

## Accelerator Systems Division Highlights for the Week Ending December 7, 2001

### ASD/LBNL: Front End Systems

The LEBT chopper was tested with a 25-mA beam in a new configuration of the summing network and performed very well up to full 6% duty factor, giving a 20-ns rise and fall time.

Ion-source tests with a 'thickly coated' (0.7 - 0.8 mm) Cherokee antenna showed that this antenna produces the same beam current as the previously employed 'thinly coated' antenna of the same manufacturer that had been utilized during the 107-hour endurance test and the 24x7 beam test. 25 mA of H- beam were produced at 30 kW of 2-MHz RF power.

The phenomenon of the parasitic electron beam obtained from the ion source was examined in depth. Utilization of the 'nozzle extractor' (previously employed with the R&D ion source and suited for beam currents up to 35 mA) did not reduce this parasitic beam as compared to operation with the standard 'bulky extractor.' We were able to minimize the current to 1-3 mA for 30 mA of H- beam by applying 3 kV dumping and 5 kV pre-acceleration voltage. We are working on a short-term solution to this problem involving active cooling of the extractor. Long-term, a modification of the outlet geometry is already underway in collaboration with the SNS ion-source group.

The magnetic dumping field of the ion source was mapped in the horizontal symmetry plane of the ion source between outlet and extractor electrodes. These data will be useful for 3D beam-transport simulations.

We have received a very high bid for a second ion-source 65-kV power-supply from the vendor of the first unit and have decided to give this part of our scope back to ASD to combine it with the intended purchase of a third unit. M. White will initiate a PCR.

A new LEBT-exit/RFQ-entrance plate has been fabricated that will allow disassembly from the upstream side for repair or modifications, without need for disconnecting the LEBT tank from the RFQ. This plate is going to be tested early next week with a nominal LEBT beam.

RF conditioning of the full RFQ has started and so far reached 50 kW at low duty factor. We noted, however, that the resonant frequency had risen significantly after installing the fixed tuners and in consequence have cut these tuners by 0.43 mm each. The frequency is now 5 kHz away from nominal, an excellent result. The RFQ couplers in Modules #3 and 4 were re-adjusted to balance the power input between all 8 couplers.

In the ongoing rf-window conditioning effort we now have obtained 8 fully functional windows and 1 spare.

The third MEBT rebuncher cavity is ready for shipment from the vendor. Initial frequency measurements had indicated that the shims will not have to be adjusted. The acceptance test for this cavity will be performed at LBNL, to save time and travel expenses.

Rebuncher cavity #4 (the first one delivered that will run at the highest power) was emitting uncomfortably high radiation at high power. We applied lead shielding over the anti-chopper box windows and assessed the radiation intensity outside the exclusion zones formed by the quadrupole covers. At 20 kW power radiation levels are now totally uncritical, but at the nominal 33 kW and full 6% duty factor a maximum intensity of 12 mrem /hour was recorded. We will deal with this issue administratively for LBNL commissioning and will later make recommendations how to proceed for final installation at ORNL.

We had visits by Tom Shea, Cole Sibley, Paul Gibson, and Syd Murray from SNS/ASD.

R. Keller attended a three-day meeting at CEA Saclay, France, on H- ion sources and linac configurations in view of a possible European Spallation Neutron Source project. At present, no single H- ion source fulfills the ESS requirements, and the participating Labs for now intend to follow two lines of development, based on cusp and Penning source types. The RF cusp source with external antenna operating at DESY with very high lifetime, but very low duty factor, found high praise. Collaborations between several European Labs and Berkeley Lab (and

possibly SNS) were encouraged. The European Labs are keeping the option of using a proton source for long-pulse beam production without injection into an accumulator ring

#### **ASD/LANL: Warm Linac**

Marconi tests on the second 402.5-MHz klystron have started and are encouraging. Initial RF tests on the input cavity did not reveal the multipacting problem experienced on the first tube. (WBS 1.4.1.1)

The first production 550-kW circulator has been connected to the LANL 805-MHz RF test stand and is ready for site acceptance tests. (WBS 1.4.1.1)

JLab continued their SRF RF power coupler tests this week. The LANL 805-MHz RF test stand provided up to 1.8 MW for these tests. (WBS 1.4.1.1)

The fully tested LANSCE klystron and transmitter were shipped to JLab this week. (WBS 1.4.1.1)

A high-voltage breakdown, caused by a shorted secondary winding in one phase of the converter modulator step-up transformer system, occurred in the prototype SNS high-voltage converter modulator (HVCM) system. The fault resulted in a shoot through failure of the IGBT driver. Initial inspection and troubleshooting point to an unfastening and shifting of transformer secondary windings. (WBS 1.4.1.2)

We were at Dynapower this week to review progress on the production HVCM substation and SCR controller manufacturing. Progress continues to exceed our expectations with the vendor significantly ahead of schedule. (WBS 1.4.1.2)

The technical evaluation of the bids for the 17 build-to-print, production HVCM converter modulators is complete and submitted to procurement. A winning bidder has been selected. (WBS 1.4.1.2)

All three DTL-3 tanks are at the assembly building and are unpacked. The DTL support stand is in position and we have begun cleaning the tank sections. (WBS 1.4.2.2)

We received the empty drift tubes for Tank 3, and have started the vacuum test on one of them. The first shipment of PMQ drift tubes is ready at Coronado. The plating shop throughput is limited to five drift tubes a week, but we expect to have all of the PMQ drift tubes by December 1 within two weeks. We also sent Coronado a BPM assembly for integration in a drift tube. Two of the EMD coils have been potted. (WBS 1.4.2.3)

The MEFT chopper structure is complete. It was shipped to Berkeley. (WBS 1.4.5.1)

Lloyd Young of the LANL SNS Physics Team was elected Fellow of the American Physical Society. Please join us in congratulating Lloyd for receiving this honor in addition to the distinction it brings to SNS. (WBS 1.4.5.3)

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

Five of six warm compressors have been delivered to Oak Ridge. The sixth compressor is now ready for delivery also.

The instrument air system is ready for shipment to Oak Ridge.

Fabrication of remaining transfer line components continues.

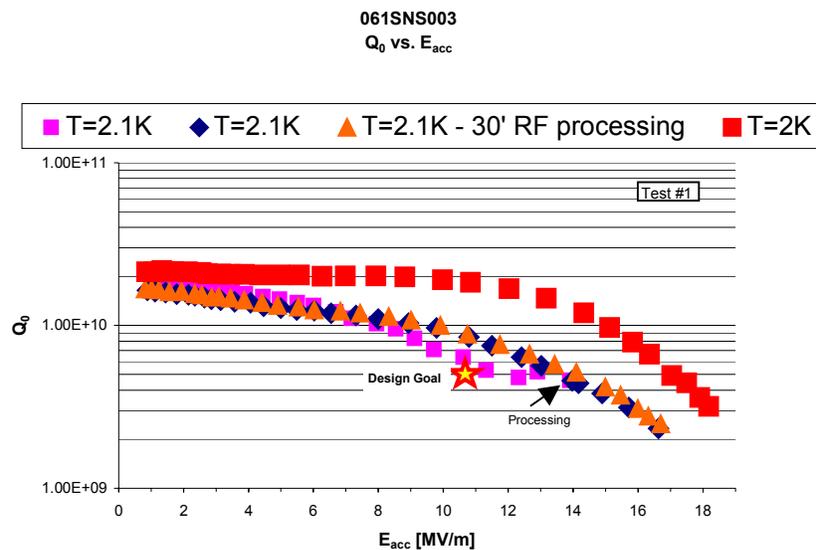
Cavity #3 was sealed using indium gaskets and successfully cryo-tested (see chart below). The helium vessel has been welded on to cavity #4. The correct resonant frequency and acceptable field flatness was achieved. Assembly of the helium vessel on cavity #2 has begun.

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

The FPCs under test at LANL transmitted 2 MW peak power pulses in a matched configuration, with a repetition frequency of 60 Hz and a pulse length of 0.5 ms, limited by heating of the resonant waveguide coupler between the FPCs. The two-week run was cut short by problems with the High Voltage Converter Modulator that could not be resolved in the time available.

The weight of the electro-polishing electrodes and support equipment was greater than expected, necessitating an increase in the size of the supporting tooling and the cabinet. All required changes have been determined and agreed to by the vendor.

The shipment from LANL containing the klystron, transmitter and some of the support equipment was received at the end of the week.



### ASD/BNL: Ring

A videoconference was held with ASD to review the assembly and cooling plans for the RTBT collimator.

A contract has been awarded to New England Technicoil to manufacture the #4 Injection Chicane dipole magnet. Design drawings for units #1 - #3 are in progress and nearly complete.

Earlier this week, Danfysik reported that they are ready to begin potting the first coils for the 27CDM30 corrector magnets.

A contract has been signed with an overseas company to perform QA inspections of the 30Q44/58 Russian quadrupoles. We are still awaiting a production schedule from the vendor, BNIP.

A bid package for the 41CDM30 corrector magnets was released to our Contracts Dept. for RFQ this week.

Our Contracts Dept. released a bid package for the vacuum turbo pumps RFQ.

Engineering efforts are continuing on the RTBT vacuum, injection magnets, extraction systems, dumps and dump windows.

Today, Bob Lambiase sent out an email that stated: "The order for the Medium Range Power Supplies has been awarded to IE Power. Next step: spares and changes."

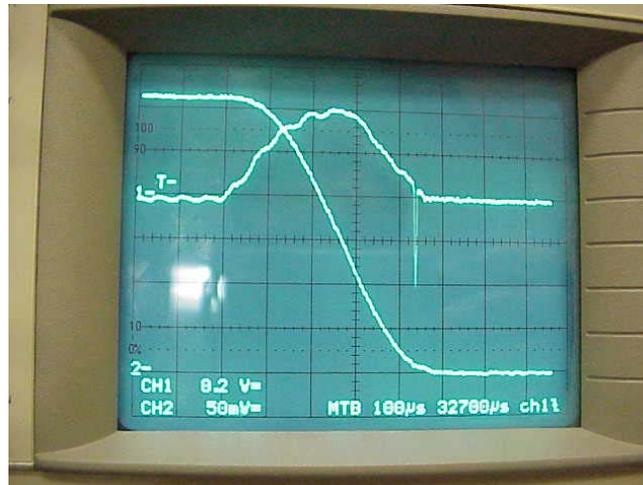
Wahfun Eng reported on the IE Power acceptance tests results of the 1<sup>st</sup> article Injection kicker power supply. These tests were quite successful; some low current regulation for tracking needs more work. See attached waveforms.

Danfysik reported that they have converted the 1<sup>st</sup> article low field power supply to 208VAC, 3 phase. Testing is underway. Work continues on the assembly of two carbon wire scanners for deliveries to LANL and Berkeley.

The 21CS26 sextupole corrector magnet is being aligned in the test stand. Magnetic measurements, for acceptance, will begin next week.

Tesla reported that the first article 12Q45 and corrector will be shipped to ORNL in early January.

Fabrication of a phosphor-screen IPM prototype for installation and testing in RHIC during the present beam run is underway.



Ch1-Output Voltage (0.2\*500V/div),  
Ch2- Output Current (0.05\*1500A/div) Output Current at 500A (peak)  
Figure #1

### Controls:

Several members of the Controls group attended the EPICS Collaboration Meeting in San Jose Mon.-Tues.

A "PLC Programming Guidelines" document was issued for comment.

An "SNS Human-Machine Interface Standard" was issued for final comment. This standard will govern the format of EPICS operator displays. Plans are to demonstrate some example screens to Operations next week to help enhance their understanding of this standard.

The "Certified for Construction" design package for FELK conventional facilities controls was issued.

### ASD/ORNL: Integration and Installation Support

Five of the six CHL warm compressors have been delivered to RATS with the sixth one to arrive on Tuesday.

ORNL has been working on getting ASD a 12k sq ft building at the lab. We should be able to start moving in towards the end of the month.

Approx. 80 survey floor monuments have been core drilled in the Linac tunnel, with grouting of the monuments starting this week. All 80 should be complete sometime next week.

The ASD installation trailers are now on site and electric service should be in soon.

## **Accelerator Physics**

An initial version of a virtual MEBT accelerator for application program testing was created, using the EPICS portable channel access server. This virtual accelerator provides users with the same channel access view as the real machine will provide, thus allowing testing of the applications. It has been used from Matlab scripts and a Java programming interface.

Analysis of a re-configured MEBT, assuming 3 additional independent quad power supplies and forgoing anti-chopping, shows reduced losses downstream. The transport of the partially chopped beam in this configuration is now being analyzed.

## **Operations**

Met with ES&H on: (a) Commissioning Hazard Analysis, (b) Waste Management Planning

Continued with changes to the Commissioning Program Plan and the Commissioning Accelerator Safety Envelope

Began to take another look at the RAM Analysis with an eye to the ASAC and held the first attempt at a RAM Meeting.

Worked on the F(PSAD)

## **Ion Source Group**

### **RF Group**

MEBT buncher cavity #2 measurement/testing is complete at LBL. Cavity #3 is shipped to LBL by vendor on Friday, 12/7; #3 RF measurement/conditioning will be made next week.

Development of reactive RF compensation of SRF cavity detuning is underway. 3-D simulation and bench measurement of waveguide phase shifter are being made.

The LLRF videos resume on the 13th at 11:00am between JLAB, LANL, and ORNL. Dan Rees will be here the 12th and we will discuss the front-end transmitter installation schedule and tasks. Updated specification for 402.5 Klystrons will be ready before Christmas. Our procurement people have copies of the LANL bid packages for the tubes Marconi is building. The linac RF group started weekly group meeting, the group is growing. Hengjie is at LANL this week and next, I haven't received an update on what went on.

Successfully hipoted the JLab 1 MW test stand HVPS and crowbar cabinet to 100 kV. A severe test of the system, occurring after dumping the 40 kJ capacitor bank with the HVPS on, has resulted in a small redesign effort of the safety dump system. This should not affect anticipated delivery to JLab by year's end.

## **Mechanical Group**

### **Magnet Measurement Group**

The first article HEBT 8D533 has been mapped at 1.0 and 1.3 GeV excitations along its mid-plane. Based upon these measurements, and other mechanical measurements, the magnet was accepted and BNL was informed to proceed with production.

We are working on the HEBT 12Q45 measurement system. Also, design efforts are underway for a measurement coil for the 8Q35 warm section Quads.

## **Cryogenics Group**

## **Electrical Systems Group**

### **Survey and Alignment Group**

The S & A Group has been in the process of verifying the location of all linac chases. This task should be completed by early next week. Also continued final network adjustments based upon final MEBT point location.

As the construction of the SNS moves into new phases, new challenges need to be addressed. One important item is the Site Surveyor's Coordinate System and the supporting control monuments. Through normal building progress, many of the initial Site Surveyor's control monuments have been lost, some have been relocated. This is a normal course of events on many large building projects. As a result, we have invited all parties performing survey work at the site to take advantage of our newly completed precision global survey network.

It is with great pride that we announce the completion of Phase I of our SNS Global Coordinate System. Today, we have a site-wide operating network/monument system with a relative confidence level of better than 1 millimeter. On Tuesday, 11 December, we have called a meeting at the RATS Building with all relevant parties to discuss the changeover to the new monument control system. Further, in the interests of making this transition as smooth as possible, many of the remaining CF Surveyor's monuments have been incorporated into our system. To minimize confusion, our SNS Global Coordinate System (meters) will also be translated into the CF Surveyor's (feet) coordinate system. We feel that incorporating the remaining CF survey control monuments into our system will also aid the CF site surveyor's in quickly developing a high level of confidence in the new system.

Prior to calling this changeover meeting, the feasibility was discussed with both ASD and CF management. Both sides agree this is an excellent course of action.

### **Beam Diagnostics Group**

LANL beam diagnostics report:

BPM pickups: The first DTL BPM was delivered to the DTL mechanical team 3/Dec. The second DTL BPM arrived at LANL 3/Dec, and after testing it, we will deliver it to the mechanical team next week. Fabrication continues on the CCL and SCL prototype pickups.

BPM electronics: Craig Deibele is visiting LANL this week to assist with the BPM electronics. Work continues to test the new timing/gain FPGA and the Bergoz analog front ends.

WS actuators: We received the prototype SCL actuator 3/Dec. After wiring it up we shall test it. The prototype SCL beam box should arrive next week, which will allow us to test the actuator under vacuum. The repaired Huntington actuator should ship 7/Dec -- the new bellows is rated for 100k cycles.

WS electronics: The new signal processor boards are being stuffed. Testing will commence soon.

BNL SNS Beam Diagnostics report:

1.5.7.1 BPM: Shops continue fabrication of parts for 21cm Ring BPMs. Two more 21cm Ring BPMs were assembled and sent out for brazing. Work continues on Ring BPM electronics.

1.5.7.2 IPM: A photomultiplier tube and phosphor screen have been ordered for a beam test of an optical IPM during the RHIC polarized proton run.

1.5.7.3 BLM: Detailed design of faster response 'parallel plate' loss monitor continues. Discussions with manufacturers are progressing well.

1.5.7.4 BCM: The LabView software and testing continues. It now includes a calibration pulse before the burst signal. The transformer droop time-constant calculator has been exercised, and has confirmed earlier analysis of transformer data. The time constant varies slightly from pulse-to-pulse, however, if the results are averaged, a good

estimate of the time-constant can be realized. The resulting measured time-constant was about 1.138mS, which agrees well with earlier measurements of 1.13759. The resulting DC restored and droop compensated signal looks excellent. Measurements of compensated droop indicate a time constant that varies between positive and negative values near 1 (0.02S to -0.6S or 5%/mS to -0.16%/mS). It is not clear if the variations observed for the compensated case are due to calculation errors since the pulse being measured was only about 225uS in duration. This yields a droop of 0.0225% in signal and pushes the digitizer resolution of 0.012%. Matt has sent us a new board, which arrived today.

1.5.7.6a Carbon Wire Scanner: Wire for limit switches has been received and connectors have been installed, limit switch installation is underway. Motor power connectors have been received and installation is underway. Electrical feed-through was replaced and is being installed. Installing the carbon wires to fork of the first article MEBT wire scanner. Designed and fabricated the protection cover for shipping the assembled fork. One end of the actuator-to-rack cable has been connectorized, and we await information on cable length so that we can cut and connectorize the other end.

1.5.7.6b Laser Wire Scanner: The laser radiation test chassis is completed and installation in the BLIP tunnel is scheduled for next week. A laser trigger has been delivered to the HEFT LPM installation. The laser is now being timed into the Linac pulse. Assembly of MEBT Laser Wire continues.

ORNL-SNS beam diagnostics report:

Craig is at LANL as mentioned above to help in integration of the BPM electronics destined to LBNL. Dave and Tom are back from EPICS workshop and ICALIPS conference. Tom meanwhile went to LBNL to discuss diagnostic support for MEBT commissioning. Saeed is working on Wire Scanner high-level applications.