Accelerator Systems Division Highlights for the Week Ending August 23, 2002

ASD/LANL: Warm Linac

The fourth factory-accepted 402.5-MHz klystron ships this week from E2V (formerly Marconi Applied Technologies) to LANL. (WBS 1.4.1.1)

The first factory-accepted 550-kW, 850-MHz klystron ships this week from CPI to LANL. (WBS 1.4.1.1)

One 402.5-MHz and two 805-MHz RF windows were delivered to the RATS building (WBS 1.4.1.1)

We are debugging the newly installed Dynapower SCR controller for the high-voltage converter modulator (HVCM). Dave Anderson from ORNL/ASD and Mike Hennessey from Dynapower are at LANL to assist. The team found a defective phase lock trigger board and repaired it to continue testing. They determined that the SCR gate firing circuit (which rides on the input 2100VAC) capacitance to ground causes turn-on surges. They made a signal mixer box that mixes white noise and a reference voltage to measure open loop performance of the SCR unit. These tests will be performed to ensure control stability under load. They have not found any show stoppers yet that impact SNS schedule, but some field modifications to the SCR units will be required. (WBS 1.4.1.2)

We updated and distributed the LLRF schedule. We had a problem with the Revision B FRCM that did not allow us to progress as far as we hoped. We are troubleshooting the board off line trying to isolate the problem. In the mean time, we are continuing the integration tasks with the Revision A FRCM and thus far are considerably further along then we were with the Revision B FRCM. We will continue to troubleshoot the Revision B FRCM in parallel because if we can identify the problem and solve it we expect Revision B to have a higher reliability than Revision A. The impact to the schedule has been that the SC LLRF delivery has slipped from August 23, 2002 to August 30, 2002 thus delaying the start of the SC LLRF testing to September 10, 2002. Availability of the 1st and 2nd NC LLRF systems has slipped by 4 days and 1 day respectively as well. We are working very hard on the integration problems and will try to make up time if at all possible. (WBS 1.4.1.3)

Initial repair welds for DTL Tank 1 drift tubes have been characterized and samples are currently being analyzed to evaluate the parameter space. (WBS 1.4.2)

All of the DTL end walls from Major Tool have been accepted. They are expected to ship late next week. (WBS 1.4.2)

A contract has been established to evaluate the maximum allowable temperature for the PMQ magnets. Initial results are expected by early next week. (WBS 1.4.2)

Four turbomolecular vacuum pump carts were delivered to the RATS building. (WBS 1.4.2)

Resonant Control cooling skids for DTL Tanks 2 and 4 were delivered to the RATS building. (WBS 1.4.2)

ASD/JLAB: Cold Linac

The second and third production medium-β cavities have been received from the vendor. Tuning of the first cavity is complete.

Upgrade of the capacitor bank in the 1 MW RF test stand is complete.

LANL and SNS personnel visited JLab to install equipment to support the upcoming integrated LLRF tests. With the support of JLab staff, the installation was successfully completed and the equipment checked out.

ASD/BNL: Ring

Bob Lambiase and Alex Zaltsman returned from Danfysik where they reviewed the 1st article production status of the low field and RF tune power supplies.

Preparations are underway for ASD visitors next week. Bill Foyt and Dave Gurd will be at BNL to review global controls and timing while Paul Holik and Lee Raines will discuss electrical systems with Jon Sandberg.

Professor Isao Yamane (KEK) will visit BNL next week to present a discussion on "Laser Stripping and Proposed POP Experiments".

Danfysik – our weekly teleconference again focused on issues that have been raised during the 12Q quadrupole production run. The first is a 3% variation in integral field (tests at SNS/OR this week point to non-zero permeability in the coil clamps/studs) while the second centers around water leaks in the stainless fittings in three coils and nine coil jumpers. Efforts are underway to determine the root cause of the problem. ASD, BNL and Danfysik are all involved in bringing these issues to a close.

Bids for the extraction PFN are due COB today and will be opened next Monday.

Testing of the injection kicker system continues at low power.

Continued design work on the collimator top plate to reduce weight and provide an integral fixture for lifting.

Magnet assembly and measurement:

- Ring dipole measurements – four type B magnets have been shimmed, fully measured and matched with four type A magnets. Additionally, four more type B magnets have been shimmed and are ready for testing.
- 21Q40 – field quality measurement of magnet #3 was completed this week. Our goal is to install, survey, setup, measure and remove one quad every three days.
- 26Q40 – magnetic testing with the pole tip chamfer was completed this week and the data are being analyzed.
- 41CDM30 – the 1st article magnet is being set up for survey alignment and acceptance testing. Magnetic testing is scheduled to begin Sept. 4.

Documentation efforts:

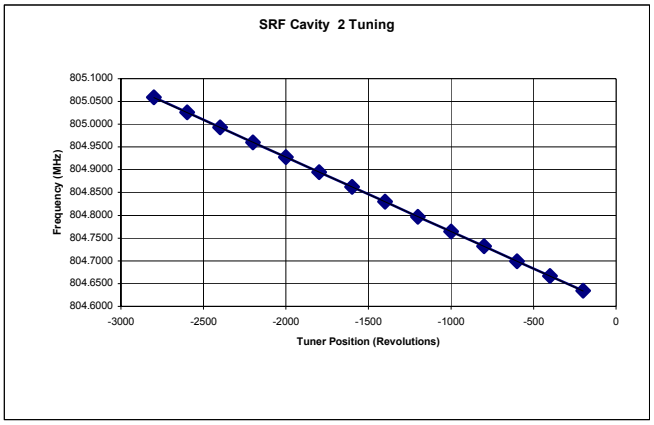
- Sign-off approvals on magnet design/parameter sheets.
- A revised Magnet Progress Schedule, dated 8/21/02, was submitted to ASD.
- Lattice drawing revision.
- SOW, APPs and budget review for FY03.
- ASAC presentations.
- BNL/SNS Design Manual.
- BNL internal notes issued on July '02 Diagnostics Design Review

27CD30 (19) – A contract has been placed with New England Techni Coil for the production run.

Controls

This was a particularly successful week for the Controls team in preparing for the upcoming LLRF integration tests at Jefferson Lab. All four control-system IOCs (LLRF, HPRF, Cryo Heater control, Timing System Master) are now installed and running at Jlab, integrated with the control consoles and with the network. The stepping motor tuning controls and the waveform generator for piezo tuning were integrated into the HPRF IOC and tested. Controlled from an EPICS console, the steppers were used to move the motors on two Jlab cavities, and map out the frequency response (See figure below. 160Hz/revolution – exactly as predicted). Timing events were programmed from EPICS, delivered on the event link to the LLRF crate event receiver (V124S) that generated an event into the CDM Board and then via the VXI backplane to the HPM Board – a fairly complete system check. HPM history

buffers could display the "RF Gate" in what looked like real time when adjusting the RF Gate on the master timing IOC. HPM history buffer acquisition could be stopped on "SAMPLE" from the timing system.



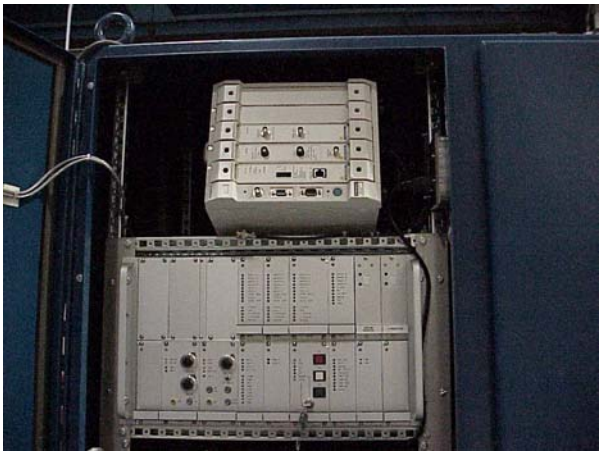
Work began on checking the Front-End control system. Using extension cords and network patch cords IOC1, IOC2 and the vacuum PLC were booted up from the production server with the Berkeley software essentially unchanged. Most of the “Hoffman boxes” were powered up and the functionality of the Allen-Bradley "blue hose" network was established. Some termination and routing errors in this network were identified and corrected. A software problem that prevented conversion of the convectron gauge readings was also corrected. A printer is being installed in the front-end building to assist with signal checkout documentation. The use of laptops to support bringing operator screens close to Front-End components for checkout was validated.

Considerable progress was made on MPS software this week. Changes in the code were made to allow software mask jumpers to be changed by a PLC during operation. This feature will only be used in master MPS IOCs. MPS database template files, one for each MPS chassis and one for each signal in an MPS chassis, are being developed. MPS engineering screens are being developed, and various approaches tried. An MPS Master IOC Application was imported to CVS. The new MPS printed circuit boards arrived from the vendor. A problem was found in the “net” files, which resulted in several shorts. The problem was fixed in the files and a new board will be made next week. The layout is complete for the MPS carrier link clock boards and test boards. After approval of the drawings these boards will be fabricated.

Colin Finukane, a co-op student from the University of Kentucky, joined the Personnel Protection System (PPS) Team this week. He will be supporting the Chipmunk effort. The Chipmunk procurement contract was awarded to RIS Corp. of Knoxville TN. This production contract covers the procurement of all parts required for sixty Chipmunks (except for the ion chambers) and assembly and testing of the first ten units. Testing of PPS PLC-A and PLC-B programs has been completed in the RATS facility. Further testing will be done after the rack is moved to the site and field equipment is installed and wired. Sverdrup is continuing the Phase 1 design for the Linac PPS PLC equipment.

At LANL, utility modules were tested and are operational. All parts are available for manufacture. The requested infinite persistence feature of the “software scope” is done along with most axis manipulation. Documentation is being developed and wire lists and PLC code checked for power supplies, hprf, rccs, and vacuum subsystems.

At BNL, testing of the injection “kicker” power supply and magnet using the Yokogawa function generator has begun. (See below) Preliminary tests were successful, however the first article power supply cabinet construction does not provide sufficient room for the function generator without impeding airflow from the cooling fan. The vendor has been contacted, and has agreed to redesign the cabinet for production units. Testing will continue using more representative waveforms, and using the Yokogawa readback capability.



A shared memory interface has been tested on a Windows Pentium computer. A LabView program generates an amplitude modulated sinusoidal wave of 100 elements and writes these as one PV to the shared memory. With an update rate of 1000 Hz the computer is about 96% idle. The data is transmitted over the Ethernet to an EPICS console. The data is tagged to verify that none is lost. The data received at the console is streamed to disk and three updates are shown in Table 1. The file shows that consecutive updates were transmitted and captured. The total throughput was 400 bytes * 1000 Hz or 400Kb/s. Because the computer is less than 5% busy, there is ample time to include actual data-acquisition and processing. The next step is to include actual acquisition and analysis. The number of PVs will be increased and an endurance test will be done. The system has run without errors overnight. In conclusion, the shared memory approach gives a high performance interface between LabView and the EPICS IOC and should give the Diagnostic Instrumentation the necessary speed. This work was done in collaboration with Wim Blokland of the Diagnostics Group, who wrote this report.

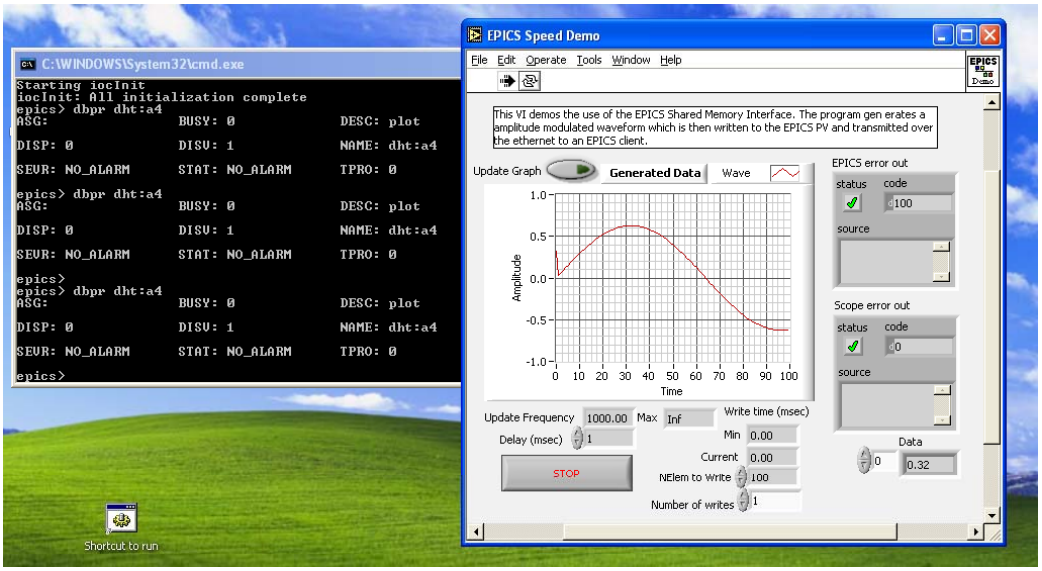


Figure 1. A Screenshot of the PC running EPICS IOC, LabView, and the shared memory.

Table 1. Printout of captured data showing the first 10 elements and the sequence number in the timestamp and first element.

dht:a4 08/23/02 11:00:51.778000618 0.618 0.042 0.084 0.126 0.167 0.208 0.249 0.289 0.328 0.366 …….
dht:a4 08/23/02 11:00:51.778000619 0.619 0.043 0.086 0.129 0.171 0.213 0.254 0.295 0.335 0.375 ……..
dht:a4 08/23/02 11:00:51.778000620 0.620 0.044 0.088 0.131 0.175 0.217 0.260 0.301 0.342 0.383 ……..

Installation

Current Forecast Component Delivery Dates with short-term installation impact are:

HVCM - 9/21/02
Front End BPM/BCM's (Reworked) 9/4/02
DTL Power Supplies 11/15/02
4K Cold Box Ship Date 9/16/02

Craft Personnel on site: 77 (Includes 2 STR Supervision)

Installation Progress: Rack Row 4 Complete

Mechanical Engineering established initial support for "Red Lines" and As Built Drawings on site.

We have still been working on ac pulls to the Front End racks. As of today, most all of the grounding has been done and we have racks FER08-FER25 power done except where a few breakers are missing in the mains panel.

Controls have turned on a couple of the IOC's and is looking at loops and electronics connections. This testing is quite beneficial to us.

We have begun walking through and verifying some of the connection drawings.

The LEBT chamber was leak checked again and looks quite good.

Many of the cable runs are being cleaned up and tray covers put on.

The Kepco power supplies and temperature sensors were checked and connected to the MEBT quads.

FER06 and 07 were installed and connected.

Accelerator Physics

Operations Group

Working on the hiring process for new Chief Accelerator Operators and Operations Coordinator.

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 ASD Operations Procedures Manual for ARR

Attended a Craft Labor discussion at ORNL pertaining to ASD Operations

Collecting documentation needed for the ARR.

Came to an agreement on how to proceed with Cell phone tower

Worked on the Management Information Systems CMMS

Chaired the G0 spectrometer ARR at JLab

Ion Source Group

Mechanical Group

Design Shop

Magnet Systems

Vacuum Systems

The Committee Report addressing the repair of the DT as part of the DT recovery program was received and is currently being reviewed.

Development of the vacuum design of the warm section of the SCL continued with the analysis being updated to the latest configuration.

The assembly load for the self-lubricating moly-disulfide O-rings were measured and were found to generate similar loads to dry O-rings. However, the disassembly/ positioning loads appeared to be significant lower than the dry O-ring assembly. The O-ring test fixture is now being modified to allow this downward seal load to be measured and the seal assembly to be leak tested following simulated DT positioning tests.

Leak testing of DTL-3 DT's continued with this week's activities concentrating on two suspect DT's in which no leaks were found, although one DT, 3-19 reported last week, had previously been shown to be leaking. These two DT's will now be baked over the weekend at 100° C, the temperature now sanctioned by LANL, before further testing. A full examination and calibration of the DT test stand was made to ensure the elimination of spurious signals.

Dressing, repair and polishing of the O-ring grooves and sealing surfaces of tank section A and B of DTL-3 continued. The ports and end flanges of tank section A were blanked and the tank evacuated for leak testing. All ports that had been previously dressed and polished were leak tight in the low 10^-8 T-l/s range but both end flanges leaked in the 10^-6 T-l/s range preventing better sensitivity from being achieved. The test end plates used for the test are currently in the process of being leak tested individually to ensure that the fixturing is not an issue. A visual inspection of the tank end flanges has been made and the surface irregularities observed may be the cause of the bad sealing. Further inspection in this area will continue next week.

Leak testing was performed on 35 manual vacuum valves for the DTL and CCL vacuum systems that had been received earlier.

The helium extension lines for FES cryopump were received and will be installed next week.

RF Group

Electrical Systems Group

Survey and Alignment Group

Cryogenics Group

A problem with installing the exhaust silencers has caused another week slip on the installation of the compressors. The compressor pads are being prepared for the compressor move that is now scheduled for the week of 9/3/02.

Four of the six exhaust silencers are in place and the other 2 are 50% installed. The cold box is still on schedule for shipment from the vendor the week of 9/16/02

All the upstream (West) supply transfer lines, except for the turn around box, have been placed on stands. The inner supply lines have been welded and leak checked and the 2.5" clamshells have been cut for the first 5 modules. Development work continues on the 2.5" clamshell leak test fixture.

Work continues on 2 supply and 2 return modules

Jeffrey Saunders, the fifth JLAB technician, will start at ORNL on Monday 9/9/02

Beam Diagnostics

BNL SNS Beam Diagnostics Progress Report:

1.5.7.1 BPM: Work on a block diagram continues with an eye toward reverting to our original concept of designing the AFE and digitizer in-house. PCI card efforts continue.

1.5.7.2 IPM: Accelerator Physics discussions of IPM magnet design have led to the conclusion that the IPM magnets should be electromagnets. Budget includes only permanent magnets. Cost implications are being evaluated.

1.5.7.3 BLM: Prototyping the analog comparator circuit for the MPS threshold input.

1.5.7.4 BCM: The digital circuits continue to be checked on the new board. A detailed list of software items to address has been compiled. Second AFE board stuffing is expected to start next week. Shop has finished welding the prototype HEBT BCM (made of copper). The mating flanges are being machined flat on the two half shrouds.

1.5.7.5 Tune: Work continues on the further development of the prototype for the SNS tune meter.

1.5.7.6a Carbon Wire Scanner: The results of communications with Huntington to determine a strategy to deal with vendor delays of the position-sensing device follow:

> Encoders were selected as the position senor over LVDTs, saving some time on the upgrading effort. Huntington has been asked to ship three feedthroughs with new stepper motors (currently available). We will send the uninstalled new stepper motors and encoders to ORNL; as soon as we receive them RF springs have been ordered to reduce wobbling of the shaft. Copper sleeves for the new wire attachment are being machined. Parts are expected end of next week. Machining MACOR spacers for the connectors to disconnect fork from the wires. Modifying extension rods and the spool pieces to allow the installation of the electrical connectors, the installation of the RF springs and an easier pump down.

ORNL SNS Beam Diagnostics Progress Report:

Craig finished his analysis of the BPM's and coupled lines. He also received the preliminary measurements from LANL on the new CCL electrode shape and they look very good. Craig will continue to analyze the results and show them next time.

Craig and the mechanical designers are working on the finishing touches of the electron collector for the laser-wire systems. We are building prototypes so that we can characterize the connectors/feed throughs as well as the isolation. Craig reports that the Fast Faraday cup sent to Italy has produced very good results though the pulse is very long and so the bandwidth could not be directly calculated. Modified version of the FFC is being made.

Dave Thomson from ORNL-controls and Wim report on shared memory is shown below:

The shared memory interface has been tested on a Windows XP 800MHz Pentium 1U computer. The LabView program, see Figure 1, generates an amplitude modulated sinusoidal wave of 100 float (4 bytes) elements and writes these as one PV to the shared memory. Each call to write data takes about 0.03 msec. With an update rate of 1000 Hz (The labview program is set to delay each iteration by 1 msec) the computer is about 96% idle. The data is transmitted over the Ethernet to an EPICS console. The data is tagged with a sequence number from 0 to 999 in the nsec field of the time stamp. The first element of the PV is also representing the sequence number 0 to 999 but divided by 1000 to stay within 1 as the rest of the PV's elements. The data received at the console is streamed to disk and three updates are shown in Table 1. The file shows that consecutive updates were transmitted and captured. The total throughput was 400 bytes * 1000 Hz or 400Kb/s. Because the computer is less than 5% busy, there is ample time to include actual data-acquisition and processing. The next step is to include actual acquisition and analysis. The number of PVs will be increased and an endurance test will be done. The system has run without errors overnight. In conclusion, the shared memory approach gives a high performance interface between LabView and the EPICS IOC and should give the Diagnostic Instrumentation the necessary speed.

Dave Purcell is reviewing the D-plate rack assignment and block diagrams sent to us by Jack Gioia from LANL. He is also supporting the efforts of Wim and Craig and the TDR automations. We had another D-plate integration meeting on Monday.

We are having another internal Laser-wire review by the ASD mechanical engineers on Tuesday. We have two optics box designs at hand to choose from. The Laser-wire vacuum beam box is complete. We will build two prototypes. On Friday, we will have our second Laser-wire discussion with SLAC experts. We will review our approach and implementation schedule.

Craig Swanson finalized the timing module's schematics and sent it out to Lumagraph for quotation.