

Accelerator Systems Division Highlights for the Two Weeks Ending June 20, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) We successfully completed conditioning of two more DTL windows. (2) Rees and Bradley were at ORNL this week to discuss and schedule the installation of the first SCL transmitter. (3) Ed Partridge was at Thales to witness factory tests for SCL klystrons S/N 005 and 006. Testing went well, but the vendor is not authorized to ship them until we receive voltage measurement information. (4) Data for CPI SCL klystron S/N 25 was approved by LANL. CPI is switching over to the new test set. The perveance is different on the new test set, and they are working on resolving this. Once this is resolved, S/N 26 will be tested, while S/N 23, 24, and 25 will ship next week

Concerns & Actions: (1) Thales delayed factory acceptance tests of CCL klystron SN 3 to 6/25 and S/N 1 in mid-July. These dates still support the integrated project schedule.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) The prototype high voltage converter modulator (HVCM) system is operating at 125 kV, 1.2-ms, and 60 Hz to support window conditioning. (2) Two 140-kV HVCM units along with three IGBT assemblies are scheduled to be shipped from Dynapower to ORNL on 6/20 or 6/23. These are the last units for the CCL. (3) Dave Anderson reported that ORNL has now completed inspection of all three installed HVCMs. Some minor problems were identified and corrected as part of the inspection process. Dave also reported that the proposed mods to the SCR controller had been done except for enclosing the printed circuit board. Dave plans to re-energize this unit later in the week to assess performance. (4) Dynapower reported that the final 140-kV unit (HEBT) and the first 80-kV unit (SCL) would be ready for acceptance testing during the week of July 7.

Concerns & Actions: (1) We are concerned over the need to have completed/approved test plans for the first 80-kV HVCM unit prior to start of testing. A plan was presented that supports the development of the necessary test documentation in time to support acceptance testing. (2) We communicated to the vendor that a number of SCR power suppliers for the HVCM were shipped without testing. The vendor is sending us test records. We will then document any non-conformances.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments Tank-1: The issue of the deformed downstream tank end wall (see below) was discussed. Repair options and possible modifications to the joint configuration to prevent reoccurrences of deformation were offered to ORNL. On 6/20, a repair tooling setup (to press the end wall flange flat) was agreed upon and it was confirmed that installing the D-plate beam box and using it to compress the RF joint C-seal and the joint o-ring would be sufficient to prevent future deformation.

Tank-4: Work has resumed on the machining of drift tube bodies cavity machining of groups A, B, C and D is in progress. Waveguide port brazing is underway.

Tank-5: Groups E and F are ready for diverter brazing and which is scheduled for next week. Group G is being prepared for diverter brazing (recall this will be done prior to water channel welding and water channel weld machining preparations are done). Waveguide port brazing is underway.

Tank-6: Diverter brazing preparations for groups H and I are in progress. The water channel weld machining preparations are also complete for these units. Waveguide was plated for equatorial brazing and will be brazed once the tank-2 unit "catches up" so they can be brazed in a common heat.

Tank-2: Fabrication of qualifying example drift tube is well underway and is expected to be complete next week.

All tank-2 group J drift tube bodies and sleeves were shrunk fit together; the shrink fitting of groups K, L & M is in progress. Waveguide half cell machining is underway.

Tank-3: Rough machining of the replacement waveguide parts continues.

EMD DT's: Six magnet coils are at ORNL for mapping; the first unit for DT installation is expected at Los Alamos on 6/23. Stem to body shell piece brazes complete for tanks 3 and 4 EMD drift tubes.

Concerns & Actions: (1) Current schedule for tank-2 drift tube completion shows inadequate time to do installation and tuning and still meet IPS milestones. (2) Stovall and Billen were at ORNL to support RF tuning work on tank-1. The resonant frequency (scaled to T = 20-deg C, vacuum conditions) when they stopped adjusting the aluminum post couplers and slug tuner last month was 402.491 MHz. After installing copper parts the frequency was 402.384. The field distribution now has a slight negative slope relative to design and before it had a slight positive slope of about the same magnitude. Either field distribution is acceptable, but the change was unexpected. The cavity

unloaded Q was unacceptably poor. We expected a Q between 36,000 and 40,000, but it appeared to be in the mid 20,000s. The causes of the low Q was determined to be a bad end-wall RF joint. They took the downstream end wall off and found problems. The flange is dished in and warped. The bolts have pushed in the copper around the holes on the side facing the tank so it holds off the flange. Before removing the wall, they measured the last drift-tube gap (for cell 60) and it is at least 0.011" too large. The second to last gap measured in the same manner was within 0.001" of design. A likely cause of the distortion is the extra large o-ring combined with the bolt circle relatively far from the o-ring. This copper piece is not very thick because it is not intended to withstand atmospheric pressure. The force required to compress the o-ring can cause the flange to take on an "oil-can" shape. The copper end wall was originally designed with a smaller o-ring with only 15% compression compared with the present thicker o-ring with 25% compression. Another potential problem is that the o-ring surface was heavily polished to remove a scratch over an angular section of ~50-70 degrees. As much as 0.010" may have been removed in the middle of this section. However, it might arise; a change in the last gap will change the tank frequency by a significant amount. The last cell has 4.4% of the total stored energy and the sensitivity of cell 60 to a change in gap is +10.8 MHz/mm for an increase in the gap. This translates into about +12 kHz/mil for the entire tank. The present frequency is low by ~110 kHz, and restoring the end wall to the design position will lower the frequency even more (~130 kHz more). It is possible that that the gap was even larger when we were doing the tuning earlier because the end wall was installed with a new c-seal at that time. When they removed the downstream end wall, they discovered three corner cubes mounted on the inside surface of the low-energy end wall, which they removed. These corner cubes are ferromagnetic and will contribute to the low Q . The effect is not as large as the end wall problem because the Q was improving as they increased field on the upstream end. A design modification is underway to correct the situation and will be implemented early next week.

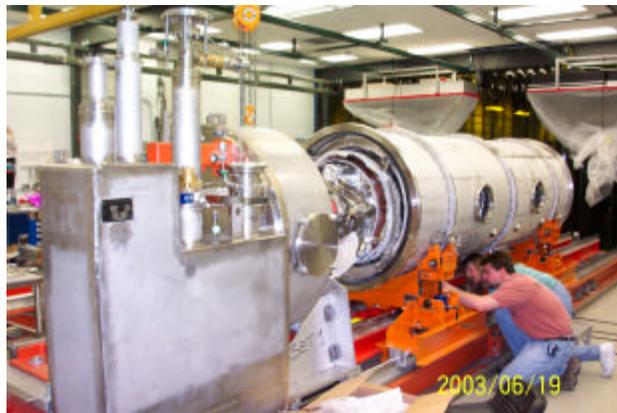
COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) Nathan Bultman, Dave Ireland, and Dan Richards were at Accel this week to assembly the first half of CCL module 1. They remain on track for tuning in early July.

ASD/JLAB: Cold Linac

There was some loss of testing time for cryomodule M-1 because of problems with the 1 MW RF source and interferences with crane operations for the SNS 2 K Cold Box. The high-power Q_0 vs. E_{acc} curve for cavity 1 is shown below to meet requirements ($Q_0 > 5 \times 10^9$ at $E_{acc} = 10.2$ MV/m). The M-4 cold mass and space frame has been inserted into the vacuum vessel. Assembly of the M-5 cold mass is well advanced (see photos). Assembly of the M-6 string has been delayed by a failure of the High Pressure Rinse pump and the resulting need to re-clean the high-pressure pipe network.

Internal piping and internal support structure has been installed into the lower shell of the 2 K cold box (see photo). The suction header with return bayonet has been positioned for installation. The mid vacuum shell has been moved into the assembly area for installation of the shield.





ASD/BNL: Ring

ASD's Tom Owens and Bryan Gross were at BNL this week to assist with testing of the Ring RF power amplifier and cavity #2.

Identification of recommended spare parts for Diagnostics is underway. Systems include: BPM, IPM, BLM, BCM, Tune, BIG, VFM, electron detectors, electronics, and DAQ.

HEBT assembly drawings were submitted to ASD. The drawings included Q5 thru Q8 and Q9 thru Q11. Work on the dipole magnets and diagnostic assemblies is in progress.

A response to ASD's design review comments on the Extraction Lambertson Magnet along with a cost estimate for radiation hardened coils were submitted to ASD.

Integral harmonics of the first article high field large aperture ring sextupole (26S26) have been measured at 1.0 and 1.3 GeV field levels. The test data have been reviewed and accepted. Alpha Magnets has been authorized to start production.

The first article 27CD30 was shipped to SNS/OR from BNL. In addition, the first four production magnets (27CD30) were shipped to SNS/OR from our vendor, New England Technicoil.

Sixteen magnet stand assemblies for HEBT/RTBT were delivered to SNS/OR. Hardware shortages (nuts and bolts) are being addressed by BNL.

At the request of ASD, a welding machine is being prepared for shipment to Oak Ridge. The one that is currently on loan should be returned to BNL (Attention: Al Farland) for needed maintenance/repairs.

After resolving all outstanding items, Niagara Transformer Corp was authorized to start construction of the main dipole isolation transformers. Testing of these 13.8kV isolation and phase shifting units is scheduled for the end of August.

An interconnection document that defines the connection between the power supplies and their loads is being generated; it should be completed by early July.

Controls

Installation

Craft Snapshot 6/11/03

ASD craft workers	81.0
Foremen, ES&H, etc	12.0
Less WBS 1.9 etc	6.0
Less absent	5.0
TOTAL	82.0

Procedures and roles for work control and safety co-ordination are under review as the result of a shock incident. Job Hazard Analyses covering work performed by AMSI craft personnel will be reviewed by an ASD technical coordinator.

DTL #1 ARR was postponed.

DTL #1 bead pull/tuning activities have encountered a problem with frequency and Q. The problem has been traced to deformation and fit up issues with the high energy DTL#1 end plate.

Clamp and insulation upgrades were completed to HVCM ME1. The same modifications will have to be made to all units.

A second iteration of DTL #1 iris sizing was completed. One or two more iterations are anticipated.

Eight of nine HEBT dipole stands were grouted into place in the tunnel. DH-15 stand was not grouted to leave access for the high momentum collimator.

Ten 12Q45 stands were grouted into position also.

Ring Tunnel cable tray installation is 40% complete. Ring cabling will begin in about four weeks.

The dc dipole bus in the ring tunnel west side is complete. Next week work will begin on the dc bus in the south ring tunnel.

One office in the 10-Plex was cleaned by ES&H personnel to determine if it can be satisfactorily done. Samples from the cleaned office were taken the AC on and off. These results should be available early next week.

Accelerator Physics

Slava, Jeff, Sarah, Stuart submitted a paper to PRST-AB on self-consistent 2-D and 3-D distributions which have linear space-charge force. These offer the potential of "halo-free" accumulation in the ring.

Sang-ho and Marc with help from Yoon and Dan Stout measured cryo-module M01 passbands. Comparison with those measured at JLAB before shipments shows identical results, indicating that the cavities are OK after traveling.

We are refining the DTL1 beam commissioning plan to integrate front-end commissioning needs, diagnostics needs and DTL1 commissioning. A detailed commissioning plan document is being produced.

Sarah and a student, with help from Applications Programming Group, have started the first ring application - ring optics tuning - to adjust tunes, chromaticity and so-on.

Operations Group

Converted PPS to Version 0.4

Presented PPS Version 0.4 in a Video Conference to the ARR Committee for approval to operate the Front End and RF Process DTL3 and DTL1. The Video conference covered the Front End Commissioning and DTL Tank3

Processing results and Lessons Learned including Radiation Survey Results and a preview of Tank 1 Commissioning. Permission to process DTL Tanks 1-3 while operating the Front End was granted

ARR Preparation

- Writing and approving Procedures
- Working with the committee on details of the review
- Held ARR Presentation Dry Run Meeting.

On Thursday postponed the ARR due to difficulties with DTL Tank 1.

Working with the MIS group to have components of the CMMS ready for the ARR

Continuing Operator Training and Certification.

Continuing hiring process for one operator this FY and two in FY 04.

Ion Source Group

Ion Source #2 has produced 25 mA when operated with 28 kW on the hot spare stand.

The LEBT extraction aperture was realigned with the RFQ entrance aperture.

When exchanging the lens 2 insulators, the new style was mounted with acorn nuts. When under vacuum, one acorn nut interfered with the LEBT gate valve. The nut was trimmed, and the LEBT valve is being tested.

All interlocked access ports to the ion source, golden matcher, and big blue box were successfully tested. In all cases the high voltage dropped out immediately and could not be restored before the port was again properly closed.

Survey and Alignment Group

S&A completed a leveling campaign to update the elevations of floor monuments in the HEBT, Ring, RTBT and half of the Linac. The observations were checked and adjusted into the global network.

Observations were also made provide a preliminary horizontal network in that area.

S & A has verified the elevation of all HEBT magnet stands in the HEBT area.

This week, the Survey and Alignment group measured the RFQ using the laser tracker. We also measured the LEBT.

Additionally completed Leveling loop over points set on the dewar tank pads. (In process currently, will require tie in with our monuments.)

Last week, Survey and Alignment traveled to JLAB to optically measure medium beta cryomodule 3. The set of measurements recorded will be compared to measurements taken when cryomodule 3 arrives at the SNS site. This comparison will enable us to determine any movement was incurred by the cavities.

Last week, the Survey and Alignment group aligned the outer support cylinder alignment pins located in the Target Monolith. These pins are secured to the target base plate and they will act as guides for the outer support cylinder as it is lowered into position.

Also this week, the Survey and Alignment group measured the first production medium beta cryomodule (MB01). Since we were not able to send a representative out to JLAB to measure this cryo before shipping, we will have to compare our alignment numbers with the final alignment numbers measured by JLAB. There is a concern (on JLab's part) that flange number two might not be aligned to the tolerance they were trying to achieve.

Mechanical Group

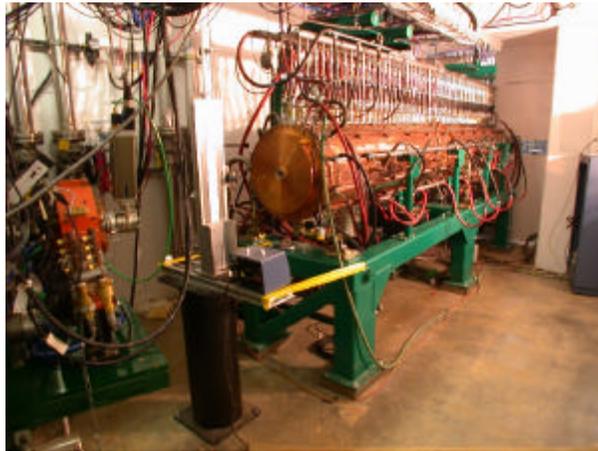
HEBT-Ring-RTBT Installation

Cable pulling in the HEBT is proceeding.
Grouting of the HEBT magnet stands is proceeding.
A partial shipment of 16 - 21Q40 magnet stands was received.
Cable tray installation of the RING is proceeding.
Buss bar installation in the Ring is proceeding.
Mounting floor plates for half-cell C1 were set.

Water Systems

Connection and testing of DTL tank 1 water systems is proceeding.
Pressure testing on ME2 - DTL 5 water systems is proceeding.
Installation of piping from the facility to the CCL3 RCCS & TRCC carts is proceeding.
The CCL4 RCCS & TRCC carts were set in position.

The post couplers and slug tuners have been installed in DTL-1 and the final tuning confirmation is in progress. Iris sizing is also proceeding and is expected to be complete early next week. The downstream endwall mounting flange was found to be cupped and must be straightened to finish tuning. Straightening will be completed on Monday.



DTL-1 Final Tuning Confirmation

Magnet Task

We have mapped 1 DTL EMD.

We are installing beam tubes into 12Q45's.

We are assembling a measurement system for 21Q40's and 27CD30's.

Electrical Group

DTL-ME1 was upgraded with additional insulation in the SCR controller bridge assembly, the addition of a solenoid valve on the water circuit, and a modified emergency off function which removes 2100 V ac power to the SCR cabinet and closes all water circuits. DTL-ME2 was inspected for manufacturing defects on the rectifier assemblies and other causes which could result in increased ripple. No obvious causes were discovered, and additional troubleshooting will occur this week. Both modulators were certified for PPS operation this week.

Preparations are underway to support long-term HVCM high average power operation, including procuring additional diagnostics, providing additional cooling for the switch plate assemblies, and developing in-house circuit simulation capabilities.

CCL magnet cables pulled

CCL module one - majority of instrumentation cables pulled

Ring installation of cable tray in progress

DC bus for main dipole magnets in 9 o'clock (injection) done except water

DC bus for main dipole magnets in 3 o'clock (extraction) 80% complete

DC bus for main dipole magnets in 6 o'clock all material prepared for installation next week



HPRF

Completed the integrated cable pull sheets for the SC transmitters. The first two SC tanks have been prepared with filament cables and socket adapter plates. They and cooling carts have been moved to the gallery.

Loaded the appropriate software and set up the first HPRF laptop to test wireless procedure downloading. We have adapted calibration and start-up procedures such that they can be downloaded, measurements taken and entered directly on the procedure form on the laptop, then sent directly to DCC (ProjectWise) for archiving and reference.

LANL HPRF representatives visited to discuss their assistance in bringing the first two SC transmitters on-line. We will work on joint set-up and calibration procedures roughly based on the NC procedures. When the MB1-4 transmitter and HVCM installation is complete, they will help implement and refine these procedures.

LLRF**Cryo Systems Group**

CHL: Work continues on the purifier piping. The nitrogen purge is remains on the charcoal absorber, the heater temp is 247F. We are instilling the warm compressor couplings. We have filled the purifier charcoal beds with charcoal. The first readiness review committee met to inspect the documentation for the LN2 system.

Tunnel: We continue to install the warm gas piping. We have installed all the Nibco valves on the upstream modules. The transfer line installation crew is on the last 2 -12" welds on the down stream modules.

RATS: We are setting up the tooling to begin the fabrication of the Cryomodule "U" tubes. The parts will arrive from JLAB next week.



2K cold box guts

Beam Diagnostics

BNL Beam Diagnostics Progress Report:

General: Spreadsheets for deliverables, cables and spares are being updated in preparation for writing PCRs for Cabling and Spares. Overall familiarization with Wim's LabVIEW template continues...

1.5.7.1 BPM: Completed cost estimates for the BPM, parts lists have been generated for both the RF section and PCI cards. Having a problem finding a company that will program the Quicklogic part needed for the LANL PCI interface cards (quantity is too small). Will try to get programmed parts from LANL.

1.5.7.2 IPM: An order for High Voltage vacuum relays has been submitted.

1.5.7.3 BLM: Continuing to wait for DOE approval of the sole source for the ion chamber order. More parts ordered for the end cap assemblies. AFE chassis mechanical work continues. Preparing for a visit to ORNL next week to deliver more ion chambers and an upgraded MPS module, and to continue installation and integration of DTL BLM system. Mounting bracket discussions continue. Work continues with Controls on system and ATE software development.

1.5.7.4 BCM: PCRs have been prepared for a new Ring toroid, needed because the present Ring toroid has a saturation problem due to a vendor design error. Another amplifier used in the BCM AFE has been obsolete by TI (6 months after release to the marketplace!). We are looking into replacements. Artwork for the production run of the AFE/digitizer board is on hold (the purchase req has been written). Parts list has been reviewed, and an inventory is underway. Calibrator logic design continues. A second-generation prototype is being developed. BNL personnel will take advantage of next week's BLM visit to go over questions about BCM software.

1.5.7.7 Beam-in-Gap: Design of continuous 4.5m strip-lines suspended within the 1.5m long vacuum chamber modules is progressing. We were driven to this by the high cost (financial, real-estate, impedance,...) of providing 1.625 EIA connectors at both ends of every 1.5m module. Investigating the possibility of using ~3.5KV kicker voltage Sarah Cousineau is doing calculations.

1.5.7.8 VFM: Development continues with the PCI image acquisition hardware from National Instruments. Met with a mechanical engineer to discuss possibility of installing the third video camera (electron catcher) in the same recess cubby hole as the primary stripping foil camera.

Electron Detector: Forwarded drawings to Craig Deibele at ORNL for E/M simulation. Developing design for bias power supply structure. Investigating solution to DAQ questions. Investigating choices for signal amplifier/attenuator

LANL Beam Diagnostics Progress Report:

BPM pickups: Weld flanges have now been added to eight DTL BPMs. This is a last step before welding the BPMs into the drift tube bodies. Four more feedthroughs were shipped from Meggit and have arrived at LANL. One of these is needed to repair the broken feedthrough on DTL BPM #11. There should be plenty of time to complete BPM #11 in time for installation into a drift tube.

BPM electronics: Last week, during a visit to install six new BPM systems in the MEBT, we were able to make only three systems functional. Some bugs in the LabVIEW code were also identified (and repaired in some of the systems). Troubleshooting continued at LANL this week. It appears that the PC boards may be faulty. Design revisions to the PCI and DFE boards are now in progress.

WS actuators: Work continued on the HEBT, ring, and RTBT wire scanner system layouts. We received computer models from Huntington for the 8 and 12 inch stroke actuators.

WS electronics: Twenty signal processor PC boards have now passed preliminary testing. The front and rear panel drawings have been finalized, the chassis order is in, and we are now ready to fab all the panels.

ED/FC: Some Glidcop material has been located that is almost the same as our specification. We are evaluating this new material to determine if it is suitable. If so, fabrication can continue on the five remaining ED/FC heads. Two rack-mount PC's were ordered for the two electronics chassis now being fabricated.

Harp: Work continued on the mechanical layout for the target harp. We are waiting on word from ORNL on the vertical aperture requirement (last week we received a correction on the horizontal aperture -- it should be 14 inches). We are finalizing details of how the wire planes will be stacked and secured.

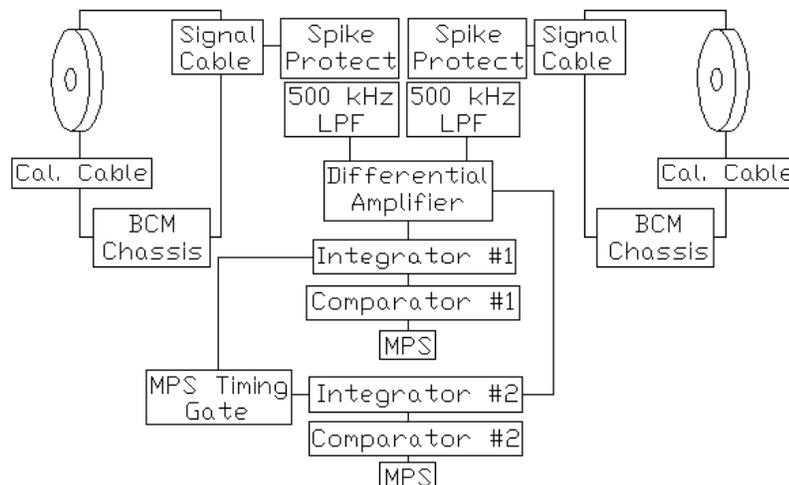
Misc: Next week Bob Hardekopf and John Power will assume responsibility for managing the diagnostics work package.

ORNL Beam Diagnostics Progress Report:

D-plate: The D-plate is moved from its final position for the fifth time to allow the Tank-1 beat-pull test. Water connections and cabling are removed. Ernest, Wim and Saeed found some cabling issues between the Harp motor drives and MPS. We will check all D-plate cables on Monday.

BLM: Three PMT neutron detectors are installed and tested. Signals are clean. We are awaiting the arrival of BNL-BLM group to integrate the detectors with their electronics. In addition, we have three semiconductor neutron detectors from INR. Our Russian colleagues installed the power supplies. We will integrate the devices to one frequency counter to testing as soon as the Stanford Research SR430 shows up. Jim Pogge is preparing schematics for the test x-ray detectors and test station gamma ray detectors.

BLAS: Beam Accounting System (differential current measurement) circuit design is complete. Jim Pogge and Craig Deibele presented the circuit design to the ASD. The total response of the electronics and the MPS is set to 7 micro-sec. (5 micro-sec for the diff. currents circuit and 2 micro-sec for the MPS) to shut down the machine in case of total loss between the two BCM. This is well within the specs. We will implement two systems by July-7-2003.



D-Box: Tom Roseberry and company have installed three actuators on the anti-chopper box (one for the beam stop/Faraday cup and 2 slits). We plan to add the beam aperture actuator as soon as a rigging fixture installed over the anti-chopper box for safety purposes.

SCL Laser Profile Monitor: The laser room installation has started. The new-coated windows are under laser blast tests. So far the results are very encouraging. The total reflectance (both surfaces) was measured to be less than 0.25%. This is considerably lower than the 7% from the uncoated windows.

The window was also subjected to damage testing. The window was subjected to over 200,000 pulses with a beam diameter of 6 mm and pulse energy of 310 mJ (peak intensity is twelve times higher than the design parameters). No damage was observed.

However, the coatings did sustain damage when 275 mJ pulses were focused to a spot size of 3 mm (peak intensity is 44 times higher than called for in the design). The glass itself, though, remained undamaged. The next test is to focus the beam to 100 times the design peak intensity for QA purposes.

Software: Wim has written a new LabView code for the D-plate Faraday cup.

Misc. Three test stations are being designed/prepared and installed (BPM, BLM and an automated three dimensional magnet mapper). A presentation was prepared for the ARR. Input received during the dry run is being incorporated. The test plan template is complete for all systems and we are entering the system-specific plans and results tables into ProjectWise. Dave Purcell attended the EPICS meeting and presented a talk on Windows based instruments.