Accelerator Systems Division Highlights for the Week Ending March 30, 2001

ASD/LBNL: Front End Systems

ASD/LANL: Warm Linac

The CCL cold model objectives have been accomplished. This week, we completed mapping the waveguide coupling iris to the cold model as a function of the angular full width of the iris. By scaling these measurements for the differences in Q and stored energy U, we determined the size of the coupling iris required for the copper hot model and also for both irises in CCL module 1. (WBS 1.1.2.2, and project milestone)

LANL and ORNL/ASD staff were at CPI this week to conduct a PDR for the 805 MHz, 550-kW SRF klystron order. The PDR was satisfactory. There were detailed presentations and productive discussions on a number of topics, *e.g.,* the RF interaction circuit, output window and waveguide, electron gun, solenoid, and collector. Strong presence and commitment by CPI senior management were evident. The detailed project schedule developed by CPI was consistent with the SNS IPS. CPI agreed to examine risk and warranty issues associated with reducing the contract cooling flow specification by 33%. (WBS 1.4.1.1)

The engineering issues associated with the DTL water system have been completed and the assembly drawings for Tanks 1 and 2 are nearly complete. Fig. 1 is an illustration of the water system on Tank #1 of the DTL. The coolant lines to the drift tubes have been removed for clarity. (WBS 1.4.2.5)

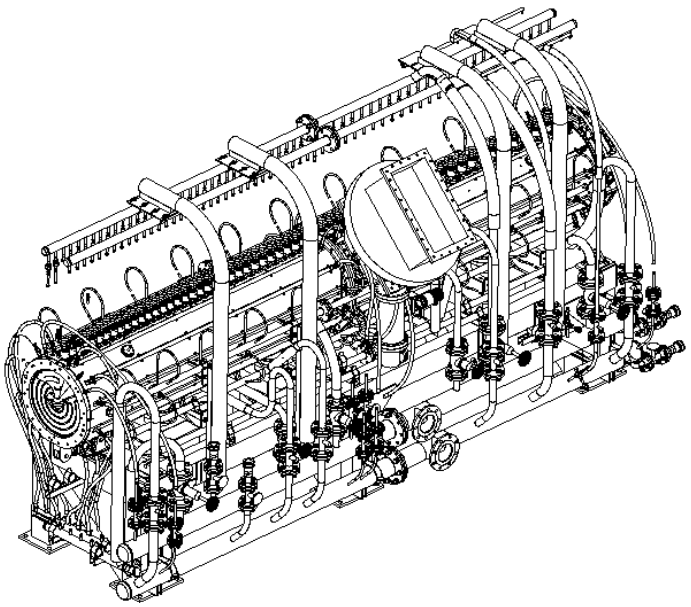


Fig. 1: DTL Tank 1 water system assembly drawing.

We completed calculations needed for final machining of all the DTL tanks. This includes adjustments needed in tank diameters to correct the frequency for effects of stems, stem sockets in the wall, post couplers, pumping slots, and half of the slug-tuner range. The purchase order for machining the DTL tank sections was submitted to purchasing. The drawings for the drive iris are nearly 100% complete. We are now focusing on the assembly drawings, diagnostics, and intertank beam boxes. (WBS 1.4.2 and 1.4.5.3)

We have started our evaluation of the copper-plated prototype DTL tank. Adhesion of the copper looks good and, the quality of the finished surface is reasonable. The quality of the plating is still under evaluation. We are planning to perform two ASTM adhesion tests before the DTL FDR on May 1. (WBS 1.4.2)

We continue to perform linac optimization studies for SRF cavities with potentially higher gradients. Fig. 2 illustrates the range of options being considered for a baseline and a backup design. The upper curve represents the energy options of our "pending baseline," which uses high-field high-β cavities if we want to add additional cavities (4 to a cryomodules). The lower 4 curves represent our options for a "backup SRF linac design" using low-field cavities throughout. In all of these designs we have reduced the fields and phases in two low-β cavities to accommodate longitudinal matching. (WBS 1.4.5.3)

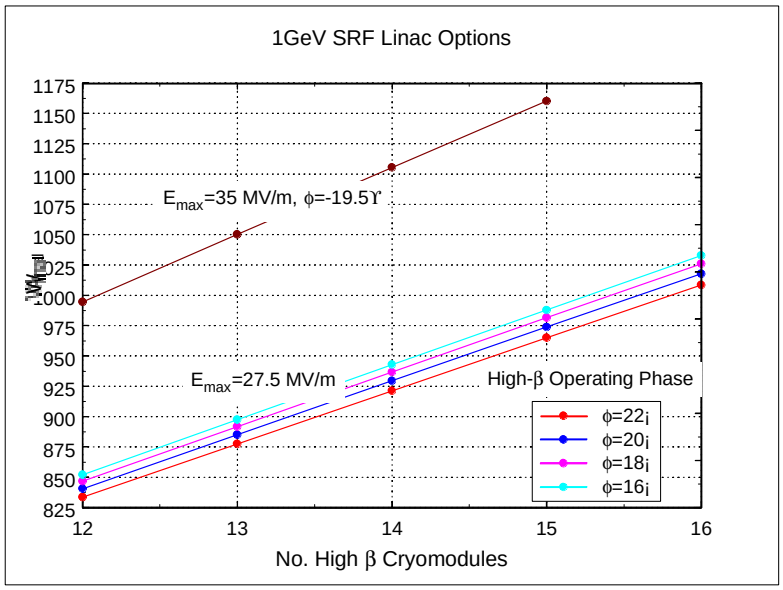
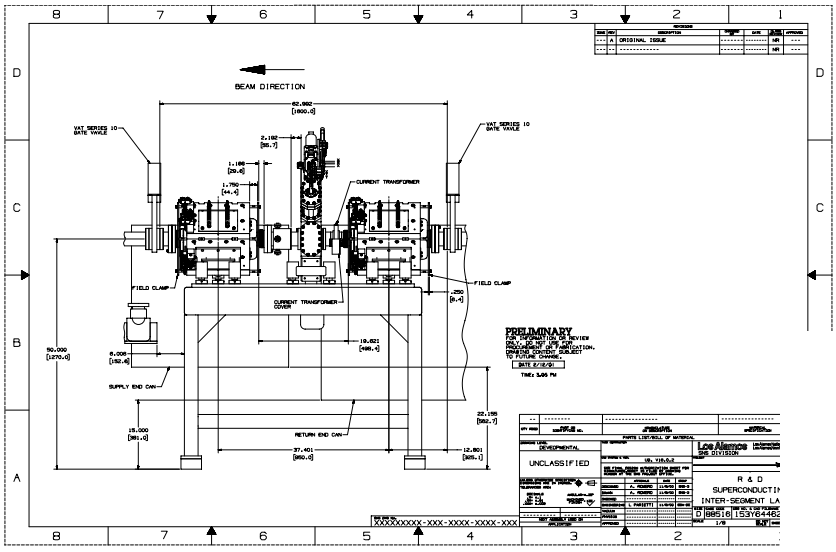


Fig. 2: Linac energy for different numbers of high-beta cryomodules for different gradient assumptions.

The BPM design team responded to the Preliminary Design Review held Feb. 27 at LANL. See SNS01-DES-XXX at http://sns.atdiv.lanl.gov/. (WBS 1.4.5.2)

We revised the layout, for the SRF intersegment regions to attach the BPM directly to the beam box. All diagnostics, alignment, vacuum, and installation requirements can be met with this layout, which has 95-cm spacing between quads. (WBS 1.4.9) Fig. 3: New layout of SRF-linac intersegment regions.



ASD/JLAB Cold Linac

The last three Gas Storage Tanks were delivered to the site.

The Eddy Current Scanner System was inspected at manufacturer.

Medium beta cavity #2-4 frequency measurements of the dumbbells continue to be made.

Fundamental power coupler preparations continue for the high power test next month at LANL. The "final" bake of the first pair is in progress. They should be shipped to LANL on 12-Apr.

Welding the single cell MB Nb and the remaining cavity ends continues. ORNL completed calculating the HOM modes for a three-cavity MB CM system; a two cavity MB configuration system is being tested. Activities continue for the identification of the three high beta HOM modes considered dangerous for power generation if not sufficiently damped.

The procurement effort for the EP parts and the cabinet continues.

The End Cans, Thermal Shield, Tuner Mechanical, and Metal Beam Valves contracts were awarded. The Space Frame contract will be awarded next week. The Magnetic Shield bids are being evaluated. The Vacuum Tank bids were received and are being evaluated. Reactor grade Nb bids are due back by 9-Apr. Cavity ends bids are due back by 30-Apr. The RFP for the Cavities was released. A prebid meeting will be held 18-Apr; bids are due 16-May.

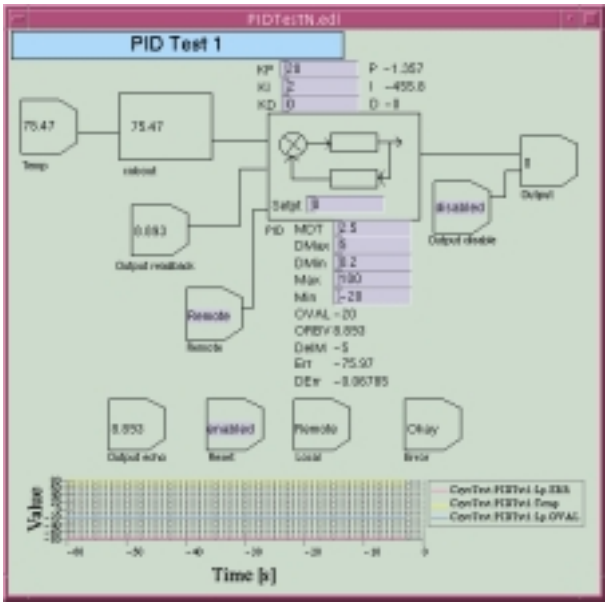
The installation cost PCR for the 1MW RF system is being prepared (LI 00-068). The civil cost estimates are being reviewed.

The LANL 1MW RF system plan for JLab testing needs to be approved (LANL LI 01-035). In the fall of 1999 as part of the MOU discussion, it was agreed that SNS would provide a skidded RF system for the JLab testing of CM's and power couplers. It is needed in the 2_{nd}Q FY02 to test the Prototype CM at full power. If the PCR is approved now, the best LANL can do is deliver a system 3 to 6 months after we start full 1 CM per month production. (Depending on interpretation, this is also a ~6 month slip in the Milestones #1b-3 and 2-30.) The ASAC last year raised this as one of the highest priorities. This system is a key element not only for conditioning and acceptance testing but also is the key to raising the High Beta Gradient from 27.5 to 35.0 MV/m. The immediate approval of this PCR is required to get LANL started working on this.

ASD/BNL: Ring and Beamlines

Controls:

A functioning PID control loop has been implemented in the Cryo Control Development System. The PID loop is used to control the temperature of a heater. The system includes an EPICS operator interface screen (Created in EDM, the SNS standard screen editor), an EPICS IOC with a MVME 2100 power PC, an Allen-Bradley ControlLogix PLC, an Allen-Bradley PanelView Local operator interface terminal, and a Remote/Local switch panel. The heater and temperature sensor are connected to PLC inputs and outputs. The PLC and EPICS IOC communicate via the SNS Standard EtherIP communication driver. The EPICS cpid record is used for the PID loop. The PID loop runs in the IOC and controls the heater when the Remote/Local switch is in the "Remote" mode. The PID setpoint and tuning parameters may be adjusted using the EPICS operator interface screen. When the switch is in the "Local" mode, the user may use the PanelView terminal to set the PLC output to the heater to any desired value (0 to 100% output). This is a significant achievement for the Integrated Control System Development. It is the first end-to-end implementation of a control loop utilizing the standard ICS hardware, software, and operator interface screens. (See three illustrations below.)



EPICS Operator Interface Screen

PanelView Operator Interface Screen and Remote/Local Switch Panel

Cryo PLC development/test station

The Central Helium Liquefier and Cryomodule Control System Functional System Design was issued for review and comment. This documents describes the implementation of the control system and the interface it provides to operations for control and monitoring of the cryo system.

At BNL, software was written to do long term stability tests on the power supply controller setpoint. Preliminary results show less than a 1-bit drift over 16 hours. Software to test the linearity of the DAC was also written. Preliminary tests show approximately one bit deviation over the range. The manufacturer, Apogee, is looking into the problem. When all the software is written, all tests will be redone and the results recorded.

The controls group has set up Linux/EPICS environments for the use of the Accelerator Physics and Diagnostics groups.

A complete protocol for control system back-ups was initiated. The back-up administration is handled by Jim Simmons from the ORNL Workstation Support Group. Incremental Back-ups are performed every night Mon-Sat. Full Back-ups are done once a week on Sundays.

The controls group has arranged a collaboration with John Sinclair of the Holifield Accelerator (ORNL) to help in the development of EDM – the display manager selected by SNS and developed by John.

An EPICS “PV Gateway” was installed and tested at LBL. This allows Front-End Controls Operator Displays to be displayed at ORNL in a secure, non-intrusive, and bandwidth-efficient way.

A Controls System Network Switch proto-type (CISCO 6509 Core Router, CISCO 3508 Gigabit Concentrator, and CISCO 3548 10/100 VLAN) was installed. This hardware is on loan to us from CISCO for 60-days, and is being set up to correspond to the SNS global controls network design.

Wiring drawings for PLCs used for in the Target utility controls are in progress. Although some process instrument specifications are not complete, output types are known allowing us to proceed with cabinet wiring. The instrument specifications will be completed by June 2001.

There has been considerable staffing progress at LANL

- Chris Treml, a post grad, was transferred into our group to work on resonance cooling.
- Chris Allen, also a post doc, will most likely join us in two weeks to work in high-level applications.
- Peregrine McGehee will transfer to the SNS division. His first assignment is to acquire/test a FORTRAN interface to EPICS channel access.

The LLRF test stand is in place at LANL, with a Labview CA client talking to a VXI IOC. There is device and driver support for register-based devices to support the testing of LLRF boards when they are ready.

The HPRF local/remote PLC control issue was resolved. The requirement needs to be restated in the contract with Maxwell and be a part of all PLC-supported systems.

Considerable progress was made in the definition of the optics tables in the site-wide technical database. A small proof-of-principle experiment was planned and will be implemented at ORNL and BNL over the next few weeks.

ASD/ORNL: Integration

Accelerator Physics

Eugene Tanke and Dong O Jeon visited LANL to work on commissioning algorithms and credible linac accident scenarios.

The new transverse impedance module for the ORBIT simulation code has been benchmarked successfully against an analytic case. This module is now also being incorporated into the UAL code framework.

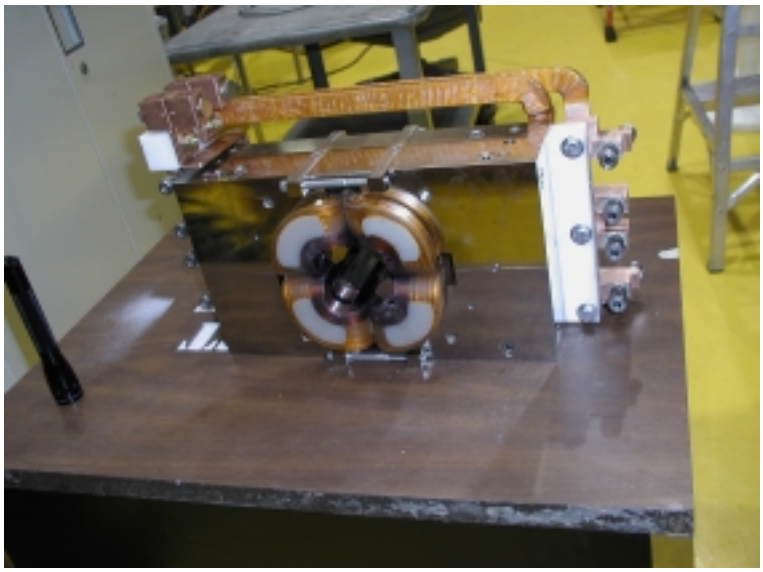
A combination of Matlab and Trace-3D is being used to test MEBT commissioning schemes. This code combination works much faster than the previous combination using parmila.

Operations

Installation and RATS Building

Magnet Measurement Group

Below is a photo of the prototype of the CCL quadrupole for transverse focusing.



Ion Source Group

At this time we concentrate our efforts towards improving antenna reliability and lifetime, which appear to become relevant issues. Our efforts include a material science search for better antenna coatings, coatings that have low porosity, low secondary electron emission coefficients, and hopefully a high, but not infinite electrical resistance.

This effort profits substantially from the support by the ORNL Metals and Ceramics group, which is highly appreciated.

RF Group

Cryo Transfer Line Group

The welding machines have been connected to AC and have been fully tested. All the cutting saws are now connected to AC and fully functional. We continue to order and set shop equipment. The portable 25KVA mobile systems have arrived and been fully tested. The Varian Helium mass spectrometer was setup and tested by a manufacturers rep. and proper operation classes were held at the time. The new date for reviewing the purifier extraction task has been set for April 5th and the vendors have been notified.

Mechanical Group

Power Supply Group

A new employee, William Barnett, joined the Ring Electrical Systems Group as an electronics technician. Mr. Barnett joins us from the Instrumentation and Controls Division at ORNL and has extensive accelerator experience.

Survey and Alignment Group

Diagnostics Group

Slits and Energy Degraders: At LANL: Work continued on the computer model of the slit's thermal characteristics. The 2-D model gives good results, and we are now testing the 3-D model. Work continued on the D-plate energy degrader. We are about 70% complete on the drawing package for this degrader, including the air actuator and water cooling. Note: This degrader is made of beryllium, due to its exceptional thermal characteristics (the other degraders are made of graphite). We are in the final stages of the design. If there are any comments on the use of beryllium, please speak now.

Actuators: At LANL: We have ordered a prototype stepper motor actuator for the DTL and CCL wire scanners, and a prototype air actuator for the Faraday Cups and energy degraders. The SCL WS actuator design detailing is expected to be completed today (30/Mar).

D-plate: At LANL: Work continued on the beam stop design. The segmented halo scraper will be made of Ni, in 8 segments, with a 6.3 inch inside diameter. Once we have a drawing package we will check with vendors for the best method off abrication.

BPMs: At LANL: The DTL BPM drawing package was signed off this week. We will now proceed to fab three units. We distributed the informal response to the BPM PDR committee. A more formal response will follow. Matt Stettler now has a working software model of his FPGA. After a few straightforward tests and tweaks, he will proceed to burn a chip and test it in a PCI prototyping card. The digital front-end design is ready to hand off to ECAD. The analog front end from Bergoz is slightly behind schedule (delivery was expected mid March). We're about half done with the design for the test fixture for the DTL BPMs. At BNL: Fabrication quote for 12 cm HEBT BPMs has been received. Based on the low incremental cost, we recommend building enough units (electrodes only) to populate all quads. This decision should be made next week.

Wire scanners: At LANL: Work continues on the wire scanner electronics. A prototype schematic was delivered to ECAD personnel and a printed circuit board is expected in the near future. We are checking for obstacles to installing laser wire scanners on the DTL, CCL, and SCL beam boxes. The only problem so far is the laser protruding into the walk space. This could perhaps be solved by installing the laser vertically. There are also the questions of beam box reflectivity on the side opposite the laser entrance, and stripping cross sections at higher beam energies (the cross section scales by more than 1/beta).

Global: LBNL: The link receiver board layout was completed and sent out for fabrication. We expect boards and enough components for prototypes in two weeks. The emittance scanner front-end board is taxing the capabilities of LBNL's layout tools. Access to higher end packages is being considered. ORNL: In collaboration with controls personnel, Dave Purcell has obtained and configured a Linux workstation that will be used to run console apps and develop code for embedded Linux diagnostics. He also attended several meetings regarding cable, Magnets, and Optics portions of the database. Even at this prototype stage, we have decided to populate some tables with diagnostics information (device names, locations, etc). We will merge data from these simple tables into the final database when it is ready. Saeed attended an intensive Matlab/Simulink training course in Chicago and organized meetings with diagnostics/AP personnel at FNAL. Craig Deibele has accepted an engineering position in the ORNL Diagnostics group. Tom Shea met with LBNL personnel to discuss the link receiver IP, emittance system, fast faraday cup design, and data server plans. A few highlights:
- We will need one event link encoder and one input module at LBNL in May. This is the fastest way to test our link receiver. Complete testing will be performed later by the ORNL diagnostics group.
- Tom will analyze faraday cup designs and performance. In parallel, John Staples will investigate alternative techniques to perform a rough bunch length measurement.
- Although the personnel have not been identified, we agreed that ORNL should take responsibility for the data servers (middleware). If possible, this should include prototypes for use during Front End commissioning.
- ORNL and LBNL need to execute a loan agreement for use of the spectrometer magnet.