

## Accelerator Systems Division Highlights Ending June 4, 2004

### ASD/LANL: Warm Linac

#### HIGH-POWER RF (WBS 1.4.1.1)

- The final site acceptance test at LANL of a 5-MW klystron is going well. We are running up to 4 MW, 60 Hz, 1.25 ms. This klystron will be used at LANL for continuing CCL window, circulator, and load tests.
- A pair of CCL windows is being baked out this week. Bake out is proceeding normally. The windows will be installed next week on the test stand.
- A 550-kW Thales klystron just finished LANL site acceptance tests. It was 63% efficient, meeting the 62% specification. We have two more Thales 550-kW klystrons to test.
- Another 5-MW klystron is completing its factory test at Thales. This klystron will be shipped directly to ORNL.
- Bill Reass, Roy Przeklasa, and Don Clark are at SNS providing installation support. Bill is working with Dave Anderson to test the HVCM for the SCL to full average current.

#### DIAGNOSTICS (WBS 1.4.5.2)

- For the RTBT harp, we have finished assembly of the 5th HV plane and started the 6th. Tests showed the first version of the harp electronics card to be highly functional. The design has been modified to clean up some issues and was delivered to the ECAD shop this week. The new boards are expected at LANL the week of June 14.

### ASD/JLAB: Cold Linac

The H-1 cryomodule was successfully cooled down. Two of the four piezo tuners failed during cooldown, and the mode of failure cripples the mechanical tuner. Intensive examination of the piezo tuners on H-3 and H-4 began immediately, searching for possible mechanical assembly problems. Problem identification is expected within a week, and in the meantime RF tests on the two good cavities will proceed. If the resonant frequency of the presently untunable cavities is close enough to the nominal value that fundamental power output to the HOM loads is acceptable, these cavities can be tested as well. This will minimize the number of thermal cycles to which the module is exposed.

H-3 cryomodule assembly is complete. The H-4 cryomodule has been inserted into the vacuum vessel and preparations are underway for the attachment of end cans.

A leaking HOM coupler probe feedthrough delayed transfer of the H-5 string to the cryomodule assembly group. The string is now leak-tight and will be transferred next week.

Two cavities of the H-6 string have been qualified.

The M-11 cryomodule has been repaired. HOM coupler probes lengths are carefully matched to accommodate manufacturing variations in the coupler resonant 'finger' and external can. In the case of M-11, cavity 2, the Fundamental Power Coupler end probe and Field Probe end probe were switched. A length difference of 0.019" was sufficient to cause one probe to nearly contact the central 'finger', leading to electrical breakdown at fields below specification, and the physical damage caused by the initial discharges lowered the breakdown field still farther. The failed probe was replaced with one of the appropriate length and the cryomodule is once again under vacuum and leak-tight. The assembly traveler has been modified to ensure that information about the match between HOM couplers and probes is highlighted for the assembly crew and recorded.

The 1 MW RF test stand has been repaired.

**ASD/BNL: Ring**

Magnetic measurements of chicane #4 dipole (with z-bump #4) are complete. Field quality measurements were taken using a long flip coil at various locations within the beam area of radius 5 cm (300 PI) and 8 cm (480 PI). All integral fields were normalized to the integral field at the center of the beam envelope. Data reviewed by AP included the excitation curve along with the integral field quality at 1.0 and 1.3 GeV.

Half-cell #29 is complete and will be shipped to OR next Tuesday. A shipping container for RF #2 (with magnet chambers, stands, lifting fixture, etc.) is also scheduled to be shipped.

Work continues on half-cells 30, 31 and 32 (our last half-cell).

Vendor bids for the RTBT 17D244 bend magnet cores are being evaluated by our Contracts Department. Included was an option for a complete magnet assembly (their core with BNL supplied coils and vacuum chamber). The successful bidder should be announced next week. This represents BNL's last magnet procurement.

TiN coating of the Ring primary collimator vacuum chamber was successfully completed. Last week's coating problem was traced to a substandard o-ring used to seal the end flange. The vacuum chamber is being crated for air freight back to SDMS in France.

Chicane #4 and vacuum chambers for chicanes 2, 3 and 4 will be added to the injection straight section mock-up next week. Plans are being made to trial fit and survey the thin foil chain drive mechanism at the same time.

Jon Sandberg, Ken Rust and Ted Hunter returned from IE Power where they witnessed acceptance testing of the Ring dipole power supply.

ASD's Cole Sibley and Dave Thompson were at BNL this week to discuss timing, MPS and RF issues with BNL's Controls group leader, Larry Hoff.

Diagnostics: a pre-production review of the BPM board was held with ASD this week via a video conference. Tom Shea was at BNL for the review.

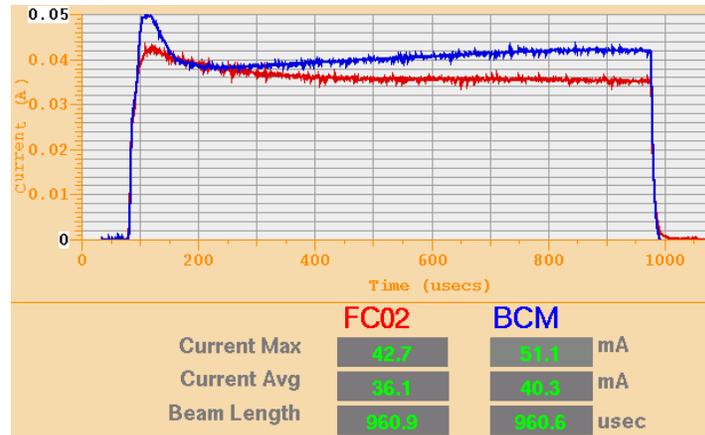
**Controls**

The Controls Group welcomed two new members this week. Sheng Peng, who has been working for SNS as part of the BNL controls team for over five years reported to work in Oak Ridge this week. Sheng will continue to support BNL subsystems, starting with the power supply control subsystem. Kay Kasemir, who has been a part of the controls team at LANL also moved to Oak Ridge this week. Kay will continue to support the Low-Level RF controls interface as well as leading the Archiver team.

Cole Sibley and Dave Thompson spent several days at BNL discussing ring timing, MPS, and commissioning issues. Meetings were held on LLRF, HPRF, timing monitor, line-sync pulse generator, V124S and V108S timing modules, BLM, and extraction kicker equipment. The goal is to minimize the number of surprises as these systems are completed and delivered for deployment on the SNS site.

LANL continued its effort to support the ongoing conversion to EPICS version 3.14, the version to be used for the upcoming warm linac run. The vacuum, resonance control and power supply applications were converted, as were the drivers for Beckhoff and serial Hytec devices. Waveform support for the SNMP driver was also delivered. LANL personnel will be on site next week for testing of the CCL water systems.

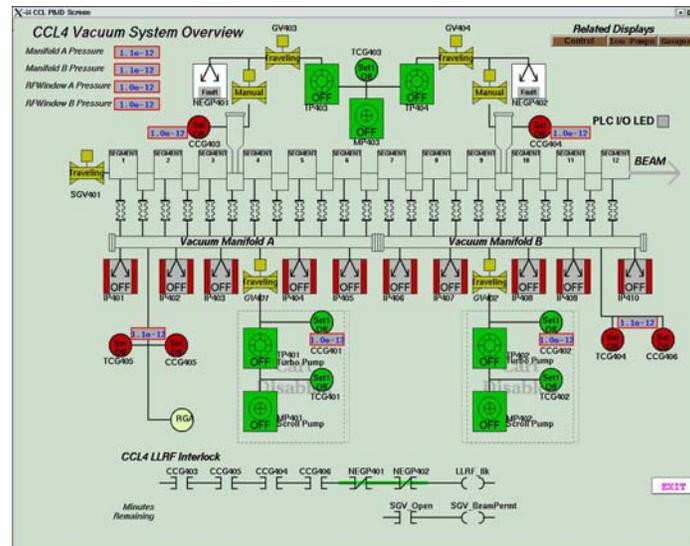
EPICS-based tuning of RF power on the Hot Spare Stand was implemented. That has permitted safe tuning of the RF to 52 kW, producing a peak current of 51 mA and average current of 40 mA. The calibrated beam current monitor is right behind the last LEBT electrode, and therefore highly reliable. The Faraday cup is many inches further downstream, and therefore shows a number of strange artifacts.

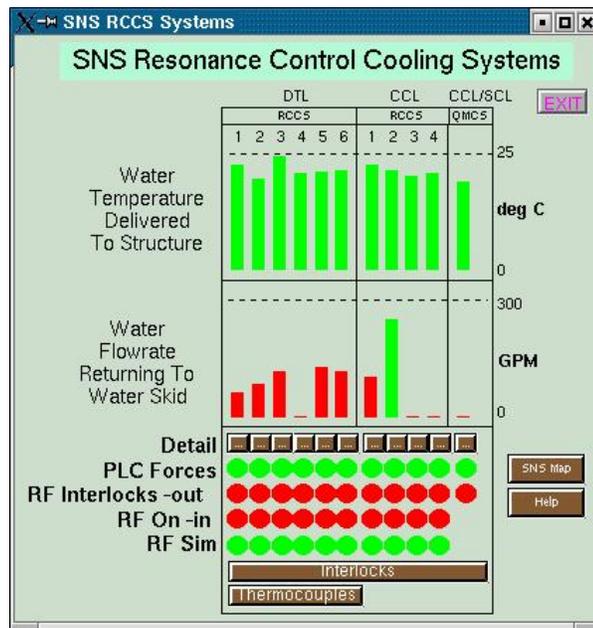
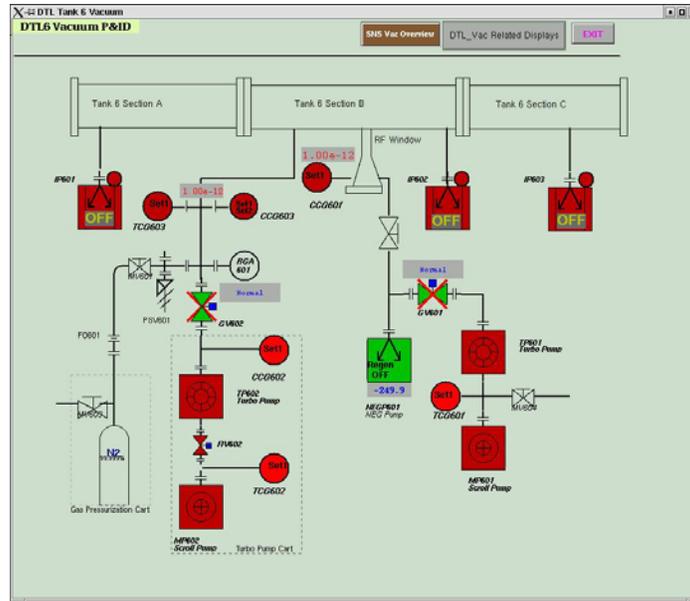


A program of conversion of nearly fifty controls servers from Red Hat Linux to the “Enterprise” version has begun. This is required because the earlier version has been abandoned by the supplier, who will offer no further support. A significant advantage of the new system will be the possibility of incremental upgrades, rather than requiring the generation of complete new systems, as is the case now. This upgrade is being planned to coincide with the necessary removal of all servers at 701 Scarboro to the site. Additional power circuits were installed in the FE Communications Room in preparation for that move.

Stripper motion control cable design was approved by BNL, and the rack and equipment design is underway.

In preparation for the LANL visit next week, test plans for the DTL 4-6 and CCL 2-4 vacuum and RCCS systems were prepared. RCCS and vacuum control software for these systems was installed and configured. See sample screen shots below.





### Installation

Craft Snapshot 6/1/04

ASD productive craft workers	<b>59.0</b>
Foremen (Pd by 15% OH)	6.0
AMSI management (Pd directly)	3.0
<b>TOTAL AMSI WORKERS</b>	<b>68.0</b>
Less WBS 1.9, 1.2 etc	<b>6.0</b>
Less absent	<b>4.0</b>
<b>TOTAL PD BY ASD/ORNL DB WPs</b>	<b>49.0</b>

## **Accelerator Physics**

Work continues on the extraction dump vacuum window. It is unlikely the window can have the desired thickness of 0.5 mm to minimize the effects of multiple scattering. We are exploring our options for 1) allowing a thicker window, 2) focusing the beam to a smaller spot size at the beam dump face, and 3) allowing a larger beam at the beam dump face.

Cabling work has resumed near the linac beam dump. We will add shielding around the vacuum window as it is presently installed. Radiation shielding model calculations are underway to optimize the shielding configuration.

Meetings have started for the organization of the testing of the cold linac over the next year. The meetings are on Tuesdays at 10:30. Relevant subsystems owners are requested to participate. Others are invited if interested.

Dan Stout, Ted Williams and Campisi are working on an integrated schedule for the Linac installation, preoperational checkout, and cooldown and testing which will help in pointing out conflicts and priorities.

Not all the cryomodules will be in place in time for beam commissioning. A decision on how many cryomodules to run with will be made as soon as the overall schedule analysis will better define the subsystems which will not be available.

The cryomodule testing groups' structure is being worked on and people identified. They will be contacted and the definition of the test plans will begin shortly.

Warm section cleaning and assembly facilities, procedures and plans will be reviewed in about one month, as requested by the DOE SAR. The members of the Review committee have been identified, contacted and have agreed to help in this matter. They are: Tsuyoshi Tajima (LANL, Chair), Mike Kelly (ANL), Peter Kneisel (JLab), Tim Whitlatch (JLab), Axel Matheisen (DESY). Information is benign provide to the Committee. SNS personnel are working closely with the Committee to successfully have the review by early July.

Superconducting cavity's coupler processing is continuing at SNS. One anomalous event occurred on June 2, during which some contamination in one of the couplers was discovered on the air side of one of the couplers during the final stages of processing of a pair. The nature and origin of this contamination is being investigated. Another pair is undergoing RF conditioning now and an additional set will be received on Saturday June 5 from JLab, to be processed lat in the week of June 7<sup>th</sup>.

Lloyd Young visited SNS and discussions were held on how to set frequencies and phases of the superconducting cavities with beam. This is the initial activity which will lead to the preparation for beam commissioning plans later in the year.

Cryomodule HB1 is now cold at JLab. Two tuners are not operational. Testing at high power will start in the next few days

## **Operations**

Ben Sanchez arrives. He is a new ASD Chief Accelerator Operator from LANL

Operations is working on the detailed schedule for SCL installation and testing

Interviewed a Chief Operator candidate last week and are preparing an offer

Working with the water engineers on the RCCS improvement program, in particular the CV1 valve upgrade

Worked on DataStream, Shane on DTL, David on CCL

Discovered a Problem with ASD support of the Equipment Tracking System, system owners are not putting in equipment locations when the equipment is installed.

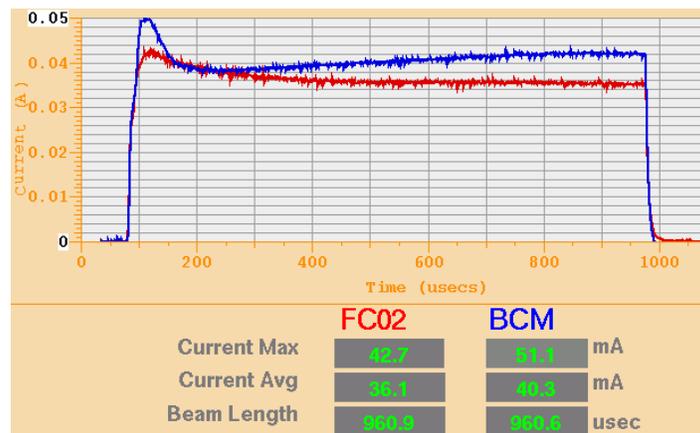
Staffing the FEB 08:00-16:00

Dealing with a myriad of CLO Move issues

### Ion Source Group

“Electric Hazards and Safety with Ion Sources” was presented at the SNS Electric Safety Workshop. The 41 slides discuss the need for high voltage when operating ion sources, and the resulting electric hazards especially of high current ion sources, such as the SNS ion source. While preparing the presentation it became clear that tuning the Front-End to 40 mA pushes the RF tuning capacitor beyond its nominal limit. We will have to reduce the inductance in the Front-End matcher from  $\sim 4 \mu\text{H}$  closer to the  $\sim 3 \mu\text{H}$  that are used on the Hot Spare Stand.

Allen Justice has made it possible to tune the RF power on the Hot Spare Stand with EPICS. That has allowed us to safely tune the RF to 52 kW, producing a peak current of 51 mA and average current of 40 mA. The calibrated beam current monitor is right behind the last LEBT electrode, and therefore highly reliable. The Faraday cup is many inches further downstream, and therefore shows a number of strange artifacts.



### Survey and Alignment

The “final” alignment of all DTL tank assemblies has been completed for the epoch.

Thursday, we began aligning CCL1 magnets. This is not an easy task due to the many line of sight obstructions. Complete alignment will probably require closer to four days than the two we originally estimated. The CCL components are very congested, may require partial disassembly of water lines and/or wiring to complete all quads.

Received CCL3 quad assignments and our calculating the ideal coordinate values for these magnets.

One additional 8Q35 and one additional CCL quadrupole magnet were fiducialized this week. By our count, we have now completed fiducialization of 11 21Q40s, 42 CCL, & 8 8Q35s.

We are in the process of designing a fixture for the Magnet Measurement Group which allows them to position 8Q35 magnets onto their measurement test stand without the need of the alignment group. The fixture should be operational by next week.

SNS Survey and Alignment prepared a proposal for vertical deformation monitoring of the Front End floor. This was spurred by some unusual differential leveling results. Long term monitoring is planned to check for seasonal effects, and automated precipitation monitoring is planned in order to see if a correlation exists between rainfall and deformation.

A calibration check was performed between all three laser trackers and two total stations to ensure that scale factors and additive constants were consistent.

Formal documentation of the “simultaneous collimation estimation” procedure was started. Briefly, this is a method by which the respective collimation errors of two levels are determined very precisely, via least-squares modeling of ‘area leveling’ data. The need for the traditional (and less precise) peg test is eliminated.

This week, we returned to fiducialization of the core vessel inserts. To date, S & A has completed the six plug core vessel inserts and we are now starting to fiducialize core vessel inserts with the thru holes and no glass guides. There is eight of this type of core vessel insert. The first arrived in the latter part of last week and was fiducialized. Before this type of insert could be installed on the alignment bench and the fiducialization process to begin, a new mounting plate needed to be installed on the alignment bench requiring S & A to reset the alignment bench after the mounting plate was installed.

We met with Target Group and the General Contractor in charge of the Target Building to discuss any concerns they may have with regards to alignment of the Target Cart Rails.

Chopper cavities 3, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17 and 18 have been measured. This is 12 of the 18 cavities completed. Today we plan on cavity number 18 which will complete the “building” north side of the monument.

### **Mechanical Group**

All DTL tanks have been checked for alignment and we had to add a few shims under all three new installations but otherwise they are ready to be connected to one another.

We are ready to begin flowing water on tank 4 and are in the process of doing a static fill test. Beamline interface connections are progressing and should be completed next week. Installation of the EMD cable connections has begun.



We are loading RF windows on tanks 5 & 6. Pumping system installation is progressing and all ion pumps are installed. Testing has begun on flow meters and thermocouples. We have done an initial water flow balance on DTL6.



CCL-3 cooling manifold installation is 80% complete. This will be completed next week.

The first four inter-segments for CCL-3 have been installed. Magnet connections are in progress.

CCL-4 bridge coupler installation was completed this week. Leak testing will begin next week.



#### Water Systems

- Piping fabrication/installation for the TRCC to the CCL-3 klystron is complete.
- DTL-4 tunnel piping from the waveguide chase to the manifolds has been completed. This concludes all the piping on the DTLs in the tunnel.
- CCL-3 tunnel water manifold piping has been installed on the support structure. The piping from the chase to the structure will start on Monday.
- SCL-ME5 TRCC cart # 9 overhead piping to the circulator and loads are complete. Still waiting on the placement of the klystrons.
- SCL-ME5 TRCC cart # 10 overhead piping to the circulator and loads are complete. Still waiting on the placement of the klystrons.
- SCL-ME6 TRCC cart #11 overhead piping to the circulators and loads are complete. Still waiting on the placement of the klystrons.
- SCL-ME6 TRCC cart # 12 piping has been pre-fabricated and the DI water system has been drained to allow installation of the relocated drops tomorrow.

- The Reference Line Instrument air does not keep up with the reference line leaks. A design package has been prepared for Chip Pillar to tie into the instrument header and filter/desiccate/regulate the air into the two reference lines.
- RCCS carts temperature control issues are being addressed with a potential valve trim change and a flow study to see what will work and what will not.
- All the resin bottles and resins have been collected for the last three RCCS carts. They will be picked up tomorrow for filling.
- The CF to ASD turnover of the DI water systems has not proceeded. CF is still supplying us the services, but for how long, is questionable.

#### Ring Systems

- Ring collimators #2&3 delivered and staged in tunnel last week, also collimator bases grouted and ready for outer shielding placement.
- This week quiet - Hechler, Savino & BNL personnel on vacation. No deliveries this week but more next.

#### Design Engineering

- Faraday cup modifications in progress – awaiting information on bias ring.
- MEBT anti-chopper vacuum vessel in manufacture – due mid June.
- MEBT anti-chopper actuators & associated equipment design complete – due end of June.
- Collimator bellows extraction mechanism design complete – being detailed for manufacture in two weeks.
- RTBT/Target interface, HARP etc in progress – conceptual design review in two weeks.
- HEBT & RTBT shield wall design in progress.
- ½ cell transporter for non-crane areas in progress.
- Low energy differential pumping station design is essentially complete - being checked.
- Experienced candidate from Y12 accepted final design slot – start date 1st August 2004?

#### **Magnet Task**

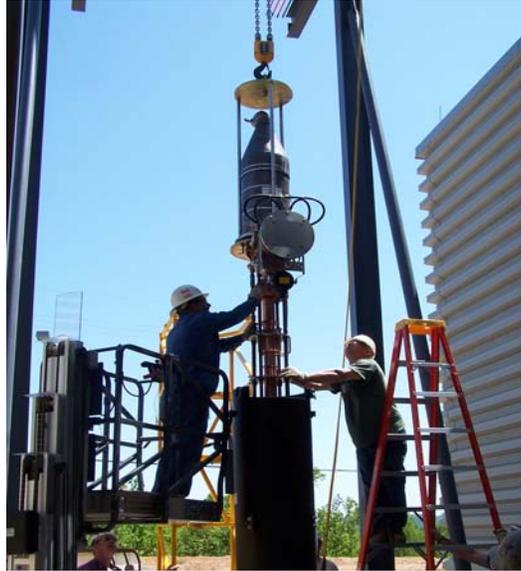
##### **Electrical Group**

Work was performed on SCL-ME3, preparing the HVCM basket for installation when the space becomes available. We began working on EPROM modifications to bring the SCL control chassis to the same state as the SCL-ME1 controller. SCL-ME1 was brought back on-line this week running the klystrons in diode mode. Bill Reass was in town to help us achieve high average power operation of the first SCL unit. Unfortunately, multiple problems with the IGBT driver cards prevented us from achieving reliable operation of the unit. We are addressing those problems, and will try and bring Bill out at a future date to continue this effort. Modification of CCL-ME4, including reconfiguration of the resistive load, was completed. Low level checkout of the unit was also completed, and we expect to begin high peak power testing early next week on this unit

##### **HPRF**

CCL3: Completed water and waveguide air cooling connections, lead shielding assembly and sensor terminations.

CCL4: Continued waveguide preparation. Lifted 5 MW klystron into magnet on HV oil tank and moved into place.



SCL ME2: LANL RF team brought two transmitters for MB 5-8 up to “Ready for HV” mode. High voltage checkout and RF power checks and calibration remain.

SCL ME5: Fabricated lifting shafts necessary to move the Thales 550 klystrons and had them ORNL crane certified. The first Thales 550 kW tube has been lifted onto a HV tank in preparation for the move to the gallery.

RF Test Facility: Disassembled and inspected waveguide in cryo-coupler test stand. Found waveguide switch had arcing contacts. Replaced with straight waveguide and installed additional arc detection points. The bad switch was unrelated to an arcing episode that occurred on a coupler being routinely tested with a 650 kW standing wave. The RFTF Cryo-coupler test stand is ready for operation.



## **LLRF**

### **Cryo-Group**

#### **Beam Diagnostics**

##### Wire scanners:

The meeting to discuss 8 and 12 inch actuator production has been scheduled for Wednesday, June 9. This will allow all experts to be present.

##### Faraday Cups:

The original seal design is being analyzed with the help of the Vacuum team. They have come up with viable fixes and components are being fabricated.

##### BLM:

Preparation of the BLM calibration facility continues with work on the motion control software. A plan for personnel access control has been drafted and circulated for comment.

##### BCM:

Requirements for the ion source test stand BCM are being developed.

##### BPM:

We participated in the Ring BPM electronics review. Since documentation was not available before the review, the comment period has been extended to June 9. A Sharepoint site has been set up to capture documentation, comments, and decisions. With help from RF, one of our students has restarted the development of a BPM scanning wire facility. Nearly all fiber optic components for the RF reference system have been received. The remainder should be received by Tuesday, June 1. Fiber termination has begun with help from the controls group, and the initial fusion splices show excellent, low-loss performance.

##### Timing:

The schematic for the production PCI card is complete. This and other design documents are being reviewed by Diagnostics and Controls to reduce the risk of errors. All components have been ordered and long lead time parts have been replaced by immediately available parts. Therefore, we expect the first production hardware to arrive before the end of June. FPGA code is still being checked and a meeting was held to discuss the existing functionality and register map. The timing interface code is being

##### Administrative and Misc:

Interviews for the Technician position have been completed. All bids for the contract technician have been received.