

Accelerator Systems Division Highlights for the Week Ending December 20, 2002

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments this week: (1) LANL technical staff was at E2V (Marconi) where the 402.5 MHz, 2.5 MW DTL klystron S/N 8 passed its factory acceptance test. (2) We were also at CPI where the 805 MHz, 550 kW SC linac klystron, S/N 7, passed factory acceptance tests. S/N 8 is sealed and is in line for bakeout. (3) LANL technical staff was at the AFT factory for testing of the last lot of 550 kW SC linac circulators. No problems have appeared thus far. (4) We were at Titan to witness first SC linac transmitter assembly and integration tests. Preparation is underway for the dry run of the factory acceptance test.

Concerns & actions: (1) LANL business staff was at AFT to discuss packaging and shipping problems with the circulators. The vendor will implement acceptable improvements.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: Four more SCR controllers, and two more converter modulator safety enclosures, tanks, and water panels were shipped to ORNL.

Concerns & Actions: (1) Transformer casting is on hold at Dynapower, pending adequate test and evaluation of the first 140-kV batch. Dynapower is finishing the fixture for the transformer partial discharge testing. In the meantime we performed more modeling of utility grid start-up transients and no load conditions. Modeling of E-field stresses caused by air bubbles under the transformer windings (which cause field stresses to go from 70 kV/cm to 95 kV/cm), and modeling of converter modulator performance as related to transformer design parameters will be used to evaluate possible design changes to the Dynapower casting procedures. (2) LANL converter modulator operations were suspended this week to evaluate and improve maintenance procedures at the interface between the linemen/facility manager/RF Group. Review and authorization are imminent.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) Our drift tube linac (DTL) Production Plan (DOE Lehman Review Action Item) was submitted to ORNL. (2) Water channel e-beam welds on 10 new Tank-1 drift tubes were completed; an additional 20 drift tube water channel welds (10 more drift tubes) should be completed this week. Machining of additional bodies and sleeves for the balance of the new Tank-1 drift tubes continues. Arrangements have been made with the e-beam welding contractor to work Dec. 30-31 and Jan. 2-3 to complete the Tank-1 drift water channel welds and finish the Tank-3 weld repair qualifications. (3) Revised process drawings for Tank-1 & 2 RF waveguide-to-iris transition were completed; after checking they will be delivered to Coronado Machining by COB Monday 23 December and rough machining of these two units will resume. (4) The ridge geometry in the Tank-3 RF test waveguide-to-iris transition was repaired and the vacuum leak fixed. (5) Parametric model for Tank-1 drift tubes process drawings was extended through the final machining step. Process drawings for Tank-1 EMD dummies (those without a dipole) were made. (6) The vendor for the aluminum inter-tank vacuum valve was contacted; valve may be obtained in stainless steel with a 12-week lead time; discussions with vendor are underway about possible conversion of the aluminum valve's stem o-rings to bellows type seals. (7) Six Tank-1 drift tubes that were scrapped (two contain PMQs) were shipped to Oak Ridge for alignment stability tests and magnet fiducialization practice.

COUPLED-CAVITY LINAC (WBS 1.4.4)

Accomplishments: Nathan Bultman, Lloyd Young, and Dan Richards remained at ACCEL for a second week. Joining them was Marion White from ORNL. CCL tuning continued. Because the segment end-cells have only one coupling slot, their tuning is slightly different than normal cells that have two. Calibration curves for tuning the segment end-cells were modified based on a series of cavity measurements. The tuning of two segments was completed and they are ready for brazing.

Concerns & Actions: The first CCL stack braze was delayed by a vacuum leak through the copper plating on the flange that connects the segment with the coupler cavity. The plating vendor (Leybold) is coming to the site on 12/20 to investigate further and to help develop a path forward.

ASD/JLAB: Cold Linac

ASD/BNL: Ring

Viorel Badea and Bill Birkholz returned from the west coast where they inspected first article and production magnets with our vendors, Alpha Magnetics and Stangenes. We have learned that Stangenes is experiencing some production problems with their sub-contractor who is machining the 26Q magnet steel cores for them. We are working with both parties to resolve the technical issues that are related to pole tip dimensions and assembly tolerances.

A Technical Forum on Electron Cloud was conducted this week by videoconference. Jie Wei presented a global view of the issues to Project Office management and staff.

Bids for the 26S26 (8) quads are still under review. Our aim is to have this contract awarded before January 1st.

Tesla reportedly shipped their last six (Ph. I) production magnets to BNL last Friday. All materials for Phase II production are in house. An updated production schedule is due soon.

Danfysik has started shipping the low field power supplies to SNS/OR in satisfaction of the BNL contract. (These are in addition to the ~136 units have been delivered under a LANL contract.)

Drawings for the welding fixture for the HEBT 12cm vacuum chambers have been released to our Shops. Design work continues on the linac dump and momentum dump vacuum systems. Orders are being placed for the RTBT vacuum components.

Collimators: All ECNs (Engineering Change Notice) are finished and sent to our vendor, SDMS, for the HEBT collimators. Design work continues on the momentum collimator and the Ring primary collimator.

The overall field quality of thirteen (13) of the 27CDM30 correctors have been measured to date. Our aim is to complete the first eighteen (10 V & 8 H) by Jan. 1st.

36CDM30 – the repaired 1st article was shipped to BNL this week by New England Technicoil.

Half-cells – assembly of unit #2 is IP. Redesign of the water manifolds is complete and in checking.





Controls

Almost all of controls team effort this week was directed at support of site operations. All systems were operating, and most were running trouble-free. A number of small bugs in EDM were identified and fixed. There are numerous MPS trips – some spurious and some real. In particular, the MPS “saved the day” when a diagnostics limit switch failed, and the MPS ran the entire week without a reboot. There are spurious vacuum system trips; some equipment changes will be made to rectify this. There are occasional timing system outages. Some of these can be attributed to persistent noise problems. At least one was the result of the unexplained change of a constant in the RF system timing gate generator. There was a breaker trip in the PPS system, and an unexplained trip that looked like (but wasn’t) a chipmunk trip. Sounds like a lot, but most of these have been minor nuisances only and overall the control system and the controls team has been a positive part of the week’s successes. We appreciate the cooperation and the indulgence of the operations team.

We shipped the first two SCL control racks - each with an HPRF and Power Supply IOC in them. I think this has us set for installation up to row 16 in the SCL.

Power monitoring for the FE substation is up and running in EPICS.

At LANL, software support for MEBT commissioning using XAL continued. Work continued on support for the D-Plate, the SCL vacuum systems, the Beckhoff and RGA drivers, the Channel History plot and gateway performance issues. Last week the controls team participated in the LANL SNS Division Review.

Final comments have been resolved with Sverdrup regarding their design of the PPS phase 1 PLC racks. Fabrication of the equipment has started with first deliver of equipment scheduled for late January. The date for the PPS Software Safety System Requirements (SSRS) review has been set for January 23, 2003. Completion of this review is required before certification of the PPS for operation of DTL1. Twenty Beam Shutdown Stations (BSS) have been fabricated by DCS and delivered to the RATS building. These are all the units required for DTL 1 and the LINAC segment.

The first five production Chipmunks were received at the RATS facility this week. These units had previously been tested at the RSCAL facility to ensure that the units could be calibrated properly with a gamma source. The remaining seven units are undergoing final component testing prior to final assembly.

A walkdown of the CHL building took place this week in order to identify locations for oxygen sensor locations. We also discussed requirements for a temporary ODH system that would be provided during commissioning before the permanent ODH system is available.

Sixty-two PSI units were shipped from BNL to ORNL to support power supply acceptance testing. The remaining PSI units at BNL are being tested and will be shipped when the testing is complete.

Three complete timing system monitor boards have been received. Effort will now start on supporting these modules in EPICS.

Installation

Craft Snapshot 12/18/02

ASD craft workers	51.0
Foremen, ES&H, etc	9.5
Less WBS 1.9 controls	-2.0
Less absent	-1.0
TOTAL	57.5

The Division Director's Weekly Installation Meeting reviewed the Nov Earned Value with the objective of improving the accuracy of the reports and overall installation efficiency.

It was determined that Linac Installation Services and Ring Installation Services must be added the ASD Sub Project Schedule and MPM (Cost Estimate) to allow proper Earned Value to be taken for these activities.

BOD of the remainder of the Linac Tunnel was taken on Thursday, 12/19/02.

The Weekly Detailed Installation Meeting focused on Field SRO status for the second week. The process is established and functioning.

CF has provided a temporary boiler to heat the Front End Building. ASD will install temporary wall air conditioning units in the FEB COMM Room next week.

A review of DTL #3 Installation Drawings was held at 1:00PM on Thursday, 12/19/02. This package represents a more complete documentation approach that will improve efficiency in the field.

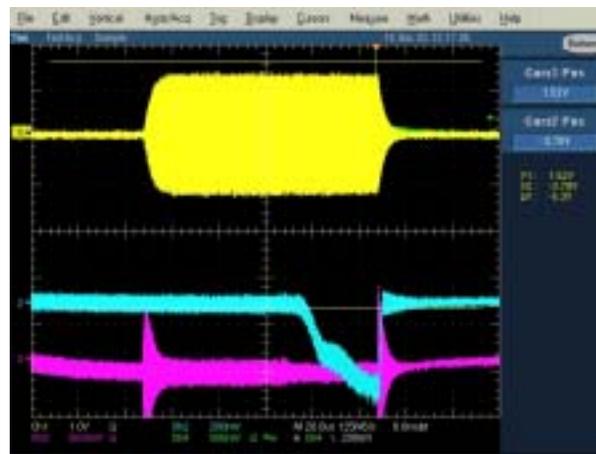
The ASD Division Director reviewed plans for DTL Assembly and Installation at 3:00PM on 12/19/02. All drift tubes will be installed and aligned in the tunnel. Adequate access must be provided on the down stream end of all drift tube tanks. LANL will be requested to add internal fiducials on the upstream end plates to facilitate drift tube alignment in the tunnel. D-plate installation sequencing will be evaluated to provide access for drift tube alignment and efficient use of drift tube installation resources.

Accelerator Physics

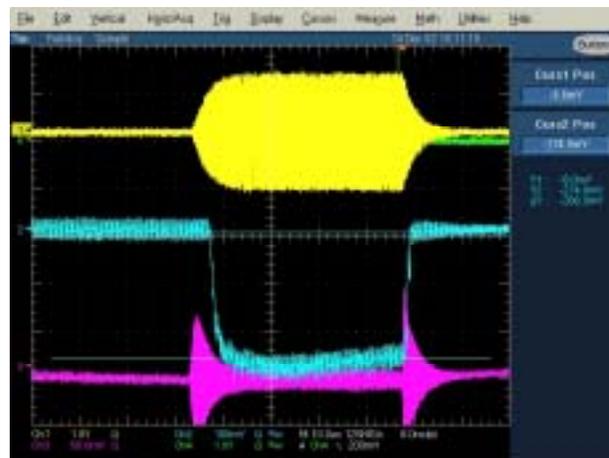
High power RF conditioning of the RFQ started on Friday 13th and had been finished by noon on Saturday 14th. SNS Front End commissioning started after that. 8mA of H- beam was accelerated through the RFQ and transported through the MEBT from the first attempt. During the week transported beam current was increased to 20mA peak. Much time was spent to troubleshoot various systems of the FE. Details can be found in the E logbook. Thursday and Friday were dedicated for the commissioning of the diagnostics: BCMs, BPMs, Wire Scanners and emittance measurement device.

Operations Group

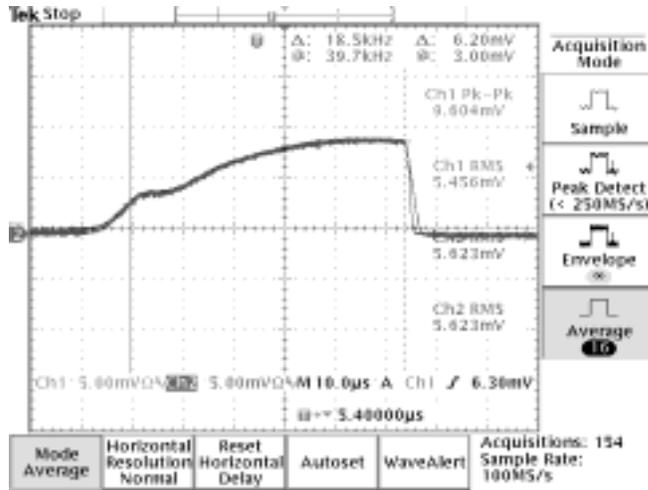
Saturday 14-Dec-02 the RFQ conditioning was completed well ahead of what was expected. The MEBT was set up for the canonical tune for MEBT-RF off. The Ion source was brought up, the LEBT valve opened and the beam was injected into the RFQ. The result from the Faraday Cup at the end of the MEBT is shown below on the Blue trace where the calibration is 4 mA/division.



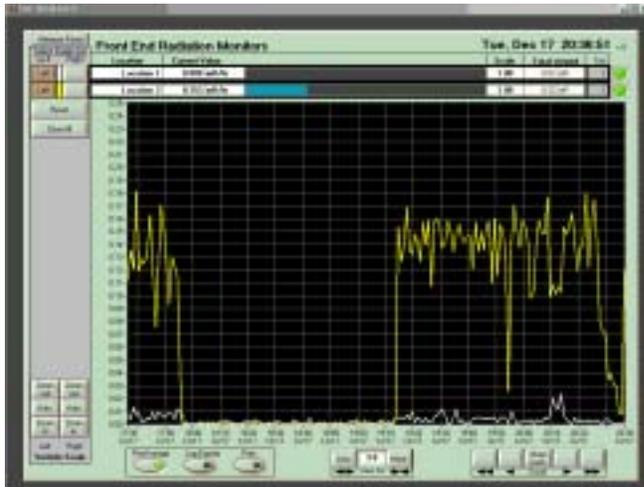
The timing pulses were adjusted and the LEBT Steering was tweaked to produce the following traces.



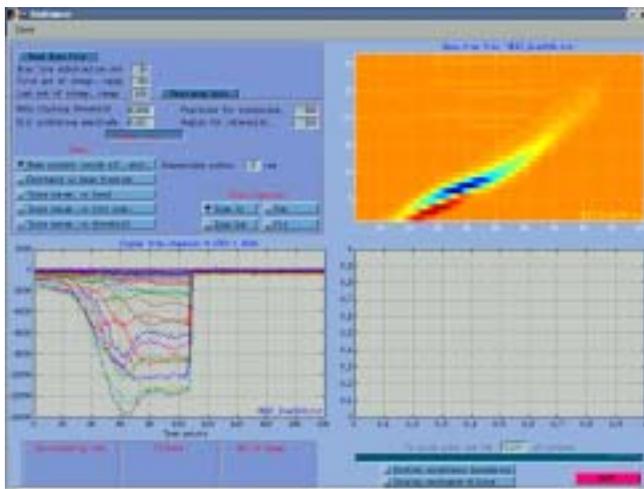
Transmission was optimized with steering and focus to produce the following BCM Traces that show BCM 02 and BCM 11 overlaid,



Radiation, measured at the RFQ (in white) and the Faraday Cup (in yellow) at the end of the MEBT, is shown below for periods of beam on and beam off.



The first test of the MEBT emittance-measuring device was made. This was just a functionality test as some support staff will be away for the holidays. The first test results are shown below:



We have completed studies of the response of transmitted peak current vs.

- Ion Source X-Y position
- LEBT Steering
- Ion Source HV
- RFQ power

The MEBT rebunchers have been powered and the radiation fields measured.

We will transport through MEBT (rebunchers on) and:

- BPMs1-3 commissioning
- Phase set of rebuncher 1
- BPMs4-5 commissioning
- Phase set of rebuncher 2
- Phase set of rebuncher 3
- BPM 6 commissioning
- Phase set of rebuncher 4
- Test the rebunchers LLRF system tuning

This weekend and next week we plan to do MEBT tuning and beam characterization. The plan is:

- Wire scanners commissioning
- Emittance device commissioning
- Q1-Q4 quad setting correction
- Q5-Q10 quad setting correction
- Q11-Q14 quad setting correction
- Global orbit correction algorithm check
- Global Q1-Q10 correction algorithm check
- Amplitude/phase scans for rebunchers 1-3
- BCM1 to BCM2 transmission measurement
- D-plate horizontal emittance vs. Q11-Q14
- D-plate vertical emittance vs Q11-Q14

Demonstration of Beam that meets Linac criteria

Ion Source Group

The Ion Source on the front end appears to work well. On Saturday it was able to deliver 10 mA to the MEBT beam stop. Retuning brought the current up to 14 mA on Sunday. Optimizing the horizontal position increased the current to 14.5 mA after it was moved ~0.2 mm. A 1 mm move cuts the current in half. This is, however, short of the 20-30 mA we obtained on the flag when the source was operated at the same power level of 25 kW RF.

We have improved our procedures for finding the optimal ion source position and tilt angle. At least two careful scans optimized with a 2.6-degree tilt yielded a maximum of 19 mA, where the maximum with a 3.5-degree tilt angle yielded never more than 15 mA. We are eager to repeat this procedure to compare 2.6 degrees with ~1.5 degrees.

Late Monday evening, the RF amplifier failed because the serial tunable output inductor started to arc to ground. Removing the damaged leg allowed to restore operations. This is the same problem encountered at LBNL late in 2001, and is caused by inadequate safety margins in the engineering. We have started to talk to QEI about re-designing these tunable coils with larger gaps to ground.

Syd Murray and Robert Welton developed an air heating system that can deliver 550 C hot air to the Cs collar. This allowed to cesiate the hot spare stand ion source successfully without plasma heating, producing up to 25 mA. This is a significant simplification in operations, and allows for delivering beam while cesiating.

Akira Ueno and Yasuhiro Kondo from KEK were visiting us for 8 days to observe the startup and operation of the Front end. They were trained as Radiation worker I, briefed on the Front end building specifics by Sam McKenzie, and attended the SNS site training to assure their compliance with all regulations.

We have prepared a presentation to train our operators on the chopper systems. This became only possible after receiving much needed information and many helpful comments from several of our SNS colleagues at LBNL, LANL, and ORNL, and after studying a wealth of information in IMAN. The study contains many checks that show the chopper design to be sound. In addition it pointed towards some potential problems which need to be checked experimentally. Most important, it has shown that the chopper system can be tested at 60 Hz without any protection system as long as the pulse length is kept below 0.17 ms for 20 mA, or below 0.13 ms for 25 mA, or below 0.09 ms for 38 mA. Below those values the MEBT chopper target will never reach temperatures exceeding the design values.

Mechanical Group

The three tank sections of DTL-3 have been reassembled using the larger cross-section o-rings (0.327" dia). Pump down and leak testing will begin next week.

A DRAFT schedule of the activities through conditioning of DTL tanks 1 and 3 has been generated that is consistent with the Integrated Project Schedule (IPS). This schedule is very aggressive and requires several key activities to be performed around the clock. The resource requirements for this schedule will be determined after the first of the year. Additional iterations are required to increase its feasibility given resource constraints.

Tank sections for DTL tanks 5 and 6 were inspected at Votaw in southern California. The tank sections look good and inspection documentation was excellent. The non-conformances were minor and can be accepted without additional work.

Nathan Bultman, Dan Richards, Lloyd Young and Marion White were at Accel assessing progress and status of the CCL and SRF cavities. The stack braze of CCL#1 did not happen due to a vacuum leak.

The next SRF cavity shipment leaves for JLAB today, now waiting for the shipper to pick up the boxes in an hour or so.

Magnet Systems

We have finished measurements of the HEBT Dipoles. BNL has reviewed the data and recommended exact placement of each dipole within the arc. We will now start installing Beam Pipes into each magnet, and in parallel, re-braze the water fittings on each coil.

Re-brazing of the HEBT 12Q45's is complete as well as changing out the coil clamps to aluminum. We have now completed production measurements on five 12Q45's.

The DTL/CCL Quad is being shipped from MCT today. The 1st article CCL Quad should arrive from Millhouse today.

We have also been actively involved with LANL concerning DTL Drift Tube EMD's.

Linac HPRF

The HVCM was repaired last week. Failure mode was a single IGBT device failed. Failure was localized to two dies, and a portion of the device was unharmed. Also, the drive board was intact. We suspect a mounting problem, but cannot confirm that. Received 3 additional IGBT switch plate assemblies, which we will inspect thoroughly for QC and workmanship non-conformance. Also received 4 SCR units, 2 safety enclosures, and 2 oil tanks. Provided hands-on training to 20 operators. HVCM has operated flawlessly this week, with administrative limits placed at 10 Hz, 100 kV maximum operations. Modified design of coincidence detector provided by LANL and am in the process of building a chassis to detect timing signal overlap.

Linac LLRF

Electrical Systems Group

An additional 20 corrector power supplies were received from Danfysik this week, bringing the total received to 74 (one returned due to shipping damage). An additional 64 are in transit, which would complete the Linac corrector order. The 220 correctors for the Ring will start shipping next month. So far, 15 power supplies have completed testing in RATS and are ready for DTL installation. Eight power supplies have been shipped to LANL for them to configure and test for CCL usage as part of the handoff agreement.

A corrector supply (Kepco) in the front end was replaced due to electrical noise interfering with BCM measurements.

Work has started on the RF test stand at RATS in preparation for the ring RF cavity delivery in March 03.

Rack bases were set for CCL row 04 and 05.

Cable trays above rack rows in CCL completed.

AC test and verification reports (field measurements) completed for DTL row 04

Survey and Alignment Group

Cryogenics Group

Beam Diagnostics