

## Accelerator Systems Division Highlights for the Week Ending March 21, 2003

### ASD/LANL: Warm Linac

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

Accomplishments: (1) We completed factory test at E2V of 2.5-MW, 402.5-MHz klystron S/N 10; (2) installed one E2V klystron and a pair of DTL windows on LANL test stand; (3) completed factory test at CPI of 550-kW, 805-MHz klystron S/N 14; (4) completed site acceptance tests of two CPI klystrons; (5) prepared next shipment of tested HPRF equipment to ORNL which will include 3 CPI tubes, an E2V tube, 6 magnets, and 3 sockets.

Concerns & Actions: (1) 5 MW testing is suspended pending repairs of broken circulators, loads, and sliding short. (2) Previously reported delay in the SC transmitter shipment was addressed. Bugs were fixed and factory acceptance tests restarted. This delay does not affect the Integrated Project schedule.

#### HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) Prototype HV converter-modulator (HVCM) operation supported klystron testing at Los Alamos. Unit ran without failure. (2) Dynapower shipped production HVCM S/N 4 to LANL. Factory acceptance tests of S/N 5 are currently scheduled to begin 4/15.

Concerns & Actions: Bill Reass traveled to ORNL to conduct Q/A review of production HVCMs that arrived from Dynapower. Travel was initiated by discussions with Dynapower personnel who had fabrication concerns.

Additional test procedures were developed to analyze boost transformers to better than 0.1% accuracy. Tests at ORNL on the second (ME2) modulator revealed the following boost transformer winding problems: (a) winding turns ratio differences between parallel secondary windings; (b) windings with reversed polarity; and (c) poor fabrication technique. The modulator response with boost transformer problems was modeled. Results confirm ORNL tests. The third delivered HVCM unit (in the ORNL SNS RF lab) was found to be satisfactory and moved into the ME2 position to support DTL-3 conditioning. We are writing additional boost transformer assembly, Q/A, and test procedures for Dynapower and ORNL, and we will send a technician to ORNL to fix boost transformers. This service is authorize by the vendor

#### DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) 31 of the 33 Tank-3 drift tubes have been delivered to Oak Ridge. Installation and alignment are well underway. Steve Ellis traveled ORNL to support installation. (2) 14 of the 16 Tank-3 post couplers have been Cu plated. Final machining is underway. (3) Final machining of the first batch of Tank-1 drift tubes is underway.

Concerns & Actions: (1) The last two T-3 drift tubes (the BPM dummies) failed their final leak check. Repairs are underway. We anticipate at least four working days to repair, test, clean, and ship. (2) The T-3 drive iris still has a vacuum leak and remains under repair. This is our critical path item with delivery scheduled not earlier than 4/7. (3) The start of T-1 drift tube final machining was delayed by almost one week. We are working with the vendor to improve communication of priorities relative to those of other customers.

#### COUPLED-CAVITY LINAC (WBS 1.4.4)

Accomplishment: (1) The segment supports for the upstream half of module 1 have been shipped to ACCEL for use in tuning the segments on their temporary assembly frame. The main support stand weldments remain in fabrication in Albuquerque. (2) A design for the layout of the assembly alignment monument system and placement of the alignment targets for CCL module assembly has been developed. The required laser reflector cubes and mounts have been ordered and they are to be shipped directly to ACCEL within the next week. (3) Initial measurements at ORNL of CCL quadrupole magnet (R177QN80) SN#1 shows good results. This is the quad that went back to Milhouse twice before with coil problems. GL data are plotted in Fig. 1. Excellent agreement is obtained with LANL calculations.

Concerns & Actions: ACCEL accidentally heated a sheet of aluminum foil with one of the segments during the stack braze operation. The foil was in place over the end coupling cell to prevent dust from settling on the rf surfaces during stack tuning measurements just prior to entering the braze oven, and during the preparation process the foil was not noticed before the segment was raised into the oven and heated. We believe that the segment can be saved and we will make a final determination during our next site visit in April. ACCEL has implemented a checklist step for all future brazes to prevent reoccurrence.

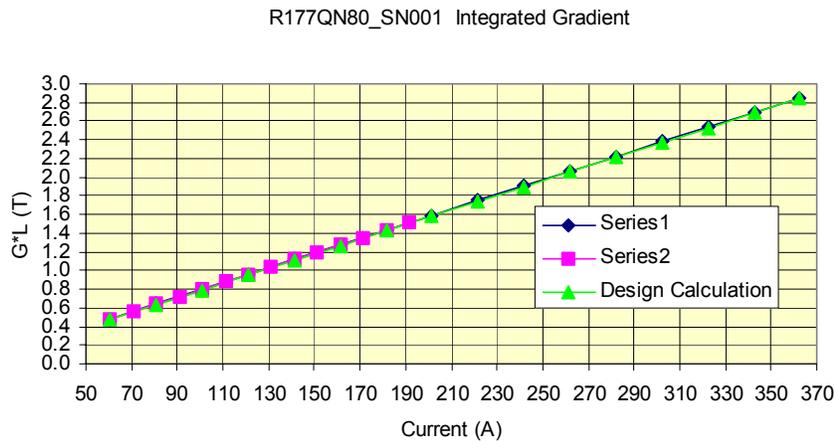


Fig. 1: First article CCL quadrupole field gradient.

### ASD/JLAB: Cold Linac

Cryomodule M-1 continues under test. Cavities 2 and 3 have demonstrated maximum gradients and  $Q_0$  well above the specification. Cryomodules M-2 and M-3 are being assembled. (See photos).

The first article high- $\beta$  cavity is being tuned in preparation for welding of the helium vessel. Post-purification of the first batch of high- $\beta$  end groups is underway.

The first electropolishing run on a cavity (3-cell, 700 MHz) was successfully completed. This was the first integrated attempt at processing, and the objective was to ensure that all elements of the system worked correctly with acid. A final cleanup punch list was generated and is being worked.



### ASD/BNL: Ring

George Mahler and Cyrus Biscardi traveled to Stangenes this week to perform an inspection of the reworked, 1<sup>st</sup> article (26Q40) production magnet.

BNL engineers traveled to NETC to inspect production components and address several technical issues.

The first article 21S26 has been accepted by BNL. Alpha Magnetics has been given the approval to proceed with production.

27CD30 – the first article corrector has been assembled and is in final inspection at NETC. After testing and approval at BNL, all production units (19) will be shipped directly to SNS/OR.

41CDM 30 – the first article production has been received from Alpha Magnetics and is undergoing initial inspections prior to mag measure.

21CO26 – magnetic measurements are underway. The 1<sup>st</sup> article production magnet has been fully measured.

A PCR has been received for a spare Injection Dump Septum magnet. Discussions are underway with BNL Contracts dept. to amend the existing contract.

The repaired 1<sup>st</sup> article 36CDM30 has arrived from NETC. The magnet is undergoing initial inspections and testing as the vendor awaits approval for the remaining production units.

RF Tuning PS – the first article PS failed during initial testing under load. At 290 Amps, a capacitor on the voltage loop driver module failed. (BNL engineers are working with the vendor (Danfysik) to identify and resolve the problem.)

Ring half-cells: BNL unit #4 was delivered to SNS/OR. Work continues on units #5, 6 and 7.

Work on the Ring doublet chambers continues along with coating of the half-cell chambers and the injection kicker ceramic chambers.

Preparations were made for the upcoming SNS design review of Diagnostic systems.

Our vendor, BINP, is struggling with the assembly of their large quads. Five magnets are now in final assembly; two are within specs and three require rework. We continue with our weekly teleconference meetings to address their technical issues.

We participated in an ASD teleconference on magnet hook-ups and cable connections for special injection, extraction and RTBT magnets. Paul Holik will advise on which magnets will be cable connected and the number and size of cables required. BNL will integrate connection pads into our magnet designs and drawings.

Efforts are underway to build a quarter-cell assembly to measure the “influence” of magnet yoke steel on the field quality between Ring quads and correctors.

## **Controls**

The Controls Group participated in the ASAC Review. In addition to the usual overview talk, Eric Bjorklund described the timing system in response to a concern expressed by the committee last time. The concerns of the committee about operating in a not-completely-line-synched mode appear not to have been fully allayed. We will monitor line characteristics and report results at the next meeting. Otherwise, the ASAC Committee report on Controls was generally favorable.

Charles Pinney of the LANL team visited the site to assist in insuring that the wiring for the vacuum subsystem was correct, and then in checking it out with software. This visit was extremely valuable, and will help assure success in the final integration testing with LANL scheduled for mid July. After meeting with operations, work began on overall summary and navigation screens for the DTL. A Linac “site map” has been created for top-level navigation.

Work continued on the design of the DTL Drift Tube Thermocouple data acquisition system. All I/O equipment has been ordered and the locations of equipment agreed. Every attempt was made to limit the length of runs of thermocouple wire. An EMI-proof (hopefully) enclosure has been designed, a contract placed and fabrication is underway. Support software is under development at LANL and will be integrated with the RCCS system, providing an interlock to the LLRF system.

Big News!! The EPICS boot server and operator interface workstation is running in the CHL control room. It is communicating with the 4.5 K cold box IOC and PLC that are temporarily mounted in the CHL control room racks. The control system network is working in the CHL building control room and is connected to the SNS site ICS network. Data collected by the CHL PLC can now be viewed on EPICS screens in the Main Control Room or at 701 Scarboro Road. Below is the CHL control room in action.



As we near the departure of the current timing system guru for browner pastures in New Mexico, several last minute changes have been made. The EDM screens for the V206 module have been reworked to display each frame in decimal and hexadecimal (some frames are better in hex, some are better in decimal), and to display a description of what each frame is for. Several other improvements were made to the timing system software both for better performance and better operator understanding. Considerable effort is being spent on documenting the timing system and in training the timing system guru to be. Checkout procedures for the timing master IOC, and the timing system portions of the HPRF and LLRF IOCs have also been written. A system, which uses a counter to simulate the ring period to update the ring period frame in the real-time data link, has been tested. Calibration against a known frequency reference is achieved by tweaking the counter's gate time.

Cable installation has started for the next PPS phase (phase 0.4, Front end and DTL 1 & 3) and the stand-alone system for DTL 3 conditioning (phase 0.3). A factory acceptance test was conducted at the Sverdrup facility in Tullahoma on the remaining PPS PLC equipment for PPS phase 1 (LINAC segment). The equipment was accepted with a few minor modifications required.

RIS Corp. shipped the 7<sup>th</sup> and 8<sup>th</sup> production Chipmunks last week. These units underwent company acceptance tests at RASCAL and passed. Our total inventory of SNS Chipmunks now stands at 8 production, 2 prototypes. We have placed a contract this week with RIS to perform a three-week study on possible replacement parts for the Motorola FET that is in limited supply. RIS has selected about 30 to 40 possible devices to test. About half are on hand and the rest are on order. Testing will start next week. RIS is retaining the last two production units to use as test beds for possible replacements. Procedures are under development for both SNS and RASCAL Chipmunk calibrations (inspection and electronic calibration will be conducted at SNS and the radiation calibration will be conducted at RASCAL). The first draft of the SNS section of the procedure has been issued for comment. The RASCAL procedure should be issued March 21<sup>st</sup> for comment. We will begin a dry run of the SNS procedure next week. When the calibration procedures are approved, we will calibrate the eight production and two prototype units for the next PPS phase (10 units on hand, 6 or 7 required for phase 0.4- FE & DTL 1 & 3).

Cable installation drawings and databases for the CHL and LINAC systems are about 80% complete. A field walkdown with the electrical installation engineer is scheduled for early next week. All parts required for the first standalone ODH system for the recovery compressor are on order. Testing the oxygen transmitter selected for the ODH system continued. The test results using O<sub>2</sub> in nitrogen and O<sub>2</sub> in helium continue to indicate that the sensor has very good repeatability.

We have been working with Environmental Protection personnel at the lab to determine the design requirements and cost for the NESHAPS stack monitoring equipment. The cost estimate based on the proposed design for this system

is in good agreement with our current ETC (there was concern that a more expensive system would be required due to a change in regulations governing this equipment).

A System Block Diagram showing all rack locations and controls network cabling was completed, as were rack equipment layout designs to be used as a standard for ring controls.

The Front End Test Stand control system and console was moved to the Front End Building from RATS, accompanying the Test Stand itself. Below is a photo of the console in the FE Building.



### Installation

Craft Snapshot 3/19/03

ASD craft workers	64.0
Foremen, ES&H, etc	9.0
Less WBS 1.9 controls	4.0
Less absent	2.0
TOTAL	67.0

Twenty-nine drift tubes have been installed in the DTL #3 Tank. The last four drift tubes will be installed on APR 2-3, 03. Receipt of the last two drift tubes from LANL for DTL #3 is expected on MAR 31, 03. Delivery of the Iris on AR 8, 03 is also a critical item in the DTL #3 schedule. Current DTL #3 installation activities are being conducted with the tank in its final position in the linac tunnel.

DTL #1 has been put into position in the linac tunnel to complete the tie in of associated cabling and support systems.

The shielding wall down stream of DTL #3 has been started.

A revised ASD Subproject Schedule has been completed to support the ETC.

The initial HB waveguide delivery is expected on MAR 26, 03.

The D - Plated was installed into position in the linac tunnel. Support systems were integrated and the D - Plate removed.

Thermocouples for DTL #3 were received and prepared for installation.

### **Accelerator Physics**

Programming group is organizing global database tables to hold measured RF cavity information of importance to physics and operation.

S. Kim has prepared drift-tube vibration measurements and has some preliminary results for tank 1 drift tubes that show expected resonances, and very small motion in the RATS environment. Analysis continues.

D. Jeon, S. Kim and M. Doleans are visiting JLAB to discuss cryomodule performance results with colleagues there.

V. Danilov and J. Holmes are investigating self-consistent beam distributions in the ring, and methods required for painting them.

### **Operations Group**

Operations are continuing with the process of interviewing accelerator operator candidates.

Maintenance Coordinators have been appointed for each group and met on Friday after the installation meeting.

DataStream 7i, the Management Maintenance System is installed. We held a telephone meeting with DataStream this week to discuss the upcoming configuration team visit Mar 31- April 2.

Fault Reporting – Until 7i is on-line personnel are requested to continue using the use e-logbook for fault and maintenance tracking.

Operations are continuing to tape ASD lectures and collect lecture material for the Training Library.

ARR Preparation. Conduct of Operations. QA has completed their review. The document is complete.

Updating of emergency procedures is ongoing

Migration of the ASD Design Review Basis data to ProjectWise is ongoing

Planning for ASD office and laboratory space in the CLO is ongoing

### **Ion Source Group**

The hot spare stand and the associated infrastructure have been moved to the Front End Building. It has been setup next to the temporary control room and is currently in the process of reinstallation.

The Stapletron has been packed for shipping to LBNL after all changes have been documented. The R&D source has also been packed after inserting expandable foam in the space between the case and the e-dump. Both will be shipped to LBNL.

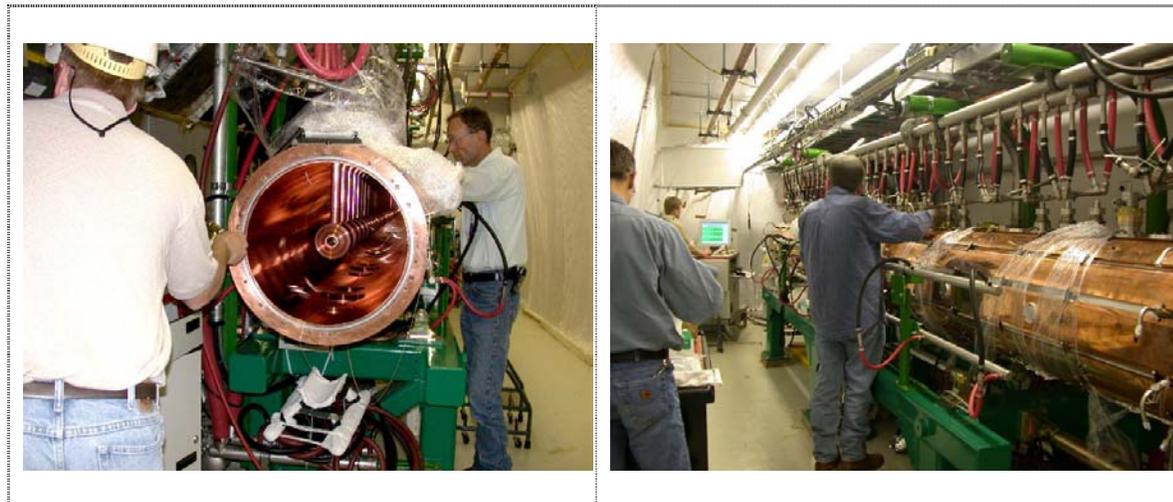
A self-consistent analysis has confirmed the superior quality of the emittance data measured during commissioning of the FE as well as the soundness of the subtraction for slit scattering. The elliptical exclusion analysis indicates a bias of roughly 0.005%, yielding self-consistent rms-emittances that are only about 0.5% smaller than the values calculated from all raw data.

### **Survey and Alignment Group**

#### **Mechanical Group**

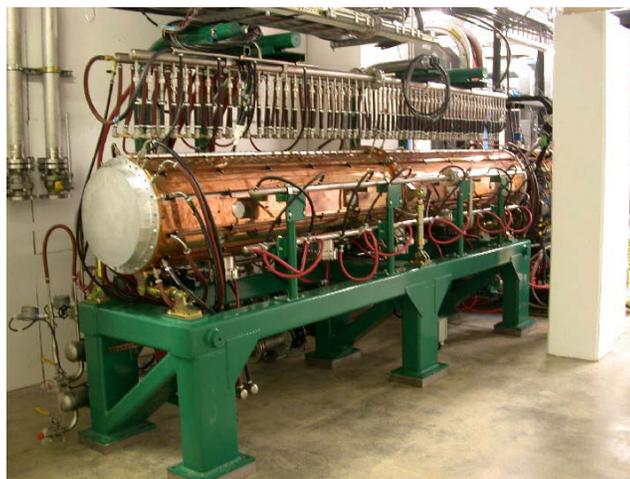
Twenty-nine of the 33 DT's for DTL-3 have been installed in the tank and aligned. The remaining 4 will be installed and aligned after the last 2 are received from LANL. This is expected at the end of this month. The

alignment team performed the alignment in the tunnel during the evening shift (3:00 pm to midnight) when noise and vibration is less than during the day.



DTL-3 Alignment Team

The DTL-1 tank was installed in the FE building on Monday (3-17) and initial alignment was performed on Tuesday. The move went smoothly from start to finish. Re-leak testing at the site indicated a small vacuum leak ( $\sim 2 \times 10^{-8}$  Torr-l/s) in the flange between tank sections. This will be repaired when the tank is moved to the FE building for DT installation in April.



DTL-1 in the FE Building

### **Magnet Task**

### **Linac HPRF**

ME 2, HVCM repaired and ready to go. Checkout of SCR unit will start on Monday.

ME 3 repairs to be performed in house with LANL people assistance starting next week.

ME 1 replacement transformers have not arrived, a week late now, expecting the around the end of the month.

RFQ wave guide section removed and wave guide to coax transition inserted for LLRF tests with 100 W into RFQ.

Found stalactites and stalagmites in RFQ circulator on water cooling channels, assuming it's from Tennessee moist air, channels not leaking, investigation on going.

DTL 3 and 1 klystrons are ready for high power testing into short, waiting for HVCM.

Piping work commencing in the RFTF, most electrician work finished, RF group work remains. We will have a technician dedicated to this work until completion in May.

Ground planes were laid in the ME2 and RFTF areas. Completed grounding upgrades to reduce EMI per recommendations from LANL Grounding Workshop. E2V representative installed modification on klystron output transition pieces for all four 402.5 MHz klystrons at SNS. This will prevent arcing from over-stressed spacers in the transitions. Interlocks were satisfied to allow DTL 3&4 RF transmitters to come up to RDY for HV. Electrical cable pulls have started on RF transmitters for DTL 5&6.

## **Linac LLRF**

ORNL

### RFQ Cleanup

The RFQ LLRF Control Rack was rearranged to be consistent with the DTL installation. This consisted mainly of recessing the rack chassis and cleaning up the cabling.

### DTL Installation

The VXI IOCs for DTL1-3 were installed and are operational.

### Reference System

The reference line directional couplers were installed this week. The installation of the reference line heater tapes was started. Installation of Heliax cables continued. The fabrication of the down conversion/distribution chassis for DTL 1&3 is progressing according to schedule. The fabrication of the 402.5 MHz reference amplifier chassis was finished this week. A plan was made for providing reference signals to the MEBT Rebuncher RF controllers.

### FPGA Code Development

Craig Swanson spent the week at Berkeley working with Larry Doolittle on the VHDL code that is targeted for the new DFE. Craig will spend the next week working at Los Alamos on the checkout of the DFE.

### JLAB Test

We are planning a 2<sup>nd</sup> round of tests at JLab either the week of March 31 or April 07. We plan to perform system characterization measurements, investigate the interaction between the piezo tuner and the RF control system, and attempt to perform pulsed Qo measurements using the SNS RF control system instead of the JLab VCO.

### RFQ System Characterization

We are planning low power (~100W) tests of the RFQ the week of March 24. The only change to the system configuration is that the klystron will be bypassed. The klystron drive cable will be connected to a coaxial-to-waveguide transition mounted at the input of the circulator. The intent is to better characterize the performance of the RFQ RF control system and to identify noise sources, if any, in this configuration.

### Miscellaneous

A team videoconference was held on Wednesday with attendance from ORNL, LBNL and LANL.

Mark Champion visited the UT Electrical Engineering department to discuss the possibility of graduate student participation in support of the SNS LLRF control system. Two members of the department will visit SNS next week for further discussion and a site tour.

The status of the SNS LLRF Control System was presented and well received at the ASAC review on March 11.

A layout of the CLO LLRF lab space was produced.

LANL

#### Hardware Platform

Work continues on producing the "Rev 0" of the new hardware platform for the LLRF system. We are still on course to have a system ready for test with the DTL at ORNL in mid June.

- a) Analog Front End (AFE): Testing of the Bergoz 805-MHz LLRF AFE has been continuing using the BPM electronics test system (DFE and PCI motherboard). We observed a problem with the isolation between the two 50-MHz (IF) channels C and D. The measured isolation was about 50 dB and the specification is 70 dB. Bergoz confirmed that they had observed this problem but did not know the solution. Initially we traced the problem to a particular location on the circuit board, involving the low pass filter on the D-channel, 50-MHz input. A simple modification was made to the circuit, which resulted in the isolation improving to nearly 80 dB. On further investigation, we think we have gotten to the root cause of the isolation issue. The coupling is coming from the +10V PS line via the output trace for the D channel. The signal gets on the PS line due to the long grounds on the bypass caps (C317) on IC302. We re-assembled the input circuit of channel D back to the original, and then added two new bypass caps on the back side of the board on the feedthrough holes that provide power to the op-amp on each IC302. This is about as good as previous fix at around 71-74dB. The input impedance match was measured on all inputs. For the two IF channels, S11 is about -31db, 6 dB better than the -25 dB specification. These two channels are fairly critical, since they are the cavity field and reference line inputs to the AFE. The RF and LO channels are not as good with S11 being about -17 dB compared to the -20 dB specification. It should be straightforward to improve the match by 3 dB to meet the specification. We have not attempted to do this at this time, since it is not critical to the operation of the AFE.

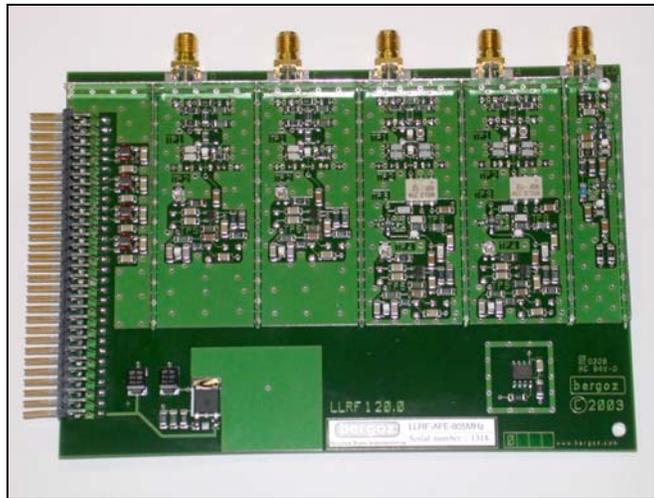


Fig. 1 Prototype AFE has been received.

- b) Digital Front End (DFE): The LLRF DFE has passed the "smoke test" mounted on a PCI motherboard. We have a second PCI motherboard that has passed testing and ready to use. We are currently working on setting up the Xilinx tools and design environment to start the detailed testing of the DFE next week.

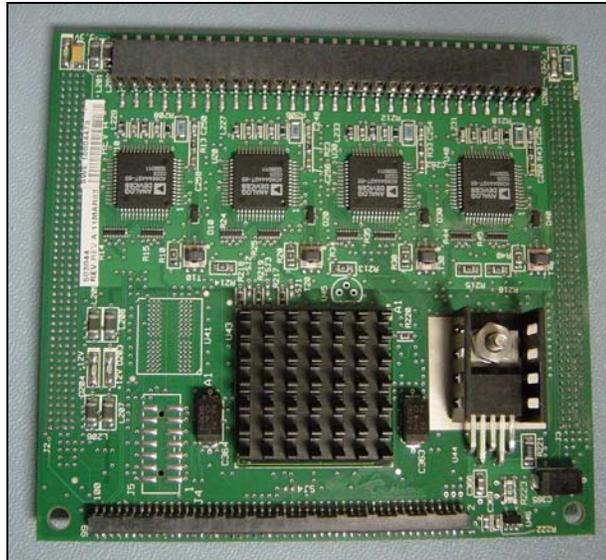


Fig. 2 Prototype DFE has been received.

- c) RF Output (RFO): We are awaiting the delivery of the prototype units. The expected delivery date is still 3/27/03.
- d) Motherboard: The schematic was modified to keep the TTLTRG and LBUS signals on the front panel of the carrier board and to add the mictor connections. The routing has been completed and will be sent out for review on Monday 3/24. The anticipated release date to fab and assembly is 3/25, delivered unpopulated PCB's 4/01, sent out for assembly 4/02 and the assembled prototypes received on 4/09.
- e) DFE Test Board: This is a simpler version of the DFE to help with testing the AFE and the RFO boards. The board has been released to fabrication and assembly. We expect to receive the prototypes 4/3/03.

#### HPM

The schematic has been sent out for review. Work continues on synchronizing the netlist names on the REV F schematic with the Altera source code.

#### Applications Firmware and Software

As a follow up to the JLAB test, we developed a gain scheduling controller that we believe can replace the current feedforward controller tested at JLAB. A memo describing the algorithm has been also written. Created top-level screens, rearranged databases and startup files for RFQ, DTL1-6 LLRF & HPRF and MB SCL HPRF.

#### Testing

Work continues on setting up a VHDL test facility using MATLAB. This included defining the requirements, defining the format for MATLAB stimulus and response files as well as the parameters for simulation.

#### Concerns

We are approaching the integration phase of the project. The main concern is maintaining close communication among team members to ensure compatibility of hardware, firmware and software components. In each area, there is a tendency to work in isolation without communicating the critical interface issues. This would in return complicated and prolong the integration phase.

LBLN – March 14

New history buffers were written and simulated. The new code uses averaging instead of decimation, for better accuracy in real life. This will allow having smoother waveforms and a more precise output. The new code still needs more simulation, the matching EPICS software, and thorough testing on hardware.

The DDS pass-through mode was written and tested with hardware at the LBL test setup. First measurements showed relatively clean spectra.

The tech note on the 50 MHz noise measurements is still being developed. Hengjie Ma provided a bit of input, and a little more contexts needs to be added before “publishing.”

We also started preparing Verilog files for CVS entry.

The fabrication of the DTL3 chassis has been completed. We have started testing it and expect to be ready to ship on 3/21. The fabrication of the chassis for DTL1 will begin soon.

A full characterization of the active elements in the LBL test stand was completed and is being entered in the existing simulation tools to provide support of the ongoing development. In particular we focused on the non-linear behavior of the solid-state amplifier used to power up the cavity.

LBNL – March 21

The chassis for DTL3 shipped on Friday 3/21 as planned. It passed the test in the lab and successfully controlled our test cavity.

The fabrication of the chassis for DTL1 has started. We are aiming at shipping this on 4/18.

We are also talking to the filter vendor to order the long lead items for the remaining units needed this summer for the rest of the DTL.

The LBNL firmware (Verilog) was uploaded on the CVS server on 3/18. This includes all the routines that were used in the Front End commissioning at Oak Ridge.

Craig Swanson visited Berkeley this week. Working with Larry the bulk of the Berkeley code was converted to VHDL, simulated and tested. This task is far from completed, as many loose ends need to be tightened. However this represents a very good start and will support most of what is needed at Los Alamos with the new hardware in the short term.

### **Electrical Systems Group**

Installed ME2, after careful checking of transformer turns ratio and secondary polarity. With Bill Reass, developed techniques for testing boost transformers after arrival from factory. We are presently working with Dynapower to expand quality assurance checkout procedures on future HVCM units. Discovered 3 poorly constructed transformers, with unmatched turns ratios and reversed secondary polarities, on one of the units. We will repair those units next week with LANL's help and continue the checkout of ME2.

\$700 K of ring and HEBT magnet cable ordered for delivery starting 4/1/03.

DTL 3 wiring complete except for thermocouple cables. Thermocouples and cable and wireway delivered.

Power Supplies: 260 of 360 Linac and Ring corrector power supplies have been delivered.

The 500 A 1 V ring medium power supply has been connected to ac and water in the magnet test area in preparation for testing.

The front-end quad magnet power supplies have been installed in a new rack configuration that will eliminate the overheating problem seen previously. Testing will begin next week.

## **Cryogenics Group**

CHL: Work continues on installing the heaters for the charcoal bed. Blain the building contractor has cleaned up the building and has moved the Kinney vacuum pump into their final locations. Work continues on the instrument air and recovery compressor installation. Leak testing of the dirty gas piping on the gas tanks is completed.

Tunnel: Work continues on installing the 10" line of the upstream return transfer line modules. Connection #5 of the 10" upstream return transfer line is completed. Work also continues on installing the warm gas piping.

Transfer Lines: The last transfer lines were shipped to the tunnel on Monday 3/10/03. Work on the return expansion can is moving along on schedule and should be completed by 4/15/03. Work continues on the return expansion can, it is approximately 65% completed. The main reliefs for the warm gas piping system have been bench tested and returned to the site for installation.

## **Beam Diagnostics**

LANL Beam Diagnostics Progress Report:

BPM pickups: Last week DTL BPM bodies were shipped to California for welding operations on the remaining five units. Vacuum feedthroughs have been ordered for the spare DTL BPM. Nineteen SCL BPMs are ready to ship to ORNL. The last 2 out of 34 needs to be mapped, then the SCL BPMs will be complete.

BPM electronics: The new BPM electronics has now been fully populated with FPGAs and the tests continue to look great. We are about 75% complete with the tests. WE are now evaluating vendor quotes to stuff 12 each sets of digital front end (DFE), PCI motherboard, and clock multiplier boards.

WS actuators: During tests at ORNL a design flaw was identified on the Huntington actuators. The joint between the actuator body and the 2-3/4 inch conflat flange does not provide a very rigid mechanical mount. That joint will be strengthened in the next production run, and a reinforcing sleeve is being developed for the existing actuators.

WS electronics: A member of the diagnostics team spent last week at ORNL installing and testing the two WS systems for DTL-1 and the D-plate. The installation and testing was successful. We are now proceeding to fabricate the electronics for the remainder of the DTL and CCL WS systems.

D-plate: A member of the diagnostics team spent last week at ORNL working on the D-plate. The water system assembly was completed as much as possible without some parts and tools that disappeared since his last visit. New parts and tools have been ordered and will be shipped to ORNL. The phenolic parts in the beam stop were replaced with Macor parts. Due to a fabrication error in the Huntington actuators the units for the second beam box could not be rotationally aligned. This beam box was removed, and the flanges will be replaced with rotatable flanges at a local Oak Ridge machine shop. The Halo scraper / beam stop signal processor and PC were shipped to (and received at) ORNL last week. A huge amount of D-plate documentation has been delivered to the database team, and it is now in the process of being added to the database.

Harp: A workshop was held at ORNL last week on the target harp. Many productive discussions took place. Design work on the mechanical parts of the harp will begin soon at LANSCE.

ED/FC: The ED/FC electronics chassis has been modified for the collision avoidance system. It will be shipped to ORNL soon.

Software: Work continues on BPM software to convert from supporting an IP module to supporting a serial bus. The test stand needed for the PCI timing card is almost set up and ready to go. It will support a BPM and a timing card.

BNL Beam Diagnostics Progress Report:

General: Presentation to ASAC Review Committee on SNS Ring Diagnostics, discussions with ORNL staff on Applications Programming, preparations for March 26th and 27th Design Review.

1.5.7.1 BPM: Received five 12cm and four 30cm BPMs from brazing shop. Parts show no discoloring after stopping use of the ceramic blanket. The artwork has been completed on the baseband front-end amplifier board. The board went out for construction and is expected back Tuesday. A parts kit pull has been completed so that stuffing can take place as soon as the boards are received. The baseband board has now been made completely functional. The board gain switching, bandwidth, channel gain, and noise have been checked. The noise is excessive, and we are investigating possible sources. A 5V power supply direct short to ground is believed cleared (burned it out). The RF front end and calibration design continues. Fiber has been pulled to bldg 817 to permit controls to establish a testing station in our SNS diagnostics lab area. PCI design efforts continue.

1.5.7.2 IPM: Pressure rise testing in the RHIC Yellow beam confirm measurements made in the Blue beam and no measurable noise or background was observed due to the pressure rise, radiation, or electron clouds. We are investigating slight changes in the electrode geometry, which will make the electric field more parallel. Requirements for the Electron Detector fast data acquisition system have been provided to Controls. Submitted a request to the design room for complete mechanical drawings of the SNS electron detector. Setting up a data acquisition system in RHIC for the electron detectors to be used during a pressure rise study.

1.5.7.3 BLM: Effort continues on sole source justification, required QA documents, and device specification to prepare for the purchase of the entire blm ion chamber detectors from LND, Inc. We have received sample parts to build a second prototype blm detector end-cap assembly to optimize the design for cost and assembly ease. The effort to complete the assembly of the 8 channels AFE module continues. Discussion with various chassis vendors continues as we choose specific parts for the AFE chassis. The MPS comparator PCB, as well as the AFE backplane design continues. Construction of the AFE test stand, and AFE chassis also continues. The requisition for the ISEG VHQ HV bias power supplies has been submitted. We received delivery of the Rexolite Trompeter cable ends. These were forwarded to ORNL. We worked with Control's on incorporating new Keithley components into the BLM ATE stand upgrade for use with the new LND detectors.

1.5.7.4 BCM: After adding the parts not mounted on our last run of boards, a board was placed into the PC and it worked fine on both channels. Initial noise measurements agree with past units. Detailed testing remains to be done. Signal shapes appeared clean. The remaining 3 boards need to be completed (add missing parts) and tested. Calibrator work proceeding. Continue work on assembly drawings for HEBT BCM

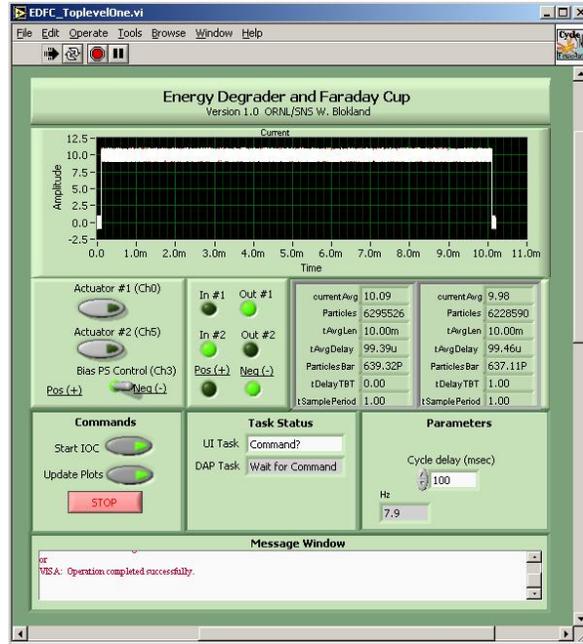
1.5.7.6 Carbon Wire Scanner: Finished cutting bellows to size and welding bellows to flanges in the shop. Finalizing the WS beam box assembly drawings

1.5.7.7 BIG/Tune kicker: Diversified Technologies has submitted a quote to build the pulser unit. The unit will fill an entire rack, and estimated delivery is 6-8 months from award to system testing. The pulser high voltage unit will move from the instrumentation room to the high voltage room. Dave Purcell (ORNL) will assign a rack for this purpose.

ORNL Beam Diagnostics Progress Report:

D-plate: The second Beam-box is back from VTI. Dave Purcell and Andy Webster led the installation of the D-plate for the third time. We are thankful to the vacuum group. They spent the entire day putting the D-plate together and started the leak checking. The beam-box at the end of tank one was also installed. Two actuators are on the tank (FC/ED and a wire scanner). John Crandall from the vacuum group will leak check the tank-1 and beam box on March/23/03. We will move the D-plate to the tunnel after all wirings are finished. These include the BSM and BLM signal, vacuum, magnet, and cooling wirings.

Software: Wim Blokland re-wrote the data acquisition software for all Faraday Cup/ Energy degraders to incorporate EPICS. The figure below shows the GUI interface talking IOC-Core/EPICS.



Matthew Stedinger presented the PC management software selection to the ORNL diagnostic and IT group.

SCL Laser Profile Monitor: We are working on the final touches of ETC, Laser room move from RATS to the HEFT service building and detailing the transport-line design.

Anti-Chopper Diagnostic Box (D-box): The new top plate and alignment test fixture are manufactured. Tom Rosebery is leading the design from the ME group. The actuators are ORNL designed, to satisfy the AP requirements for absolute and relative accuracy measurements; the design team will work with the alignment group to setup a test stand at the RATS. This will take place in the next two weeks. Figure-2 shows the start of the test setup.

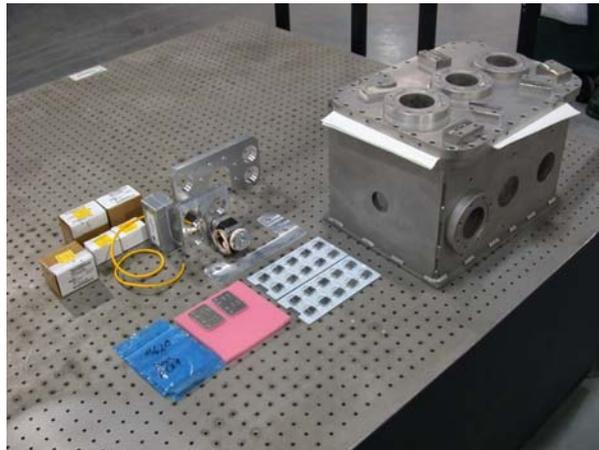


Figure-2) D-box parts at testing station in RATS.

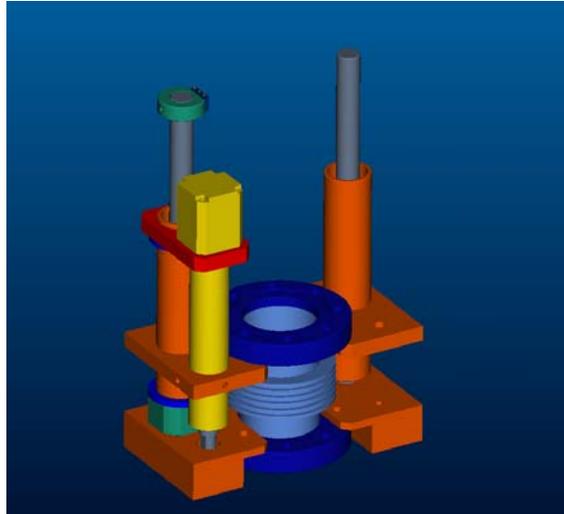


Figure-3) D-box actuator design.