Accelerator Systems Division Highlights for the Week Ending October 18, 2002

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)
Accomplishments this week: (1) Performed troubleshooting on non-performing 402.5 MHz circulator. Manufacturer (AFT) was at LANL to modify temperature compensation units; waveguide flex section with high VSWR was discovered and replaced. We expect to have one circulator pass high power test today with a second to follow next week; (2) fifth Marconi klystron arrived at LANL; (3) second CPI 550 kW klystron was installed in the test stand and is ready to test; (4) third CPI 550 kW klystron passed factory acceptance tests; (5) vendor acceptance tests of prototype solid-state amplifier for the SC linac klystrons were successful; (6) a 402.5-MHz load passed high-power tests at LANL and was packed for shipment to ORNL. Another load was installed in the test stand for testing.
Concerns & actions: Installation of untested high power RF equipment at ORNL. Risk summarized in a memo submitted to ASD. To better coordinate our testing program, we now receive 30-day installation look-aheads from ORNL, and have requested 90-day look-ahead for high-power RF equipment only.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)
Accomplishments: (1) Dynapower delivered the first article production HV converter-modulator to ORNL; (2) Bill Reass worked at ORNL to assist ASD in first article installation in the SNS klystron gallery. The tank basket assembly was installed in oil tank. Completed assembly was installed in the safety enclosure. Capacitor racks were also installed in the safety enclosure. The cabling and cooling interconnects between safety enclosure, modulator, and cap racks are in progress.
Concerns & actions: (1) Untested oil tanks were prematurely shipped to ORNL from Dynapower – dye penetrant test kits are now at Dynapower, who will test nine unpainted tanks next week. (2) Water, mud, and trash were discovered in the first (RFQ/DTL) substation and switchgear at the SNS site - substation and switchgear were cleaned.

LOW-LEVEL RF CONTROLS (WBS 1.4.1.3)
Accomplishments: (1) provided input and helped finalize the requirements document; (2) developed a draft budget for FY03 to include support for RFQ and Jlab commissioning as well as participating in the design and development of the production Rev of the LLRF system; (3) acceptance testing of the Rev D of the HPM module is nearing completion indicating very good immunity to channel-to-channel cross talk and 2-3 microsecond response time. Two units will be shipped to ORNL next week; (4) PLD code (in AHDL) documented modularized, allowing unit testing as well as ultimate translation into either VHDL or Verilog for use on the LBNL LLRF board; (5) started studying the LBNL LLRF system with the aim of coordinating development and integrating the two teams; (6) with ORNL and LBNL, we developed a draft of the SNS LLRF Team Plan. Final version is due October 30; (7) with ORNL and LBNL, we have planned a meeting in Berkeley on October 25 to select architecture for the ultimate LLRF system. Attendees include Hovator (Jlab), Regan (LANL), Doolittle (LBNL), Corredoura (Agilent, formerly SLAC), Stettler (LANL) and Prokop (LANL). The goal is to proceed quickly to the design, prototype and online testing with the DTL before committing to the production numbers (~95); (8) developed a draft schedule for the ORNL/LANL/LBNL activities leading to the delivery of the first SRF Linac LLRF system (Feb. 2004).
Concerns & Actions: Schedule for the production of the final system seems aggressive - may have to resort to outsourcing a major portion for schedule relief.

DRIFT-TUBE LINAC (WBS 1.4.1.2)
Accomplishments: (1) Four Tank-1 drift tubes were welded at ISYS this past week with the 0.075" high weld ring. The welding went extremely well (Fig. 1). No eruptions occurred during welding indicating that all of the previous weld porosity had been removed and no additional passes were required on any of the welds. All drift tube temperatures were monitored and stayed well under the maximum allowable steady state drift tube temperature of 300 F. Based on previous measurements of magnet temperature during welding this correlates to a maximum magnet temperature of less than 160F. Weld coupons were produced and inspected immediately prior to and following welding of the drift tubes. The weld depth was nominally 0.055" +/- 0.005" and no porosity was observed in the weld. The chilled plate used during welding proved to be effective and resulted in rapid cooling of the drift tube body following welding. These drift tubes have been sent back to Coronado Machining Inc. for machining to net shape to determine how well the weld cleans up following machining. Travelers, including a physical inspection report, now accompany the drift tubes during processing. ISYS support of LANL weld development activities is

excellent. Two experienced welders have been dedicated to support the weld development and repairs. A malfunction of the CNC table detected in the morning was repaired by maintenance staff before lunch. (2) Tank-1 water manifold assembly was delivered to ORNL.
Concerns & Action: (1) Schedule impact from drift tube remanufacturing - we started the process of qualifying additional E-beam welders to provide a backup and/or parallel processing capability for drift tubes. An arrangement was made with the E-beam welding facility at LLNL to produce weld coupons for welds currently being used in the manufacture and repair of drift tubes for evaluation. (2) It was verified that the contaminated weld that occurred during welding of the Tank-1 drift tubes was due to the copper plating on the drift tube surface. A CDA10100 welding coupon partially plated with copper was welded with the parameters specified for the drift tube weld repair. A normal weld was produced on the unplated copper surface. The weld on plated surface produced a contaminated weld identical in appearance to the welds seen on the plated drift tubes (Fig. 2). Further analysis of the plated sample will be conducted to determine the cause of the contaminants in the plating.

Fig. 1: Repaired Tank-1 Drift Tubes

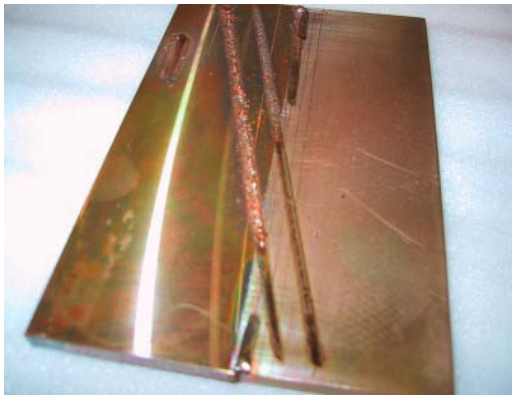

Fig. 2: Effect of copper plating (left half of coupon) on E-beam welds.

COUPLED-CAVITY LINAC (WBS 1.4.4)
Accomplishments: Bultman, Young, and Billen were at ACCEL and successfully completed tuning of Bridge Coupler (BC) # 44. They confirmed that linearly interpolated values from BC #1 and the CCL Cold Model have produced the required frequency for BC #44. This is a significant milestone for the bridge coupler manufacturing in that the engineering design has been verified with RF measurements over the entire range of beta for the CCL system. The series production of all BC components can proceed with confidence that no problems with cavity geometry should be encountered for the remaining 42 assemblies. The bridge coupler body machining is being done at ACCEL and the production of noseplates for the bridge couplers has been moved to a subcontractor who is doing very good work and will allow for an optimal rapid rate of production. Mechanik Center Erlangen (MCE) is now contracted for segment internal plates of modules 2 and 4, and the endplates for all segments 1-48. This is a production leveling decision made by ACCEL. As we discussed in a project meeting at ACCEL in January, this can and will most likely occur many times during the fabrication period to optimize production to best utilize the resources available between the MCE and ACCEL shops at each phase.
Concerns & Action: LANL rejected the two CCL endplates at MCE, which will delay the final tuning and stack braze by approximately one month; however, this should not delay IPS milestones. Final pre-braze tuning of the first segment was planned to be accelerated to this week to allow completion during the LANL-ORNL visit to ACCEL but some difficulties with the segment endplate machining has delayed the process. MCE encountered problems with the fixturing and clamping methods they planned to use for final machining of the plate as the methods employed were causing deformation of the parts. The manufacturing sequence and fixturing details are being resolved to prevent this from reoccurring during production. The two affected endplates will be remanufactured before completing the stack braze.

ASD/JLAB: Cold Linac

ASD/BNL: Ring

ASD's proposed Installation Priorities has been reviewed and comments were presented at this week's STL videoconference.

The SNS Spares list is being updated for the DOE review, as requested by George Dodson.

Evaluation of the extraction kicker PFN bid packages is complete. Our Contracts Dept. has been directed to place the production order with APS of Hicksville, New York. APS was low bidder, received a very high technical score and has demonstrated to our satisfaction that they can successfully complete this project.

Continuing efforts to develop BNL acceptance check lists for individual magnets and half-cell assemblies; these are to be reviewed and completed prior to component shipment to SNS/OR.

Danfysik is preparing to ship the last five 12Q45 production magnets to SNS/OR.

G. Murdoch distributed minutes of last week's Installation Update meeting; J. Tuozzolo submitted amendments to the notes.

Work is underway to satisfy ASD's Documentation Summary for the DOE review.

Magnet assembly and measurements:

- Assembly continues on the #1 half-cell. Installation of magnet bus and water, and component survey are underway.
- Ring dipole measurements – thirteen type B magnets have been shimmed, fully measured and matched with thirteen type A magnets (30/32 are complete). Additionally, two more type B magnets have been shimmed and are ready for testing.
- 21Q40 – field quality measurement of quad #9 is complete. To date, eight of these magnets have integral fields within the desired range for Ring grouping.
- 21CS26 – measurements underway; 4 are now complete.
- 26Q40 – has been re-measured with its modified pole chamfer. Test data are being evaluated for magnet acceptance.
- 30Q58 – the poles have been shortened by 0.75 mm in order to reduce duo-decapole component of the harmonics. This magnet has been surveyed and is being prepared for final testing and acceptance.
- 36CDM30 – 1st article awaits testing.
- Chicane #4 - waits testing.

Controls

Progress continues on vacuum control system simulation at LANL. Each vacuum device is being simulated with an EPICS sequence. The simulated analog and digital inputs and outputs of these devices are being provided to the vacuum PLC by a simulator PLC. This exercise is revealing code deficiencies and user interface issues at every device. The vacuum controls documentation is continuing in parallel.

Installation of communications cabling in the DTL area of the Klystron Building continued. Several fiber optic cables were terminated, which should enable turning on permanent network service to the first two groups of DTL control racks next week. The second network layer-3 (core) switch was installed.

Implementation of the timing system for the Front End continued. We successfully installed diagnostic timing gates for 6 BPMs, 5 Wire Scanners, 1 Beam Current Monitor, and 1 Laser Wire.

The EDM versions of the Front End vacuum control screens are now ready for use. After some additional verification checks, these screens will go into the CVS repository early next week. The plan is to use them to operate the front end (as opposed to using the original DM2K screens).

The contract for the assembly and wiring of the cryogenic control system medium beta cryomodule IOC and PLC racks was awarded to DCS. There is a pair of racks per 4 medium beta cryomodules for a total of 6 racks. The IOC has inputs for the silicon diode cryogenic temperature sensors and the cryogenic control valve position indication. The PLC monitors and controls the Sorensen heater power supplies and the American Magnetics liquid helium level meters.

Procurement for the 3 medium beta marshalling panels was started. The marshalling panels contain the PLC I/O modules and equipment for monitoring the cryomodule pressures and controlling the coupler window temperature. Each marshalling panel supports 4 medium beta cryomodules.

Procurement of the cables needed for installation of the Integrated Control System equipment for medium beta cryomodules and the CHL building was initiated.

All the American Magnetics liquid helium level meters needed for the SCL were received. The Sorensen programmable power supplies for the medium beta cryomodule cavity and window heaters were received. The power supplies for the high beta cryomodules will be ordered later in the FY.

The cryogenic control system PLC logic, EPICS database, IOC software, and EDM screens were updated to support the new design of the watchdog timer. The new watchdog timer provides a standardized means for all IOCs and PLCs to monitor the 'health' of other IOCs and PLCs. This is an important function for the cryogenic control system because many of the control loops and algorithms are dependent on the status and 'health' of other parts of the cryogenic and RF systems. The cryogenic control system itself contains 11 IOCs and 20 PLCs. If any one of these is not operating properly, the others are programmed to take appropriate actions that range from generating an alarm to shutting down cryogenic system components.

Installation

ASD Craft Labor as of 10-16-02:

1.9 Global Controls Support	4
ASD Support	65.5
Accelerator Subtotal	69.5
Absent	2
Total On Site	67.5

The FY03 Service Request Order system was discussed in the ASD Weekly Installation Meeting held on 10/18/02. A draft master for the Master SRO covering the installation of SCL ME-1 was discussed along with the plan for the implementation on sub SRO's. Sub SRO's cover the scope, schedule and resources required by a specific group i.e. RF, to complete their portion of the Master SRO.

Partner Laboratory FY03 Work Packages were discussed in the Division Director's Weekly.

Accelerator Physics

Operations Group

This week ASD Operations hosted the Front End Systems Accelerator Readiness review. The committee concluded: "It is the consensus of the ARR Team that the SNS Project management has conducted a comprehensive review and all provisions of the SAD necessary for Front End and klystron gallery commissioning are being addressed. Adequate controls and policies will be in place to extract beam from the source and transport beam safely to the Front End beam stop. A number of procedures and actions have not been completed at the time of this review that will need to be in place prior to the start of commissioning. This Team will monitor progress in completing these items and will recommend approval once all issues have been closed."

Every effort will be made to complete these actions prior to the anticipated start date of October 29,2002

Ion Source Group

As planned the week started by finishing the RF check out which gradually became a conditioning effort. Finally on Thursday, we were able to generate an adequate plasma, injecting up to 30 kW RF power with only 400 W reflected. The measured RF and the 475-A antenna current clearly qualify this operation as sufficient for initial operations. It was achieved with the capacitive tuner in the same position (58.77) as it was at LBNL, while the frequency was increased to 2.04 MHz. The observed change is likely due to the new 13 MHz matching network, which altered the stray capacitance. Having found a satisfactory set of parameters, we will next pursue an extraction test.

To prepare the ion source for long term operations during the front end commissioning, the small size Hydrogen bottle was replaced with a slightly larger one. The bottle was placed in a horizontal orientation on the 65 kV deck. The installation appeared safe and secure: the bottle could neither fall over nor become a projectile as it was confined between the two heavy electronic racks on the 65 kV deck. However, on Wednesday afternoon it was pointed out to us that the installation was in violation of a technical code, which requires the valve end to be up if the cylinder size exceeds 110 cubic inches. Wednesday evening, the installation was changed to be in full compliance with the code.

In addition, it was discovered that one of our technicians was using the LOTO procedure they used at his previous job in the Physics division, despite having successfully passed the SNS-LOTO training on May 31, 2002. While this may have been a perfectly safe standard in the Physics division, it is clearly unsafe because the inconsistency leads to confusion, which in turn can lead to accidents. The technician was retrained early Thursday morning with a practical test administered shortly before Thursday noon. This and other safety issues were thoroughly discussed in our group meeting on Thursday morning.

Mechanical Group

This week the Ion Source Group continued testing in the Ion source area and made a 2MHz high power plasma. This gives a bright forecast for making beam by the end of next week.

Diagnostics worked with the help of LANL members to test the now installed wire scanners on the MEBT.

All RFQ cryopumps showed signs of helium contamination and were high pressure purged to eliminate the problem.

A BPM was found to leak on the MEBT due to a damaged bellows. It was replaced with the spare unit but an installation leak test is still pending.

The 18kW RFQ chiller was brought up and functions well.

Magnet Systems

We have repaired (re-brazed) 8 12Q45's and completed measurements on two of these magnets.

We have completed measurements on the 1st article SRF 8Q35 Quadrupole including dipole steering and fringe field measurements.

Vacuum Systems

Linac HPRF

Installed first article (RFQ/DTL1/DTL2) this week, with help of Bill Reass. Finished electrical cabling for HVCM. Provided cable header top plate assemblies to machine shop for modifications (2 sets). Verified operation of 13.8 kV switchgear units, including remote operating station. Retrofitted first SCR unit with Dynapower retrofit kit. Downloaded PLC code to equipment control rack. Started checkout of equipment control rack. Tested and transported resistive load/HV divider to klystron gallery. We should initiate testing of HVCM unit at ORNL on Wednesday, October 23rd.

Completed installation of the Water System interconnections for the RFQ and DTL1 RF systems. Began pressure testing. Found bad throttle valve in the RFQ Water Cart. Replaced valve, testing continues.

Linac LLRF

Hengjie Ma is at LBNL assisting with the assembly and checkout of the LLRF control system to be used for RFQ commissioning.

The RFQ LLRF VXI crate is powered and has a running networked IOC. A CDM and two multiplexers are installed. Cable checkout is in progress. An HPM, Rev.D, is expected from LANL by middle of next week.

The new Systems Requirement Document for the Linac LLRF control systems has been completed.

The draft plan for continuing the development of the Linac LLRF control system is nearly complete and will be distributed to the advisory board and ASD management Oct. 20, 2002.

Electrical Systems Group

Ken Rust visited Alpha Scientific Electronics to witness the CCL Quadrupole Power Supply Shunts acceptance tests.

Partner Laboratory Work packages were reviewed.

Modulator 13.8kV switchgear second walk through completed and feeder is ready to be energized, minor house keeping needed before switch over – memo sent to CF.

FE-SS1, KL-SS1, KL-SS2 and KL-SS3 are now on permanent feeder from main switch house.

KL-SS1 500MCM feeders for ASD panels in klystron building installed, power outage coordinated with ORNL maintenance.

Survey and Alignment Group

Epoch 5 of Linac Floor Settlement Survey has been completed. Data will be published in the near future.

The S & A Group has successfully mapped the Klystron Gallery "asbuilt". The "asbuilt" footprint of all installed equipment has been mapped. Additionally, walls, beams, etc. has also been mapped. Exact locations of column lines have also been identified.

Continued mapping/fiducialization of quadrupole magnets.

Cryogenics Group

Beam Diagnostics

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