Accelerator Systems Division Highlights Ending October 15, 2004

ASD/JLAB: Cold Linac

Three cavities are qualified for the H-11 string.

H-8 and H-9 cryomodule assembly continues on schedule.

The H-10 cavity string was assembled and is being evacuated in preparation for final leak checking.

ASD/BNL: Ring

Mike Hechler and Ray Savino were at BNL to review: the injection mock-up magnet string; diagnostic chambers; foils, scrapers and drives; vacuum status; drawing status; review of assembly procedures for the primary collimator, scraper and shielding; status of 36Q85 magnet assembly; extraction Lambertson and the RTBT bend dipole; extraction kicker magnets; delivery schedule for all remaining mechanical equipment.

Chip Piller and Tom Hardek were at BNL to meet with Kevin Smith and Alex Zaltsman for the purpose of conducting tests on Ring RF cavity #4.

Ken Rust was at BNL to meet with Jon Sandberg and Bob Lambiase to view power connections for the Injection mock-up magnet string. While on Long Island, Ken traveled to APS to witness testing of the last PFN module (#14).

Measurements of the injection dump septum magnet were completed. The integral fields were measured along the H-zero and H-minus arcs as a function of magnet current. The approved bump is 1" thick, installed on the upstream end of the magnet. This magnet has been accepted by AP.

An updated delivery schedule for all remaining mechanical beam-line equipment has been sent to M. Hechler.

The next shipping container is being prepared for SNS/OR. This container will likely contain diagnostic chambers for the RF and Collimation straight sections, including: 1.5M Tune Kicker/PU; 0.75M QMM Tune Kicker/PU; (2) 0.5M Damper Kickers; (1) BCM; and assorted vacuum chambers/components.

Alpha Magnets has started the coil winding operation for the extraction Lambertson and RTBT bend dipole. Yoke steel is being machined by their sub-contractor, Allied Engineering, who reported that machining is ~60% complete.

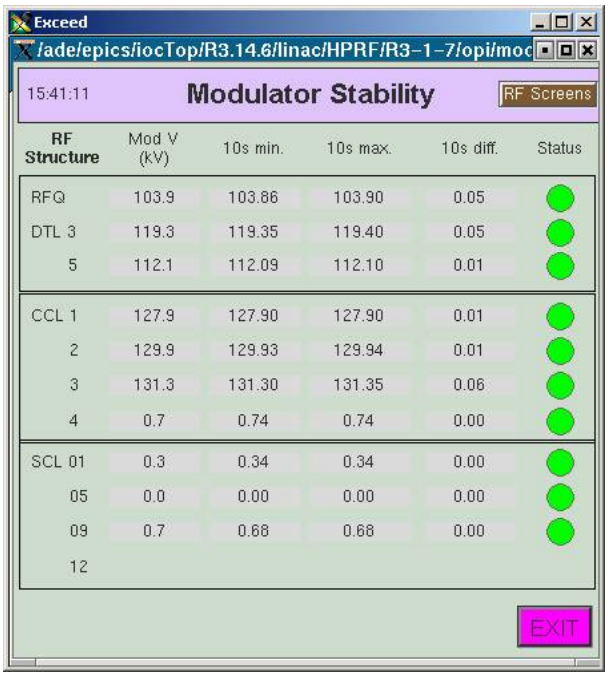
Coating of extraction kicker #7 is IP.

Personnel changes - Youngbin Leng (BNL/SNS Controls Group) returned to China.

Controls

Along with most of the warm linac subsystems, the control system performed well this week (and most of last) and contributed thereby to the satisfyingly high beam availability. Minimal changes were introduced during the brief maintenance period, and the system came back up with no difficulty.

During that maintenance period, the operating status of each IOC was folded into the IOC summary PV, so that the summary ignores any IOCs defined to be in any state besides the operating state. In addition, there is now a set of PVs that give the status of modulator stability. For each modulator, the stability is OK if the voltage has not changed by more than 0.1 kV in the last 10 seconds.



Several high-level power supply control screens were developed and tested for the MEBT/DTL/CCL dipole correctors, and functionality was added to the previously-installed magnet power supply overview screen.

In preparation for upcoming tests, remote monitoring of the SNS potable water system was set up in the ORNL steam plant control room.

Work began on a revision of the Controls Web Site, and first thoughts and a preliminary implementation were presented for discussion at the Controls Group Operations meeting. Links will be available from this website to Controls drawings in ProjectWise.

With systems running relatively reliably, the issues to address were what one would hope for – beam-related issues. In collaboration with the RF group, work began to address LLRF beam loading with the introduction of feed-forward compensation. A simple "pulse" was effective when manually placed at the correct time, but uncertainty as to the actual beam start was a problem. A fully adaptive method was then implemented in Matlab, first for amplitude only and then for full I and Q compensation. As this appeared to be effective, work began to implement the algorithm in IOC code. There are a number of issues still to be resolved.

In response to concerns about performance of the Physics applications in the Front End Control Room (FECR), the Network File System (NFS) on the Physics servers was tuned this week. Preliminary indications are of a marked improvement, but with more to do. New graphics adapters were installed in FECR OPI8 on Thursday. These adapters significantly improved the performance of the display, although a performance measurement remains to be made.

The Controls Team discussed means of problem tracking. As an experiment, the widely-used open source problem tracking software "Bugzilla" has been installed. In addition, a "Tripware" mechanism has been installed to monitor the Controls Application Development Environment (ADE) (or any other software environment) for changes.

Sheng Peng visited BNL this week for a series of meetings, including with ORNL and BNL RF staff to discuss various interface design issues; with ORNL and BNL Power Supply (PS) staff to discuss issues with the test procedure used for injection bump power supplies; with Tom Nepsee to further discuss power supply hand-off issues; with Ken Rust to identify the PS components and test equipment to be shipped to ORNL for installation, further development and test; and with Yongbin Leng to further discuss BLM hand-off issues. Time was also spent

discussing possible causes of Beckoff driver failures, enhancements to timing monitor software, and other general controls issues.

Regrettably Yongbin Leng, who has been an important member of the SNS controls team at BNL and a major contributor to the BLM systems, left the project this week in order to pursue a position at the Shanghai Synchrotron Radiation Center. We wish him well.

Also at BNL, the stripper motion control drawings are essentially finished, completing Title II design on Ring Controls.

Work continued on the LEBT Chopper prototype controller. Board 2 of 2 is in fabrication. The FPGA code is designed and the VHDL code and testbench written and simulated. The FPGA design has been bench tested. Prototype on a real system is planned for next week.

A discussion was held with users of FPGA development tools at both SNS and ORNL with a view to finding the most cost effective means of acquiring and sharing these expensive tools. For the immediate future and as an experiment, ORNL generously allowed SNS to share the use of their existing floating license at no cost. This approach will be evaluated after a few months.

Installation

Craft Snapshot 10/5/04

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	**2.0**
TOTAL PD BY ASD/ORNL DB WPs	**51.0**

Accelerator Physics

Operations

Ion Source

On Wednesday afternoon, the front end ion source was cesiated, which increased its output to 38 mA measured in the MEBT. This current is desired for many of the remaining commissioning tasks.

Tuesday evening, around 9 pm, a hole developed in the antenna of the ion source on the hot spare stand. This terminated the run that started 18.3 days before to produce about 34 mA with a 7.4% duty cycle. When subtracting the time lost during the few encountered trips, the ion source produced beam for a full 17.5 days at 7.4% duty cycle, 17 of which were with currents in excess of 30 mA. This was achieved by conditioning the source with a cold collar.

Survey and Alignment

The first actual warm section, to be installed in the LINAC, was aligned in the old magnet measurement location. This alignment determined the new position of the 8q35 warm section magnets. The warm section magnets required repositioning to make room for the laser/optics box.

S&A continued its realignment campaign of the HEBT dipoles along with the initial alignment of the QH14 quadrupole rafts.

We completed the first campaign of settlement monitoring of the compressor and compressor building located just outside the RTBT.

We performed rechecks of several of the instrument beam lines that were absent of core vessel inserts. The results were very good repeatability.

We attended one meeting to discuss the issue of alignment of guides and components on the instrument floor.

We aligned the core vessel insert stand located in the clean room of the Target Building. This stand was previously located in the Robotics lab. Upon completion of the stand alignment, beam line 5's core vessel insert guide was installed and aligned in its respective core vessel insert. This is the first core vessel insert with guide to be aligned.

Two 8q35's were fiducialized.

Mechanical

Magnet Task

So far we have mapped 26 – 8Q35's. Several of these have been chosen as pairs suitable for assembly onto rafts.

We have assembled the first warm section beam tube, magnets, and wire scanner box. Alignment is aligning this unit now.

We are also moving to the CLO. The DI system is functional so we are moving the 8Q35 mapping system to the CLO Lab.

Electrical Group

Ken Rust visited BNL to verify cable connection plans for the Ring injection straight.

Linac work this week was working on all terminations for cryo cavities MB 3-11. This work should finish next week.

Ring Service Building cable tray for the high power RF systems were completed this week and RF cable pulling started.

Corrected wiring and checked out electrical connections for the warm section clean room.

Installed chokes for variable frequency motor drives for the DTL 1 and 2 RCCS systems.

Installed replacement waveguide sections for the RF group.

Grounded ion pumps on SCL cavities in linac tunnel.

SCL-ME1 was retuned and measurement started. At full peak output power, IGBT commutation currents were ~1kA in the retuned circuit vs. the ~1.5kA previously. Also, body diode currents were lowered by about a factor of two. Due to water problems, 60 Hz operation has been delayed. We expect operation at 60 Hz is now possible with the reduction in IGBT currents. Due to other concerns with the audible noise, we will only operate there for a brief period of time, though.

SCL-ME4 is nearly ready for resistive load checkout. The LEBT chopper was repaired, but still exhibits a fault which will have to be addressed.

HPRF

CCL4 HPRF testing, into shorted waveguide complete, this includes LLRF, epics and timing, integration complete.

Preparing SCL-ME3 for integration testing in November.

SCL Coupler conditioning on going, 8 more couples to go.

LLRF

Operations: We continue to support beam commissioning of the warm linac. The recently developed Auto-Run sequencer greatly simplifies turn on of the RF systems.

Development: We demonstrated adaptive feedforward beam compensation using Matlab scripts (see Figure 1) and are currently working on an IOC implementation. We anticipate testing this implementation next week. We have discovered and eliminated the cause of VXI register write errors in the FCM.

Installation: The installation team focused on finishing up the tunnel work needed to support the upcoming medium-beta cryomodule tests. The 2nd half of SCL ME-3 is ready for checkout, but so far there is no AC power available in that area. Otherwise we are keeping pace in the SCL installation and are ready for more installed racks and more pulled cables.

Ring RF: Chip Piller and Tom Hardek spent the week at BNL working with the BNL team on LLRF and HPRF issues. This was Tom's first visit to BNL since he joined SNS.

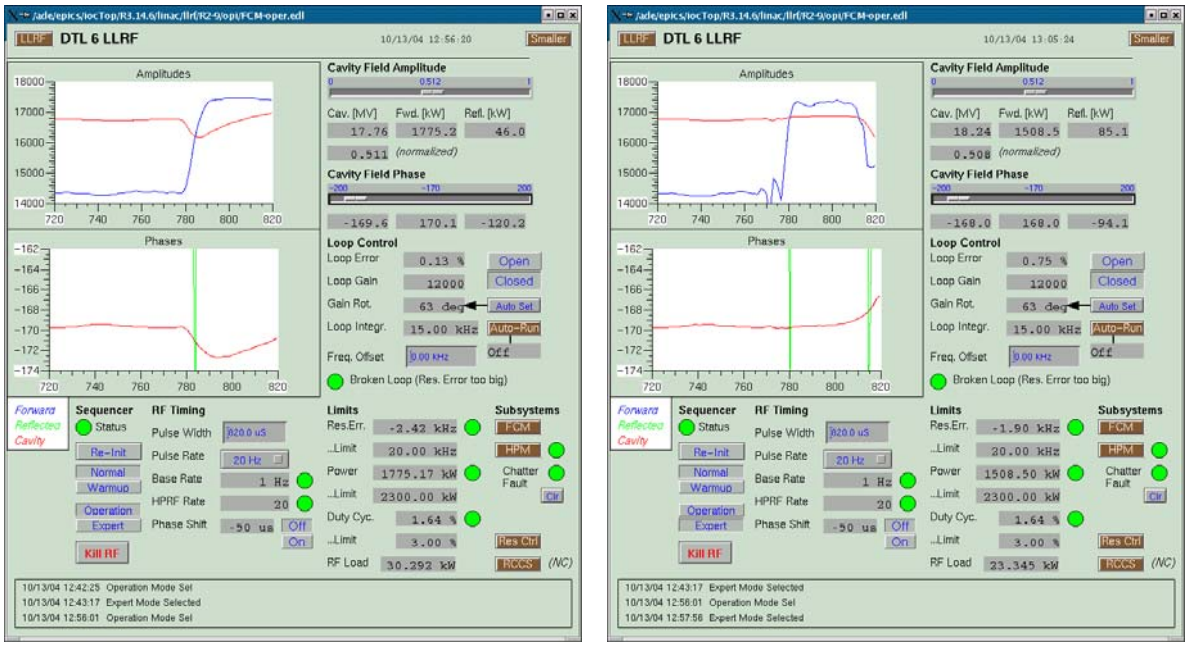


Figure 1. Illustration of DTL6 operation with and without adaptive feedforward beam compensation. The beam pulse begins at about 780 us. The image on the left shows a significant perturbation of the cavity field amplitude and phase. The image on the right shows that this perturbation is eliminated with feedforward compensation.

Cryo Group

Pressure testing and leak testing the LN2 and He circuits on the 2K box was done successfully.

We have installed and tested all the signal cables and have begun installing the power cables and insulating inside the box.

First time activated magnetic bearing on cold compressors installed

U-Tubes; 63 complete and 33 yet to build

Dummy Cryomodule 30% complete

Beam Diagnostics