

Accelerator Systems Division Highlights for the Week Ending December 21, 2001

ASD/LBNL: Front End Systems

The RFQ couplers in Modules #3 and 4 were re-adjusted to balance the power input between all 8 couplers; the maximum output-power difference is now ± 0.5 dB. The entire RFQ was moved and connected to the LEFT tank while it was being held under vacuum. The LEFT tank is now being supported off the RFQ support frame, in the final mechanical configuration.

We received the first of five wire scanner assemblies from BNL as well as the MEBT chopper structures, mounted on the beam box lids, from LANL.

The MEBT support frame was moved to within one inch of its final position behind the RFQ at the LBNL Integrated Testing facility. The frame for now carries the completely assembled third raft (except for antichopper structure and wire scanners) and a diagnostic platform in place of Rafts # 1 and 2 that carries a full-power stop for the RFQ beam and the off-line emittance expansion-tube and beam box. Final (LBNL) installation of the remaining infrastructure items for both subsystems is proceeding.

The fourth MEBT rebuncher cavity is on its way from the vendor to LBNL.

The LBNL director, C. Shank, signed the SNS-LBNL follow-on MOA as signed off by Bill Madia and Thom Mason; this MOA is now actually in effect.

ASD/LANL: Warm Linac

We continue having nearly daily interactions with Marconi. Two-shift operation in support of our contract started this week. The second 402.5-MHz klystron is now undergoing pulsed high-voltage conditioning, up to 120 kV, to date. (WBS 1.4.1.1)

LANL and ASD were at Titan-Beta to participate in the first factory acceptance tests of the 402.5-MHz transmitter. Several of the scheduled tests were performed; however, the vendor was not ready in several areas. Software was incomplete, and some equipment such as solid-state amplifiers did not meet specifications. Deficiencies are being corrected. The vendor forecasts resumption of acceptance tests on 1/14/02. (WBS 1.4.1.1)

The control racks and the remaining waveguide for the high-power RF test stand were shipped to JLab on Dec. 18. (WBS 1.4.1.1)

A contract was sent for signature to the winning bidder for the 17 production high-voltage converter modulators. (WBS 1.4.1.2)

The ASD and LANL Mechanical System Teams started installation of drift tubes on DTL Tank 3 (Fig. 1). (WBS 1.4.2.7)

The contract for the DTL water skid was placed, and the RFP for the water manifold was issued. (WBS 1.4.2.5)
The RFP for the CCL quadrupoles was issued. (WBS 1.4.4.3)

We completed a comprehensive document for tuning the CCL cavities and power couplers for use by the vendor, ACCEL. (WBS 1.4.5.3)

LANL SNS-Division Chief of Staff, John Tapia, was at Oak Ridge this week working with the SNR/ORNL Business, Procurement, Finance, Property, and HR teams. (WBS 1.4.6.1)

LANL submitted comments on the ASD "Lead/Mentor/Consult Roles and Responsibilities During SNS ASD Installation" draft memo. (WBS 1.4.6.1)

LANL submitted PCR LI 02 005, "Transfer of Installation/Assembly Integration Budget from LANL to ORNL." When implemented, this PCR will transfer \$9.9M from LANL to ORNL. The reduction in LANL scope is completely consistent with all 10 signed handoff agreements between ASD and LANL. (WBS 1.4.6.1)

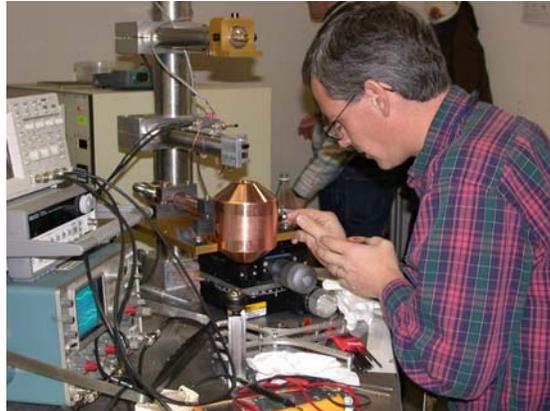


Fig. 1: DTL-3 magnet tests and assembly.

With the ASD/LANL Mechanical Systems team fully engaged in DTL assembly, we also look forward to staff and technicians from the ASD RF team at LANL in January to participate in klystron transmitter installation and high-voltage converter modulator upgrades. In the mean time, we have sought additional help from another partner (Fig. 2)



Fig. 2

ASD/JLAB: Cold Linac

The charcoal vessel of the Oil Removal system has been received at SNS.

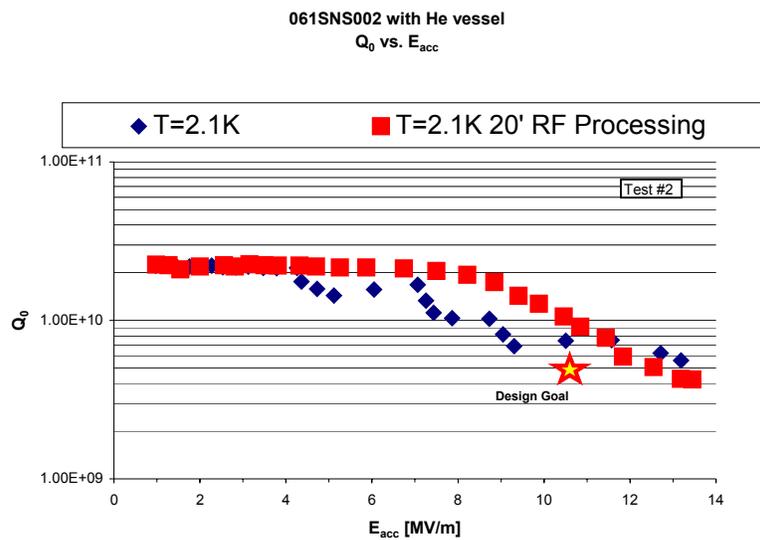
The warm tunnel wall piping design package has been released to SNS.

The instrument air system has been received at SNS.

The first installation design package was released and sent to SNS.

Fabrication of remaining transfer line components continues. This task is expected to be complete in early January

Cavity #2 met specifications in cryogenic testing (see Figure below) and is now certified for string assembly.



Cavity #4 was re-tested after undergoing a roughly 24-hr thermal soak at 100 K to see if there was any indication of Q-disease. As shown in the Figure, within experimental uncertainty, its performance was the same before and after the soak. This validates the process (600°C bake for 10 hr) used to remove hydrogen from the niobium, and certifies cavity #4 for string assembly.

Cavity #3 was unable to make gradient after an incident during high pressure rinsing when the wand struck the interior cavity surface. The problem will be addressed when all staff return from the Christmas break. This will not delay string assembly, since work can begin with the other two cavities.

Initial tests, including thermal shocks to 77 K, of prototypic indium cavity seals were successful.

Investigation of the problems with the aluminum-magnesium gaskets continues.

ADC proved to be unable to execute the cryomodule vacuum vessel contract. It was withdrawn, and has been re-awarded to Meyer Tool and Technology.

Bids have been received for the production run of Fundamental Power Coupler outer conductors. They are being evaluated.

All components so far received have been put in place, and we await delivery of additional elements of the test stand in the New Year.

ASD/BNL: Ring

The BNL Diagnostics group shipped a 1st article prototype carbon wire scanner to Berkeley on Monday.

Magnetic measurements of the first article 21CS26 sextupole corrector magnet were completed this week. Field quality was poor and the magnet was returned to the vendor for improved alignment of the pole tips prior to retesting.

The 21CO26 is now being set-up in the test stand for field quality testing.

17D120 Ring Dipoles: magnet #6 is in the high field test stand for magnetic measurements.

George Mahler is back for Stangenes where he observed production status on the 26Q40 quadrupole. George reported that vendor work is progressing well and a first article is expected in January.

Work is underway to assist ASD with technical and cost transfers related to the HEBT Momentum Collimator/Dump as requested by K. Reece. SNS/OR will assume the Lead role for designs and hardware.

The welding fixture for the HEBT (21cm) quad vacuum chamber is being fabricated for the upcoming production run.

Ring half-cell vacuum chambers #5 and #6 are being prepared for assembly.

Bids are in for the vacuum gauge controllers. Vendor proposals are being evaluated prior to contract award.

A production order has been placed with Varian Products for the remaining ion pump controllers.

SNS/PO visitors this week included C. Strawbridge, K. Boudwin and N. Holtkamp.

BNL's comments on draft proposal for "Installation: Lead / Mentor / Consult.." proposal were sent to N. Holtkamp.



Fig. #1: Coating a Half Cell Vacuum Chamber

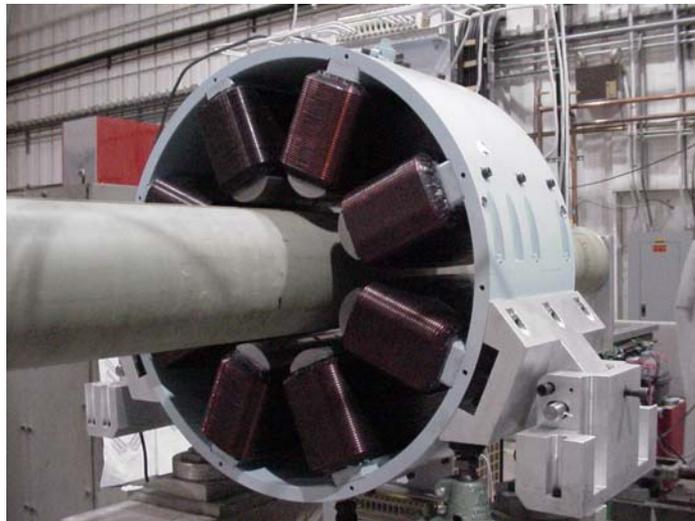


Fig. #2: 21CO30 Corrector at BNL

Controls:

The "PPS Phase 0 and Phase 1 Hardware Final Design Review" was held this week. The reviewers gave the go-ahead for procuring Phase 0 and Phase 1 hardware. There were a number of constructive comments made.

Inspection of the warm compressors was started. So far they look good with only a few minor problems found.

Efforts continue to prototype the control system network. The ORNL network support group has loaned us a Cisco 6506 core switch to enable us to test redundancy/failover of the control system network core switches. The network support group will conduct failover tests soon. An evaluation unit (i.e. loaner) Cisco PIX firewall has also been received. Plans are to buy a firewall this spring after we try out this unit.

Control system design support for the front-end test stand continued. G3 remote I/O hardware was ordered. A network block diagram was drawn and circulated for comments. A control equipment list was finished.

A system administrator, Greg Lawson (from SAIC), joined the group this week. Greg will work on a number of control system workstation and network tasks that have been languishing.

The conventional facilities controls "90% Title II Design" issue of sensor specifications was received. The specs are now being reviewed.

BNL shipped 5 power supply interface units to the RATS building. Additional units will be shipped periodically or as needed. BNL has started updating the power supply ICD in preparation for a design review in late January or early February.

BNL received their first group of 21-slot VME64x crates and will check them out by using them for the timing hardware.

BNL is working with WindRiver to fix procedural problems with the VXWorks license contract.

LBNL reports that all VME hardware for the final (i.e. the "to-be-shipped") control system configuration has now been received.

The LANL controls team participated in a transmitter test at the vendor's site. Deb Kerstiens and Martin Pieck have been added to the controls team. Deb will help with RF controls and power supply software development. Martin will work on the High Power RF controls.

The external review committee for the FDR of the Personnel Protection Systems believes the design is sound a fail-safe and recommends procurements as planned. It was obvious that the PPS group has had good communication with other affected groups; and they also came away with the strong belief that the SNS PPS group has already (quite well) put into practice many of the system designs that are both robust and "User friendly". They look forward to reviewing the PPS group efforts on System software architecture in the near future. The review committee final report should be available soon after the first of the calendar year.

ASD/ORNL: Integration and Installation Support

Accelerator Physics

S. Cousineau visited BNL and worked with N. Catalan-Lasheras on the collimation scheme. Moving the locations of some of the collimators arrived at a new configuration that leads to reduced losses on the ring collimator section quadrupoles. Also the new ORBIT and previous K2 collimation models were compared to verify consistency. The new model allows for beam tracking important for multi-turn collimation).

J. Wei and J. Holmes participated in PSR experiments. The main emphasis was collection of data to verify space charge modeling. Varying beam sizes and intensities were run, and large space charge blowup was observed for some cases. The data is being analyzed with the ORBIT code.

A preliminary real-time display of an X-Y correlator package that can be used with EPICS was developed. This package will allow real time (time-correlated) display of any two EPICS process variables, and is expected to be a valuable tool in commissioning the pulsed SNS machine. P. Mcghee at Los Alamos wrote the correlation engine used in this application.

Operations

Ion Source Group

Rudolf and his fellow reindeers brought us a box! It is big! It is blue! It is the [Big Blue Box!](#) Beginning of January we will start to connect AC power and start to install the internal components.

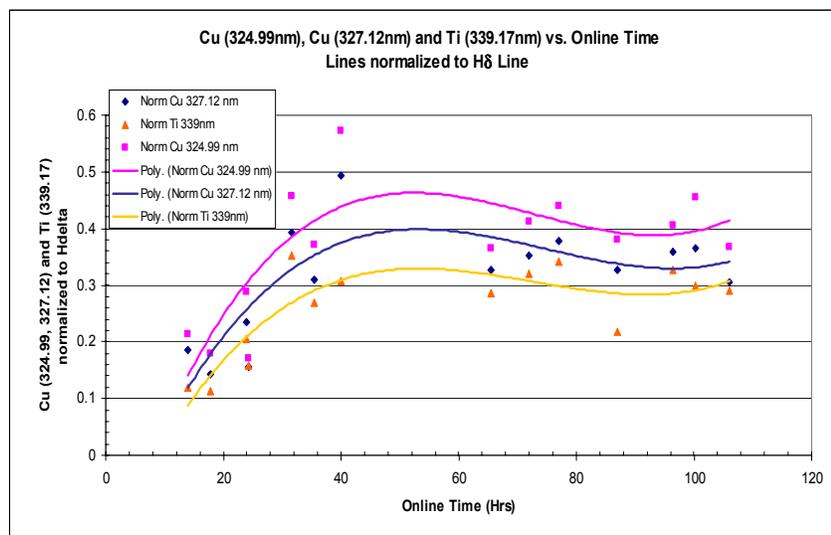
The 80kW 2MHz amplifier is undergoing testing at the vendor's location. Extended operation with mismatched loads will be tested on December 27 and 28. Droop at high power levels and controllability at very low power level will receive special attention during acceptance test scheduled for January 3 and 4, 2002.

The order for the LEBT electrode package has been placed with the Coalfield machine shop.

A quote for the redesigned ceramic standoffs for a glue-less LEBT has been received. The entire LEBT package comes in under budget.

Robert Welton completed a literature review and analysis of the H⁻ production in cesiated ion sources. He points out that most of the extracted H⁻ ions have to originate a few mm from the meniscus because H⁻ ions are easily destroyed by electron impact ionization and by recombination with protons. He continues to calculate the H⁻ yields and emittances that could be expected for different geometries of the output collar. More detail will follow.

Sachin Babu presented "Spectroscopic Analysis of the SNS Ion Source", where he summarized his analysis of the logbook and the spectroscopic data obtained during the endurance test lead by Thomas Schenkel. Sachin clearly demonstrated that the Hydrogen lines could be used to track the plasma density as well as to determine the electron temperature. The optical fiber sampled a volume outside the coil where no E-field is generated and therefore the measured electron temperature was only 0.4 eV. He shows that Cu and Ti can be observed clearly and show interesting trends, whereas Cs appears to require some more work. Copies of the presentation are available from Robert Welton.



RF Group

Vendor testing of the 1st 402.5 transmitter started 17-Dec.2001 at Titan. Progress was slow; many of the tests performed were done for the 1st time. Hardware test went fine but software testing was minimal, there are bugs in the PLC program and that's where all the effort is going. Testing will resume Jan. 14th and is scheduled for 2 weeks. A new schedule will be presented today.

The LANL team has conducted the initial test on the first prototype of High Power Protection Module of the LLRF system. The test confirmed the hardware design was basically successful. The firmware test and debugging for this module will soon follow.

The clock distribution module prototype and master oscillator for the frequency reference line are being under gone a performance test. The initial result indicates that the CDM needs some further improvement to meet the current requirement in phase error tolerance. The test for the master oscillator was also in the phase stability of the frequencies it generates. The test is not yet completed at this time.

The third MEBT cavity has been tested and RF conditioned completely to 30kW using two amplifiers with a combined output. The forth cavity has been shipped by the vendor this week.

The RFQ RF system has been moved into the final position for the testing in January with the beam from the ion source.

Mechanical Group

Magnet Measurement Group

We have completed on axis measurements of the 1st HEBT dipole and are proceeding to setup off axis measurements. We are working on the 12Q45 measurement bench, the 8Q35 measurement bench, and are procuring a small reference dipole that will be used to calibrate probes. We have also investigated better ways to lift the HEBT dipoles.

Cryogenics Group

Electrical Systems Group

A meeting with conventional facilities and Knight-Jacob construction engineers was held on Wednesday to start the sequence and division of tray and panel installation.

Motor control center (MCC) equipment standardization was held with Cutler-Hammer representative and conventional facilities.

Cable plant labeling discussion held in the Installation meeting – still ongoing.

Survey and Alignment Group

Beam Diagnostics Group

BNL beam diagnostics report:

1.5.7.1 BPM: □ Two more 21 cm ring BPMs (#5 & #6) were brazed, assembled, leak-checked, and delivered to the vacuum group. The shops have cleaned the parts for the 25 sets of 21 cm ring BPMs and we will pick them up and begin assembly next week. Preparing response to Saeed's email requesting BPM design information.

1.5.7.2 IPM: The PMT for the optical IPM test is in house. We will use existing RHIC IPM amplifiers for the beam test. The shop drawings for the screen and electrode support structures are being prepared. The goal remains to have this prototype installed during the present RHIC run.

1.5.7.3 BLM: Conceptual sketches have been made of several approaches to a cylindrical ion chamber design, which should decrease the ion collection time, by a factor of 10. These have been sent to the vendor and are presently being evaluated by them for feasibility of mass production. Belden 9054 cable is no longer being manufactured. The replacement costs 3 to 5 times as much. Cabling is under review. Drafting has the second cut PC board schematic.

1.5.7.4 BCM: We are still having problems with the PCI interface board. Although, the new board responds differently to the software than the old board, we are still unable to get two channels to down-load together. We suspect the Testing Board simulating ramps is not working. Using our BCM electronics board, we can individually acquire each channel, and with the larger FIFOs on the new board we are able to store a calibration pulse and a full millisecond of simulated burst with room at both ends for base-line and additional droop calculations. We continue to puzzle over this problem. It is significantly holding us back. As a backup we have started the stuffing process of another board, which should be ready for testing next week. We are characterizing the BCM software computation time, and reducing this time to fit the calculations into the inter-pulse period. Continuing efforts on LabView software for the PV calculations. The updated schematic, undergoing final reviews, has been put into the queue for layout. Work has started on modifying the PC rack.

1.5.7.6a Carbon Wire Scanner: Completed a wire scanner actuator assembly and shipped the unit to LBNL on 12/17. Work continues for delivery of the remaining 5 scanners by Jan 12th.

1.5.7.6b Laser Wire Scanner: The MEBT LPM platform assembly continues. All parts are here and everything fits

together. The laser radiation test is underway. The 200MeV POP experiment has been ready at the end of the linac for over a month. Attempts to see a signal with the <100 micro amp polarized beam have been unsuccessful. We will be installing a preamp in the tunnel at the earliest opportunity to improve this possibility. We are also making efforts to successfully integrate our need for high intensity unpolarized beam with RHIC polarized proton operations.

LANL beam diagnostics report:

BPM pickups: The low impedance measurement on the DTL BPM electrodes has been resolved. The low impedance was measured by exciting a single electrode, but when all four are excited, as in the realistic case of a beam passing through the BPM, the impedance will be the correct value of 50 ohms. The transition at the vacuum feed-through meets requirements, but can be improved. Craig Deibele and Sergey Kurennoy will work together to optimize this. CCL and SCL prototype fabrication continues. A check of the BPM apertures showed that all DTL, CCL, TR, and SCL BPM apertures are equal to or slightly greater than the beam pipe / drift tube apertures (assuming the SCL warm region beam pipe design has not been modified since its handoff from LANL).

BPM electronics: The gain in the analog front end is a bit too high -- it saturates on the calibration pulses. The PC cards will be modified to lower the gain. A bug was found in the new I/Q FPGA chip. It should be resolved in the next couple of days. Operating systems are now being loaded on to the PCs needed for the LBL delivery.

WS actuators: The repaired prototype DTL/CCL actuator was received this week. We are preparing to test it for many cycles in a vacuum chamber. During testing of the prototype SCL actuator a defective ball lead screw was discovered. This must be repaired before testing can resume.

WS electronics: The new PC board for the signal processor tested OK. We are now stuffing the other PC boards needed for the LBL delivery. Operating systems are being loaded on to the PCs. LabVIEW software development continued.

D-plate: Design work continues.

ED/FC: Design work continues.

BNL-SNS report

The first MEBT wire scanner was shipped to Berkeley. Development of the BCM electronics is continuing toward delivery in early January. Assembly of the MEBT laser wire is nearly complete. The 200MeV tests await higher beam intensity.

ORNL-SNS beam diagnostics report:

Dave improved the bar code scanner connectivity to the Oracle Database. Craig is working on BPM design optimization. Saeed and Tom worked on integration of the diagnostics at ORNL. They also had discussions with an ORNL post doc in laser technology. Saeed presented a summary of ring diagnostics and commissioning examples at the ring commissioning videoconference. Dialog with potential Russian collaborators continues.