

Accelerator Systems Division Highlights for the Week Ending May 17, 2002

ASD/LBNL: Front End Systems

MEBT commissioning continued over the last two weeks, with participation of several members of the SNS Accelerator Diagnostics community from Oak Ridge and Partner Labs.

On 5/13, a round-the-clock beam endurance test with the entire front end was started, and it continued through the entire week. This test was very successful overall and suffered from one single, unplanned interruption. The cause for that failure is well understood and was fully resolved when the test resumed. P. Gibson, M. Stockli, E. Tanke, R. Welton, and M. White participated in these tests as beamline operators, and their contributions, especially their willingness to take on night shifts, are thankfully acknowledged. The test was intentionally terminated on May 17, 4 p.m., with all systems running. The ion-source antenna easily lasted for the entire test duration.

Parasitically to the endurance run, members of the SNS Diagnostics community carried out tests of various diagnostics elements, among them the Laser Profile Monitor, and implemented improvements.

Six FES staff members took part in the semi-annual DOE status review of SNS, May 7 - 9, at Oak Ridge. The review did not result in any recommendations for the Front-End Systems group.

ASD/LANL: Warm Linac

The 96-hour heat run on the first 402.5-MHz klystron was successfully completed. Tube was taken off the LANL test stand, and prepared for shipment to ORNL. (WBS 1.4.1.1)

The second 402.5-MHz klystron is being installed into the LANL test stand. (WBS 1.4.1.1)

Progress was made at Marconi on the third 402.5-MHz klystron. The tube operated stably at over 2.3 MW and 123 kV at 1.34 msec and 59 Hz. (WBS 1.4.1.1)

Factory acceptance tests on the second 402.5-MHz transmitter are underway. Results to date are satisfactory. (WBS 1.4.1.1)

The prototype high-voltage converter modulator (HVCM) performed without failure during the 96 hour klystron heat run. After the run, we pulled the high-voltage assembly out of the oil tank for inspection. Mechanical ties of the high-voltage secondary transformer windings were found to have worked loose. A modified design is being implemented. We do not anticipate this being a problem with the production HVCM since those windings are epoxy cast. (WBS 1.4.1.2)

Mitsubishi engineers were at LANL to witness and review IGBT operations in the prototype HVCM. They came with their own diagnostics. They confirmed our assessment that previous failures were due to over-heating and were seemingly due to low gate drive conditions. They saw no impediments in our 20-kHz resonant conversion application. They suggested performance enhancements through changes in internal IGBT resistors. Their measurements revealed clean switching waveforms. Calculations of power loss were consistent with our calorimetry, with minimal thermal cycling that will have zero impact on lifetime. (WBS 1.4.1.2).

Alignment and tuning of DTL Tank 3 (Fig. 1) are complete. The assemblies are now ready to be shipped to Oak Ridge. (WBS 1.4.2.7)

The first shipment of Tank 1 drift tubes should ship on May 31 and the second shipment should ship on June 15. The EMDs will also ship on June 15. (WBS 1.4.2.3)

Three of the four potted Tank 1 coils from New England Technicoil arrived at LANL today. The fourth coil was lost during the shipment. We are in the process of trying to locate the fourth coil, while simultaneously having New England Technicoil provide us with a replacement. (WBS 1.4.2.3)



Fig. 1: DTL Tank after alignment and tuning.



Fig. 2: Final clean up of DTL

Votaw is aggressively working on the tank sections for tanks 4, 5, and 6 (Fig. 2). WBS 1.4.2.2)

The support stand for Tank 1 was shipped to the RATS building. (WBS 1.4.2.6)

LANL staff were at ORNL this week to complete the systems level electrical engineering integration plan. It was a highly productive meeting in which we agreed on LANL and ASD responsibilities for the water, vacuum, magnet, and EPICS controls systems. We also coordinated ASD and LANL schedules, and worked out the mechanics to get funding transferred from LANL to ORNL to cover the cost of cables and racks. (WBS 1.4.2, 1.4.4)

ASD/JLAB: Cold Linac

Cooldown of the prototype cryomodule started with the cooldown of the shield circuit. After 12 hours, the shield inlet temperature had been reduced to 50 K, and the outlet to 70 K, values which are as expected. A small leak has been found between the helium circuit and the insulation vacuum, but it is well within the capacity of the insulating vacuum pump and no operational consequences are expected. Cooldown of the primary circuit has begun.

ASD/BNL: Ring

Visitors from SNS/OR this week included N. Holtkamp, C. Strawbridge, S. Herron and J. Hill. In addition to an "All Hands" address by Holtkamp and Strawbridge, the focus of the visit was on assembly/production status, Project

Controls and Management, Finance and Property Management. The All Hands meeting was particularly well received by the one hundred or so SNS/BNL worker bees that were in attendance.

Bruno Zotter (CERN) and R. Gluckstein (Cornell) were visitors at BNL this week. B. Zotter conducted a Physics Seminar on "Impedances and Wakes in High Energy Proton Accelerators".

N. Simos and H. Ludewig traveled to SDMS (France) this week to perform a final inspection, test and acceptance of the 1st article RTBT collimator. The report on this first assembly was very good. We expect shipment of this first article to SNS/OR in early June. This visit was used as an opportunity to review the production drawings for the HEBT beam tubes/collimators. These units are next in their production line. Issues related to spare beam tubes must be addressed soon.

Craig Dawson traveled to LBNL this week on behalf of BNL to participate in a Post Commissioning Workshop on the MEBT Diagnostic Systems.

In preparation for the upcoming meeting later this month (5/28) with IE Power, R. Lambiase, M. Hemmer and D. Raparia are working to confirm all operating parameters on the medium field magnets and power supplies.

IE Power reported that they have reduced voltage ripple to acceptance levels on the first article Injection Kicker PS. R. Lambiase will follow up on this issue during his 5/28 visit.

HEBT Dipoles – Our Physics Group received data on the integral transfer function (ITF) of the first two HEBT dipoles. A final evaluation will be made after all the dipoles are measured.

Dipole shimming status: 15 of the first lot (16) have been shimmed, tested and are ready for half-cell assembly.

Inspection and electrical testing of the first four production octupole corrector magnets (NE Techni-Coil) is underway.

BINP: all 4 coils have been wound and vacuum impregnated. Core machining is complete. Magnet assembly is in progress and on track for a 6/1 delivery to BNL.

An RFQ for the main ring dipole power supply has been released. Bids are due back on June 6th. DOE Committee suggestions related to hot / cold spares must still be addressed.

Ring RF - testing of the anode PS for the RF system continues.

Bids for the RF tuning PS have been received. Danfysik was the successful bidder for these four (4) units.

Survey inspection of the 1st article 26Q40 is complete. This magnet is being prepared for magnetic measurements.

Field quality measurements of the following magnets are in progress: 17D120, 21Q40, 27CDM30, 21CS26 and 21CO26.

The bids for the 21S26 (q=12) are in house and being evaluated. We expect to award a contract before June 1.

Electro/mechanical optimization of the Extraction Kicker magnets (gaps) are being reviewed for a final time.

The Mechanical Group conducted an internal design and drawing review of the HEBT Momentum (dump) Collimator.

Assembly work continues at BNL on the #1 Injection Septum magnet. Core / coil fit was tested this week.

36Q85 – a contract was awarded Raynor to fabricate the magnet cores while a ceramic test piece was successfully brazed to a piece of the mineral insulated coil at BNL.

Controls

1.9.2 Global Controls: A firewall and DNS server were successfully implemented for the prototype ICS network at 701 Scarboro. This completes our milestone for prototyping the ICS network. FE communications room cabinets are scheduled to be shipped to the site next Wednesday.

1.9.4 Linac Controls: System diagrams were generated for the DTL control systems.

1.9.8 Conventional Facilities Controls: An updated design package containing latest information for CF Controls in the FELK was issued "CFC".

1.9.10 Cryogenic Control System: A purchase order for the acquisition of 9 of the 21 slot VME crates was placed with Wiener Plein & Baus Corporation. These VME crates will be installed in the Cryogenic Control System racks in the Klystron Building and HEBT service building.

A purchase order to the Rack Factory (DCS) for fabrication of the CHL control room racks was initiated. On a separate order, one of the EPICS operator workstations for the control room was received.

1.10.2.5 Controls Ops Support: Remote control of a mass flow controller on the ion source test stand was implemented. This was significant in that a number of EPICS system components (IOC, OPI, "Group 3" I/O subsystem, etc.) had to all be implemented to make this happen.

Installation

Accelerator Physics

A parallel computer cluster has been purchased for beam dynamics simulations

Eugene Tanke is at LBNL participating in front-end commissioning

The applications programming group benefited from time to test programs here at ORNL using real-time MEBT data, and look forward to additional beam-time next week.

Database populating continues with the first magnet measurement results from ORNL being prepared for database entry.

S. Danilov et al. have proposed a scheme for H-minus laser stripping which may be achievable with lower laser power than previous laser stripping schemes. Collaboration continues with ORNL laser scientists to produce a demonstration experiment that could be deployed in the linac dump line. An article describing the method has been prepared for publication.

L. Kravchuk has checked the multipacting study for the medium-beta superconducting cavities and finds good agreement with previous results obtained by the Helsinki group.

Operations Group

New draft of "Hold for Radiation Safety" lockup procedure written – to be submitted to the Radiation Safety Committee for review.

Began evaluation and discussion of Radiation safety concerns raised by LBNL paper "Expected Neutron Levels from MEBT".

Reviewed and approved PLC control drawings for PPS Phase 1.

Began evaluation of Electronic Logbooks, looking for one that would most effectively integrate with our EDM database and Facilities management software.

Evaluated a database manipulation and development tool (WebObjects).
 Helped others to get started using the Equipment Tracking System and Bar-Coding of equipment.

Ion Source Group

Paul Gibson, Robert Welton, and Martin Stockli participated in the 24-5 test as a part of the commissioning of the front end at LBNL. The test turned out to be an invaluable ORNL-staff training as well as a useful equipment shakedown. To train the ORNL staff to a high level of proficiency we were given the opportunity to cover almost exclusively the evening- and night shifts. A steady number of resets were required due to frequent arcs, also the number dropped considerably with time. Operations hovered around 2% duty cycle with only one significant interruption when the LEBT glue failed due to a malfunction in the cooling water loop.

The emittance analysis program written by Robert Welton has been used for a thorough analysis of the JAERI data as well as recent LBNL emittance data. The bias current of the JAERI data has previously been calculated at 0.2%, but was found to increase with distance from the core of the beam. Introducing elliptical rings allowed for determining the bias at 0.16 +/- 0.02 % in the vicinity of the beam. Subtracting the determined bias from the raw data, the normalized rms-emittance becomes 0.22 +/- 0.02 Pi mm mrad, which is substantially higher than the value of 0.13 reported in the literature, which is obtained when thresholding the data at 10% to eliminate the noise.

The LBNL data were found to have a bias of 0.16 +/- 0.04 %. After subtracting the determined bias, the normalized rms-emittance was found to be 0.185 +/- .005 Pi mm mrad, significantly below the 0.2 requirement. It is, however, larger than the previously reported value of 0.15, which was obtained with thresholding.

RF Group

David Anderson spent week developing system documentation for HVCM and warm linac RF systems.

Mechanical Group

Magnet Task

HEBT Dipole #2 is mounted on a support stand; Joe Error's group is measuring the gap to insure that no damage was sustained during shipment. Measurements are complete on Dipole #3. Dipole #4 is in the RATS building.

With the exception of fiducialization, measurements are complete on the first 12Q45/16CD20.

Two ring dipole busses are complete. A third is approximately 50% complete. Six more to go.



Vacuum Task

Conducted pre shipment survey of FE mechanical installation and familiarization of vacuum control station at LBNL. Discussed disassembly and reassembly plans, engineering documentation and controls integration with technical staff.

Conducted two day meeting with BNL vacuum staff engineer to discuss technical, documentation, hand-off and schedule related issues. Hand-off discussion addressed in particular cabling and rack issues.

Purchase orders were prepared for the leak test pump carts and RGA's needed to support the SCL cryo transfer line installation.

Preliminary leak testing and cold shocking of the root passes and final leak testing of the extraction beam dump flight tube was completed. This completes the beam dumps for the accelerator systems.

Accelerator equipment received this week included four custom gate valves for the DTL/ CCL installation.

Assembly and population of the vacuum system controls test stand with vacuum gauging, pump controllers and associated equipment continued in conjunction with the Controls Group.

Support to the Magnet Group for leak testing of the buss bars following fabrication continued.

Cryogenics Group

Transfer Lines: Supply modules MB11/HB1 And HB2/HB3 have the anchor boxes assembled and leak tested. Return module MB3/MB4 is 40% assembled. Tooling is completed for the 2nd return assembly line and will be installed as soon as the helium compressors are moved from the area.

Helium warm compressors: All 6 compressors are pressurized with low-pressure argon and wrapped for outside storage at the site. The compressors are scheduled to be moved to the site staging area at the CHL on Monday 5/20/02

Beam flight tubes: The final flight tube was telescoped this afternoon and the final weld will be made on Monday 5/20/02

Electrical Systems Group

Members of the Electrical Systems Group participated in the System Electrical Engineering Integration Plan (SEEIP) meeting with our LANL partners held on 5/15/02. The mutually agreed to hand off procedure was signed by both partner labs.

Installation activities in Klystron Gallery and Linac Front End Building (Terresa Toomey): The cable tray in the Communication room for the Front End bldg. is installed, the clean power panel box is mounted on the wall. The cable tray is approximately 33% installed for the Front End bldg. The clean power panel box for the temporary control is mounted on the wall. The clean transformer and distribution panel box is mounted on the wall in The Front End bldg. These panels and the Comm. room listed above is approximately 30% of installed for the Front End bldg., we still have panels to install in the Klystron Gallery. The power distribution cable tray for the north wall is installed. The signal cable tray for the north wall is half way to the 3.5 column line. The supplemental power tray for the Modulator equipment, that runs north to south is installed. The supports for cable trays running north and south for the 3.5 column line will be completely installed by Tuesday. This is approximately 50% complete for the 3.5 column line

Survey and Alignment Group

Beam Diagnostics

General - Group members participated in the Beam Instrumentation Workshop. Papers were presented for almost all systems.

1.5.7.1 BPM: A paper was presented to BIW. In conjunction with the BIW, a meeting was held to discuss using Bergoz to incorporate a Ring and RTBT base-band design into their AFE for the Linac BPM. A specification was prepared to provide Bergoz with information needed to proceed with a design.

1.5.7.2 IPM: The luminescence gas profile monitor was removed from the AGS to make modifications to reduce noise, and then reinstalled. Beam signals were seen. There is beam pickup with the PMT off, but with PMT on there is a signal several times higher. Signal was distributed across the eight detector channels in a way consistent with a crude beam profile. No gas was injected, so if we were seeing beam-induced signals it was from the residual gas in the pipe. We are making preparations to bleed in Nitrogen.

1.5.7.3 BLM: A paper was presented to BIW. In conjunction with the BIW, a meeting was held to discuss the new design. Decision was to go out for prices for the new design.

1.5.7.4 BCM: A paper was presented to BIW. Fabrication of Rev 2 Circuit boards continues. A shroud testing apparatus is being constructed. LANL is working on shroud resonance calculations. A comparison/evaluation of a Keithley 2002 DMM with an HP 3458A 8-1/2 digit meter was completed. We ordered the HP.

1.5.7.5 Tune: A paper was presented to BIW. UAL modeling of beam transfer function measurement continues to show good progress.

1.5.7.6a Carbon Wire Scanner: Preparations have begun for refurbishment of the MEBT wire scanners.

1.5.7.6b Laser Wire Scanner: An invited talk was presented to BIW. Additional data was taken at 200MeV in the Linac. Raw data was stored for further analysis.

ORNL SNS Beam Diagnostics Report:

This has been a week of bringing the engineers and the commissioners in the same place to evaluate the proto-type diagnostics. Over all the diagnostic team received high remarks for making the MEBT commissioning a success. We had a one-day meeting at LBL to discuss the strategy to bring the diagnostics from the prototype state to the production form. John Staples and Sasha Aleksandrov made a numerous constructive suggestions. We concluded that the systems need to be revamped as we have mentioned but much of the problems at LBL have been due to poor timing management (triggering with respect to the reference time has been arbitrary). BCMs malfunctioned after the experts left and the timing changed. We recommend that the cycle start time be invariant as a function of pulse length. The commissioners should be allowed to increase or reduce the pulse length without tampering with the diagnostics. This will add reliability to the systems. Craig Dawson at LBL verified that the BCMs work but the triggering was the reason for malfunctioning rather than the electronics. BPM-4's problem is due to the cabling or the electrode rather than the electronics, this is the conclusion of John Power at LBL. Craig Dawson successfully brought up the Laser wire again. Saeed took several profiles, but could not compare the results with the conventional carbon wire due to the vulnerability of the carbon wires at high duty factor and rep. rate.

The diagnostic group at ORNL is preparing a laser wire progress report for the May-20th. Numerous Labview analysis programs to support the MEBT commissioning are being written. Wim Blokland is helping in DTL Tank-3 tuning algorithm application per Craig 's request. The ORNL team is getting ready to install the cables. Dave Purcell is the point person for the Cable information. Wim is also collaborating with Fermilab on Labview for their high-energy collider run. Craig is going to China for Schoolwork for the next 2-weeks.