

Accelerator Systems Division Highlights for the Week Ending February 8, 2002

ASD/LBNL: Front End Systems

With the help of Saeed Assadi, Dave Purcell, and Ernest Williams from ASD, the problems with the emittance data capture and stability of the emittance positioning system were solved, and a substantial number of RFQ-beam emittance measurements in the horizontal and vertical planes were taken at current levels up to 30 mA. The remarkable results are: 1), the emittance sizes in both planes are very close to each other, the shapes show practically no distortion, and both very closely match simulation predictions using the code Toutatis; 2), Emittance sizes vary only very little when parameters like beam current and RFQ rf power level are changed. RFQ commissioning is now complete, and the Front-End Systems team recognized the achievements with a lunchtime celebration. Details of the test results will be discussed next week at the ASAC Review.

ASD/LANL: Warm Linac

We stay in nearly daily contact with Marconi. They are gathering performance data from the 402.5-MHz klystron in preparation for our return Feb 19 for acceptance tests at reduced specification. After being tested at 2 MW with $V < 130$ kV, $I < 32$ A, and 50% efficiency, the tube will be shipped to LANL, by the end of February if all goes well. (WBS 1.4.1.1)

LANL staff was at CPI this week to review progress on the 805-MHz, 550-kW SRF linac klystrons. All parts are on hand for the first article and assembly is underway. Pump down, baking, and sealing are scheduled for the remainder of the month, with factory acceptance tests anticipated at the end of March. (WBS 1.4.1.1)

LANL staff returned to Titan-Beta this week to aid in the preparations for klystron transmitter acceptance tests, rescheduled to start late next week. Considerable progress was made in the software development and shakedown. Titan has followed through with their commitment by devoting additional resources to open the software bottleneck. Once completed there are six transmitters ready for test (Fig.1). (WBS 1.4.1.1)



Fig. 1: Klystron transmitter high-voltage supply and water cart assembly lines.

The prototype high-voltage converter modulator (HVCM) has been upgraded and repaired. It is under oil waiting testing, which will begin after implementing changes to the prototype SCR controller. An engineer from the manufacturer (NWL) was at LANL all week to troubleshoot this unit. (WBS 1.4.1.2)

We now have 25 drift tubes installed in DTL Tank 3 (Fig. 2). Coronado is still repairing two PMQ drift tubes. Drift tube #7 was recently sent back for additional plating applied on the radius closest to the bore tube. Drift tube #9 came back from Isis after the weld repair. Isis felt the most reliable method to repair the nose was an e-beam weld. This produced a small recessed area at the joint of about 0.015" deep. Calculations confirm that this will not have a

negative affect on the RF. We are planning to have Coronado repair this DT using the same copper plating technique as DT #7. We are hoping to receive both drift tubes before February 18. We will measure the field and phase angle of both drift tubes before they are installed into the tank. (WBS 1.4.2.3)



Fig. 2: DTL Tank #3

The fabrication process associated with the drift tubes requires numerous trips for welding and brazing. Of the 33 drift tubes in Tank 3, two of them came back from the welder with bent stems. We believe the damage was a result of mishandling or poor process/configuration control during the process of welding the DT body. We are taking steps to resolve this issue and assure that it does not happen in the future. Both BPMs DTs have bent stems. They are now back from Isis and Coronado is in the process of repairing the stems. The BPMs should be finished by February 18. The horizontal coil that we rushed to New England Technical Coil for potting was returned on Monday. It was immediately installed in the drift tube and successfully passed the hi-pot; however, it still requires three more trips to Isis for welding. We are expecting to receive the two vertical EMDs by February 25 and the two horizontal EMDs by March 12. We are currently planning to begin tuning Tank 3 on or before March 18. Our goal is to meet the IPS date for installing tank 3 in the tunnel on or before June 14. (WBS 1.4.2.3)

This week we verified the positional accuracy of the end wall after removing it from the DTL tank. In all cases, we were able to reposition it within $0.0005''$, which is essentially the accuracy of the laser tracker. We also configured the turning hardware and attached the post coupler plugs to the tank. Next week we are planning to begin aligning the drift tubes. (WBS 1.4.2.3)

The physics team completed running end-to-end (LEBT-to-foil) simulations using measured LEBT emittance distributions, longitudinal and transverse mismatch, and linac error. Simulations of the chopper section with beam through LEBT mapped-field are in progress. We also Completed and verified with two independent codes the validity of simplified SRF linac commissioning scheme (WBS 1.4.5.3)

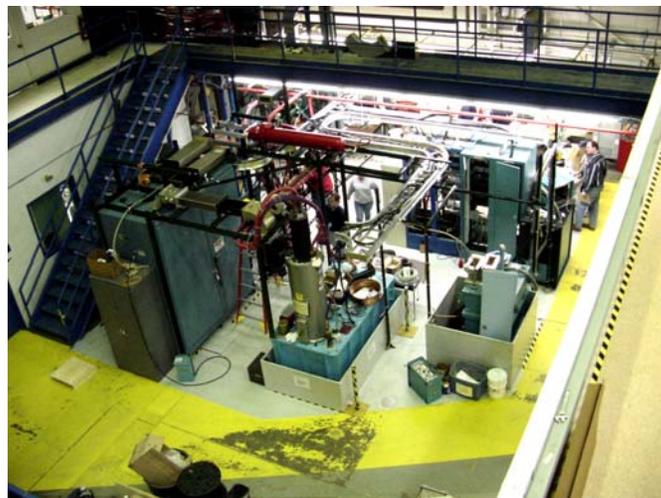
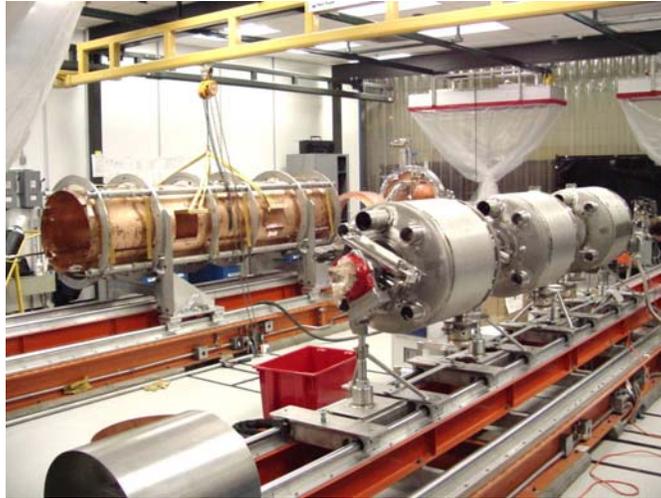
ASD/JLAB: Cold Linac

The vacuum leak in the prototype cavity string was identified and repaired. Leak checking was completed and the string transferred to the cryomodule assembly area. See Figure.

The first article cryomodule stand has been received.

The integrated test of the tuner with a more powerful motor was successful, with smooth operation of the tuner throughout the temperature range down to liquid helium temperatures.

Assembly and commissioning of the 1 MW RF Test Stand continues. See Figure. A failure was identified in the transformer that provides high voltage isolation for the crowbar thyatron filament supply. This may have been the cause of operational problems with the crowbar system as reported last week. The transformer has been repaired and the crowbar system is being recommissioned.



ASD/BNL: Ring

Preparations and dry runs were finalized for the ASAC Review.

The first seven (7) 27CDM30 corrector magnets arrived from Danfysik this week.

Our Electrical Group conducted an internal workshop for “SNS Extraction Kicker Production Planning”. Arlene Zhang led this effort.

The BCM electronics were shipped this week to LBNL, attention Larry Doolittle.

The fabrication of the last (#9) Type A half-cell vacuum chamber was completed this week. These chambers have been welded, leak checked and vacuum baked. Modifications to the assembly welding fixture are underway so that work on the Type B models can begin next week. Six of the Type A chambers have been TiN coated.

Work continued on the MEBT Laser Profile Monitor. The laser has been mounted to the beam box housing.

Efforts continued with the assembly and testing of a prototype BLM. Testing was conducted in air and in argon using an external calibration source. Feed throughs were weak and are being replaced. Initial test results are promising.

Eight more of the 21cm BPMs were delivered to the Vacuum Group this week. To date, twenty-one of the thirty-two units have been delivered to support the vacuum chamber assembly effort.

Lambiase, Cutler and Henderson are near closure on final quantities and spares for the medium range power supplies (including two PSs for the linac dump).

Test plans are being developed for the 17D120 ring dipole magnets to determine the variations in field transfer function between various assemblies and field repeatability after magnet reassembly.

Extraction kicker PFNs: Testing continued with the PFN in oil. Late reports indicated testing levels to 35kv at 55Hz. The initial goal is to achieve 35kv at 60Hz.

Controls:

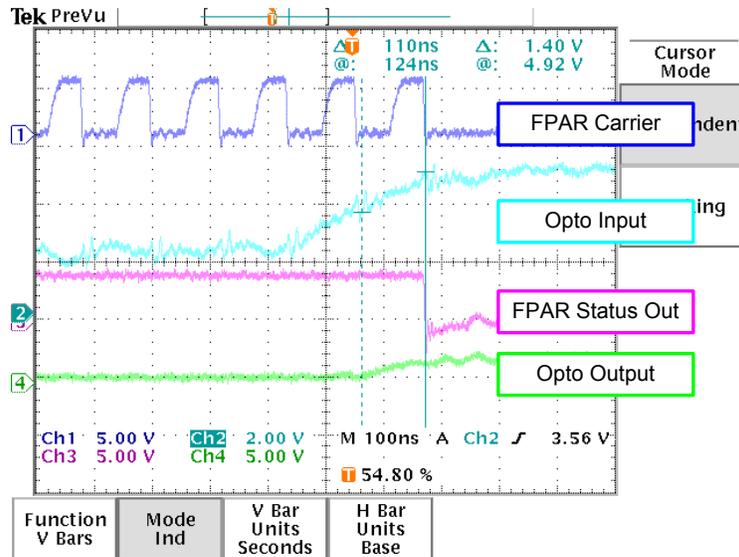
Bryan Moss is a new Daddy.

Alan Jones and Derrick Williams started work with the controls team this week. Alan will work on the Machine Protection System Electronics, and Derrick on linac installation plans.

The Controls team toured the SNS construction site together. If that didn't strike fear into the hearts of us al, nothing will!

The MPS system is now functional and will start to undergo testing. The waveforms below show the response to a simulated input trip: a set of contacts opening. The carrier (dark blue trace) drops out after approximately 110 nsec. from the optocoupler turning off (green). The status out falls in coincidence with the carrier and this is used to turn off front-end equipment, thus the beam. The following functions have been tested:

- Mode Masking
- Invalid mode masks
- Event link faults
- RTDL faults
- Input channel self test
- 60 Hz auto reset
- Fault counters



The controls team supported RFQ emittance measurement runs at Berkeley this week, using an ICS145 digitizer, OMS-58/BC-5/Nextstep motor electronics, new ICS145 driver, scan records, prototype Matlab data analysis with confirmation from independent analysis by J Staples. This concludes the RFQ testing. This was an excellent collaboration with the ORNL diagnostics and Berkeley physics teams.

The interface box for the MEBT turbomolecular pumps was completed.

Work continued at LANL on interrupt support for the low level RF (LLRF) High Power Protect Module (HPM). Problems remain due a backplane communication error between the CPU and the HPM module. Work began on implementation of the EPICS database for the LLRF Frequency Control Module.

The design/build package for the Phase 0 PPS equipment has been issued for a comment cycle. This equipment consists of a PLC rack with Operator controls and a 480 VAC device interface rack. This equipment is required for operation of the Front End and DTL tank 1. Expectations are to issue the package approved and proceed with fabrication by the end of February.

Technical evaluation of the Conventional Facility Controls I&C Contractor proposals has been completed. All proposals look fine. Cost evaluation and work toward contract award is proceeding as planned.

Review of the 90% design package for CF Controls Site and Utilities was completed.

Penetrations for the Linac and Extraction dumps thermocouples into the tunnel were added to drawings by Conventional Facilities designers. These thermocouples will be used to monitor 25 locations in the passive dumps.

The drawings for the Injection dump control cabinet locations, including a PLC and IOC, were submitted CFC as part of DCN-17. Target Systems will provide this equipment, but the IOC will be integrated into the Ring control system.

Installation Services

The linac tunnel cross section drawings were approved and issued for use. Similar cross sections will be prepared for the ring to ensure mockup details are reflected in the actual construction package. Monuments were set in the RATS building CCL/DTL assembly area, and the HVAC modification was received and is ready for installation. The first part of the DTL shielding wall (three rows on the north and south side) will be installed next week.

Accelerator Physics

A first version of an ORBIT difference application using the new XAL programming infrastructure is ready.

Initial global coordinates and beamline positions for diagnostics in the DTL and CCL were collected and entered into the global database.

A requirements document for the CCL-SCL transition, the inter cryomodule warm sections and the SCL-HEBT transition section was written and distributed.

In a meeting this week the need for leaving the CCL beam stop in as part of the beamline for operations (i.e. after commissioning) was discussed and agreed upon. Without it, whenever one tunes the CCL (e.g. at start-up after some shutdown period or for machine studies) the beam would have to be transported all the way through the SCL to the linac dump. However, whenever one puts the beam stop into the beam, there might be some risk of particulates coming off the beam stop and possibly polluting the sc cavity downstream. By having the downstream gate valve close simultaneously with the beam stop, this risk is reduced. Also, rearrangement of some elements in the CCL-SCL transition region (not affecting the lattice) may help to reduce the risk of pollution in the SCL. After commissioning the CCL, analyzing surfaces in the beam stop to SCL region on possible deposits may be a way to estimate the extent of the risk.

Operations

Ion Source Group

The Big Blue Box is getting ready to be wired, as most of the conduit and distribution boxes have been installed.

We received all remaining vacuum parts from TTI. All deficiencies found in the latest shipment will be corrected locally as TTI again agreed to a price reduction.

We have received a 75 kV high voltage divider from Ross Engineering, which will allow us to test all high voltage supplies off-line before they are installed on the hot spare stand.

We continue to interact with manufactures of high voltage supplies to help us define specifications for an alternate 65 kV supply for the hot spare stand and for the test- and development stand.

Robert Welton visited LBNL for three days and participated in the emittance measurement of the accelerated beam emerging from the RFQ.

RF Group

First LLRF rack layouts and cables documents have arrived. 1st drawing of the CCL waveguide layout has been seen, revision is in progress and should be done soon.

Assembly of waveguide section has begun in Rat's; section lengths are being kept to around 6 feet for ease of handling.

Job offers will be made for 2- LLRF technicians.

Developing a detailed cable listing for HVCM equipment, including interface points. Arranged for Lloyd Gordon of LANL ESH-5 to come to the SNS and provide training for Electrical Safety Officers next week. Working with installation group, have developed planning for arrival of 1st HVCM unit and installation into front-end building.

Mechanical Group

There are two major activities in magnet measurement. We are finishing up and refining measurement techniques for the HEBT Dipole stand. Shipment of the next HEBT Dipole is expected later this month.

We are doing some testing of the 12Q45 measurement stand. Shipment of the 12Q45/16CD20 is expected later this month.

Evaluation of bids on RGAs received from qualified vendors, selection targeted for next week.

Conducting an evaluation with Magnet Group on the interaction of the ion pump magnetic fields with magnets in the SCL-WS design.

Setting up of vacuum shop in RATS continues with limited operational capability expected within next of weeks. Cage for bonded receiving area delivered to RATS, erection scheduled for next week.

Capital purchase orders for EVAC flange and sealing hardware and vacuum oven issued.

Arrangements made for the loan of a dry pump from VRC to specifically evaluate particle generation from this pump.

Review and assessment of suitability of both hardwall and softwall cleanrooms located at and surplus by Y -12. Size and condition does not make acquisition of the hardwall cost effective, but the softwall (10' x 20') has been acquired and arrangements are underway for it to be shipped to RATS.

Particulate measurement from the second valve of an operational leak detector was completed and a report is in preparation.

Cryogenics Group

Completed assembly of all transfer line piping from the Central Helium Liquefier (CHL) to the tunnel.

Completed assembly of the supply "T" section of transfer line for the tunnel.

Completed assembly of the return "T" section of the transfer line for the tunnel.

Received all (6) warm helium compressors from the vendor.

Received the final components of the oil knock out system from JLAB.

Electrical Systems Group

Instrument Rack (1), Power Supply Interfaces (6), and Power Supply Controller (1) were sent to Danfysik for 1st article testing purposes on the small corrector power supplies. (+/- 20A @ 35V) Testing begins the week of 2/25-3/1.

Engineering Change Notice was initiated to utilize spare instrument racks in Row 2-7 of the DTL. The spare racks are required for the new DTL Dipole Magnet Power Supplies Layout.

Supports for cable tray in the LINAC installed. Tray installation begins 2-11-02.

PPS Interface Control Chassis for Power Supply Test Stand complete.

Provided guidance on the Phase Scan Signature Matching technique that will be used to tune a portion of the SNS linac. Eugene Tanke will present some of the information conveyed at the ASAC review next week.

Assisted in orientation and assignment of initial duties for Eddie Tapp, who started work on the ring RF system this past Monday.

Exercised new test hardware received this week for the ring RF

Survey and Alignment Group

Beam Diagnostics Group

LANL Beam Diagnostics Progress Report:

BPM pickups: The welded (into the drift tubes) DTL BPM pickups are now due Feb.18. Quotes for 8 more are in progress. The CCL/SCL prototypes are now due next week. The SCL BPM will be baked to 250 deg. C at the vendor's and tested for changes in electrode position.

BPM electronics: Work continues to prepare the LabView software.

WS actuators: Positioning accuracy tests on the prototype DTL/CCL actuator are very encouraging. The positioning accuracy along the actuator axis is about +/- 0.0015 inches, within the accuracy of our measurements. We also observed about +/- 0.006 inches of movement perpendicular to the actuator axis, which we plan to cure with a small design change. Lifetime cycling tests are now in progress. The SCL actuator should be re-wired soon, whereupon positioning accuracy and lifetime tests will be conducted.

ED/FC: Work continues on the drawing package. It should be ready for checking by 8/Feb.

D-plate: An engineering design review of the beam stop was held 6/Feb. No showstoppers were identified. The full D-plate design review will be held mid-March.

CM pickups: Vacuum tests (out-gassing rate and gas constituents) testing is in progress on one of the DTL CMs.

ORNL Beam Diagnostics Progress Report:

LBNL and ORNL SNS diagnostic groups with Control support successfully implemented the emittance device at LBNL. We measured the RFQ emittance under different conditions and the results will be presented at the ASAC (Feb. 12-14-2002). LANL diagnostic experts will go to LBNL to setup and integrate the BPM and WSs with ORNL staff. Diagnostic operation manuals are the highest priority for the users at LBNL. Tom spent two days at LANL discussing progress, scope transfer and preparation for the March review. Dry runs were held for the ASAC presentations. We had some last minute negotiations on diagnostic performance requirements and modified several specifications. These changes are currently being discussed with the partner lab engineers, and simulations to back up the requests are being performed by AP.