Accelerator Systems Division Highlights for the Week Ending March 15, 2002

ASD/LBNL: Front End Systems

The parts for the planned LEBT modifications (cooling of the extractor support and sparking reduction) are completed, and the LEBT has been pulled out of its vacuum tank to allow installing this hardware.

The RFQ has been conditioned to full 6% duty factor at nominal 640 kW power, and we plan to push its conditioning level somewhat higher to accommodate anticipated beam-loading effects.

The first unit of our LLRF system has successfully operated on the RFQ hot-model cavity in closed-loop mode, so far utilizing the analog part only.

The main efforts of FES staff are directed towards completion of the MEBT installation; some staff members are working overtime. The quadrupole magnets are connected to their power supplies; all five wire scanners are installed and being supported by customized brackets; chopper and anti-chopper structures and the chopper target are installed. The water lines serving the RFQ are now connected to the feeder lines running underneath the MEBT, in the final configuration. The four rebuncher cavities have been frequency-analyzed in preparation for installing the fixed tuners.

The controls cables for vacuum and water systems have been rerouted on the newly installed cable trays to the designated interface boxes; operations resumed without any sign of problems. The temporary setup for three controls workstations has been relocated to make room for the diagnostic plate that will be installed downstream of the MEBT.

ASD/LANL: Warm Linac

We continue to prepare the 402-MHz RF test stand. Cooling hoses were installed. The ES&H hazard control plan was written, reviewed, and approved. (WBS 1.4.1.1)

CPI developed the acceptance test procedure for 805-MHz, 550 kW klystrons. It is under evaluation. The first article assembly continues (Fig. 1). The final seal process is underway and pump down scheduled to start within a week. (WBS 1.4.1.1)

Fig. 1: First 805-MHz, 550-kW SRF klystron - assembled RF body ready for setting of tuners.

The prototype SNS high-voltage converter modulator (HVCM) was pulled out of the oil for inspection and upgrades. The unit looked good. Changes in grounding circuitry and diagnostics were made. (WBS 1.4.1.2)
LANL shipped GFE (*e.g.,* high-voltage capacitors and fiberglass grates) to Dynapower in support of the production HVCM converter modulator contract. (WBS 1.4.1.2)

LANL personnel were at ZTEC to review the acceptance test plan for the HVCM control rack first article. All the components are ready for integration in the rack (Fig. 2). Acceptance tests commence next week. (WBS 1.4.1.2)

Fig. 1: HVCM control system first articles.

Bids for the medium-beta SRF waveguide are in. They are under evaluation. (WBS 1.4.1.1)

One of the BPM drift tubes for DTL Tank #3 will arrive at LANL on 3/15/02. The second BPM is still suffering from a vacuum leak in the area of the stem repair. This drift tube may have to go back to Isis for an additional weld repair. (WBS 1.4.2.3)

The EMD drift tubes for DTL Tank #3 are still scheduled to arrive at LANL by 3/28/02. (WBS 1.4.2.3)

This week we installed and rough aligned the last two PMQ drift tubes in DTL Tank 3. Julius Fazekas from ORNL reviewed the alignment procedures and participated in the installation and alignment. His comments were very informative, and we will attempt to incorporate them into the procedures during the final alignment. We have also installed the cooling channels without the thermal grease. Our current plans are to apply the thermal grease at ORNL after the alignment and tuning check. (WBS 1.4.2.7)

Votaw has finished three of the five tank sections for DTL Tanks 1 and 2. They were accepted by LANL and will ship to Germany next week. The remaining two should be finished by the end of March. (WBS 1.4.2.2)

DTL vacuum seals and other parts were kitted and prepared for shipment to ORNL. (WBS 1.4.2.4)

The SNS Diagnostics Advisory Panel convened at LANL to conduct Final Design Reviews for the linac BPMs, current monitors, wire scanners, energy degrader - Faraday cups, and DTL diagnostics plate. Results were satisfactory. (WBS 1.4.5.2)

We are focusing our physics studies on beam behavior through the LEBT and MEBT choppers. We received a 3-D field map of the LEBT section. The detail map together with the code PARMELA is now being used to generate realistic beam distributions at the input to the RFQ from the measured beam distribution received from LBL. The objective is to generate distributions that correspond to the different LEBT chopping sequences and relative timing. While waiting for such realistic distributions, we made some preliminary studies. The intent was to evaluate the behavior of the MEBT section with a measured beam distribution at the LEBT. For this, we started with the measured distribution received from LBL, and generated a 300 k particle distribution of ~42 mA at the input to the RFQ. At the output of the RFQ, we have about 250k particles with about 37.5 mA beam current. Figure 3 below shows progression of an unchopped beam bunch through the MEBT chopper section. The chopper target is set to intercept and remove 1% of the unchopped beam. By the time the beam reaches the DTL input, it redistributes itself and has practically the same phase-space distribution projections as an untrimmed bunch. The loss pattern of such a bunch in the DTL and CCL is statistically identical to an untrimmed beam bunch. To get an idea of the effectiveness of the MEBT chopper, we subject this same unchopped beam bunch from the RFQ to the chopper voltage of the MEBT. The phase space (y-y') and transverse-real space (x-y) distributions at several locations along the MEBT are shown in figure 2. Less than 0.1% of the beam survives the chopper target. Out of 37 mA, only about ~20 μA of the beam enters the DTL. This corresponds to $\sim 5*10^{-4}$ of the beam in the gap. The requirement is ≤4 μA or $\sim 1*10^{-4}$. Considering the specified efficiency of the LEBT, we can safely conclude that with LEBT chopping on, this figure will be met. (WBS 1.4.5.3)

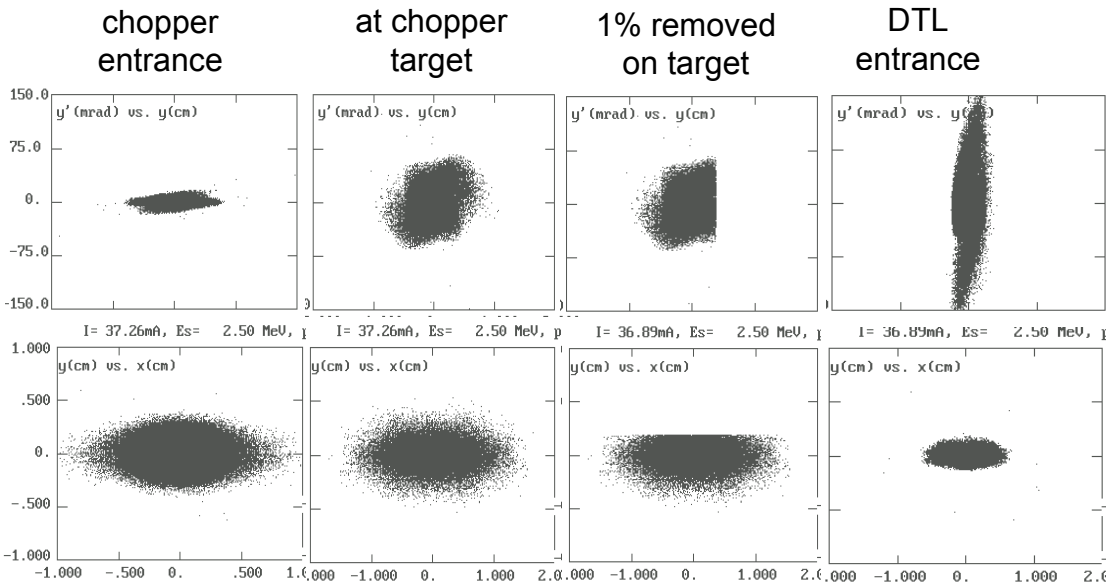


Figure 3:Phase space (y-y') and real-transverse space (x-y) distributions of an unchopped beam bunch from the RFQ at specific locations of the MEBT chopper section.

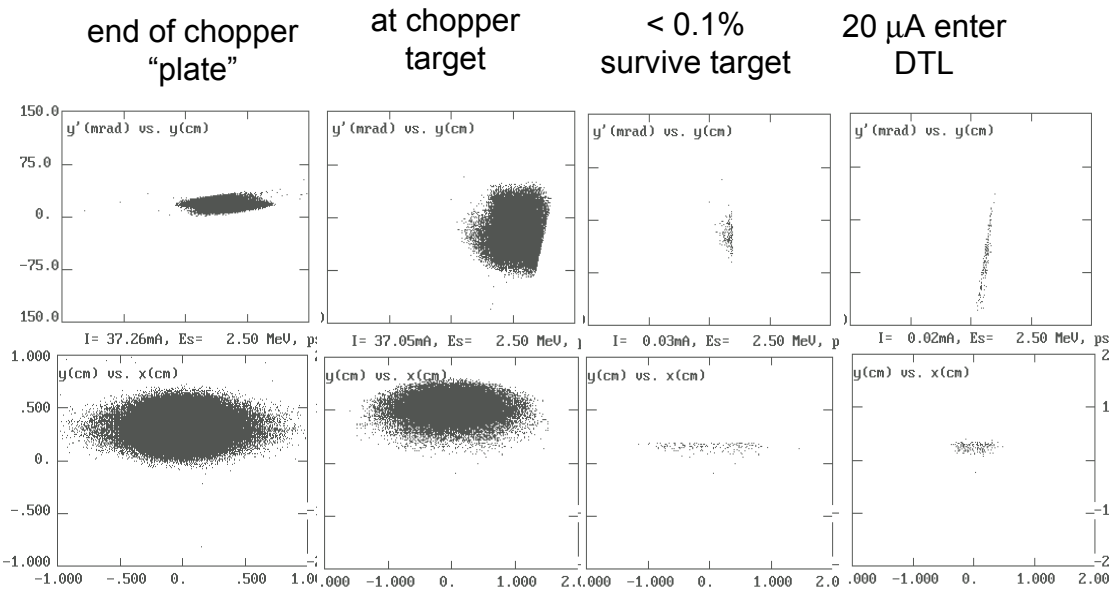


Figure 4: Phase space (y-y') and real-transverse space (x-y) distributions of an unchopped beam bunch from the RFQ at specific locations of the MEBT chopper section with the MEBT chopper turned on.

Lucie Parietti has completed her assignment in SNS and has returned to LANL Engineering Science and Applications Division. While in SNS Division, Lucie performed analysis and design in support of the warm linac and the SRF linac warm sections. We thank Lucie for a job well done and wish her continued success in her new assignment. (WBS 1.4.6.1)

ASD/JLAB: Cold Linac

Prototype cryomodule assembly continues. Installation of RF cables for field probes and HOM output is complete. Heat stationing of the cables is in progress. The rods that support the cold mass from the space frame have been

installed and transfer of the load from the 'lollipop' supports to the space frame is imminent. Final fit issues with the thermal shield are being worked out.

Effort on the 1 MW test stand focused on completing waveguide installation to support operation of the Fundamental Power Coupler processing stand and integration of the interlock system required for routine operation.

ASD/BNL: Ring

Ring dipole magnets: nine (9) of the half-cell ring dipole magnets have been measured and/or shimmed to achieve integral field transfer functions within a tolerance range of +/- one part in ten thousand. This effort is moving forward without any surprises.

Testing of the extraction PFN continues at 35kv and 60Hz using the prototype kicker magnet. An external oil cooler and pump have been added to the PFN tank assembly to improve cooling of the oil bath and reduce the high cost associated with having the external cooling tubes mounted to the outside surface of the tank.

Extraction kickers are being repositioned within the existing lattice to optimize performance while improving specific PFN parameters, such as reduced operating voltage, which in turn will provide added design margin and reliability.

Quotations for the RTBT Collimators' "inner box" are in. We received three responsive bids that are being evaluated.

Ioannis Marneris returned from Danfysik where he participated in the acceptance testing of the 1st articles for the Low Field Power Supply. Some issues were identified as related to form, fit and function (size, noise, internal connections). All principal parties are reviewing these issues; some redesign will be required by Danfysik. Another iteration of inspections and testing will be required prior to the start of their production run.

A Project Director's Review of Cost and Schedule Performance was held last Friday by videoconference. No major issues were identified.

Acceptance testing of the 27CDM30 (7) was finished this week. The data are being reviewed so we can provide final approval to Danfysik.

H. Hseuh has completed all of the type B half-cell vacuum chambers (16 of 32); half have been coated. The vacuum chamber assembly fixture is being modified for the type C chambers.

We have been advised by ASD that six of the HEBT dipole chambers are at SNS/OR for acceptance inspection; one has been installed inside a dipole magnet. In addition, three special HEBT dipole "Y" chambers are in route to BNL. All Ring dipole vacuum chambers have been received from SDMS.

The first article gauge controller has passed all acceptance testing and the vendor has been given the green light to start production.

BPM production continues to move forward. To date, 28 of the Ring (21cm) and 2 of the HEBT (21cm) units have been delivered.

Our Diagnostic's staff is attending a final design review of Linac Diagnostics this week at Los Alamos National Lab.

M. Nekulak and Project Controls personnel are at ORNL attending an MPM workshop.

ASD's Jeff Patton was at BNL this week participating in a database workshop with our Electrical, Mechanical, Survey, Physics, and Control Groups.

Jon Sandberg reported that the specification for the main ring dipole (high field) power supply is complete and being sent to ASD for final review prior to RFQ.

Jie Wei released a new organization chart for the SNS/BNL management organization.

Induction measurements of the (solid core) ring dipole magnet are in progress.

Vendor updates:

- The 21Q40 quads are in route to BNL (Tesla)
- The 12Q45 + corrector assemblies are in route to SNS/OR (Danfysik)
- The ship date for the 26Q40 is March 25 (Stangenes)
- Bids for the 36Q85 magnet steel are due March 29
- Bids for the 36CDM30 are due today

Controls

Larry Hoff will take over from John Smith as the Controls Level 3 Team Leader at Brookhaven. Welcome aboard, Larry!!

The PSAD was reviewed and edited in light of the recent decision not to proceed with the "High QA" MPS subsystem.

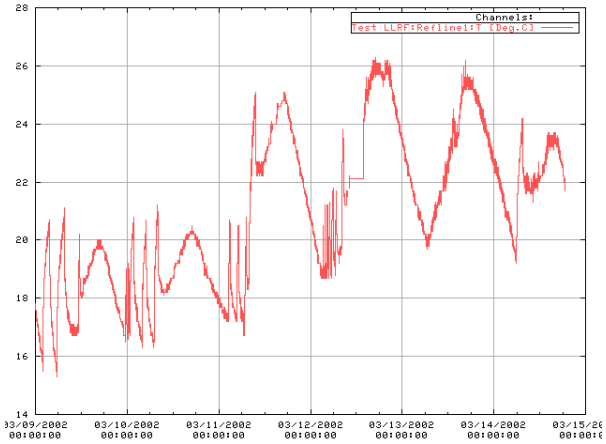
The contract for manufacturing the cryogenic gas management control system racks was awarded. The PLC software for the gas management and warm compressor subsystems was completed.

The last technical obstacles to the elimination of any dependence upon the Solaris operating system were themselves eliminated, and now all controls activities can (and will) use Linux.

The first High power RF transmitter at LANL, where network preparations are in progress to allow remote access to the PLC via and EPICS IOC

The Linac RF Reference line will have ~12 'Omega'(TM) Temperature controllers. Using a serial interface the temperature can now be read and the setpoint changed. This has been operating at LANL, monitoring room temperature and displaying it on the Web. In the attached plot, note these important truths:

- Before ~noon, the heater periodically turns on. Then the room cools down again.
- From ~noon to midnight, the combined heat of the sun and possibly hard-working LLRF people outclasses the heater.
- It's cooler on the weekends.



Work continued at ORNL to improve, adapt and automate the Berkeley code for emittance calculation and display.

Jeff Patton visited BNL this week to discuss database issues. Presentation were made by J. Wei, M. Hemmer, R. Lambiase, T. Nepsee and covered requirements for the Optics database, Magnet Measurements database, power supply database, controls and cabling issues.

Informal temperature cycling testing was performed on the first Chipmunk prototype from RIS Corporation. The unit performed well at elevated temperatures (50 deg. C) but performance was erratic when the unit was cooled down. We are searching for a test chamber to perform a 48 hour temperature cycling test in accordance with FermiLab procedures.

A quality assurance survey was performed at Innovative Controls in Knoxville by the SNS QA department. It was determined that that this company meets quality assurance requirements for QA level 1 equipment (that would include PPS equipment). Innovative has designed and is currently fabricating the PPS racks for Phase 0 (Front End and DTL tank 1).

At Berkeley, all Front End IOCs are now running on the SNS standard PowerPC computers. All vacuum and cooling interface chassis are online. The EPICS PV Gateway is ready for all diagnostics nodes.

Installation

The acceptance criteria were completed for the RF controls this week. All acceptance criteria have been signed and agreed upon. The accelerator turnover plan will be revised to reflect this, which essentially concludes hand-off planning.

The first five waveguide chase inserts were installed between the klystron gallery and the tunnel.

The ASD Division Director held the second of ten (10) planned system Installation Estimates Reviews at @2:30 on Friday 3/8/02. The Building Prep and Front End Installation estimates were reviewed. Both presentations went well.

An action item from the meeting was to cross check Front End Installation Estimates against Work Packages to insure that appropriate resources are in place to accomplish the planned work.

The ASD Division Director held the third of ten (10) planned system Installation Estimates Reviews at @1:00 on Friday 3/15/02. The DTL/CCL Installation estimates were reviewed. The presentation by Gary Johnson went well.

An action item from the meeting was to review the Integration and Conditioning estimates from both DTL and CCL with personnel who have recent experience in these tasks. Tanke/Kravchuk

The Division Director specifically determined that if a bead pull test is necessary to investigate the effects of moving the first DTL to the tunnel, that such a test would be performed back at RATS-NOT IN THE TUNNEL.

Scheduled for next week, 3/22/02, is the SCL/Cryomodules/Warm Beam Sections with Stout/Smee/Mangra.

The IPS-ASD Installation Integration Links were completed for the DTL, CCL and SCL. The HEBT links will be completed on 3/18/02. Completion of the Ring System and RTBT are four days behind schedule. They will be submitted Friday, 3/22/02.

Accelerator Physics

Consideration of the acceptance in the RTBT reveals that the limiting aperture of the line is in the "flight-tube" which takes the beam from the last optical element in the RTBT to the target proper. The acceptance of the flight tube is 220 pi mm-mrad in both planes, compared with 400 pi mm-mrad for the RTBT collimators and about 300 pi mm-mrad for the fixed ring collimators. Under nominal conditions this flight tube would act as a scraper, potentially receiving 1 kW beam power. Under abnormal conditions, this limiting aperture is the first place that beam would be lost. The flight tube is not designed as a scraper, and in fact has no active cooling capability.

Together with the target group, we are looking at solutions to the problem. The target group is working on making the aperture as large as possible, but there are limits having to do with specialized vacuum chamber components. Meanwhile the physics group is considering tighter collimation in the RTBT.

An application program has been written for setting the longitudinal phase of the MEBT cavities. It was tested using a version of the virtual accelerator that also mimics the BPM phase output.

A new simulation server (ap01.sns.gov) was installed, and ring tracking software ported to it.

Calculations were made to investigate the possibility of checking field flatness of the cavities after installation in the cryomodule. This was instigated by a desire to examine the state of the cavity with softer than expected strength that is in the medium beta prototype cryomodule. However the idea of determining field flatness from Q signals does not appear promising.

There is one BPM in the CCL-SCL transition region, which was designed differently from all the other SCL ones because it included tapering from the CCL to the SCL bore. As there is no physics reason for this, this BPM could be made identical to the other SCL BPMs; a separate piece of beam pipe could be used to match the different bores. Danny Mangra will look into this.

There is some concern about neutrons coming off the CCL beam stop, which could affect nearby O-rings, if any (do we have any in the beam stop?). Irina Popova has made some calculations on expected neutron dose; scaling should be applied to her results to get the integrated dose we expect.

In the IPS (R250), the first 4 SCL cryomodules are to be installed last, whereas it is preferred to have them in place for CCL module 4 (CCL4) commissioning because this avoids a temporary arrangement of beam pipe/diagnostics/magnets (which would be needed for CCL4 commissioning) thus giving time contingency. Also, having these cryomodules installed in order avoids having to modify the (CHL) transfer line. Beam loss in the SCL during commissioning might be an issue, both for CCL4 and for SCL commissioning. Dong-o Jeon and Jim Stovall will calculate how much and where one would lose beam. Irina can then calculate the resulting additional cryogenic heat load.

When transporting the SCL beam all the way to the linac dump (again, during commissioning), the location with the biggest risk of beam loss is most likely the collimator. George Dodson will see if the collimator installation can be delayed.

Operations

Ion Source Group

Our small radiation monitors were made available to the division. All three units are hanging from our hot spare stand cage and can be checked out anytime. Please leave your name and phone number on the adjacent clipboard, so that the units can be retrieved when needed.

The insulator has been glued to the aluminum-backing flange.

The Coalfield machine shop started with the fabrication of the housing for the matching network.

Interlock relays, surge suppressors and fuse panels continue to be wired.

RF Group

Fuja was at APS this week; we discussed PPS implementation at APS, Jlab and LANL. As far as RF amplifiers go, all turn of the AC to the amplifier, they also turn off the HV Klystron power supply. This is exactly what we are doing. No ill effects will occur to the Kalmus amplifiers located in the transmitters. Hengjie was at LANL last week and made good progress on reference line issues, will let you know specifics next week. Two LLRF technicians start work on the 18th.

Developed complete cable list for HVCMs, which is out for review by partner laboratories and equipment vendors. Developing ORNL acceptance testing plan for HVCM. Updated installation labor estimates for RFQ / DTL 1&2 HVCM efforts.

Mechanical Group

The labor estimates for the vacuum installation of the FES, DTL and CCL tanks were reviewed and updated.

The first beam dump flight tube was cleaned using an Alconox solution with a final rinse of de-ionized water prior to final leak testing per vacuum group procedures. No detectable leaks were found. The flight tube will now be pumped over the weekend and an RGA scan taken early next week. High outgassing rates with significant peaks at high mole weights (some hydrocarbons) were measured during RGA scans taking during testing of the flight tube. This is thought to be due to the elastomer gasketing arrangement and the liberal amounts of vacuum grease needed to seal the end plates during testing. As a result, test specific sealing plate are now being designed to minimize the quantity of gasketing material and the need to use grease to affect a seal. These plates will be available for testing of the next flight tube.

High voltage cables for shop testing of ion pumps and multi-conductor cabling required for first article testing of the RGA has been defined and ordered.

Survey of the second HEBT dipole chamber that has been planned for the last two weeks was again delayed due to other priorities.

The first article support brackets for the HEBT dipole chamber were received, and the magnet group is now undertaking a trail fit-up.

VTI staff in support of the demo leak test unit that is currently being evaluated made two technical support visits. This unit is being used for leak testing of the first flight tube beam dump.

A vacuum heat-sealing unit has been purchased. This unit will allow small vacuum components to be sealed in poly bags under an inert atmosphere for storage.

Magnet Group

A lifting fixture, designed to lift the upper coil from HEBT Dipoles, has been constructed and delivered. This will be used when we insert beam tubes into the dipoles. We are participating in procurement of parts for the bus design effort. Parts are on order for the SRF 8Q35 measurement system. The first 12Q45/16CD20 is presently at the Atlanta airport and will be shipped here soon. The next HEBT Dipole will arrive in Charleston the 25th. Today, we will finish measurements of the #1 HEBT Dipole. Yesterday, we did an 8-hour run of the Dipole that indicated no problems.

Cryogenics Group

CHL: The contractor was notified on Tuesday that the building steel will be delayed 5-6 weeks. He is checking the schedule impact and will have an update on Tuesday 3/19/02. The piping for the gas storage tanks was released for construction.

Warm Compressors: After repairing multiple leaks in the instrument piping the compressors are now within the acceptable gas leak rate of 10 scfh.

Beam Dump: The first beam dump is completed and released to vacuum testing for final acceptance.

Buss Bar: A new welding coupon was welded with the new torch assembly. The coupon has been sent to the machine shop for dissecting.

Electrical Systems Group

AC distribution panels have been selected for klystron gallery and equipment racks, orders were placed for partial panel needs

AC panel placement in the equipment racks were communicated to LANL

Survey and Alignment Group

The Survey & Alignment Group is heavily involved in Phase II or the Global Network Campaign. Specifically, at this time we are in the process of re-measuring the site elevation network.

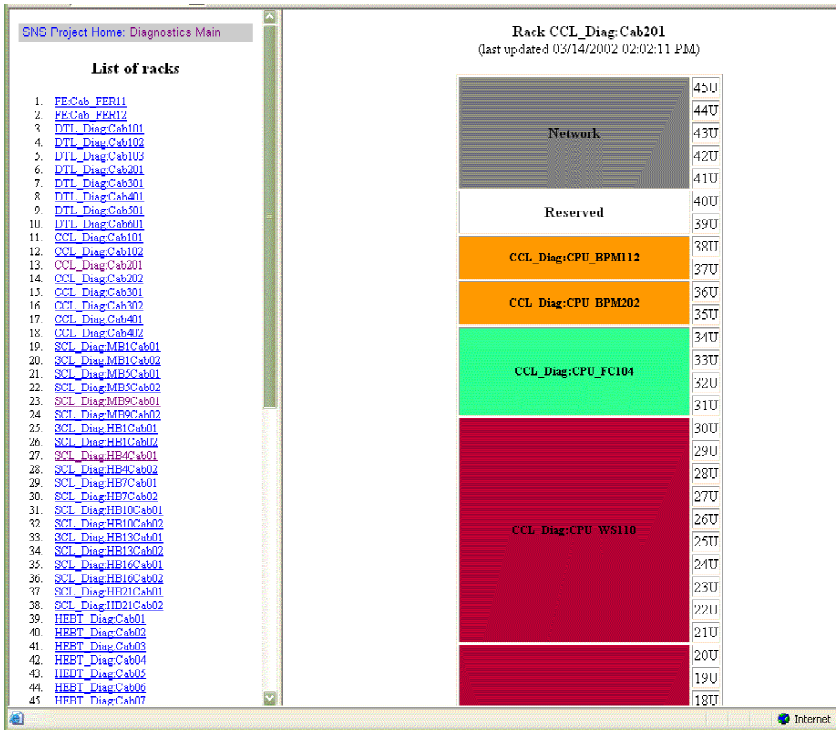
Beam Diagnostics Group

At Berkeley, final installation and cabling continues. Work concentrated on the wire scanners. Engineers from LANL and ORNL will visit Berkeley the week of the 18th and work on system integration. This effort will begin with BPM integration and continue with wire scanner integration. The goal is to prepare and debug the systems and their dm2k screens.

BNL provided Berkeley with information about MEBT wire scanner hookup. In support of laser system development, noise floor measurements were performed in the AGS linac. The BNL group awaits delivery of the Q-switched laser from LANL, which was shipped on Wednesday. Marty presented a BCM talk at LANL's Diagnostics Advisory Committee (DAC) review.

At LANL, the week was devoted to the final design reviews for the wire scanner, energy degrader / Faraday Cup, BPM, BCM, and D-plate systems. All the reviews were successful. The committee has promised a report by the end of the month.

Tom went to LANL for the DAC final design review. At ORNL, others attended the review via the videoconference. Warren wrote a tech note on the effect of laser focusing on the vacuum window. Wim and Dave Wrote a Labview program that links the diagnostic Oracle database to the Web. The results of the diagnostic rack profile assignments are generated by this program and are available at: http://www.sns.gov/diagnostics/documents/Racks.html
An example report is shown below:


SNS Project Home: Diagnostics Main
List of racks
1. FE:Cab_FER11
2. FE:Cab_FER12
3. DTL_Diag:Cab101
4. DTL_Diag:Cab102
5. DTL_Diag:Cab103
6. DTL_Diag:Cab201
7. DTL_Diag:Cab301
8. DTL_Diag:Cab401
9. DTL_Diag:Cab501
10. DTL_Diag:Cab601
11. CCL_Diag:Cab101
12. CCL_Diag:Cab102
13. CCL_Diag:Cab201
14. CCL_Diag:Cab202
15. CCL_Diag:Cab301
16. CCL_Diag:Cab302
17. CCL_Diag:Cab401
18. CCL_Diag:Cab402
19. SCL_Diag:MEICab01
20. SCL_Diag:MEICab02
21. SCL_Diag:ME5Cab01
22. SCL_Diag:ME5Cab02
23. SCL_Diag:ME9Cab01
24. SCL_Diag:ME9Cab02
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Rack CCL_Diag:Cab201
(last updated 03/14/2002 02:02:11 PM)
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Reserved
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CCL_Diag:CPU_BPM202
CCL_Diag:CPU_FC104
CCL_Diag:CPU_WS110
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