

Accelerator Systems Division Highlights for the Week Ending July 20, 2001

ASD/LBNL: Front End Systems

The first ion-source antenna coated by Cherokee Porcelain, Knoxville, functioned rather well during operation at 6-7% duty factor. Inspection after 2 1/2 hours of operation revealed the presence of many azimuthal rings that could point to micro cracks in the coating, but no open spot was detected on the entire length. This antenna is still fully functional and in a much better shape than one of the last received standard antennae coated in Oakland, after it had undergone similar duty.

A test with a pure tantalum antenna was not successful: it was possible to run a discharge at very low rf power, but attempts to reach power in the order of 10 kW failed completely.

RFQ Module #3 has been conditioned to full power at full duty factor, utilizing the nominal configuration of two couplers.

The MEBT Rebuncher Cavity #1 has undergone first power tests up to 14 kW; so far only very weak x-ray emission was recorded at the highest rf power level. Of the remaining three cavities, three covers and one main body have been machined to the point where they can be stress relieved. All three MEBT rafts have been welded together and stress relieved before nickel plating.

The two MEBT chopper-box covers were shipped to Los Alamos on 7/19 to have the LANL-built chopper structures mounted once they are completed.

The FES underwent a Cost/Schedule Performance Review on 7/17 and presented a closeout scenario that will be the basis of a new Estimate-to-Complete. Planned termination date for the Front-End Systems project activities is July 15, 2002. The SNS Project Office reviewers voiced no concerns or recommendations.

The FES were visited by DOE officials Jeff Hoy, David Wilfert, and Larry Radcliffe who were briefed on the subproject status, were shown the existing Integrated Testing Facility at Berkeley Lab, and discussed open project issues with FES management.

FES staff took part via videoconference in the MEBT chopper review on 7/16 and the Linac Diagnostic Plate Preliminary Design Review on 7/18.

ASD/LANL: Warm Linac

Low-power tuning of the CCL hot model is complete. The structure's $\pi/2$ -mode frequency is 805.108 MHz (scaled to 70-deg F, vacuum). The target is 805.11 MHz, where the extra 110 kHz anticipates the expected frequency shift between no-power and power conditions. A positive stop band gap of ~250 kHz was left to ensure that the stop band gap would remain positive under operating conditions. An important measurement on the hot model will be the stop band gap at full RF power operating conditions. The change in the stop band gap with high-power RF power is an important piece of design information that we have no other way of obtaining. A 250-kHz gap is easily tolerated on the two-segment, 33-cell hot model. The modes nearest the $\pi/2$ mode are ~2 MHz away. On a 12-segment structure, the nearest modes will be only ~300 kHz from the $\pi/2$ mode, making tighter demands on the tuning. (WBS 1.1.2.2)

A preliminary design review for the second SRF Linac klystron contract was conducted at the vendor facility. (WBS 1.4.1.1)

The contract for the production SRF loads was awarded. (1.4.1.1)

The SNS prototype power substation for high-voltage converter modulator (HVCM) was installed. Winning bidders were selected for the production HVCM substations and control racks. The SCR controller RFP was reopened for one week to accommodate an altered test plan. (WBS 1.4.1.2).

Draft acceptance criteria for the HVCM were developed by ASD and sent to LANL. They are under evaluation. (WBS 1.4.1.2).

Fabrication of the DTL PMQ drift tubes is underway. Drift tube bodies (Fig. 1) and diverter tubes have been rough machined. (WBS 1.4.2.3)



We completed tests to examine the alignment of a drift tube assembly under vacuum. The drift tube was aligned in a vacuum chamber at atmospheric pressure and rechecked once under a vacuum. The experimental data indicated very little offset, if any, in the position of the drift tube. A report detailing the experiment and results will be released soon. (WBS 1.4.2.3)

We modified the coolant manifold for the drift tubes to include a fitting for a RTD. In doing so ASAP, we minimized costs and the potential impact to the fabrication schedule. Further efforts to incorporate thermal couples or RTDs on the DTL and control system will require a PCR. (WBS 1.4.2.3)

The RFP for the DTL EMD drift tubes was issued. (WBS 1.4.2.3)

The RFP package for the DTL RF drive iris was submitted to procurement. (WBS 1.4.2.2)

DTL tank machining has started (Fig. 2). The contractor is expected to finish tank #3 segments in October. (WBS 1.4.2.2)



The top of the DTL support stand has been modified to extend the horizontal members by two feet in the longitudinal (beam) direction. This does not affect the width of the DTL structure. However, it improves the location of the supports for the drift tube water manifold and provides additional flexibility for transporting the assembled DTL down the linac tunnel. (WBS 1.4.2.6)

LANL hosted a MEBT chopper review. LBL and ORNL participated via videoconference. (WBS 1.4.5.1)
 LANL hosted two diagnostic design reviews for the wire scanners and for the DTL diagnostic plate. The review committees included specialists from FNAL, SLAC, JLab, and LANSCE. BNL and ORNL participated via videoconference. (WBS 1.4.5.2)

ASD/JLAB: Cold Linac

Most of the cryogenics group has been participating in the Cryogenics Engineering Conference this week. Fabrication of transfer line components continues.

Testing of prototype cavity #1 (medium-) with helium vessel but without tuner is complete. The cavity has been removed from the vertical test stand for installation of the dummy tuner.

Fundamental Power Coupler: Four plated outer conductors and two waveguide coupling sections were received. All center conductors have been modified to produce the correct Q_{ext} in the cryomodule. The activity is still on schedule to ship the equipment to LANL for testing on August 4.

Electro-Polish Facility modifications to accommodate installation of the cabinet are underway.

Received several pieces of tooling to support Cavity and Cryomodule production, including the cryomodule assembly benches. They are currently in incoming inspection

A paper on the cryogenic design of the SNS cryomodule was presented at the Cryogenic Engineering Conference in Madison, Wisconsin.

ASD/BNL: Ring

Members of BNL's Survey Group attended Laser Training at SNS/OR this week.

Dick Hseuh traveled to SNS/OR to participate in discussions of design options for the Injection Dump vacuum system.

Staff participated in separate videoconferences for the LEBT Chopper (LANL) and Wire Scanner (LANL).

Bill Weng and Mike Nekulak reported on cost and schedule status for WBS 1.5 at the Deputy Project Director's quarterly review videoconference.

Injection Septum magnet drawing packages have been released for quotations.

Fabrication of Injection Foil mechanism is underway.

Injection system – the first article ceramic tube with end cuffs has been ordered.

Bill Weng provided a written proposal to ASD outlining Early Handoff for WBS 1.5 RF Systems, Diagnostics and Project Support.

Efforts continue on Estimate to Completion (ETC) and schedule for all WBS 1.5 electrical and mechanical systems.

We continue to work on year-end planning, normal and accelerated procurements, FY02 plans, and schedules.

Work is underway to identify the scope and dollars related to WBS 1.5 Early Handoff for transfer to ASD.

Field measurements were completed this week on the 21Q40 quadrupole with and without its welded vacuum chamber. See photos below.

A final design review was conducted on the 41CD30 corrector magnet in preparation for RFQ.

Joe Tuozzolo called an internal meeting with the Mechanical Group and Physics Group to identify and define operating parameters for the Injection and Injection Dump magnets.

Using a flip coil, magnetic field quality measurements of the 1st article, production, ring-arc dipole magnet was completed this week. Measurements were taken at 1.0 GeV current. Our Measurements Group reported that all measurements are within specification and that the production magnet is in full agreement with its earlier prototype. Field data at 1.3 GeV is next.

Tom Nehring provided BNL's comments to Knight on Ring Conventional, Title II, 90% status review.

P.K. Feng completed calculations on air and water heat loads into the PFN building (extraction kickers). This info has been forwarded to Jack Stellern.

Tuozzolo and Birkholz continue their weekly teleconference calls with our vendors, Tesla and Danfysik, to address magnet production issues.

The bid package for the 30Q44 and the 30Q58 Ring quadrupoles is complete and awaiting ASD approval for RFQ release.



Picture #1: Field Quality of 17D120 w/ Vacuum Chamber



Picture #2: Field Quality of 21Q40 with Vacuum Chamber

Controls:

A Preliminary Design for EPICS Software Support for the SNS VME-based Timing System has been completed.

At Tullahoma, the set up of a CF controls standard and EPICS scripts for generating production control software were completed.

A prototype Group-3 interface to the just-delivered QEI 2 MHz, 80 kW RF generator for the Source plasma successfully tested.

The controls team participated in a review of the front-end choppers. Some scope will be transferred from LANL to LBNL.

The first tree VME crates were delivered by Dawn to ORNL. A testing program will begin immediately.

The controls team underwent a cost and schedule review this week. There was considerable discussion of the growing schedule variance – both causes and possible solutions.

Pictures below document recent progress in the Personnel Protection System.



This development rack contains an Allen Bradley PLC with control panels representing:

- Four Beam Shutdown Stations and final sweep switch (top panel)
- Linac segment tunnel status controls, i.e., restricted access, sweep, controlled access, controlled access magnets on, power permit, and beam permit access,(middle panel)
- Personnel access door controls and Ion Source controls (bottom panel)

Except for the Ion Source controls, agreement with Operations has been reached regarding the functional logic of these controls.



Shown above is a mockup of the inner door (closest to tunnel) of a personnel access station. From left to right: telephone, beam shut down station (will actually be located every 100 ft in the tunnel), exchange key station, tunnel status display over door, door with position switches, rotating beacon for indication of power or beam permit status in tunnel.



This is a digital photograph of a computer monitor displaying a view of the Personnel access station through an Ethernet video camera.

ASD/ORNL: Integration

Installation Support

ASD personnel walked through the construction site to observe concrete progress. In conjunction with this, an ASD transmittal was approved to weld the rebar to the grounding grid in the tunnel.

DI water piping to the ion source has been installed and hydro tested. Power to the ion source area will begin 7/23. Compressed air piping to shop areas is about 40% complete. The air compressor will be wired and tested the week of 7/23.

Six CCL segments are now complete (Styrofoam) and work has begun on the cross member supports for the mock up. A high beta cryo module vessel is complete with work starting on the base support structures and a warm section table to begin the week of 7/23.

Much of this week was spent estimating the building prep work and inputting installation tasks and estimates into the ASD installation schedule.

Don Getz (from Argonne) was here the 18th and 19th to assist with and discuss the Davis Bacon determination and the SNS installation plan.

Accelerator Physics

E. Tanke and D. Jeon participated in dose rate measurements at LANSCE the week of July 9-13. Dose rates from the RF generated x-rays were measured in the vicinity of the first two DTL tanks. These measurements are useful in shielding estimates and planning for installation and commissioning.

J. Wei and S. Henderson participated in the Snowmass workshop on the direction of high-energy physics. The proton driver working group summary references the SNS project as a test-bed for pertinent linac RF superconductivity development.

S. Danilov developed a model for the impedance of the ring injection kickers. This model uses a finite length, as opposed to previous estimates, and will be useful in predicting the optimum coating thickness.

The ORBIT collimation model is being benchmarked with the K2 code, for single pass effects. The implementation in ORBIT will also be able to do multi-pass collimation studies, and is being considered for benchmarking with the STRUCT collimation model used at FNAL.

Operations

Ion Source Group

Rahul Rauniyar is writing a data analysis utility that allows the extraction of the Twiss parameters after some basic data manipulations, which is needed to extract reliable emittance values from simulations as well as from measurements.

Dan Cheng and Mike Forrette have been key players in the successful transfer of the information required to continue on the Hot Spare Stand project. When completed the hot spare stand will feature a fully tested and condition ion source that can replace the ion source on the front end in a moments notice.

Sonali Shukla continues to identify and order parts required for the hot spare stand, including verifying some of the many details of the Big Blue Box.

Rob Welton develops a numerical model of the plasma sheath/insulator/antenna interface similar to those developed for ICRF antenna design for fusion devices. Such an analysis may help to evaluate material properties and thickness for improved antenna life.

RF Group

Cryo Transfer Line Group

Mechanical Group

Magnet Measurement Group

We are busy integrating slides into Labview and programming Labview to take measurements of HEBT dipoles.

A local shop is manufacturing search coil parts for the HEBT dipole measurement.

We are placing an order with a local shop for CCL Quadrupole alignment adjustment mechanisms.

Power Supply Group

Paul Holik attended the Ring 90% Conventional Construction Design Review in San Francisco

Cable specifications are being reviewed with special regard to radiation resistance

Survey and Alignment Group

The SNS Survey & Alignment Group as well as key survey personnel from other labs has been attending a Leica training class with respect to software upgrades on laser tracker and total station instruments.

Additional work is being conducted on the ever evolving lattice which now contains nearly 2000 magnet related positions throughout the site as well as survey exterior and interior monuments, and 500 conduit locations. A Survey & Alignment Lattice /Building Drawing and accompanying spreadsheet is updated each month with the latest available information. This information is available to anyone upon request.

Beam Diagnostics Group

BNL-SNS beam diagnostics Weekly report:

1.5.7.1 BPM: A decision has been made to produce the machined parts of the BPMs in the central shop. An RFQ has been prepared and submitted. An ECN is in preparation to increase wall thickness of the mounting flange and the shell of the 12 cm BPM for easier machining as per shop recommendation.

1.5.7.3 BLM: Completed testing several first stage amplifiers. A breadboard prototype front-end is under construction, with selectable gain and signal splitting for fast and slow response.

1.5.7.4 BCM: A breakout circuit board has been received. This board allows access to the digital signaling connections of the BCM AFE without inserting the BCM circuit board into Matt's digital interface board. The DAC circuitry has been exercised by a programmed digital logic pattern generator, and appears to work. Some noise issues were observed, and additional filtering of the DAC output may be necessary. A consolidated BCM design considerations document has started.

1.5.7.6a Carbon Wire Scanner: Group members participated via video in the wire scanner PDR at LANL.

1.5.7.6b Laser Wire Scanner: Work has begun on a technical note documenting the survivability of NdYAG lasers in the SNS radiation environment. BNL Participated via video in the wire scanner PDR at LANL. Shop drawings are finished for the MEBT Laser Profile Monitor. The actuators have arrived and were tested. With the delivery of the actuators, all mechanical parts are in-house. The optics have been ordered, and we are starting to develop an EPICS application.

LANL-SNS beam diagnostics Weekly report:

Much of the LANL-SNS diagnostic group effort this week centered around the Wire-scanner and D-plate PDR's held July 17 and 18. In general the PDR's were successful. An outcome of the PDR's is that we will quantify the beam loss caused by the wire scanners and quantify the impact of mis-steered and mis-focused beams in the D-plate. We will also investigate modifications to the D-plate beam stop to allow it to function as a Faraday Cup.

BPM's: Work continues to stuff a new PCI motherboard to replace the one left at BNL. Once this is complete, BPM testing will resume. We hope to have the FPGAs ready for the digital front end in the next couple of weeks.

ORNL-SNS beam diagnostics Weekly report:

Craig worked on the detailed budget and engineering the microwave parts for the Faraday cup. He also started working on the E&M heating of the wires placed in the Accumulating Ring with high intensity beam present. Dave has spent most of his effort this week on the conversion of the dm2k front-end screens to edms. He also added the ppt presentations of the wire scanner and D-plate PDRs to the diagnostic web site that are available for review. Saeed attended the MEBT chopper review on Monday at LANL. Tom and Saeed also participated in wire scanner and D-plate PDRs on Tuesday and Thursday. Saeed joined the LEDA operation group on Thursday and Friday to learn about LEDA's approach in beam Halo measurements.