Accelerator Systems Division Highlights Ending September 10, 2004

ASD/LANL: Warm Linac.

ASD/JLAB: Cold Linac

ASD/BNL: Ring

All purchase orders for WBS 1.5 have been put on hold to assure that we remain within the authorized BA. Additionally, all credit card orders for the WBS 1.5 Ring System, travel (foreign and domestic) and truck shipments from BNL to SNS/OR are on hold. We will continuously review the BA situation thru September and make changes on a case by case basis.

Three IE Power supplies were received at SNS/OR this week. They were: (1) 800V, 1400A pulsed power supply; (1) 4000A 18V DC power supply and (1) 1300A 125V DC power supply (a first article).

Applied Power Systems delivered four (4) extraction kicker PFN assemblies to SNS/OR. Included were HV modulators, auxiliary systems and vendor documentation (units #8 - 11).

We have been advised by SDMS that the Ring primary collimator is on schedule for shipment from France on September 17th. ETA at Charleston is October 3rd; ETA at SNS/OR is October 11th.

PCR RI 04 015 has been submitted for a second (spare) chain-saw foil drive mechanism. The other three PCRs that are on-line awaiting approval are the BCM, 36Q measurement, and the 36Q ceramic breaks.

RF straight section: The first of two doublet assemblies is being pre-surveyed for magnet assembly.

RF straight section: The QMM and Tune vacuum chambers are set-up and ready for TiN coating.

The #2 injection dump septum magnet has been pre-surveyed. The magnet was subsequently split and the (modified) VC chamber installed. This assembly will be added to the injection mock-up beam line next week.

Magnetic measurements on #1 injection dump septum magnet (with bumps) were started this week.

Modified “bumps” for Chicane 1 have been installed on the magnet. A new set of measurements will commence on Monday.

Diagnostics Group is working on assembly of the BIG chamber.

Charlie Pearson reported that a pin-hole was discovered in the outer casing of a mineral insulated 36Q85 coil; likely the cause for low resistance to ground. After some initial rework, the ground resistance has increased from 250k to 5 mega-ohms.

Design Room: A fast valve support stand is being detailed for use in both the HEBT and RTBT; the design of 12” and 14” drift pipes downstream of extraction kickers continues; the Ring arc valve support design is complete; design of the straight section ion pump mounting is underway.

A fifth extraction kicker magnet is being TiN coated today; nine more to go.

The specification and RFQ for heating jackets for the extraction kicker chambers has been prepared. The order will be placed when funding is available.

RTBT: Fabrication of the 21cm drift pipes continues. The drawings of the Q26 chamber and the 21cm drift pipe downstream of the Lambertson have been released. The design of the Q27 - Q30 chambers is pending a final lattice revision.

M. Hemmer, M. Plumb and D. Raparia are working on lattice position of the Target centerline for inclusion (reference position) on our RTBT Installation drawing.

Work continues on a test set-up to measure the overall impedance of one complete extraction magnet assembly (coated ferrite magnet in vacuum chamber) with its PFN. Our aim is to have system measurements complete in time for ASAC.

The SNS shipping container with RF anode module, RF anode rack, Danfysik 8000 PS, RF electron tube and the long injection kicker magnet assembly is on hold due to spending restrictions. The new ship date is October 5th.

Work is underway to define budgets, plans and BA for FY05.

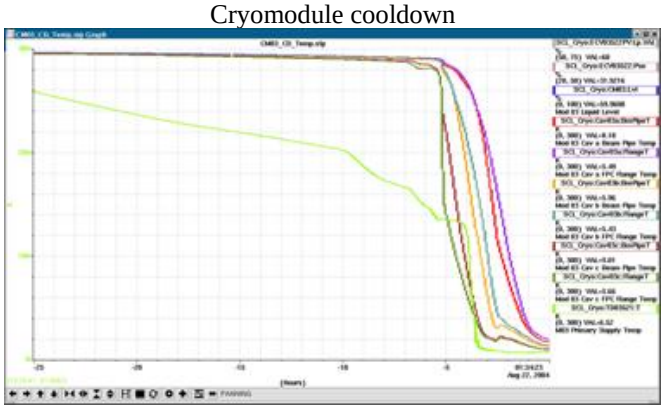
Controls

Considerable effort went into preparing a BA plan for FY05. This was presented to project management at the end of the week, and will be developed further next week.

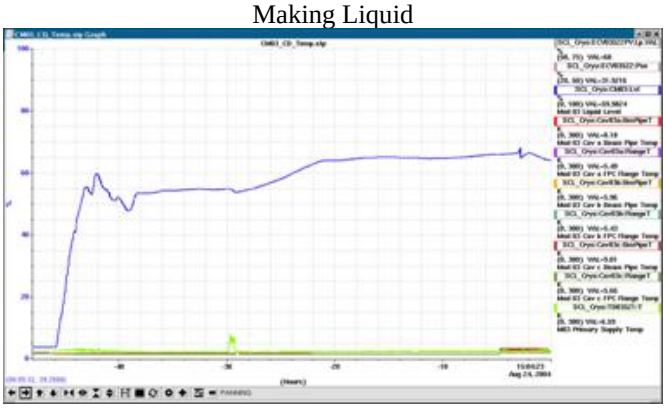
The week was spent primarily in support of the DTL/CCL commissioning that started on Tuesday. The control system performed reasonably well, with some problems operating the MPS and Timing systems. (See abbreviated list at the end of this report.) As in the past, operations could have been more efficient with better designed overview screen.

At the same time as beam commissioning started for the CCL, the controls team continued to support the first tests of a cryomodule (MB3), culminating in the successful introduction of RF power into three cavities together. This was a good week for the cryo system. The ICS functioned properly throughout the cryomodule commissioning. Several graphs are shown below.

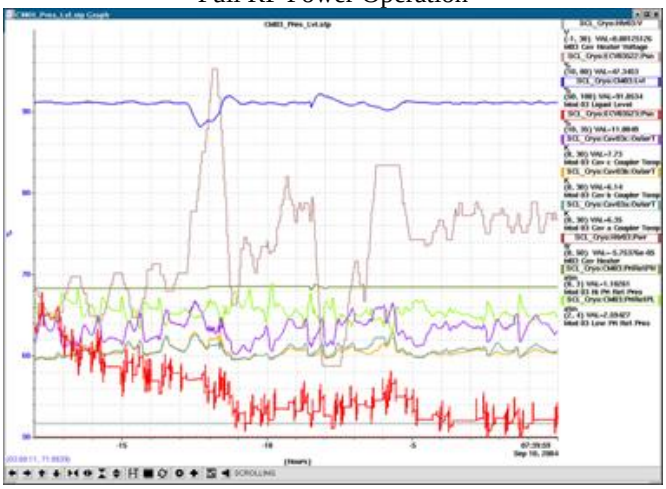
Cryomodule cooldown



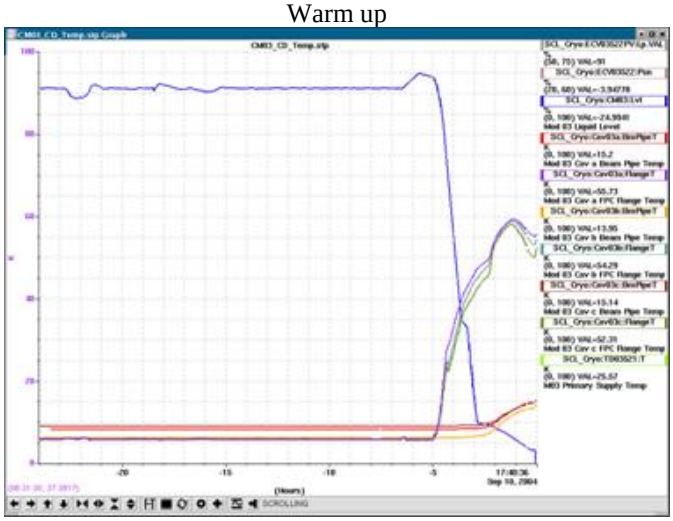
Making Liquid



Full RF Power Operation

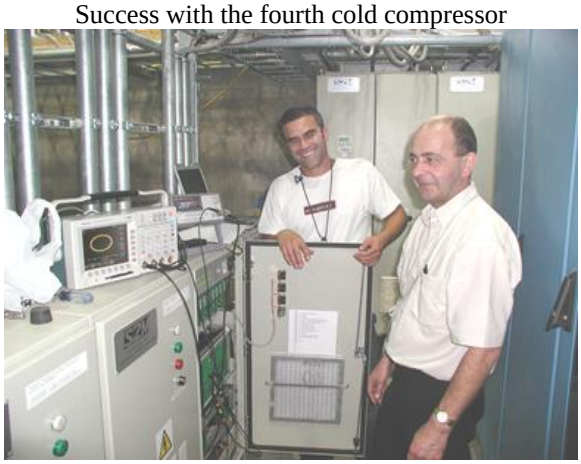


Warm up



It was also a good week for the Cryo Crew. ICS personnel supported the installation and testing of the replacement feed through connectors for the 2.1 K Cold Box Cold Compressors.
Replacement Feed Through

Success with the fourth cold compressor



The last of the CCL magnet maps were received from the magnet measurement group and installed into Oracle. The files have been exported by the SplineFit tool and installed in the CCL power supply IOCs. All CCL magnets are now using the proper magnet maps.

An SRO was submitted for installation of communication cables for SCL rack rows 18 through 22. This work represents approximately 400 hours of Davis Bacon labor. Communications cable installation continued for SCL rack rows 13 through 17 and in the HEBT Service Building.

A bug in EPICS core was identified while testing the Ring LLRF. This will be reported to the core maintenance group at the APS. Improvements and bug fixes were made to the BLM software. A test stand was set up for the ring injection kickers. The scope application developed for use with the ring extraction kickers was set up for use on the DTL RCCS system.

Support was provided for Residual Gas Analysis (RGA) on the Ion Source Test Stand.

Operational issues that were dealt with during the course of the week included:

- Changing tight loops in LLRF operating sequence that caused communication disconnect
- Reworking LLRF screens to show more system status info on one page
- Creating a set of alarm handler configuration files (again by operator request) specific to monitoring the LLRF systems
- Diagnosing spurious trips of the quadrupole magnet power supply that powers the quadrupole between DTL6 and CCL1. This supply is the only one of its type (Alpha) in use in the DTL/CCL train.
- Setting up alarm handler screens to facilitate operation of the LLRF systems

Installation

Craft Snapshot 9/7/04

ASD productive craft workers	**63.0**
Foremen (Pd by 15% OH)	5.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	71.0
Less WBS 1.9, 1.2 etc	**10.0**
Less absent	**6.0**
TOTAL PD BY ASD/ORNL DB WPs	**47.0**

Accelerator Physics

DTL/CCL Commissioning is underway. As of Friday 9/10, full beam transmission to the beam stop at the end of CCL 4 has been achieved. DTL tanks 1-5 have been tuned for proper RF amplitude and phase setpoints. Several

XAL applications are being tested and exercised with beam, included the phase and amplitude setpoint (PASTA), the BPM Viewer, the CCL delta-T data acquisition, and others.

Ring beam stability analysis based on analytic coasting-beam formulae is underway to address an ASAC recommendation. General agreement is found in comparing the analytic to ORBIT simulations of coasting beam. The simulations with real bunched-beam have no analytic result for comparison.

SY Lee and Bob Macek visited the SNS last week to discuss a possible experiment to test active damping of the e-p instability at the PSR. Calculations show that a 400W RF amplifier with bandwidth 50-200 MHz could damp the instability in the PSR.

Cryomodule medium beta 03 (serial number M04) has been preliminarily tested at 4.2 K over three nights. All systems performed flawlessly. One minor inconvenience was that one of the couplers' cold cathode gauges would not start due to too low a pressure. This inconvenience was easily circumvented and full testing was possible. The highlights of the testing are as follows:

- 4.2 K operation of up to 1.3 msec and to 30 pulses per second was demonstrated at the design gradient with closed loop controls. Operation at 60 pulses per second was not possible due to the present setup of the High Voltage Converter Modulator.
- Open loop fields as high as 14 MV/m were reached with all three cavities in operation
- Lorenz force detuning was observed at the previously noted frequency near 2 kHz and compensated for by the LLRF control system
- No cavity to cavity RF, mechanical, pondermotive or thermal interference was observed.
- Stable operation at 10 pulses per second, 10 MV/m, 1.3 msec was maintained for over 15 hours
- For a brief time, 30 pulse per second, 1.3 msec pulse length operation with closed loop controls was attained at around 13 MV/m in all three cavities
- The couplers sustained full power from the beginning and did not need any conditioning

Operations

The ARR Committee recommendation to begin commissioning DTL Tanks 4-6 and CCL Modules 1-3 was received late Tuesday morning. This was closely followed by the DOE authorization to proceed with commissioning.

We began system turn-on Tuesday afternoon. By Friday morning the beam had been transported to the CCL beam stop.

Ion Source

We have completed a thorough calibration of the Allision emittance scanner on loan from LBNL. To calibrate the deflection voltage versus the entrance angle x', we have recorded the output of a resistive divider connected a deflection plate, first the upper, then the lower. The results indicate a perfect scanning process. The recorded voltages were compared to a scan performed with a fixed voltage that was measured with a digital multi meter. The accuracy of the digital multi meter was confirmed by our quality assurance expert John Mashburn. This let us determine that 761V are applied to both plate when recording the 100 mrad data, which compares to 749 V when calculating the voltage from first principal. The 1.6% difference is likely due to a difference in the fringing field correction.

Additional measurements with the new cesium collar have yielded currents between 45 and 60 mA with RF power levels between 25 and 50 kW. The rms emittances are between 0.34 for 60 mA and 0.38 mm-mrad for 55 mA. The increased emittance is due to intense long tails most likely due to hot negative hydrogen ions being emitted from the surface and reaching the meniscus without a resonant charge exchange with a cold hydrogen atom.

Helium plasma was produced in the source to confirm the absence of electrons in the beam. No current was detected. However, a few mA of negative current was detected after the source was cesiated while operating with Helium plasma. We are still discussing whether the small signal was due to electrons, or another contaminant, such as oxygen.

After the Helium experiment we resumed to hydrogen plasma that produced ~10 mA with a much smaller emittance that waits to be analyzed. This confirms our belief that the increased emittance is due to the surface produced negative hydrogen ions.

Survey and Alignment

Magnet Task

We have mapped two more 8Q35's.

We have installed two 21Q40/27CD30's in the HEBT Beam line.

Also, during the week, Steve Heimsoth has been working on Linac RCCS cooling systems.

We are making preparations to move into the CLO and have moved some equipment.

Electrical Group

Redesign work for the SCR Controller Hard Fire PCB continued this week. Installation of SCL-ME4 continued as well, with the safety enclosure and SCR hardware in place. Work continues in this area, and we expect to be able to check the system out in early October. CCL-ME2 experienced a failure in the SCR bridge, and repair of that unit and ensuing secondary faults took 1.5 days. The bridge had a design flaw which will need to be implemented on the other SCR units during the next available maintenance period

Received 2 Ring Medium Power Supplies, the final 4000A, 18V supply and the first article 1300A, 125V supply, for a total of 44 of 77 supplies in this order.

Received 1 additional injection kicker supply, for a total of 6 of 9.

Received 4 additional extraction kicker supplies, for a total of 11 of 15.

In the linac, SCL ME2 area the last few terminations are being made.

In SCL ME-3 area, cable pulling and terminations are in progress.

In SCL ME-4 area, ac terminations and technical cable pulling is under way.

In SCL ME-5 area, half of the racks have been installed as well as the Modulator SCR Supply.

In the tunnel, terminations are complete for SCL MB 2-7.

HEBT ongoing work consists of vacuum, controls and diagnostic terminations.

HPRF

Supported NC commissioning effort.

Calibrated and installed waveguide directional couplers in SCL ME2 RF systems.

Installed cryo-coupler transitions on MB4 Cryomodule

Made baseline S-parameter measurements on SCL MB3 and supported its conditioning.

Continued mounting klystrons on SCL ME-7 HV tanks, should complete next week.

LLRF

Cryo Group

For us it was huge week.

- Production of the Cold Compressors FT's
- Assembling of the FT's on the CC's
- Test of the Compressors
- End of the Run in the tunnel

Beam Diagnostics

BPM: All BPMs through CCL have seen beam and provided phase and position measurements. Noise levels appear reasonable. Intra-pulse phase waveforms in the CCL are still being studied. A meeting to discuss production of additional linac BPM electronics was held. We decided to first understand the cause of the yield problems with the current electronics and then decide which additional components are required.

BCM: All BCMs through SCL00 and the temporary beamstop have provided current measurements. Electromagnetic interference is still significant, but the waveforms and calculated parameters are stable to a few percent. The current measured by the SCL00 BCM is lower than that measured by the beamstop. We will keep an eye on this unit to see whether the heavy beam losses in this area are affecting the signal or whether this is an instrumentation issue. The order for the balance of the linac BCM digitizers has now been approved. A prototype chassis and calibrator has been received from BNL. The calibration pulser is functioning in our lab. We are still working with BNL to demonstrate the timing receiver.

D-Box: The Emittance Scanner software is nearly complete. The mechanical engineering group is working with a local vendor on expedite fabrication of the remaining D-box components. We expect to be ready for emittance system testing as soon as beam is available.

Wire Scanners: Most wire scanners have been used with beam and noise levels are reasonable. We expect to obtain more detailed data as matching studies commence. Wire scanner electronics have been installed in the HEBT.

Faraday Cups: All DTL Faraday cups measured beam current as expected through the energy degraders. The faraday cup in CCL has yet to see beam through its degrader. Measurements of beam energy in the CCL have begun to see if low beam energy is the cause.

BLM: All ion chambers and neutron detectors are working very well, and measurements of local losses (i.e. near an inserted faraday cup) match expectations. Strong signals are also seen on the thermal neutron detectors.

BSM: The planned weekend BSM studies have been deferred by the suspension of commissioning operations.

Misc: The work packages for FY05 have been prepared and submitted. To avoid work interruption, emergency extensions for the subcontractors have been submitted. The last candidate for the engineering position has been interviewed. A meeting was held to discuss and prioritize mechanical support activities for diagnostics in FY05.