished modifications for most of the strip-lines for the 21cm Ring BPMs in the shop (~70% so far). Received complete order of the outer shells for the 21cm HEBT BPMs. Ordered aluminum rods for the shop to be used to fabricate the assembly tool for the 26cm, 30cm and 36cm BPMs.

1.5.7.3 BLM: Prototype fast ion chamber (with 0.25" gap) mechanical assembly is nearly complete. BLM front-end electronics 2nd generation prototype circuit schematic is complete from the design room. We are gathering components for PC fabrication.

1.5.7.4 BCM: Channel Access Software development continues. A document describing the equipment being shipped along with software operating instructions has been completed. The second generation AFE board artwork is under review.

1.5.7.6a Carbon Wire Scanner: Continued updating the drawings to reflect the WS configuration that we had added and modified.

1.5.7.6b Laser Wire Scanner: A profile was successfully measured at 200MeV line. The Beam condition was about 100 micro Amp polarized beam. An expert from Big Sky (our laser vendor) is at BNL to determine the reason for failure during our radiation testing. We are interested to see if the radiation-sensitive components can be moved to the power supply to make the head more rad hard.

LANL SNS Beam Diagnostics Weekly Report:

BPM pickups: The DTL tank 3 pickups are expected back next week after being welded into the drift tubes. Each one needed to be repaired following the welding operation. One had a leaky weld joint, and the other had a hole burned into the side. The BPM mapper modifications are complete and ready to go. The CCL and SCL prototype pickups are scheduled to arrive next week. We have modified the DTL pickup design for a smaller "ridge" at the end of the electrode. This will increase the clearance between the ridge and the BPM body, and improve the impedance mismatch.

BPM electronics: Work continues on the calibration signal bleed through problem.

WS actuators: Work continues on the prototype DTL actuator fork and the collets for the SCL fork. Work continues on the spare bellows for the SCL actuator. DTL/CCL and SCL actuator lifetime cycle tests will resume next week.

WS electronics: Tests of the prototype actuator from BNL showed acceptable noise levels on the signal wires during simulated profile scans. Integration issues were minimal.

CMs: Plans are underway to vacuum test the DTL transformers and check their out-gassing characteristics.

D-plate: Final design work continues. The beam stop detailing work is about 98% complete.

ED/FC: The prototype water-cooling lines are expected to arrive today or tomorrow. If the cooling lines look good we will proceed to build the DTL tank 1 ED/FC.

Software: We are now able to serve process variables to EPICS. We still need the interface software for the individual WS and BPM programs.

SCL inter-segment region: ORNL re-design calls for no beam line flanges on the BPMs or beam box, no vacuum port on the beam box, and no support feet on the beam box. Post-prototype modifications will be necessary.

Misc: Plans are firming up for the final design reviews scheduled for March 12-14.

ORNL SNS Beam Diagnostics Weekly Report:

Controls and diagnostic group members worked on the Berkeley emittance scanner EPICS driver, software, easy-to-use integrated front panel, data acquisition and storage. The integrated system is under test. LANL and ORNL staff worked on the BPM electrode simulation and performance enhancement calculations. Tom is back to BNL to meet with controls and diagnostics personnel and to participate in beam studies. The plan for diagnostics/controls ICDS was revised. The controls work plan for BCM support was reviewed. The 200 MeV beam at the BNL linac was measured with the laser profile monitor and the carbon wire. Although the laser profile monitor successfully measured profiles, performance was hampered by unexpected pulse-to-pulse variations. We did not observe these variations in upstream pickups, nor during the 100-microamp experiments, so further investigation is required. The carbon wire measured one profile before we lost continuity. It's suspected that the wire failed due to beam and RF heating. More investigation is also required in this area.