Accelerator Systems Division Highlights Ending September 19, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)
Accomplishments This Week: (1) 402.5-Mhz, 2.5-MW E2V klystrons: We finished the 96-hour heat run for S/N 8. The factory acceptance test dates for the three remaining 402.5-MHz klystrons are in Oct, Dec., and Jan. (2) 805-MHz, 5-MW Thales klystrons: The Thales representative is still at LANL working with us to solve the arcing problems in the output. This week we

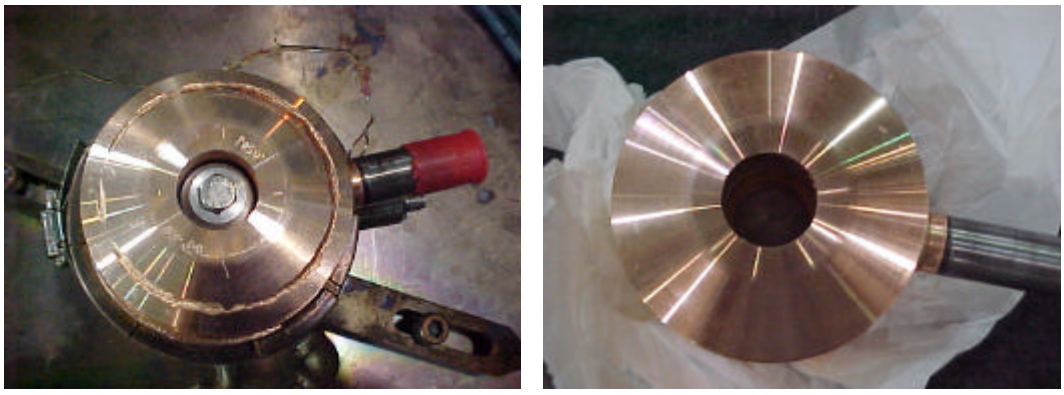
- replaced the copper gasket near the alumina window,
- replaced all the rings sealing the SF6 at that joint,
- moved the Kapton window 16 inches farther from the klystron,
- installed air cooling on the straight section in the lead shielding,
- faced off the flange between the miter and taper, and
- installed thermocouples to measure waveguide surface temperature.

After these changes we got up to 5 MW with a 1.1-msec pulse at 60 Hz. We then got circulator load arcs and klystron window arcs. After replacing the Parker seal between the straight section and the miter, we ran again to 5 MW before arcing started in the circulator load. (3) 402.5-MHz RF windows: We still need to do the sliding short test on the windows. (4) RF transmitters: We reviewed and approved factory acceptance tests and heat run results for SC transmitter S/N 9.
Concerns & Actions: The 5-MW Thales klystron and associated components remain our biggest concern. In addition to the actions listed above, we are currently making changes to the circulator. We are moving the air-cooling exit port closer to the circulator load and exchanging the air inlet and exit ports on the waveguide between the klystron and circulator, putting the air inlet near the Kapton window.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)
Accomplishments: (1) Operations: We supported the 5-MW, 805-MHz klystron operations using the prototype HVCM, and we supported the heat run of the 2.5-MW, 402-MHz klystron using the production HVCM. (2) Production: We witnessed the successful acceptance tests of last two 80-KV HVCM systems at Dynapower this week. The plan is to ship these units to ORNL by the end of next week, marking the successful completion of this major production effort and critical SNS deliverable. Dynapower will develop a schedule for the manufacture, test, and delivery of spares that are listed in the various contracts. (3) Modeling: New modeling suggests ripple inherent with the design is caused by differences in IGBT switch timing. A solution is achievable by addition of 20-kHz and 40-kHz harmonic traps, which do not impact pulse parameters or klystron fault energy. We are working on implementing the trap designs.

DRIFT-TUBE LINAC (WBS 1.4.2)
Accomplishments – Tank 2: We are likely to be able salvage most of the group J's using a quickly developed cosmetic weld repair pass (0.300-inch wide by 0.120-inch deep). A repair weld on one of the DTs (see photo below) is being sectioned to look for any subsurface issues. Two group J's will have to be rebuilt; on-hand spare parts will be used, and diverter brazes will be attempted next week. All group K's have caps welded and will receive cosmetic pass. All group M's are at cleaner. Last two group-L magnets were being loaded this morning. The Tank-2 waveguide is being shipped back to Los Alamos for a water flow test.

Fig. 1. Tank-2 drift tube with cosmetic weld (left) and after machining (right). Although the surface looks good, we are sectioning this drift tube to ensure that no voids exist below the surface.



Tank Four: 12 units went to plating on Thursday. Two and a half of the last four units to be profiled are done. We expect to have drift tubes at Los Alamos by mid-next week for final processing – there is a possibility that we will be start shipping drift tubes to Oak Ridge the end of next week.
Tank Five: Group-E drift tubes have been repair-welded and leak checked; awaiting visual inspection at Hanford and will ship to CMI tomorrow. Group-F's cap welds are complete and water-channel repair welds are underway. Group G's are at CMI for water-channel weld repair machining preparation; will ship back to Hanford on Monday.
Tank Six: All cap welding complete; being shipped to CMI tomorrow for water channel weld repair machining preparation.
Tank Three: The waveguide is at CMI for final machining.
EMD and BPM DTs: There is another welding campaign scheduled at Sciaky next week. There are four leaking EMD DTs (water-channel to magnet-cavity leaks), and further attempts will be made to repair these units. If these repair efforts are not successful then rebuilding of the units starting with a salvaged stem and upper yoke is likely to be required. BPM DTs made thus far are not leaking. Tooling and procedures are being revised to detect possible EMD DT leaks sooner in the welding/manufacturing process. Some EMD and BPM DTs are likely to go to vendor for stem plating the week of September 29. Protective lead covers are being made for the EMD and possibly also the BPM DTs.
Concerns & Actions: There is a conflict for stem-plating resources; we are checking into additional vendors. We are also considering engaging LLNL e-beam welding as a back up to ESCO if problems resurface. Additional Los Alamos personnel (designers and engineers) are being sent to ESCO to help monitor work there.

COUPLED CAVITY LINAC (WBS 1.4.4)
Accomplishments: (1) Module-1 tuning: This was a good week for module tuning activities. The bridge coupler machining was completed for installation of the screw tuner and nose machining to get things within range. Also the physics crew, including SNS staff, was making progress with the bridge-coupler coupling cell tuning in parallel with the coupler machining (see photos below).

Fig. 2. Screw tuner on bridge coupler (left) and tuning underway at ACCEL (right)

(2) Intersegment hardware: ESCO has nearly completed all of the non beam-box units and will ship everything in that category next week. Module 1 parts come to LANL and others go on to the SNS site. Magnet leg machining is underway in Albuquerque, and we will be receiving parts to begin hardware assembly here at LANL shortly.
Concerns & Actions: We have received updated module delivery schedules from ACCEL, and we are digesting that data now. We are concerned about the delays in starting Modue-2 segment brazing – we will discuss these issues in

PHYSICS & DIAGNOSTICS (WBS 1.4.5)
Accomplishments: (1) BPM pickups: The four BPM drift tubes for DTL Tank 2 were checked for continuity following welding – all units checked OK. (2) BPM electronics: The four PCI cards that were brought back from ORNL were repaired and sent back to ASD this week. The failures were caused by trace errors in fabrication of the PC boards and do not require a design change.
Concerns & Actions: We submitted the advanced procurement plan for the HEBT, Ring, RTBY, and Dump wire-scanner actuators to ORNL as part of the ASD-mandated closeout of LANL procurement activities. Only the first articles (already on order) will be received and tested at LANL.

ASD/JLAB: Cold Linac

ASD/BNL: Ring

Talks for the ASAC Review were completed, reviewed and submitted to the Project Office.

Tesla shipped three additional magnet stands to SNS/OR. The stands are for the 21Q40 HEBT magnets. ETA is October 8th.

Installation drawings showing coordinates of the HEBT momentum collimator are being developed, as requested by J. Error.

Vacuum chambers for Ring collimators #2 & 3 and the injection dump septum magnets were received from SDMS. The collimator vacuum chambers will be TiN plated at BNL before being returned to SDMS for final assembly.

We have been notified that the final shipment of magnets from BINP is stalled in NY harbor awaiting "special" inspection by US Customs.

An engineer will visit Oak Ridge Tool & Engineering next week to observe production progress on the outer shielding for the momentum collimator.

Preparations are underway for shipment of a complete RF System to SNS/OR. The scheduled departure/arrival is Oct. 1st.

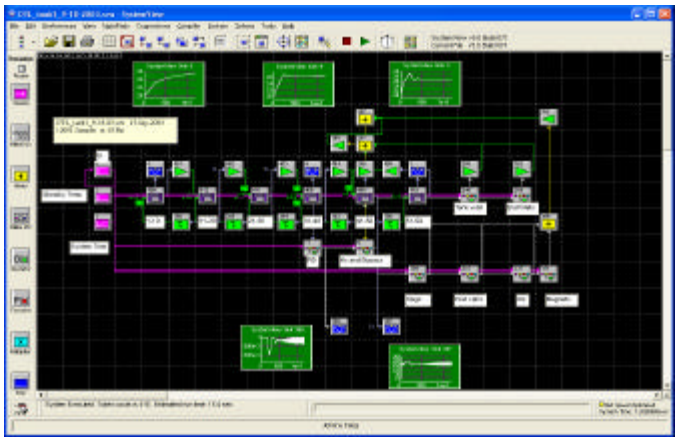
Technicians are working on the assembly of our first Ring doublet (quads).

Controls

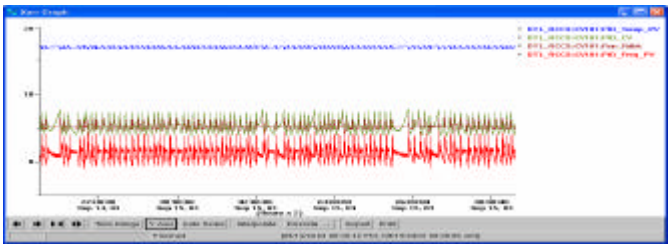
This week was spent primarily in support of the current DTL1/D-Plate run. The control system has run reasonable reliably, however electromagnetic interference (EMI) continues to be a source of down time, affecting primarily Machine Protection System (MPS) inputs. Most noise appears to be from the High Voltage Converter Modulators (HVCMs) as waveform pictures show the switching frequency from the closest HVCM and the same characteristics are seen "wandering" through the scope from the other HVCM. The switching frequencies are not locked. The problem is most prevalent on inputs originating from Programmable Logic Controllers (PLCs). The fix has been to boost the current to the MPS optocoupler and/or add a filter capacitance across the MPS input. The inputs from the MPS interface chassis have not been affected. A new interface chassis with better filtering and shielding is under consideration as a possible solution.

The second major operational issue related to the control system is the performance of the Resonance Control Cooling System (RCCS) which provides the frequency control for the DTL and CCL. The system has not performed reliably, and does not regulate adequately over the necessary frequency range. A workshop will be held next week to discuss possible solutions to this problem. Meanwhile data is being gathered using both the existing system and a model used in its design at LANL.

LANL's version of the dynamic thermal control model for DTL tank 1 has been ported, installed and tested on the ORNL computer with an evaluation copy of System View software (see below). A validation process has begun since the model was created before the final design review. Some assumptions and constants in the model will be changed to agree with the installed reality of DTL tank 1.

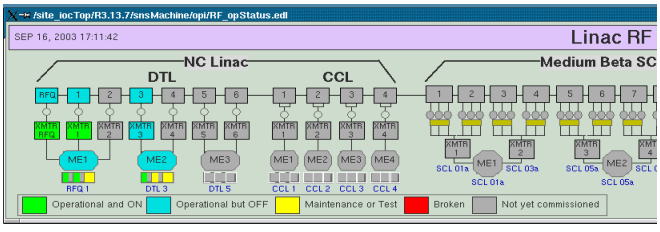


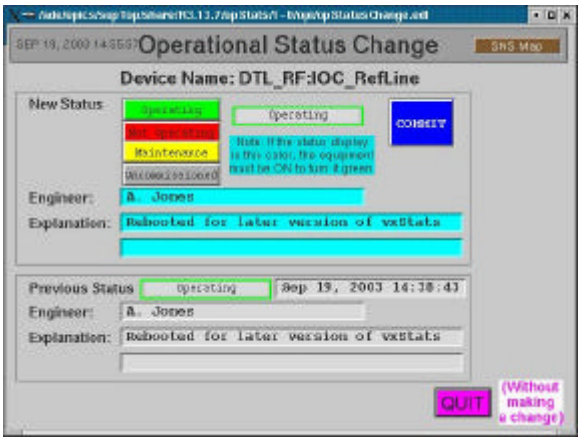
Temperature control for the tank 1 is pretty stable under 0.5 degree C. One degree change is about 6.5 kHz resonance frequency shift on average.



A full suite of differential beam current monitors was installed late in the week. This gives differential MPS inputs from MEBT Beam Current Monitors (BCMs) 02 and 11 and DTL BCMs 200 and 248. The slow integrator gain stages have been modified to operate at losses of between 3% and 30% of 38ma.

This week, the new RF operations summary status screen was deployed (below) and Low-level RF IOCs were added for DTL4 and DTL5. The infrastructure for IOC operations status screens was added but not yet deployed (second illustration).





Data has been collected on the line characteristics on site. Several large frequency "steps" or large slew rates have been observed. The potential problem with these large deviations is loss of line lock when running at low slew rates. Although this is not a problem for present operation, it will be a factor with the neutron choppers.

Four Chipmunk radiation detectors were delivered by the vendor last week (four out of ten on this order). Three of the units passed the on-site acceptance test. One unit did not function correctly and will be returned to the vendor. (Fourteen units on hand, five installed, four spare, five to be calibrated).

Procurement of the rack equipment for the CHL Oxygen Deficiency Hazard (ODH) system is complete. Assembly of rack components in the lab is 40% complete. A technical design review of the rack drawings was completed and the drawings were updated based on their suggestions. Rack drawings were reviewed and are completed and ready for approval. Installation work for the field devices is continuing in the warm compressor area. Device and conduit installation is 60% complete in the warm compressor section of the CHL. Drawings for Linac ODH control racks are approximately 50% complete and 30% of the ODH cabling has been installed in the LINAC.

There is continued progress on the PPS Phase 1 system for the Linac. Cable pulls to BSSs in the LINAC tunnel are continuing. Cable pulls to junction box at LINAC north side emergency exit is complete. Locations for Chipmunk interface panels #2 and #3 have been determined in the Klystron gallery. Terminations are complete in the first Klystron rack. A sweep simulator panel has been built that will be used in implementation testing of the Phase 1 system.

First results from the SNS event-link monitor were achieved at BNL. The monitor was demonstrated to correctly detect events occurring on the event link. This preliminary software will be checked into CVS by the end of this week, and made available to ORNL next week.

The new "PLC force" standard was applied at BNL to the beam dump PLC logic and EPICS database. After successful tests, the results were checked into CVS.

Installation

Craft Snapshot 9/16/03

ASD craft workers	60.0
Foremen, ES&H, etc	12.0
Less WBS 1.9 etc	9.0
Less absent	1.0
TOTAL	62.0

The RATS I moved close to completion this week. Due to hurricane in Virginia the third medium beta cryomodule was not shipped. It will be shipped w/o 9/22/03.

As a result of the third cryomodule shipment not occurring this week, the prototype cryomodule will be the last item moved from RATS I to RATS II. We need the JLAB fixture to move the prototype.

Discussions where held with AIMSI senior management to reorganize the management of DB crafts on the site. Another meeting will be held with KJ/AIMSSI on Tuesday 9/23/04. The objectives of this reorganization are to increase the control of ASD Technical Groups and improve installation efficiency.

Accelerator Physics

Operations Group

Ran Commissioning Shifts on DTL Tank 1

Reactivated the Beam Accounting Software

Interviewed a Chief Operator Candidate

Participated in discussions on TVA Interruptible Power Rates

Participated in discussions of the SNS CAD systems

Ion Source Group

Currently the front end ion source is running fine. However, RF matching requires the source to run with about 50 kW, much above the typical values of the past. This is confirmed by a 600 A antenna current. This concern drives us to repair the RF amplifier on the Hot Spare Stand as quickly as possible. Yesterday we placed an order with "Surplus Sales of Nebraska" for two 15 kV 11 uF capacitor to replace the twelve 2 kV 45 uF that were installed as two rows of six in series. The elimination of the voltage dividers required for the serial installation and the higher voltage rating significantly increase the robustness regarding adverse voltage conditions. The 27% lower capacitance is no problem during commissioning and can be addressed later.

High voltage systems are designed to withstand occasional sparks. Less common, but equally important, is the prevention of secondary arcing within the system because it is normally much more susceptible to arcing. Secondary arcs can be prevented with low impedance interconnections and spark gaps, neither of were found in the FE ion source system. Over the period of the next few maintenance periods we will add low impedance connections between the ion source and high voltage deck, and the matcher. Later we will add spark gaps at the source, the matching network, and at the output of the RF amplifier. These measures should substantially reduce the problems we have encountered with the RF amplifier and the RF connections.

Survey and Alignment

This week the S & A Group fiducialized four DTL End walls.

The fiducialization of all CCL Quads currently here was completed.

Recorded a number of measurements for the design department to facilitate the installation of the laser optics diagnostics system in the HEBT.

Continued other ongoing HEBT work including:

12Q45 magnet alignment in HEBT area.

Preparation of data for layout of HEBT Collimators

RTBT / RING / HEBT Floor Elevation Update

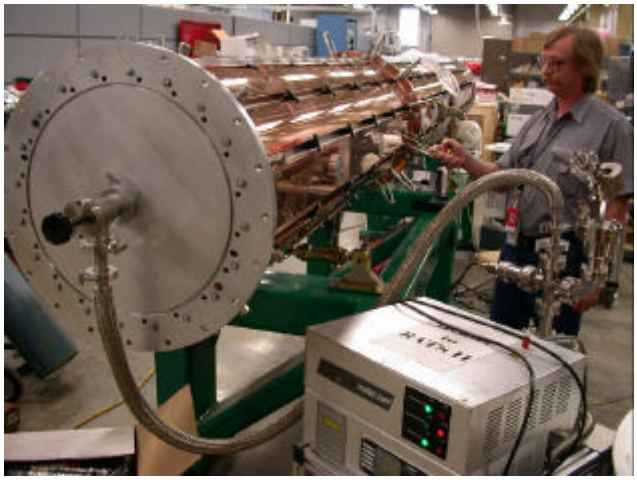
Elevation run through Target Beam Line II area.

Mechanical Group

The endwalls for DTL-2 and DTL-4 have been fiducialized in the FE building. The taut wire system and laser tracker are used to find the magnetic center of the endwall and relate it to fixed fiducials. Fiducialization of DTL-5 and -6 endwalls has begun with each endwall taking about 1 day to complete.

DTL Endwall Fiducialization

Leak testing of DTL-2 is in progress. A small leak is suspected but has not yet been found. This effort is expected to be completed next week.



DTL-2 Tank Leak Testing in the FE Building

Water Systems Installation

Installation of SCL-ME1 Piping from TRCC Cart #2 continues.

Installation of piping to the DTL4 Klystron started.

The Klystron body copper cooling lines on DTL5 and DTL6 were modified.

Installation of piping to the CCL-1 HVCM continued.

The RING magnet DI water headers were drained to install low point drains.

Magnet Task

This week we mapped three DTL EMD's. Two were received from Milhous after re-work. They checked out okay and were sent to LANL. The third magnet was welded into a drift tube, #1-55. This magnet had incurred a short to ground during e-beam welding. We mapped it and compared to previous measurements which showed that the magnet is still functioning properly. After measurement, the ground fault disappeared. I'm sure it will return. If this magnet is installed, the power supply will have to "float". The assembly is being returned to Sciaky for further welds.

We also mapped another 27CD30 dipole and started measurements on another CCL Quad.

Electrical Group

Operation of DTL-ME1 and –ME2 progressed without incident this week. Early stages of operation of DTL-ME3 into two 2.5 MW klystrons began this week, with anticipated high average power operation of this HVCM to begin next week. CCL-ME1 checkout proceeded as far as possible without cooling water terminations complete (should be complete early next week). Continued pre-installation work on CCL-ME2. Installed SCL-ME1 in oil tank, and expect to fix safety enclosure and install cap racks on Monday. The RFTF modulator ran at 420 kW into the beamstick, which represents the highest average power operation of the HVCM at ORNL to date. The positive MEBT chopper pulser unit experienced a discharge, probably due to a water leak, and took out the current-viewing resistor array. The system was quickly back on-line with replacement of the spare (anti-chopper) unit.

Tested 3 SCL Quadrupole magnet power supplies and installed 2. Tested 18 additional SCL corrector supplies.

Repaired one of the 2 front end quadrupole magnet supplies that failed last week.

The last of the SCL quadrupole magnet power supplies were delivered this week. All linac power supplies have now been delivered.

HPRF

A 402.5 MHz 2.5 MW klystron was installed in the DTL4 RF Station. The collector cooling pipes were connected to the cooling cart and in series with the klystron in the DTL3 RF Station. This permits resumption of the high power testing of the DTL3 tank. Body water connections remain to be fitted before testing can start on the DTL4 klystron.

With their RF outputs blanked off, DTL 5 & 6 klystrons were brought up to power as diodes. This will facilitate the testing of the ME3 HVCM and accumulate hours to gauge longevity.

IP addresses were installed in RF Transmitter 2, 4, 5 & 6 PLCs in preparation for EPICS control and readout.

Pam Gurd installed a new RF Status page to reveal the condition of the HPRF Systems for the entire Linac at a glance. Detailed information about specific systems can be gained by clicking on the equipment symbol in question.

LLRF

Cryosystem Group

Beam Diagnostics