

Accelerator Systems Division Highlights for the Week Ending August 2, 2002

ASD/LANL: Warm Linac

AFT was at LANL all week testing 402.5 MHz circulators to full power with the Marconi klystron. Due to the reduced voltage standoff at altitude and the fact that these circulators are not pressurized at all, the specification they needed to meet here in Los Alamos was 2 MW. There were difficulties meeting this power level for a few days, but there was success by the end of the week. One unit completed testing Aug-1-02. We hope to have 3 total units tested by BOC Aug-02-02. (WBS 1.4.1.1)

LANL sent an engineer at CPI to witness the first CPI 550 kW klystron acceptance test. (WBS 1.4.1.1)

We started the next round of transmitter tests at Titan. (WBS 1.4.1.1)

Three HVCM SCR controllers were delivered to ORNL this week. (WBS 1.4.1.2)

Work continues at Dynapower on the HV converter modulator construction. Subsystem assembly is well underway (Figs. 1). We finalized the boost transformer design with Dynapower. The design minimizes electric field stress and gets these stresses into a reasonable operating range. (WBS 1.4.1.2)



Fig. 1: Construction and assembly of production HV converter modulators at Dynapower.

We added redundant calorimetry on the IGBT cooling circuits in the prototype modulator in order to better measure the IGBT losses. (WBS 1.4.1.2)

We fabricated a production-design output filter choke for use on the prototype modulator. It requires some trimming prior to installation. (WBS 1.4.1.2)

We modeled the modulator output with the new production boost transformer parameters. The results showed that the production boost transformer parameters would work fine. (WBS 1.4.1.2)

We submitted our weekly status of the LLRF schedule. The DSP software tasks appear to be holding well to the schedule. Due to a problem in getting parts to the fabrication vendor for the Rev B FRCM modules, there is a 2-day delay in getting these units at Los Alamos. Because of the project links, this week's schedule shows a similar slip in the overall JLAB system delivery, but we hope to make up some of this time in next week's work. (WBS 1.4.1.3)

The documentation sets that were due this week (FRCM motherboard, RF board, DSP software, CDM, and EPICS) are all completed. Released is pending issuance of LANL release number, expected imminently. (WBS 1.4.1.3)

More DTL end walls with vacuum test flanges were delivered to ORNL this week. (WBS 1.4.2)

Tom Ilg was at ORNL this week to join with ASD staff in testing prototype drift tube stiffeners. ASD and LANL completed the test plan and all seven prototypes were tested. The team shared preliminary findings on 8/2/02 and is rapidly converging on the solution. (WBS 1.4.2)

An independent review committee consisting of Pierre Grand (Chair), Mark Franks (LLNL), Carl Necker (LANL Materials Sci. Div), Don Precechtel (Westinghouse-Hanford), Mike Skonicki (ORNL SNS), Kimo Welsh (consultant, formerly BNL) was formed to advise on the vacuum leak problems observed in the drift tubes. They will characterize the problem, recommend corrective actions and remediation processes, and recommend vacuum inspection procedures. The committee had their first meeting Aug.1 and 2, which included extended site visits at ISYS (e-beam welder) and Coronado Machining. Metallurgists from CTC Materials Engineering and Testing Services also participated. The committee is expected to issue initial findings and recommendations before Aug. 16. (WBS 1.4.2)

Accel performed the first article CCL septum braze (Fig. 2) (WBS 1.4.4)



Fig. 2: Preparation for the first CCL septum braze by ACCEL.

An axisymmetric SUPERFISH based model has been developed. This includes frequency effect of stems, post-couplers, slug-tuners and end-field modifications. It's being fine-tuned; the results will be reported in an internal memo. (WBS 1.4.5.3)

RFQ particle-distributions have been generated with LEBT chopper voltage set to 90% and 100% of maximum. Only about 0.01% of the particles make it through the RFQ with the voltage set to maximum. The distributions have been transported through the MEBT chopper to determine the residual transported beam. This is part of the ongoing chopper study. (WBS 1.4.5.3)

PCRs approved this week included: LI 02 030 which accommodates revisions to BPM electronics (no cost); LI 02 034 which transferred \$50K of LANL budget to Jlab to support SC LLRF integration at Jlab; LI 02 035 which aligns BCWS and technical scope (no cost); LI 02 036 which takes \$67K of contingency for SRF manufacturing transmitter scope change directed by ASD; (WBS 1.4.6.1)

ASD/JLAB: Cold Linac

The first phase of prototype cryomodule testing is complete.

Work to prepare the Cryomodule Test Facility for the forthcoming integrated test of the LANL low-level RF control system continues.

Essential maintenance of the supporting helium refrigerator is underway, but the system configuration allows the cryomodule to be kept cold (4 K) during maintenance.

One batch of five sets of end groups for medium- β cavities has been post-purified and shipped back to Accel. The second set has been heat-treated and will be chemically processed and shipped over the weekend.

Clearance has been received from French customs for the export to the US of the frequency converters for the cold compressors. Shipment is imminent.

ASD/BNL: Ring

Visitors this week from ASD included G. Murdoch, T. Hunter, M. Hechler and T. Owens. Owens is here to work with our RF Group while Murdoch, Hunter and Hechler are meeting with our mechanical engineers and designers to review the Project status of WBS 1.5 mechanical systems. Work efforts included:

Magnet Parameter's Configuration Control

Contingency Risk Based Plan

Parameter Risk Based Plan

Preparations for next week's Project Director's Review (August 6) covering the last five months.

Summary talk by Peter Cameron on last week's Diagnostics design review.

Technical and cost evaluation of the Ring high field dipole power supply bids.

Dipole measurements (type B) – 2 magnets fully measured; one shimmed and in stand to be measured; five shimmed and waiting to be measured.

27CDM30 (28) – Danfysik's production is complete. All magnets are at BNL.

41CDM30 (9) – Alpha Magnetics finished winding the 1st article magnet. It has been shipped to BNL and should arrive shortly.

The bid date for the extraction kicker PFNs has been extended to August 23 at the request of one of the vendors.

21Q40 measurements – completed eddy current measurements for Beam Based Alignment study. Also conducted tests to determine alignment sensitivity related to mechanical roll vs. electrical roll. The second test station is ready for production measurements.

30Q58 (BINP) – magnetic measurement of the first article is underway.

27CD30 – bid opening has been extended one week.

Conducted magnet design reviews this week with ASD personnel:

- 26S26 sextupole
- Injection kicker magnets
- RTBT magnets
- Ring extraction magnets and vacuum

17D244 (RTBT bend magnet) – RFQ package is being prepared for BNL Contracts.

Controls

All of the Resonance Control Cooling System (RCCS) racks are complete and have been delivered to RATS. The Pulizzi power conditioners arrived from LANL last Friday and were installed in the RCCS racks this week. The PLC programs will be loaded next week. Work on the DTL Control racks for rows 2 through 7 is almost completed in the RATS building. Fanouts and network switches along with other equipment are being installed in these racks.

Coding and initial testing of EPICS device support for the Windows shared-memory DLL was completed. This will initially be used on a windows PC or smart oscilloscope to pass data between a LabView program and EPICS. This approach will have better performance and increased flexibility over the ActiveX object that it is replacing. Still planned are performance diagnostics for the EPICS device support routines, waveform output capability in the IOC device support, and a means to pass events from EPICS to LabView.

A home page (<http://ics-web1.sns.ornl.gov/hardware>) was created on the Controls web server to support software development. This page has links to data sheets of computer boards in use, VXWorks manuals, and local documentation related to the MVME2100 IOC.

Factory test of Conventional Facility Controls software for the CHL was completed.

We are developing the EPICS tag names for all of the PPS related devices in the LINAC in order to proceed with the detailed design for the phase I equipment. This effort has also required that the total number of devices connected to the PPS be reconfirmed. Production programming for the “B” PLC is 50% complete. The rack that controls 480 Volt power to the front end has been installed on site.

After a wiring problem was corrected, the prototype Chipmunk successfully passed an abbreviated temperature cycling test. An extensive review of the wiring drawings has been conducted to verify that the wiring is in accordance with the schematics. A procurement effort will be initiated next week to obtain the production units required for front end commissioning.

Two issues related to the beam loss monitor system were raised at the Beam Diagnostic Review last week and are receiving close attention by the controls team at BNL:

1) The review committee suggested selecting a digitizer from among those tested. Of the two digitizers that meet minimum requirements, the more accurate digitizer is more sensitive to temperature variations. A test is being run to demonstrate that the temperature variations can be effectively compensated for in software.

2) The ORNL diagnostic group suggested a higher level of redundancy than had previously been planned (or budgeted). Details of the impact of adding this level of redundancy are being worked out.

Control of the hot spare ion source RF Pulse Generator (including EDM EPICS screens) is working and ready to go in the “blue box.” An operational demonstration is planned as soon as some missing connectors are received.

The contract for the fabrication of the Central Helium Liquefier Control Room Racks was awarded to DCS. These 9 racks house the operator workstations and communication hardware required for monitoring and control of the CHL refrigerator, the transfer line, and the cryogenic portion of the superconducting Linac.

Specification and drawings for fabrication of the PLC rack for the main 4.5 K cold box were completed. A final check is in progress. An estimate was received from DCS for the fabrication of the 4.5 K cold box PLC rack.

Development of the software and operator interface screens for control of the cavity heater was completed and tested. This includes the logic and control sequences for controlling the amount of power supplied to the cavity heater control based on the amount of forward and reflected RF power, the cavity gradient, and the pressure in the primary return transfer line. Several screens are provided that not only allow set-up and tuning of the control algorithm, but also display status of the PLC, IOC, and power supplies. The PLC program was developed and tested. It includes interlocks for cryomodule helium liquid level and primary return pressure. The hardware was assembled, interconnecting wiring installed, and tested as a system with the software. High power resistors were connected in place of the cryomodule heaters. Input signals from the cryomodule and RF systems were simulated. Control of the heater was successfully demonstrated. The system was disassembled and shipped to JLab. Information learned during this development and testing was incorporated into the main heater control logic for the production system.

Heater Control was only one aspect of work towards the Jlab test that was accomplished this week. Consoles have been shipped to Jlab, and will be installed next week. The timing system infrastructure will be installed the week of August 12. The function generator to be used with the piezo tuners is now working and ready to ship. The motor tuning system is working at LANL and will be shipped before August 19. A plan is in place for activities at Jlab August 19-23 in preparation for the test on September 3.

As a result of work at BNL, interrupts are now working on the event encoder module (V123S). New code is now installed in all the V123S modules at Oak Ridge, including the one we will bring to Jefferson Lab. The "Bad VME Write" problem with the V124S board appears to be fixed - the latest code does not exhibit the problem at Brookhaven, Oak Ridge, or Los Alamos. The event link software has been updated to comply with the recommendations of the January software review. The first stage of arbitrary rep-rate support has been added to the V124S software. This software allows the triggering of a gate at any arbitrary rep-rate from 0.1 to 60.0 Hz (in 0.1 Hz increments).

Installation

A vacuum leak check was performed on the fully assembled FES and no leaks were found.

Cable routing continued between the racks and technical equipment.

- The diagnostic timing cables have all been routed to the racks and equipment. The Diagnostics group is checking the cables to make sure that they survived the transfer.
- The low level RF cables have all been routed to their respective locations on the RFQ and shortened.
- Miscellaneous chasses continue to be installed in the FES RACKS.
- Cable were connected in and between the racks in the BBB.s
- MEBT Vacuum cable routing is continuing.

Initial testing of the modified drift tube mount concepts was completed this week. These mounts are designed to stiffen the existing drift tube mount so that motions during all loading conditions are reduced. The testing included imposing external loads up to 100# on the top of the drift tube and looking at motions due to assembly and disassembly of the mount. Based on these results, we plan to proceed with the two most promising concepts, which are the collet and the bridge designs.

The initial issue of the Installation 30 Day Look Ahead schedule was circulated at the Installation Meeting 8/2/02. Installation of PPS Racks was schedule to start last week and continue through the sixth. One rack is in place.

Milestone DTKRE RFE of the Klystron Building to 225MeV was taken on 7/31/02.

Plans were completed for the LANL "Lead" Visit to work with the RF Group starting on 8/1/202.

A Division Director Installation Review (8/2/02) was conducted on the Front End installation progress and the ASD Installation Earn Value Reporting system. FES installation is approximately one (1) week ahead of schedule. Refinements are being implemented in the Installation Earned Value Reporting System.

Accelerator Physics

S. Cousineau has evaluated the effect of reduced beam-in-gap kicker strength and finds that a 0.6 mrad total deflection is acceptable.

Ten members of the AP group will be trained as operators for front-end commissioning.

The AP group is working with Operations on the training documents and presentations.

Beam dynamics simulations continue on the ORNL Eagle Supercomputer. A feedback module has been written for ORBIT to evaluate requirements of a wideband damper system for the ring.

A JAVA-based correlator is being developed for correlation of EPICS PVs on a pulse-by-pulse basis.

M. Doleans and S. Kim reported on Lorentz-force detuning modeling which used low-power RF measurements performed at JLAB.

Operations Group

The Commissioning Program Plan Submitted to DOE for signature, our second and final pre-ARR commissioning document

Assisted with the roll-out of the new version of the Equipment Tracking System and did some one-on-one training

Worked on electrical safety LOTO issues in the Front End and Klystron buildings

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

Negotiated with Accelerator Physics on "Volunteers" for Chief Operator training

Continued development of the Operations Training Program

Began Sign Off process for ASD Operations Procedures Manual for ARR

Ion Source Group

Tests on the 2MHz RF-matching network have been completed. It was found that a 50-ohm impedance requires 12 primary turns on the transformer. Maximum plasma density, however, has been found with only 4 primary turns. This differs from the 6 turns found to provide best operations at LBNL. Once the front-end matching network installation is complete, its impedance will be fully documented to find and understand differences between the networks.

The ion source has been vented and the pumping system locked out. This will enable the high voltage system tests planned for next week, without becoming an RGD.

John Munro succeeded in controlling the RF amplifier with EPICS. A modified EPICS control allows controlling all relevant parameters and therefore we will no longer need a pulse generator to control the repetition rate and pulse length.

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

The entire ion source group and Paul Gibson have volunteered for operator training.

Mechanical Group

Magnet Systems

Vacuum Systems

RF Group

Electrical Systems Group

Survey and Alignment Group

Cryogenics Group

Contractors have submitted pricing for the trench and south wall piping packages. The bid prices are being reviewed and the contract should be awarded within 30 days.

The return "T" section of the transfer line is welded in place and ready for final vacuum certification. The warm gas helium piping is 15% complete

Supply transfer lines S-HB10/HB11 and S-HB13/HB14 are 90% complete. Return transfer lines R-HB7/HB8 and R-MB6/MB5 are 90% completed

Beam Diagnostics

LANL Beam Diagnostics Progress Report:

BPM pickups: We received the two repaired DTL BPM pickups from Coronado. The other six are at ISYS for welding. So far two out of 14 SMA vacuum feedthroughs have been damaged during welding. We will send one back to the manufacturer for evaluation. One 4-inch D-plate BPM is on hand ready for testing. The CCL prototype BPM should ship 1/Aug. All mounting brackets for the mapper system are now complete.

BPM electronics: Cable fabrication is in progress for the "down hole" DTL pickup cabling. We placed an order for 5 ea. 402.5 MHz and 8 ea. 805 MHz analog front ends (AFEs). ECAD work continues on the digital front end (DFE) revisions. The PCI motherboard modifications are almost complete and ready for fab.

WS actuators: Fabrication continues at Huntington on the prototype and D-plate actuators. The TR BPM / wire scanner beam box assembly drawing was completed and sent to Danny Mangra. A vendor for rad hard isolated BNC connectors with Rexolite insulator has been identified. We will order 250 ea. connectors, which should be enough for all the wire scanner actuators in the facility.

WS electronics: Fabrication continues on the positive HV bias daughter cards.

CM: The spare CCL transformer was sent to Saeed, together with the first-generation SCL BPM (electrodes subtend a 60-degree angle).

ED/FC: Design work continued to finalize details of the actuator assembly.

D-plate: Fabrication continues on the D-plate mechanical systems. Completed items include the overall stand, the quad magnet stand, the beam box stands, a 4-inch BPM, and most of the spool pieces.

BNL SNS Beam Diagnostics Progress Report:

Gathering notes to complete the informal BNL internal report on last week's Design Review.

1.5.7.1 BPM: Travel arrangements completed for a visit by Craig Deibele during the week of August 12th to discuss impedances of various modes of the BPM PUEs.

BPM PUE: wire scanner mapping facility was restored to operation, and preliminary transfer function measurements were completed. Working on calibration routine. Continued discussions with AP about matrix methods of beam-based offset determination, with an eye to removing the need for the relays and power supplies. Confirmed that traveler system is in place (has been from the beginning - was implemented by the lead tech) for the BPM PUEs.

1.5.7.2 IPM: A prototype collector circuit board has been built. An optics experiment has been done to understand the depth of focus problem with the fluorescence profile monitor. The present concept is to use F/8 optics and average over about 20 turns to get a 3% measurement at the end of the store.

1.5.7.3 BLM: Working on implementing and evaluating suggestions and comments brought up at the recent final design review. These include minor changes to the analog front end, interfacing with the controls digital I/O, and addressing the request for redundancy of hardware to enable machine operation in the event of a module/chassis failure or service.

1.5.7.4 BCM: The rev2 circuit board is being tested. Analog signals have been traced through the analog system. Detailed analog testing is now underway. Digital testing has also started. As per suggestions of the design review committee, BCM calibrator design is under review to include special features to assure safe operating conditions for the transformers during calibrator failures.

1.5.7.5 Tune: Allocated space in the Ring lattice for the tune kickers.

1.5.7.6a Carbon Wire Scanner: Completed redesign of carbon wire attachment method for MEBT wire scanners, parts are in fabrication, and assembly and testing will take place next week. Second letter of intent was written for the transfer of responsibilities for carbon wire scanners from BNL to LANL. LANL will assume responsibility for all areas except vacuum envelop/beambox, which will remain with BNL. LANL is writing the PCR.

1.5.7.7 Beam in Gap: Sarah Cousineau completed simulation of gap cleaning efficiency with 0.6mrad kick instead of 1.0mrad. Conclusion is that smaller kick is acceptable if number of kicks can be increased from 50 to 80. Contacted vendor to confirm that this is acceptable (our present understanding of the duty cycle spec is that this will be no problem).

ORNL SNS Beam Diagnostics Progress Report:

Dave Thomson from ORNL Control's group improved the coding and initial testing of the windows shared memory DLL and Epics device support for the shared memory dll. Wim modified the LabView code of the test device (Tektronix scope) to take waveforms at a faster rate and take advantage of the new dlls. Students finished their summer projects, prepared their posters and departed to go to school. Over all, it was a successful summer for them. Dave and Craig have started verifying the MEBT cables. The spare MEBT BCM should arrive week of August 5th. The two BCMs sent to the vendor are due at the end of the August. Marc Ross from SLAC visited us for a day. We had a productive Laser-wire scanner meeting with him. We are ordering parts for the Laser room at RATS. The diagnostic group interviewed candidates for the entry level engineering position and a senior technician. A new WBS element was created by the Controls group to support diagnostic integration. Term positions for entry-level technicians and engineers will be opened under this account.