Accelerator Systems Division Highlights Ending April 30, 2004

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)
Accomplishments This Week: (1) *805-MHz, 5-MW Thales klystrons:* We are making progress on the next 5-MW klystron. We are now up to 5 MW, 60 Hz, 1.3-msec pulses, and the tube looks pretty good. The body power is a little higher than what we are used to seeing, but still within our comfort range. The 5-MW klystron whose RF window fractured thermally at full power is still at LANL. We are applying pressure to Thales to admit the contract responsibility, but so far they haven't agreed. However, they did agree to take it back for further evaluation. (2) *805-MHz, 550-kW Thales klystrons:* A Thales 550-kW klystron passed its site acceptance test this week. (3) *ORNL Installation support:* We have another team at ORNL this week. They are working on installing the CCL-3 klystron and bringing up the 13-24 SCL klystrons. They also helped with the tuning of the circulator on the CCL-1 klystron.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)
Accomplishments: Both LANL HVCMs are running well, one for the 5-MW klystron tests and one for the 550-kW klystron tests.

DRIFT-TUBE LINAC (WBS 1.4.2)
Accomplishments: Tank-6 post couplers machining was completed at CMI, and they were shipped to ORNL on Monday. This completes LANL's final deliverable for the DTL!

COUPLED CAVITY LINAC (WBS 1.4.4)
Accomplishments: ACCEL is packing Module 4, and it is scheduled to be shipped to ORNL on Tuesday, May 4. This will complete LANL's final CCL deliverable.

PHYSICS & DIAGNOSTICS (WBS 1.4.5)
Accomplishments: (1) *RTBT harp pickup:* We are finalizing the details regarding the wire connection from the harp cards out to the vacuum feedthroughs. Macro-Metalics is proceeding on schedule to deliver the harp cards by early June. (2) *RTBT harp electronics:* During last week's SNS harp electronics review, we agreed to look at the noise observed on the LANSCE IPF harp cables under the premise that it might be close to what should be expected on the SNS RTBT harp. We distributed a document showing the results of these measurements, and concluded that the present SNS harp electronics design should work as expected. We ordered 90% of the hardware for the harp electronics this week. The target completion for the electronics is still mid June.

ASD/JLAB: Cold Linac

Assembly of the H-1 and H-3 cryomodules continues.

The M-11 cryomodule has been cooled to 2 K. Low power tests are complete and the first cavity has been tested at more than 18.5 MV/m.

Assembly of the H-4 cavity string is complete and the unit is under vacuum. (See photo)

ASD/BNL: Ring

Talks for the upcoming DOE Review are being finalized. Dry runs were conducted for the plenary and break-out sessions. The Ring breakout talks will be divided into three parallel sessions covering mechanical, electrical, and diagnostics.

Craig Dawson (Diagnostics Group) reported on his recent trip to SNS/OR and the results of BCM electronics testing during DTL commissioning.

Half-cell #27 is assembled and will be shipped to SNS/OR next Tuesday. Work on HC #28 is underway.

Performance and heat run testing on two of the extraction kicker PFNs is underway at APS.

A copy of the SNS Ring Diagnostics Production Plan was submitted to ASD for review and signature approvals.

Graeme Murdoch, Mike Hechler, Mike Holding and K. Potter were at BNL to review the RTBT rad hard quad design, installation drawing status, vacuum production and coating, delivery schedules, and installation mock-up of the injection line straight section components. A report by M. Hechler will follow.

RF systems #2 and #3 are ready for shipment from BNL. We hope to deliver #2 before the DOE Review. Unit #3 will follow immediately afterward.

Dick Hseuh is working to successfully coat an extraction kicker (ferrite) magnet. The TiN coating did not properly adhere to the first sample. Coating of sample #2 is underway.

Field quality tests using a flip coil are underway on Chicane #1.

We have been advised by SDMS that their delivery of the vacuum chamber for the Ring primary collimator will be delayed ten days (for TiN coating by BNL).

From the mock-up assembly of the injection straight section, it has been determined that the vacuum chambers for chicane #4 and the injection dump septum must be modified. Efforts are underway to determine the root-cause of the problem. Corrections are underway at BNL.

We have been advised by our vendor, Alpha Magnetics, that they are unable to locate sufficient quantities of 1006 steel for the Extraction Lambertson Septum magnet. Other sources and options are being explored by both parties.

We still owe Joe Error the installation survey drawings for the Ring quarter-cell assemblies. Frank Karl has given this a top priority.

The first production PFN extraction kicker with control racks is ready for shipment from BNL to SNS/OR. Container assignment will likely follow RF #2.

Controls

Starting this week, anyone coming to the Front End Control Room will be welcomed by the two lovely ladies, Delphy and Susan, at the Controls FECR Welcome Desk.

Much of the week was spent in preparation for upcoming meetings: The Beam Instrumentation Workshop, The EPICS Collaboration Meeting and the DOE Semi-Annual Review.

Considerable effort went into support for the CHL turn-on that took place this week.

It was reported at the post-run Controls Team meeting that 16 of our IOCs were up 100% of the time during the run (no reboots.) The reboots that there were in general scheduled. The hard work on "IOC Disease" seems to have been successful. The MPS system was also reported as "not an issue."

Work continued on the Hot Spare stand. The 65KV controller is tested and ready to install, as is the QEI RF Pulse Generator. Fiber Receiver and Fiber Transmitter Boards are stuffed and installed. Software for the Cs Heater controller for both "blue boxes" is complete, and wiring is in progress. The Steerer supplies, the Matching Network, and the 65Kv switch remain to be done. This will complete the controls work for the hot spare.

The CCL IOC1 and Beckhoff bus controller for the shunts is configured and operating. The IOC has given us problems for more than a week with failure to reboot reliably. The shunt control testing will be done in coordination with Ken Rust and the Electrical Group since they do not have a satisfactory way to do that testing without EPICS. Also on the power supply front: Martin Pieck became the father of a baby boy on Friday.

Not all desired power monitoring is yet available, and meetings were held with the CF Group to see how the missing data can be obtained.

A second timing master is being set up in the RF cavity testing lab at BNL. One of the 4 LLRF IOCs is being moved to the lab to drive the cavity. Previously, the cavity was driven via a generated reference signal. EPICS is now being used to control and monitor the BNL HPRF equipment, as well as the LLRF system, including the timing for the LLRF equipment.

Installation

Craft Snapshot 4/20/04

ASD productive craft workers	**61.0**
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	70.0

Less WBS 1.9, 1.2 etc	**5.0**
Less absent	**2.0**
TOTAL PD BY ASD/ORNL DB WPs	**54.0**

Interviews were completed for seven candidates for the ASD Research Mechanic – Electrical Trainee position(s). A selection will be finalized by May 10, 04. The new Research Mechanic – Electrical will report for work on May 24, 04.

A study of uniform requirements was completed for ASD. The results were provided to the SNS committee developing a project wide policy.

Accelerator Physics

Initial results from the ring injection radiation modeling effort show that a gamma blocker will not be required for the back streaming radiation from the ring injection dump after the beam is off. Previous estimates had indicated that a blocker would be desirable, but the more detailed computer model shows that these estimates were unrealistically high.

Operations

Ion Source Group

Jimmy Greer, retired from LBNL, helped us to find the drawing that document the modifications made on the Glassman EQ high voltage supplies. Rod Keller helped us to solve another documentation issue.

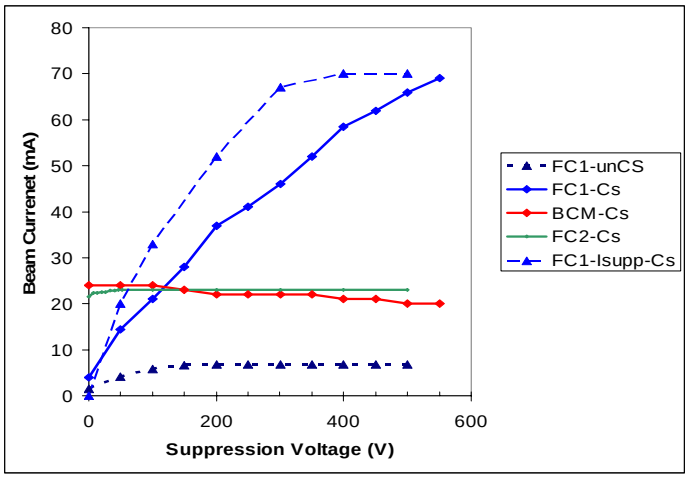
Susan Griego, Delphy Armstrong, and Ernest Williams helped retrieving data from the DTL1-3 commissioning. The data show that the 65 kV power supply failed to maintain 65 kV already 2 hours before the problem was fully recognized. Accordingly it took a total of 6 hours for the 65 kV to be restored, which increases the ion source downtime to 2.2% of the DTL1-3 commissioning. The data also show that the current draw started to increase about six hours before the failure, enough to plan an expedited recovery. Three measures are being taken to avoid a reoccurrence of this problem.

Bill McHargue, Willem Blokland, Craig Deibele calibrated the beam current monitor installed in the ion source hot spare stand. This allowed us to understand our current measurement problems:

The large aperture, deep Faraday cup (FC2, green line), on loan from KSU, requires 40 V on the suppressor and agrees with BCM measurement. Unfortunately, this cup can take the full beam only for a short time period because it lacks water cooling.

Inserting the water-cooled LBNL Faraday cup between the BCM and FC2, and increasing its suppressor voltage to at least 200 V yields correct results when measuring a 10 mA beam before cesiation (FC1-unCS, black dotted line). However, with a 25 mA beam, obtained after cesiation, back streaming electrons cause the BCM current to decrease with increasing suppressor voltage (BCM-Cs, red solid line).

With 25 mA, the cup measurement (FC1, solid blue line) increases almost linearly with suppression voltage. The excess current appears to come from its suppressor (FC1-Isupp, dashed blue line). It appears that the additional charge causes a part of the beam to hit the suppressor, adding electrons to the beam current.



We have restarted lifetime tests with a peak current of 38 mA and a flat top of roughly 30 mA.

Survey and Alignment Group

The team finished aligning the segments for the CCL 3. This alignment was needed so that the owners could finish installing the rest of the hardware for the CCL 3.

We fiducialized two additional magnets; one 8Q35 and also a CCL Quad. From our records, we have now fiducialized a total of 38 CCL quads, 4 8Q35, and 11 21Q40 magnets. We have been informed that the 21Q40s will require re-fiducialization.

We positioned the Linac Dump Flight Tube Flange and then verified its location throughout the welding process.

We set the alignment bench that supports the core vessel inserts. The bench is located in the Robotics Laboratory at X-10 and is also where the core vessel inserts are fiducialized and tested. Our responsibility consisted of leveling the alignment bench and finally setting the core vessel mounting flange. Since the alignment bench was not anchored to the floor by any means, we were only able to level the table to 0.005". We then plumbed the mounting flange to an angle of one second.

Once the alignment bench was set in position, we installed our core vessel flange fixture to the alignment bench mounting flange and set out adhesive targets which represent a reference line perpendicular to this flange. This line will be an important reference required for performing subsequent alignment work on this project.

Last, we performed a fiducialization of the first core vessel insert. The first insert is a solid plug which resulted in a minimal amount of work on our part. A mirror was installed in a pocket located in the core vessel insert. We had requested this pocket early on in the design of the core vessel insert. We surveyed the horizontal angularity of the mirror with respect to our reference line and the vertical angularity with respect to gravity. Those values were recorded. When the core vessel insert is installed into the core vessel, we will survey the mirror a second time and determine if the core vessel insert is seated properly in the core vessel.

Field work was completed for the remaining portions of the HEBT – Ring – RTBT tunnel network. Exterior ties between penetration points was also completed. Our target date for the completion of the newly updated survey global network encompassing the HEBT, Ring, and RTBT is the first week of June.

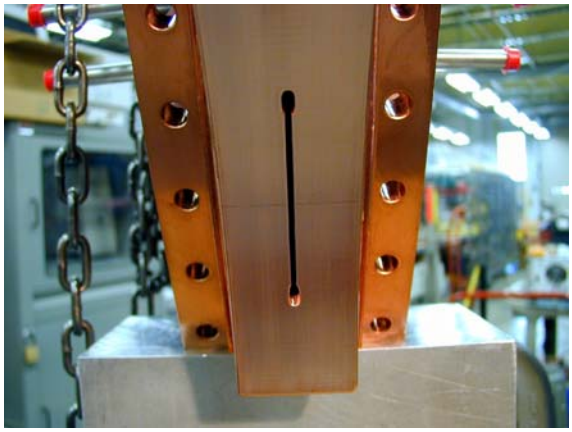
We have received information from BNL from BNL which should allow us to verify our installation coordinates for components in the upper and lower section of the Ring.

We are also in the process of updating our drawing base with respect to RTBT components.

Mechanical Group

We completed the successful commissioning of DTLs 1 – 3 late on Friday the 23rd. This past week we have observed a "cool-down" period for the beamstop and beamline components. During this time we made a change to the DTL 1 cooling system and ran a few tests at full RF duty cycle on that cavity.

All slug and post coupler tuners were inspected, tested, and installed. A rough leak test was done so that a vacuum could be pulled on the tank for tuning. Final iris sizing has just been completed; therefore, with only a few minor tasks remaining this tank will be ready to go to the tunnel. Photo of the tank side of the RF Iris.



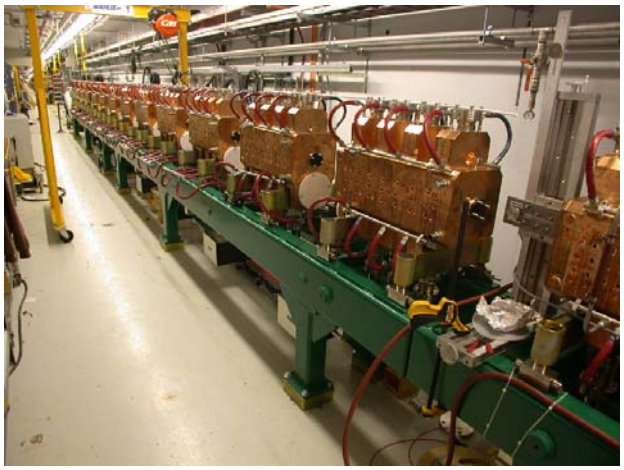
Slug tuners have been inspected, tested, and installed. Post couplers have arrived and are being flow tested. All of the water header system is installed but several days of hose connections remain. We should be able to begin tuning this tank as early as late next week.

CCL-1 conditioning is complete. 2.5 MW with a pulse width of 1 millisecond at 20 Hz was put into the CCL-1 module. The main tank vacuum was consistently in the low x 10^{-7} Torr range. Conditioning went very smoothly and was done in 3-4 shifts (8 hours each) from start to finish.

CCL-1 in Tunnel

The magnet cooling system was fixed and is now working properly. This allowed CCL-1 magnet power supply testing to continue and was completed this week.

CCL-3 segments have been aligned and bridge coupler installation will begin next week.



Water Systems Installation

- The assembly and installation of the manifold for CCL-2 and DTL-6 were completed.
- Installation of the piping from the waveguide chase to the CCL-2 manifold was completed and the filtration unit installed in preparation for flushing.
- The relocation of the 'temporary' CPVC manifold for testing magnet power supplies was completed and turned over to the PS for operation.
- The feed piping from the CF headers to the SCL TRCC skids 9 and 11 was completed.
- Installation of the piping to the RF equipment on SCL-ME5 and SCL-ME6 was started.
- The QMCS cooling system was made operational enabling the related magnet testing to be completed.
- The HEBT Collimator remote cooling connection system was installed and leak tested.
- The change out of the heat exchanger on RCCS-DTL1 DI system was completed.

Ring Systems Installation

- The RING Half-Cell #26 (Unit B4) was installed
- The remote water connections on the HEBT Collimator #2 were installed tested, and the outer shielding reinstalled.
- The Linac Dump beam window installation was started.
- The DC cable connections to the HEBT 12Q45 magnets continued.
- The pulling of the kicker magnet cables into the RING Injection straight section was completed.
- Installation of the racks in the HEBT Service Building was started.

Magnet Task

We now have 9 CCL module 2 intersegments ready to install.

We mapped and fiducialized an 8Q35 and another CCL Quad.

We helped out in the tunnel with the CCL magnet cooling system.

JG went to Opera training.

Electrical Group

Completed integrated testing of all CCL 1 magnets and power supplies.

Started installation of power supplies in HEBT service building.

Interviewed candidates for Research Mechanic – Electrical Position(s).

Vladimir Gorbounov, a visiting engineer from Russia (IHEP Moscow), returned to Russia this week. He has worked here for ~ 1 ½ years and was invaluable in the electrical systems installation design.

Our new visiting Russian scientist, Vladimir Peplov, arrived this week to help with the HVCM effort. Activities this week included preparation of the SCL-ME2 modulator for checkout, removal of CCL-ME3 for upgrades, initiation of installation of the SCL-ME3 basket assembly, repair of LEBT chopper pulser units, interviewing candidates for technician position(s), and installation of new LOTO systems on all modulators.

AC feeder installation and inside electrical in temporary building between Klystron and HEBT building has been completed, test and installation verification will be done Monday.

Two HEBT AC feeders termination in the HE-SS1 completed

HEBT vacuum and instrument rack (two rows) in the building installed on base frames.

HEBT tunnel magnet terminations has begun this week

Injection bump twisted cabling completed in the RING tunnel

HPRF

CCL-1: CCL-1 RF station exhibited waveguide arcing at 1MW power levels. Found bad flange between klystron and circulator, cleaned and sanded. Inspection showed circulator port-2 Kapton window slipped slightly in flange, replaced Kapton film. Tested klystron to 4.5 MW, 30 Hz, 1ms pulse width into a waveguide short; OK. Returned RF station to Operations to complete CCL-1 structure conditioning satisfactorily.

CCL-2: Tested to 4.2 MW, 30 Hz, 1ms pulse width into waveguide short.

CCL-3: Installed 5MW klystron, pipefitters starting cooling interface work.

SCL: Continued waveguide connections and adjustments, terminated magnet and filament cables through MB-8.

Interface plates to support the 550 kW Thales socket were spec'd and fabricated. Prototype worked OK, ordered 11 more for SCL ME5 klystron array.

LLRF

The LLRF group provided support for CCL1 RF conditioning and klystron/circulator testing.

The group is working on CCL3-4, SCL ME1 and SCL ME2 installation.

We received an additional 53 HPMs for a total of 116 received to date.

Local Oscillator distribution cables for intra-rack distribution were received this week from our cable vendor.

Cryosystem Group

We now have liquid helium in the test dewar, all 5 turbines are operating, 4 compressors are on line and we have the calibration heaters at test wattage. So it appears as of this writing that we have a refrigerator that meets specifications. Our intention is to stabilize the plant during the night, complete the test tomorrow and shut the plant down before midnight on Friday.

Beam Diagnostics