

Accelerator Systems Division Highlights for the Week Ending September 13, 2002

ASD/LANL: Warm Linac

The fourth Marconi 402.5-MHz klystron has been installed in the LANL test stand in preparation for its heat run here. The third tube is being packed for shipment to ORNL. (WBS 1.4.1.1)

The fifth Marconi 402.5-MHz klystron is ready to begin its factory acceptance test on September 16. (WBS 1.4.1.1)

The first CPI 550-kW, 805-MHz SRF klystron has been installed in the LANL transmitter. (WBS 1.4.1.1)

The second CPI 550-kW, 805-MHz klystron was taken off the pump and has no leaks. It is being prepared for HV conditioning. (WBS 1.4.1.1)

Two more Titan Transmitters passed their factory acceptance tests and are being prepared for shipment to ORNL. (WBS 1.4.1.1)

Two 805-MHz RF loads and 2 arc detectors were delivered to the RATS facility. (WBS 1.4.1.1)

Bids for the high-beta SRF waveguide have been received and evaluated. An award is imminent. (WBS 1.4.1.1)

LANL and ASD have a crew of six people at Dynapower this week supporting high-voltage converter modulator (HVCM) subsystem assembly, testing, and shipping. (WBS 1.4.1.2)

The first article production HVCM SCR controller at LANL continues to have difficulties. The problem that remains is that the controller will self-trigger randomly and create an over voltage on the converter/modulator output (compared to the set point) of several 10's of kV. Our attempts to fix this thus far have been unsuccessful. We have requested that Dynapower send their engineer back out to Los Alamos next week to help us get past this problem. (WBS 1.4.1.2)

We have been testing the dynamic saturation characteristics of the HVCM IGBT's to optimize the gate drive for reduced switching times and to reduce the losses. (WBS 1.4.1.2)

We achieved open loop operation of the LLRF controller at JLAB with the klystron and mapped the operating characteristics with respect to klystron drive. These tests included fully functional EPICS screens and a fully integrated timing system. (WBS 1.4.1.3)

LANL hosted an internal review of the LLRF system by a mixture of internal and external reviewers (Shoae, Thuot, Ziomek). The results of that review have helped us map a plan for getting past the current difficulties in getting to first-system completion. (WBS 1.4.1.3)

DTL Tank 1 drift tubes are being prepared for repair. Two sets were baked at Solar Industries and shipped to ISYS for e-beam welding. LANL personnel went to ISYS to oversee the repair work. The first four leaky tank-1 drift tubes were scheduled to be welded on 9/12/02, but we are being delayed by vacuum problems in the ISYS welding chamber. Our physics team evaluated the impact of the drift tube surface changes, caused by the e-beam welds, on tuning, and found the contributions to be negligibly small (a 2-mm wide, 0.2-mm deep annular groove causes 16 kHz and 30-kHz changes in DTL Tank-3 and Tank-1, respectively. (WBS 1.4.2)

Machine drawings for the DTL drift tube stabilizer/stiffener cans are completed and released. Materials will be ordered this week. Production should begin next week. (WBS 1.4.2)

LANL technical and procurement specialists were at Coronado Machining, Inc. to start negotiating drift tube contract modifications associated with the repairs, procedure changes, schedule requirements, and QA. A revised statement of work is being drafted by LANL. (WBS 1.4.2.)

Six more DTL tank endwalls were delivered to the RATS facility. (WBS 1.4.2)

The DTL Tank-1 tuning ring drawings are complete. Design thermal analyses are satisfactory. Machining can begin next week. (WBS 1.4.2)

The MEBT and LEBT beam choppers need to be properly phased to operate as a coupled system, and they must operate effectively to provide a clean gap in the beam. We studied four different scenarios where the two are ramped up and down in voltage at different relative timing sequence. Some results are illustrated in Fig. 1. Assuming very conservative ramp-up and -down times as 12.5 and 25.0 ns for the MEBT and LEBT choppers respectively, we conclude that the option where both choppers are phased to start ramping up at the same instant of time is the most effective way to operate the choppers. It reduces the effective beam-transient time *i.e.*, increases the gap length and keeps the beam power dissipation at the chopper target to a fraction of the design specs. (WBS 1.4.5.3)

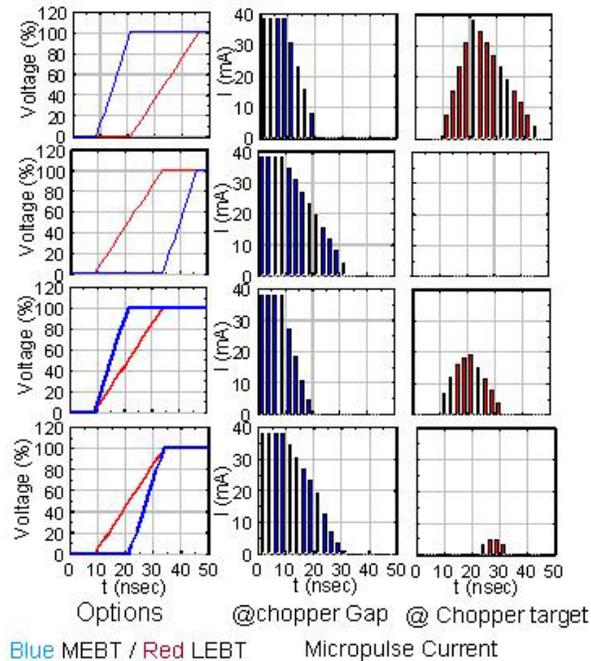


Fig. 1: The effect of LEBT and MEBT chopper risetimes and timing on micropulse beam current s in the chopper gap and onto the MEBT chopper target.

ASD/JLAB: Cold Linac

Cold performance testing of cavity MB01 was completed, showing an acceptable low-field Q_0 of $\sim 10^{10}$, but with strong field emission that limited the gradient to 5 MV/m. Field emission is almost always associated with particulate contamination. A search for possible sources of particulates immediately revealed that the vacuum system to which the cavity is attached for VTA tests, not used in more than six months, had built up a considerable burden of particulates. The vacuum system has been cleaned in preparation for tests of the second cavity next week. The remaining Accel cavities have been baked to remove hydrogen dissolved in the bulk of the material.

The integrated LLRF test was able to control cavity field to 15 MV/m, well above specification, open loop. Attempts to operate with a closed feedback loop continue.

ASD/BNL: Ring

Preparations are underway for six ASAC talks. Dry runs are scheduled for next Tuesday.

Six vendor bids were opened on Monday for the extraction PFNs. They are currently being evaluated.

A mechanical design review of the Collimation and Extraction Elements has been scheduled with ASD for October 9 and 10th at BNL.

Yuri Shatunov was a visitor at BNL this week. See attached photos of Yuri inspecting the BINP magnets and pole pieces.

Participated in a videoconference this week with ASD to review issues related to the brazing of stainless steel water fittings to copper conductor.

At BNL, we are experiencing problems (three vendors) related to leaky water fittings (21Q40 magnets are the latest). To first order, problem seems to be an improper manufacturing procedure resulting in reduced capillary penetration between the stainless steel fitting and the copper wall (we see a brazed surface fillet around the ss fitting w/o any penetration into the joint). There is also concern about use of an optimum braze filler and flux (H&H 630 with a type B flux). Sample testing is underway at ASD, BNL and several vendors. All BNL vendors have been advised of this problem and a stop work has been issued until the problem is understood and resolved.

During this week's teleconference with Danfysik, the issue of field irregularities in the 12Q45 magnets appears to be resolved between all parties. A heat treatment of the coil bracket assembly eliminates permeability that develops during machining/spot welding.

Magnet assembly and measurements:

- Ring dipole measurements – eight type B magnets have been shimmed, fully measured and matched with eight type A magnets. Additionally, three more type B magnets have been shimmed and are ready for testing; five are un-shimmed awaiting initial measurements.
- 21Q40 – field quality measurement of quad #7 was completed this week. To date, six of these magnets have integral fields within the desired range for Ring grouping.
- 26Q40 – pole piece chamfer is being re-machined. An ECN and drawing revision will be made to reflect the revised pole chamfer.
- 30Q58 – the first article pole piece is being re-machined.
- 41CDM30 – the 1st article magnet is being acceptance tested.
- Assembly of first half-cell is underway. October shipment to SNS/OR is planned. Quad S/N 004 has been selected for the assembly. Pictures for ASAC will be sent to ASD next week.

Vendor deliveries:

- Today, Danfysik will ship seven more 12Q45 magnets to SNS/OR. These magnets have been extensively tested for leaks. A Danfysik rep will visit BNL (and possibly ORNL) next week.
- Tesla reported that they plan to ship HEBT dipole #7 to SNS/OR early next week. Machining of dipole #8 is IP.
- Tesla also reported that in addition to the seventeen 21Q40 that are now at BNL, seven more are 50% complete and the remaining six are IP. Phase II production (30 more) will begin next month (October).
- Chicane #4 (vendor repaired) has been received at BNL.
- 36CMD30 - 1st article arrived at BNL and will be uncrated for inspection next week.

Documentation/design efforts include:

- Sign-off approvals on magnet design/parameter sheets
- Lattice drawing revisions
- SOW, BA and APPs for FY03
- Design Manual for the BNL/SNS Ring and Transport System
- Magnet design of the 26S26 high-field sextupoles
- Design of the Injection Chicane Magnet #1
- Designs for the extraction kickers, septum and RTBT bend dipole



Controls

The third stage of the Bill Foyt Review of WBS 1.9 Project Controls procedures was completed at Oak Ridge this week. Reviews at LANL and BNL were completed earlier. The review appears to have gone well. The report for the BNL part of the review was submitted to project management.

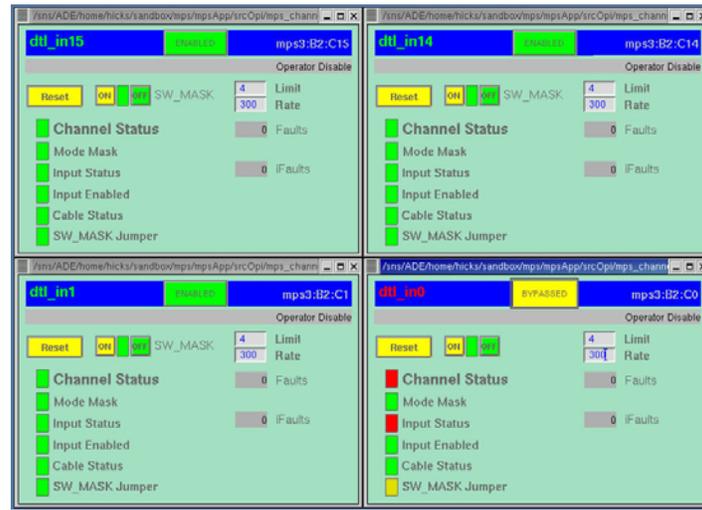
The timing system master crate was installed in the Front End (FE) control room, and is generating events – although no one is listening. The tape Back-up Server is installed and has been configured to perform automated back-ups. The Archive Server is installed and ready for archiving, and the Intrusion Detection Server is being configured. Operator Interfaces (OPIs) for the FE and “Phase 0” Personal Protection System are installed and operational, and FE IOCs are undergoing checkout. A MEBT pump down was initiated and monitored from the control room.

The FE Machine Protection System (MPS) IOCs have been installed, and installation of additional MPS hardware is underway. The MPS Driver has been ported to EPICS v3.14, and several changes to the software implemented. These include an automatic trip when N faults are detected in M pulses (see screen shot below), and an approach to reduce (from 40% to 4%!!) the CPU load. MPS Test boards and Clock generator cards have been sent for manufacturing.

Using an already-prepared FSD, the interface between the chiller control system supplied by Trane and the CF controls system was agreed and finalized.

At BNL, a final decision on the modules required for the Beam Loss Monitor (BLM) system is expected next week. Enough components will be purchased to build two complete BLM IOCs, one for DTL commissioning and one for software development. Development of IOC software and control screens can now begin in earnest. The High

Voltage power supply chosen did not withstand hands-on evaluation, and a fallback strategy to meet DTL schedule requirements has been developed.



At LANL, the CCL cabinets, including the vacuum PLC cabinets for CCL1, are complete and have been shipped. A review of the vacuum PLC code was held with vacuum engineers and LANL project engineers. Improvements were made to the oscilloscope application, and an initial layout of controls equipment for the SCL was completed.

Operation of the Ion Source Hot Spare in the RATS facility now uses the same EPICS version as will be used at the site. The display manager still has to be updated to the SNS standard.

The first phase of testing the Main 4.5 K cold box turbine PLC logic with the EPICS simulator screen was successfully completed. Matlab was used to independently verify all PLC turbine control calculations. The simulation is fairly good. Sudden changes in operating parameters cause appropriate responses in the logic, including shutting down the simulated turbine. Some minor changes to the displays remain to be made.

Installation

This week we were able to install the FE Beam Current Monitors and leak check the connections. This makes us ready to install missing quads first thing next week.

We made progress on FE electrical systems and are ready to turn on the outlets on the MEBT and RFQ rafts and power to racks FER10,13, 20-25. Racks FER14-19 will follow very shortly after.

The MEBT emittance scanner and beam stop diagnostic assembly was rough positioned and is ready to be attached to the MEBT.

A long-term stability test of the DT Stabilizer Shroud "Can" concept is in progress. A drift tube was installed, aligned, and locked in place on Wednesday (Sept 11). Early next week its position will be rechecked to determine if any motion has occurred. The o-rings for this test were only lubricated with alcohol.

All tank sections for DTL tanks 1 and 3 have been successfully leak tested and no detectable leaks were found when the tank was bagged with helium (leak detector sensitivity $< 1 \times 10^{-9}$ Torr-l/sec). Oversize o-rings have been received and some testing done to determine if this will solve the DTL end flange leak problem. This problem has been attributed to lack of compression with the standard 0.275" cross-section o-rings. O-rings up to 0.290" cross-section have been tried and are leak tight. This is the largest o-ring that will fit in the existing o-ring groove.

The brush-plating test of an o-ring groove was completed this week at the vender's facility in California. The plating was within specifications.

Completed shortening and re-terminating the cables between three sets of circulators and the Temperature Control Units (TCUs). Ran cables for the waveguide window temperature sensors (RTDs) from the tunnel to the RF cooling carts in the klystron gallery for DTL1 & DTL2 systems.

Used temporary AC power to power up PLCs in the RFQ, DTL1 & DTL2 transmitter racks. Verified rudimentary PLC operation. Manually input appropriate (vendor derived) klystron filament voltage and current constants into transmitter EEPROMs.

Loaded eight additional detector cards into the Arc Detector chassis and connected the fibers from the RFQ windows.

28 Heliac cables for measuring field strength, forward and reflected RF power were pulled between the RFQ and the LLRF rack in the gallery and terminated.

We have laid, and mounted the Rack Base in preparation for DTL-Row 5. All racks are in the Klystron Gallery and are staged next to the Base for Row 5, to be installed, however tomorrow Fri. 13Th there will be a major power outage, and all of the site including the Gallery, will be in Darkness. Furthermore the Skilled Craft/ Davis Bacon are off on Fridays, so there won't be much action until Monday or Tuesday for getting the racks completed on the base for row 5. All Rack Bases have been fabricated for the DTL Rows one thru seven now. In the Klystron Gallery, hopefully by the end of next week or thereafter, Row six and finally Row Seven/ The last of the DTL will be installed!

All racks for DTL, Row 01, 02, 03 and 04, are in permanently in place and internal electrical installation work continues. The Internal Wiring/ Cross Connect Blocks for the AC Distribution in Row 1, 2, 3, and 4, still need some work as we are now missing two Electricians to complete the installation. It is getting there though.

Accelerator Physics

Operations Group

ARR Process underway –

- Held telephone conference yesterday with ARR Committee -
- Committee visit scheduled for on-site meeting the week of October 14
- The agenda is being written
- Les Price agreed for his closeout to be the visit closeout on Oct. 17
- Setting up a website for the review
- Finalizing review documentation for the ARR
- On schedule with Training Courses for Operator Certification and Subject Matter lecture in the Operations Training Program
- Underway with Review and Sign Off process for - Operations Procedures Manual for ARR.

Two interviews this week for the Operations Coordinator. One interview next week for Chief Operator

Attended IBB Meetings with Craft Labor representatives at ORNL pertaining to ASD Operations staffing

Ion Source Group

All group members continue to participate in the operator training.

Paul Gibson and Robert Morton continue to participate in the installation of the front end.

The hot spare stand is now increasingly controlled from the 4-screen control station next to the big blue box. This week John Munro loaded the same EPICS version that controls the front-end, an important step in the effort to have a real duplicate. He successfully controlled the Hydrogen gas flow and the 13.56 MHz RF.

The 4-segmented lens 2 of the LEBT broke into pieces during an attempt to remove excess glue. New ceramic pieces have been acquired and the lens 2 is re-glued.

Yoon Kang found a bad cable in our RF setup while QEI found a loose potentiometer shaft coupling, both of which are likely to have contributed to last week's mishap. QEI has repaired the pulse generator. Yoon Kang tested the RF amplifier dumping up to 20 kW into a dummy load.

A list of ion source and LEBT checkout and conditioning procedures have been assembled and submitted for coordination.

A purchase order has been initiated to start removing the broken fast disconnect switch from the DTI 65 kV supply.

Robert Welton submitted his manuscript for LINAC 2002.

Mechanical Group

Magnet Systems

We have continued with measurement efforts on 12Q45's as well as working out water leaks and coil clamp permeability problems.

The first article SRF 8Q35 was delivered and we are setting it up in the measurement bench.

Vacuum Systems

RF Group

ASD HVCM personnel spent the majority of the week at Dynapower helping LANL personnel finish production of the first article HVCM. We completed the safety enclosure, and made considerable progress on the remaining subsystems. We fully anticipate shipment of major components requiring interface to the facilities, thereby expediting installation activities. Also, based on observed progress, we expect shipment of the remainder of the first article by the end of the month.

Electrical Systems Group

Prepared Work Package for FY03

Reviewed bid proposals for ring extraction kicker power supplies.

Discussed power supply water fitting specifications in televideo conference with BNL.

Met with CF group to discuss this week's site outage and transfer from temporary to permanent power.

Survey and Alignment Group

Cryogenics Group

The warm helium compressors and the Kinney pumps were moved into their final locations in the compressor room (photo). Forming for the grouting has begun.

Proquip, the vendor for the 4.5K coldbox is now working a 7-day workweek to complete the cold box by the week of Oct. 7. Jlab has been receiving daily updates on the progress. At the current time Proquip is running approximately 2-3 days behind schedule, mainly because of initial equipment setup.

The vacuum skid/south wall valve rack, pressure test manifold, loose field valving and transfer line supply can bayonets will be shipped to SNS Monday 9/16/02.

Cold box room piping installation design package will be released to SNS on 9/13/02.

Work on the purifier, LN2 transfer lines, recovery compressors and the 2k coldbox continues at JLAB.

The 3.5-inch clamshells in the tunnel have been welded on the upstream supply transfer lines and leak checking has started.

Two supply and 2 return transfer line modules are ready for shipment to the tunnel on Monday 9/16/02

Jeffrey Saunders, the fifth technician for JLab has started this week. Jeffrey along with Brian Hannah and Terry Pennisi will report to JLab the week of 9/30/02



Beam Diagnostics

ORNL SNS Beam Diagnostics Progress Report:

Craig Deibele worked on the electron collector, and filter. He tested the first prototype electron collector. The S12 on that proved that we could eliminate the mesh and still have excellent RF isolation on the cup. The fast faraday cup effort continues. Craig is also spending 50% of his time on DTL warm model tuning.

Wim worked on LabView template, design of laser-wire DAQ and slides. He also prepares spec list for memory Interface and spec list for rack-mountable PCs. Warren is working with the Mechanical Engineering group on Laser-wire optics, beam-boxes and Laser diagnostics. Arrangements of the RATS laser room are coming along very well. We expect to have the Laser room ready next week.

Craig Swanson is working with Joe Meade at BNL on ETC PCI board schematic. He is working with Lumagraph in making sure they have no more issues with getting the board layout done. We need to obtain SNS document numbers for this device.

Dave Purcell is working on the diagnostic Web page, documentation database work; D-plate and DTL rack equipment layouts and cabling.

Tom and Saeed are working on ASAC presentations. The dry run for SCL laser-wire was held on Thursday. LANL, BNL, SLAC and ORNL discussed the Laser-wire design and the short-term goals. The ME group should be commended for their extra-ordinary hard work and support of the Laser-wire design.

LANL SNS Beam Diagnostics Progress Report:

BPM pickups: We've received the 13 right-angle DTL SMA vacuum feedthroughs welded into the inserts at Meggitt. We can now proceed with fabrication of the DTL BPM pickups. Five more feedthroughs will be ordered to replace the previously damaged ones. We are now testing and mapping the new CCL BPMs. Some bad electrical connections have been found between the vacuum feedthroughs and the electrodes on 4 units, probably due to low contact pressure between the electrode and the feedthrough. These units have been returned to ISYS for repairs.

BPM electronics: Work continues to stuff and test the new digital front end PC board. The board is now ready for the FPGA chips. On 12/Sep/02 4 four BPM electronics chassis were shipped to ORNL for FES re-commissioning. Two new PCs are being prepared to allow development to continue. Design modifications continue on the analog front end (AFE) at Bergoz.

WS actuators: The beam box for the wire scanner in the CCL to SCL transition region is being redesigned at the request of JLab to use conflat flanges and seamless tubes. Work continues at Huntington on the wire scanner actuators.

WS electronics: On 11/Sep/02 4 ea. WS electronics units were shipped to ORNL for FES re-commissioning.

CM: Work continues to completely pot the DTL transformers, which presently exhibit excessive out-gassing.

D-plate: Fabrication continues at local machine shops. The steering magnet winding by LANSCE-2 should be completed 13/Sep.

ED/FC: Fabrication of the prototype HV bias PC card is complete.

BNL SNS Beam Diagnostics Progress Report:

1.5.7.1 BPM: Discussions of BPM sum/difference mode impedance match continue. TDT measurements are in progress. PCI interface card design effort continues. Work continues on baseband AFE.

1.5.7.2 IPM: Evaluation of cost implications of electromagnets continues.

1.5.7.3 BLM: Prototype circuit evaluation and testing for interface with the MPS continues. Design effort continues on the analog front-end chassis, including back-plane, module layout, power supply choice, and interface methods with the controls IOC. Met with SNS controls to discuss the choice of HV bias, digital input, digital output, ADC, and DAC VME boards. We expect data on the Far West Technology, Inc. detector prototype filled with argon soon.

1.5.7.4 BCM: The MEBT BCM Electronics were shipped to ORNL. Software upgrades are still in process. Completed the weldment for the prototype HEBT BCM.

1.5.7.6a Carbon Wire Scanner: Integration of fork assemblies, cables, connectors and motors/encoders to the Huntington feedthrough/actuators is in progress. Reworking the flange (which mates with the LBL beam box) of every spool piece. The opening on this flange was enlarged to allow faster pump out without realizing that the hole now is larger than the width of the rectangular o-ring on the beam box. Completion of spool piece rework is estimated to be Tuesday (9/17). Scanner assembly shipping will begin at that time.

1.5.7.6b Laser Wire Scanner: H-minus will not be available in the AGS Linac until after the New Year. This impacts plans to test the electron detector. We are investigating the possibility of dedicated time in November. Finalized on the location in AGS Linac HEBT line, with existing BPMs and carbon wire scanners available. Expediting with ORNL for detailed dimensions of the SCL beam-box. Continuing evaluation of the laser welder option.