Accelerator Systems Division Highlights Ending April 1 and 8, 2005

ASD/BNL: Ring.

April 1, 2005:

Items shipped this week:

- BPM 2U Chassis: shipped 30 units; 20 more are ready to go.
- Two VC welding fixtures for HEBT and Ring/RTBT.
- The K1 extraction kicker magnet assembly & kicker parts.
- Two vacuum pipes.
- Extraction kicker PFN power supply (spare).
- BIG chamber (BNL assembly tech arrives in two weeks).

Next week's shipment (April 6th):

- Truck #1 – 41CDM30 (1) spare
- 7DS300 (#1 & 2) Injection Dump Septum Magnets
- Stand for Injection Dump Septum
- Stand for 17D224
- Six (6) vac clamps, chain type 250
- Eight flags and G-10 blocks for 30Q magnets
- RTBT Q1/Q2 magnet assembly
- Truck #2 – 36Q85 (#1)

Followed by:

- 36Q85 (#2)
- Movable scraper assembly for primary collimator
- Vacuum chambers, tooling and spares
- Four boxes containing a Dell Xeon PC, and a Dell Power Edge Server (attn. S. Peng)
- Remaining BPMs & Video Foil Monitor
- Carbon-carbon foils

And, finally:

- 36Q85 (#3 & 4)
- 17D224 magnet assembly
- 17ELS224 magnet assembly
- Lifting fixture for 17ELS224 & 17D224
- RTBT QH26 and d/s vacuum chambers
- Permanent shielding for the Primary Collimator
- Equipment spares and tooling

Orders that are on hold pending BNL/SNS budget approval:

- Injection thin foil chain-drive mechanism (spare).
- Order for permanent shielding for the two RTBT collimators.

Carbon-carbon foils were shipped to BNL this week (3/28) from Fiber Materials, Inc.; we are awaiting their arrival.

April 8, 2005

Equipment that was shipped this week (April 6th):
Truck #1:

- 41CDM30 (1) spare
- 7DS300 (#1 & 2) Injection Dump Septum Magnets
- RTBT Q1/Q2 magnet assembly

- Stand for Injection Dump Septum
- Stand for 17D224
- Stand for 17ELS224
- Lift fixture for quad doublets
- Six (6) vac clamps, chain type 250
- Eight flags and G-10 blocks for 30Q magnets

Truck #2:
- 36Q85 (#2)

Scheduled for shipment next week (April 13th):
Truck #1:
- 36Q85 (#3)

Truck #2:
- Injection kicker vacuum spares
- Thick foil and thin foil (chain saw) drives
- Ceramic beam pipes for injection magnets (2)
- Spare parts (bellows and tees) for injection magnets
- Supports for 14" vacuum chambers
- Four boxes containing a Dell Xeon PC, and a Dell Power Edge Server (Pepe to Peng)
- Remaining BPMs
- Video Foil Monitor

To be followed by:
- Movable scraper
- Control Racks for foil drives
- VC for chicane magnets #2, #3 and #4.
- Last vacuum tee for extraction straight section.
- 36Q85 (#4)
- 17D224 magnet assembly
- 17ELS224 magnet assembly
- Lifting fixture for 17ELS224 & 17D224
- RTBT QH26 and d/s vacuum chambers
- Permanent shielding for the Primary Collimator
- Equipment spares and tooling (misc.)

Nineteen (19) rigidized carbon foils, produced by Fiber Materials, Inc., were mailed to ASD's Mike Plumb this week.

Jim Alduino is planning to execute a BNL/SNS document file dump in mid April, as requested by ASD's Mike Hechler.

Bob Sikora's 4/13 trip to SNS/OR has been canceled due to BNL/SNS funding restraints.

Orders that are on hold pending BNL/SNS budget approval:
- Injection thin foil chain-drive mechanism (spare).
- Order for permanent shielding for the two RTBT collimators.

Controls

April 1, 2005

The Central Control Room (CCR) south arc console was installed and turned over to operations. The prototype console that had occupied that location was moved to the Target control room.

The LEBT chopper was installed in the Hot Spare and testing began. The schematic for the “next generation” LEBT/MEBT chopper was completed. PCB layout will begin shortly. Controllers for the high voltage supplies in the hot spare were also installed, and screens have been updated. Remote viewing of the hot spare from the CCR was verified.

The first set of automated MPS test procedures was verified.

Readout of the O2 sensor installed for DIWS 2 was added to the appropriate screen and a new record added to the appropriate EPICS database. CF PLC program files were backed up, putting current versions from Tullahoma in the CVS repository.

The target controls archive request file for the four target water loops were completed and the target server and IOCs set up.

Xiaosong Geng has transferred from the BNL NS controls team to ORNL. All development systems associated with Ring vacuum and HPRF systems have been shipped to ORNL.

The Ring LLRF application is complete, has been successfully run at ORNL, and the final version has been checked into CVS. Along with the program itself, final versions of both user and programmer documentation have been checked into CVS.

The Ring vacuum IOC has been shipped to ORNL. This is the final BNL-supplied operational IOC. BNL continues to provide controls infrastructure to support remaining Diagnostic (BPM and VFM), RF (LLRF and MPS), and timing (line-sync) efforts. As these efforts wind down, the remaining development systems will be shipped to ORNL.

PPS installation has started for instrument beam line 2 and the transfer service bay (formerly known as the transfer cell).

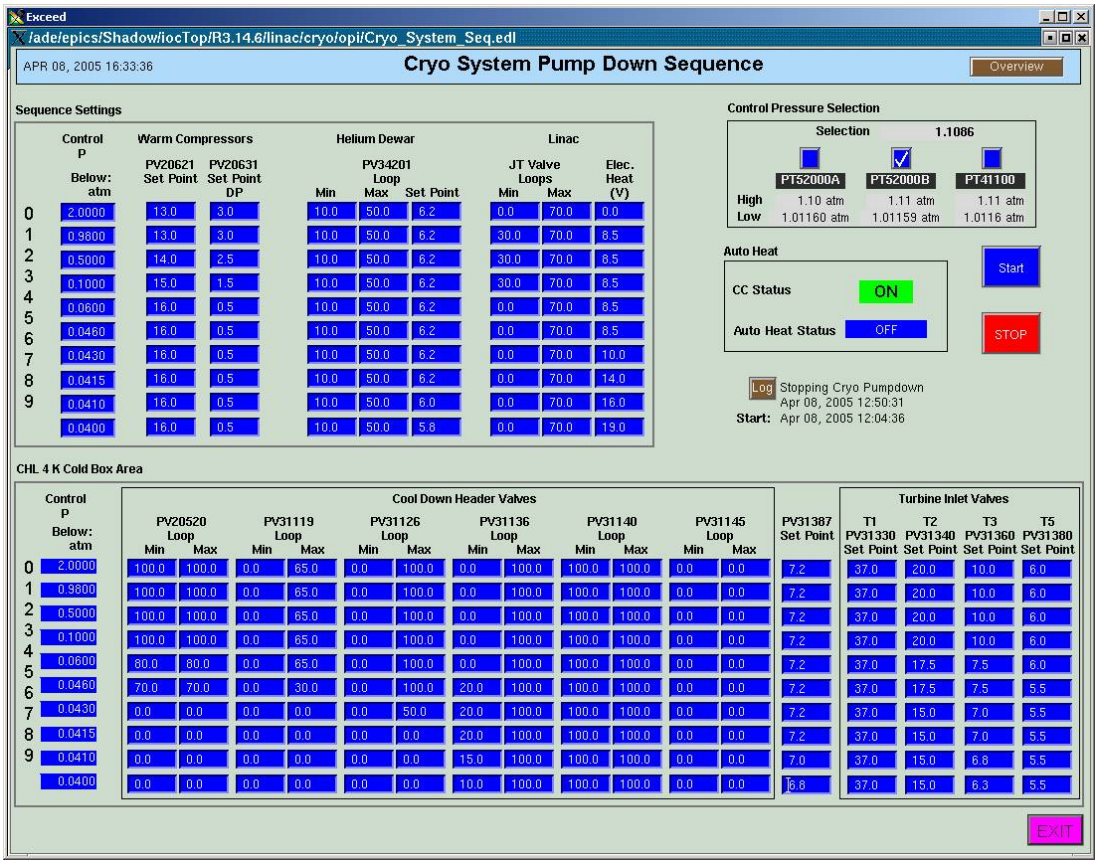
The current LLRF adaptive feed-forward implementation has one hard-to-tune parameter (“time shift”) and uses heavy averaging to make up for inconsistencies. A new approach has been developed that should compute a correction closer to the optimal correction, and make tuning less critical. Initial laboratory tests have not shown as dramatic an improvement as hoped for.

The SCL LLRF was updated to a new interlock scheme (more tests, better detection & display of 'override' conditions). Similar changes will be implemented for the normal conducting linac.

April 8, 2005

The console laminate panels and tops were installed, completing the south and northwest console arcs in the central control room (CCR).

Improvements were made to the 2K cold box backfill and pumpdown routines, including interlocks on the conditions required to start the procedures. A Cryo System Pumpdown Sequence was added and the 2K cold box was pumped down automatically setting values in the warm compressors, the helium dewar, the cryomodules and the 4K cold box.



Some statistics-keeping code was added to the archive engines to determine which engines are spending the most time in writing or responding to its web server. It appears that having many connections (handling many different IOCs) is the main problem. The LLRF, PS and iocHealth engines are the slowest because they have many network connections. Handling many samples (as the RCCS engine does) doesn't hurt as much. The reason for this observation is unclear – the Channel Access client library handles all the connections, and the channel archive engine should not care about the source IOC. Timing is a possible cause. When many values arrive from one IOC, there is a burst of callbacks for those values, which might clash with disc writing.
Requirements were developed for oxygen deficiency hazard system for Cold Neutron Chopper Spectrometer (CNCS, beamline 5)

Design drawings are nearing completion for the PPS racks for the target basement control room. Drawings are being checked and will be ready for approval early next week

Revised accelerator PPS control panel layouts were reviewed with ASD operations (reflects recent changes to Ring and RTBT segments)

The PLC program for HEBT chipmunks is in place and operating in PPS hardware for HEBT. Simulated Chipmunk input from HEBT field I/O correctly displays in CCR

An interlock was added to protect against damage to HPM ADCs.

The “new” adaptive feed-forward (AFF) code is being converted from Matlab to “C” so that it can be run directly on the LLRF IOC.

All the warm section and the cold section RF transmitter PLC firmware as far as transmitter 20 have been upgraded to version 13.

Installation

Craft Snapshot 4/5/05

ASD productive craft workers		**68.0**
Pipefitters	10	
Electricians	54	
Others	4	
Foremen (Pd by 15% OH)		8.0
AMSI management (Pd directly)		3.0
TOTAL AMSI WORKERS		79.0
Less WBS 1.9, 1.2 etc		**14.0**
Less absent		**7.0**
TOTAL PD BY ASD/ORNL DB WPs		**47.0**

Diagnostics Installation Status Summary

BPM

MB03-HB04 and HEBT installed and connected in the tunnel
SCL BPM05, 06, 07, 08, 09, and 10 phase match complete.
SCL BPM 11, 12, 13, 14, 15, and 16 phase match in progress
SCL BPM 17 through 32 terminations in progress
HEBT BPM01, 02, 03, 04, 05, 06, 07, 08, and 09 phase match complete.
Linac Dump BPM01, 02, 03, 04, 05, and 06 phase match complete.

BLM and Neutron Detectors

Ion Chambers received and calibration in process
HB4-HB21 long haul cable terminations in progress
MB01 and MB02 need the conduit installed and the cables pulled to them

Laser Scanner

LW01 and LW02 have been wired and tested and are ready for installation on warm sections MB01 and MB02
MB03 (LW03) and MB04 (LW04) are installed and have been function tested through the long haul cables
HB01 (LW12) through HB04 (LW15) and HB21 (LW32) tunnel connected in tunnel
IOCs arriving by 8 April for installation

SCL equipment rack

Racks complete through row 25 (12 of 20)
Rack prep in progress for remaining 8 racks
RF Distribution chassis installed in SCL (6 each)
RF Distribution chassis wired in SCL row 15 and HEBT rack 03H02Other Open Items

Accelerator Physics

We now have a designer assigned to work almost full time on the temporary target view screen. We expect rapid progress on the layout and final design now. Also, radiation tests on the Sumitomo and Fujikura optical fiber bundles, done at Y-12 with a 9 MeV photon beam (at no cost to SNS); indicate that the fibers will perform well at least to 100 kRad.

We're working to resolve global coordinate issues on the extraction kicker magnets and the chicane magnets.

The effect on a phase scan from energy loss in unpowered superconducting cavities has been calculated by Y. Zhang and D. Jeon. The effect is substantial (10s of degrees) for cavities on resonance, but when their resonant frequencies are moved more than 15 kHz from resonance; the effect is reduced to 1-2 degrees. This is important for planning how to carry out phase scans when tuning up the SCL.

Phase scans for SC cavities are being incorporated into the existing phase scan application (PASTA) and another standalone application for auto-setup of the SCL based on phase scans is underway

SCL Testing activities:

- Turned on cavities in cryomodules HB 04, 05, and 06 for the first time and processed the couplers to over 100 kW peak power.
- Operated 45 cavities simultaneously in 13 separate cryomodules.
- Maintained low level (30 kW) incident power in all 45 cavities for 3 days.
- Preparing to test all available 45 cavities to determine limiting gradients under various pulse lengths and open and closed loop

Operations

Ion Source

After extended problems with lens 2, the ion source has been restarted producing 20 mA, sufficient for the first chopper test on the Ion Source Hot Spare Stand.

A lens 2 discharge appears to have damaged some of the chopper switches while they were operating at 500 V. The electrical group made a big effort to fix the switches. At the same time the Hot Spare Stand was reconfigured to obtain a configuration identical to the front end. This has paid off as the chopper showed practically no over-current problems when it was restarted with 500 V.

Together with controls and electrical staff, we continue to support the chopper test on the Ion Source Hot Spare Stand. The low-voltage run was terminated last weekend after the operators noticed problems with the signals. The electrical group identified the problem and modified the high voltage switches accordingly.
Switching on the ion source RF for the next run, caused the TTL data selector IC in one of the HV switches to fail. Switch repair will continue on Monday when parts are received.
Grounding and shielding was improved, and now the noise appears to be acceptable. Currently the chopper is tested with 1000V on two of the surviving switches and operates correctly in the presence of RF. The central control room is monitoring the test.

Robert Welton and Martin Stockli moved to the CLO. The IT and moving staff did a great job and put us back in business in less than a day, although many boxes wait unpacking. Syd Murray will remain in the Font End Building as long as the Ion Source Hot Spare Stand remains our workhorse. When Robert and my work benefits from the vicinity of the Front-End, we will work in two workspaces set aside in the ASD owned trailers near the Front-End.

Survey and Alignment

We are currently aligning the replacement High Beta Cryomodule to final position in HB #7.
S&A aligned Medium Beta Cryomodule #2 into final position and warm section #2 in the SCL area. S&A aligned High Beta Cryomodules in slots CM18, CM21 and CM22 to their final position in the SCL region. This leaves two cryomodules (slots CM1 and CM23) left for alignment once they are installed in the tunnel.

See attached S&A SCL Alignment Status:

The alignment of the lower straight section of the Ring (RF Cavities & Doublets) was completed.
S & A currently working on the alignment of collimators and other components on the north side of the Ring.
Field work continued on the re-observation of the Target Building control network. This effort was complicated by multiple power outages, each outage requiring the laser tracker warm-up process to be performed again. Processing, checking and adjustment are underway for the portion of the network covering beam line 2TU.

In preparation for the annual exterior leveling campaign in mid-April, an inspection was made of all exterior survey monuments. Concrete monument 111 was found to be damaged; one of the leveling screws was sheared off, apparently by over tightening. This monument will be repaired before the leveling campaign begins.

A review of last year's field notes for the leveling campaign was conducted to assist in scheduling the current effort. The most recent version of the physicist's lattice coordinates were compared to the S&A coordinate database, as a quality control measure.

We aligned four warm sections (CM17, CM18, CM19, and CM21) to their final position in the tunnel. This leaves four warm sections (CM1, CM20, CM22, and CM23) left for alignment once they are installed in the tunnel. S&A reset the dummy cryo pipe CM32 since it had previously been removed

See attached SCL PDF's

Mechanical

RF Pick-up loop calibrations were done on DTL's 5 and 6.

The RFQ was returned to service after vacuum maintenance. More maintenance is planned.
We have begun the initial conditioning of CCL4.

Warm Sections and Magnet Measurements

- This week we installed Warm Section 21. This leaves four more to be installed out of 32.
- We also mapped another RTBT 21Q40.
- We completed assembly of the last warm section.
- We also finished mapping another RTBT 21Q40. We have four matched within 0.1% and the fifth just slightly out of the group of four.

Ring Systems Installation

- The HEBT arc Ion Pump support brackets' and pumps were installed.
- The Ring Extraction straight section Kicker Magnet K1 assy was received and staged for installation.
- The Ring Extraction straight section BIG assy was received and moved to the CLO for diagnostic installation.
- The RF Straight Section two IPM Support stands were installed and the IPMs staged for installation.
- Alignment of the RF Straight Section lattice components was completed.
- Alignment of the Collimator Straight Section lattice components was started.
- The bulk of the RTBT vacuum chambers and drift pipes were received and stored in the RATSII.
- The RF Straight Section two IPM Diagnostic chambers were installed.
- Alignment of the Collimator Straight Section lattice components continued.
- The RTBT-Target 36Q85 Quad Magnet Assembly #1 was received and staged in the Target Building.
- The Injection Dump Septum magnet was received and staged.
- The Injection Dump Septum magnet support stand was received and staged.
- The Injection Dump Septum spare magnet was received and stored in RATSII.
- The Injection Dump quad QV01 - 41CDM30 Magnet was received and sent to the magnet measurement lab.
- Four Ring Quad magnets 2-30Q44 and 2-30Q58 magnets were relocated to the magnet measurement lab.
- The Extraction Lambertson magnet support stand was received and staged.
- The RTBT Doublet Assy QV01 and its support stand was received and staged.
- The RTBT Dipole – 17D224 magnet support stand was received and staged

Water Systems Installation

- Installation of the Linac SCL Cryo Warm Section cooling connections continued.
- Installation of the Ring SB PFN cooling system manifolds continued.
- Installation of the Ring tunnel arc magnet cooling connections continued.
- Fabrication of the Ring Collimator Straight Section Collimator Closed loop system was started.

- Installation of the RTBT Service Building PS cooling system continued.
- Installation of the Linac SCL Cryo Warm Section cooling connections continued.
- Installation of the Ring arc magnet cooling connections continued.
- Installation of the Ring RF Cavity cooling connections was started.
- Fabrication of the Ring Collimator Straight Section Collimator Closed loop system was started.
- Installation of the RTBT Service Building PS cooling system continued.
- The pressure and flow rate for the HEBT magnet cooling headers was adjusted to insure adequate flow to the 12Q45 magnet assemblies for completion of testing.

Electrical Group

Working on cable terminations for SCL module SC-12 and warm section terminations in the tunnel.

Linac Klystron Gallery:

- SCL ME-6 area – final cable terminations in progress
- SCL ME-7 area - ac power terminations, cable terminations in progress
- SCL ME-8 area – ac power terminations, diagnostics and vacuum terminations in progress

Ring Building: Installed remaining medium power supplies, except for the 6 – 1400 A supplies. Terminated magnets in the "C" arc.

RTBT: Magnet cable pulls in progress, also ac power installation.

Completed integrated magnet/power supply/controls testing for SCL warm sections 2, 17 and 32V (32H is in series with the High Energy Differential Pump stand and magnet which are not yet installed), bringing the completed warm section integrated magnet/power supply/controls tests to 24 ½ of 34. Started integrated magnet/power supply/controls testing for SCL warm section 18.
Installation of SCL-ME7 (Mod 21) completed. Checkout should begin next week. Operation of CCL-ME4 supported throughout the week. Work on the ion source test stand to support LEBT chopper testing continued throughout the week, and some minor upgrades were done on this system.

HPRF

The RF Group has been supporting the parametric measurement and conditioning of the cryomodules.

The installation in the Klystron Gallery is complete as of 4-8-05. Check out and high power testing remains for the last three SCRF transmitters (20, 21, and 22).

Resources are starting to shift to the Ring RF and RF Test Facility in preparation for spare klystron (402 MHz) factory acceptance testing.

Spare 402 klystron arrived from Thales, RFTF preparation is slow, and testing is planned for June.

All HPRF transmitters will have their PLC software version upgraded from 8.02 to 13.0 to conform with SNS standards. This is a huge advantage in configuration control.

Ring RF System

- Cavities are aligned.
- We have circulated cooling water through all four cavities with some small leaks in external plumbing connections.
- Control wiring is underway. (part of the DC power connection package)
- DC/Control wiring 50% complete.
- AC Power for Ring Service Building RF Control Room is complete.
- High Power RF control room equipment mounted in racks.

LLRF

Cryo Group

Beam Diagnostics

April 1, 2005

BPM:
- Changes to electronics are in progress, support for RF Distribution system on going.
- Awaiting delivery of splitter boxes and the optical amplifier; the HEBT BPM testing can't proceed until these parts are received. In preparation for the LANL staff visit, installation of the Linac BPM electronics is in progress.
- Continued phase matching cables in the SCL.
- Received Ring BPM software from BNL.
- Received first half of the Ring BPM electronics shipment from BNL.

BCM:
- Differential electronics are slated for design and test to mitigate noise
- Prepared conceptual design of FPGA based BCM electronics for beam accounting and interfacing to XFD.

BLM:
- For the FBLM, low noise amplifier, and HV power supply are built and being tested.
- New BLM IOC software is developing. The best time line was achieved
- BLM concentrator software was started. It was moved from epics 3.14.4/MVC++ 6.0 to epics 3.14.7/MVC++.NET. Epics 3.14.7 has some changes. Additional time is needed to double check BLM concentrator on Epics 3.14.7 from scratch.

Wires:
- Working to repair and re-install warm linac wire scanners. 5 wire scanner fork assemblies have been ordered.

Laser:
- Quad sensors redesigned to incorporate modifications to allow the switch from the 532nm CW to the 1064 nm pulsed laser. Delivery on or before April 15th to meet testing schedule. The design is complete, currently fit checking and ordering parts.
- New PCB built. Installation will begin with laser scanner MB03.
- PCs ordered have arrived.

Faraday Cup:
- DTL FC160 problems are being addressed.

Harp:
- Harp signal cables ordered.

D-Box:
- Emittance electronics are in final design incorporating, -100V Bias, Differential transmitter and receiver and adjustable gain controls. PCB design is underway. Delivery by May.

Video:
- Received video system software from Chris Degen at BNL.

Timing/Reference:
- 250+ ETS Timing cards are delivered, programmed and tested, approx 14 need rework, bad IC loose connectors etc.
- Tested several PCBs and he has begun installation into BPMs.

- All timing cards required for SCL commissioning have been received and tested.

Installation:
- Proceeding. Future plan is to first install all BPM systems possible prior to the LANL visit. Then install build and install the laser system IOCs. Then mod and install the BCMs. And last to build and install the HEBT FBLMs.

Software Integration:
- LabVIEW - Epics CA library (version 2) was moved to Epics 3.14.7 / MVC++.NET. Waiting answer concerning fixing bug in Epics from Jeff Hill.

Configuration:
- Purcell attended the Altiris Conference and identified some techniques to manage NADs more efficiently.

General:
- Mezzanine lab safety walk through was completed. It looked well organized and clean.
- Reviewed tune feedback R&D for the LHC.
- Prepared ASAC presentations

<u>April 1, 2005</u>

BPM:
- Setup in Mezz, timing card and BPM card, no conflicts so far.
- Timing card control through local software.
- Template updated to handle extra tasks and interface with EPICS.
- Changes to electronics needs documentation, support for RF Distribution system ongoing and waiting for delivery of parts.
- Working on installation plan to have all linac BPMs installed in time for LANL visit.
- The BPM Timing card was installed with J. Diamonds help and the latest BPM software installed.
- The test BPM is running and ready for Timing software.

BCM:
- Preparing BCM with BNL calibration/timing card -> After BPM has timing we'll add same task to BCM
- Differential electronics are slated for design and test to mitigate noise abatement.
- Added BCM in HEBT for LDRD to installation plan.

BLM:
- Andrei has been testing performance of BLM
- Low noise amplifier, and HV power supply are built and being tested.
- New BLM IOC software is developing.
- Primary test of VME block transfer - PCI DMA library was done.
- Built several of the HV Bias chain terminators.
- Cable termination in progress for SCL row 35 loss monitors and neutron detectors.

Wires:
- Working to repair and install wire scanners.
- Working on an order for more fork parts.

Laser:
- Synchronized video profile pictures taken of pulsed laser (with EPICS interface) Video profile being used to tune the laser.
- Quad detector tested, updated hardware tested and passed.
- Quad sensors will be redesigned to incorporate modifications to allow the switch from the 532nm CW to the 1064 nm pulsed laser. This will be turned around by April 15th to meet testing schedule.

- Quad sensors will be redesigned and new PCB built. Installation will begin with laser scanner MB03.

Faraday Cup:
- DTL FC160 and CCL FC104 have problems that are being addressed.

Harp:
- Must update from version 7 to 7.1 to properly program cRIO, Purchase Req will follow.

D-Box:
- Emittance electronics are in final design incorporating, -100V Bias, Differential transmitter and receiver and adjustable gain controls.
- PCB design will commence soon. Delivery by May.
- Will remove harps and blank off MEBT.
- The mods will be made to the harp actuators and reinstalled later.

Timing/Reference:
- Test setup for timing cards ready to go
- Timing task for all NADs being outfitted with new timing library.
- Final assembly of ETS card is in progress, Timing system is down for testing. We should have signals early next week in time for delivery of remaining boards.
- Awaiting PCBs.
- Will test PCBs then install in the BPMs.

Installation:
- BLM. Ion Chambers - HV daisy chains - Boxes with resistor were installed in CCL area.
- SCL IOCs 1&2/HEBT IOCs 1&2 racks - absent LEMO cables were installed.
- SCL IOCs 1&2/HEBT IOCs 1&2 are switched on.
- Plan is to first install all BPM systems possible prior to the LANL visit. Then install build and install the laser system IOCs. Then mod and install the BCMs. And lastly to build and install the HEBT FBLMs.
- Released a different version of the 2nd tier cable list, named BPMs to the "Mike Plum" scheme

Software Integration:
- Updates to template to support external tasks such as the timing task

Configuration:

General:
- Lab work is proceeding. Updated the lab layout to better assign utilities.