Accelerator Systems Division Highlights for the Week Ending April 19, 2002

ASD/LBNL: Front End Systems

Front-End commissioning continued for the entire week.

Most significantly, a transported beam current of 36 mA has been recorded downstream of the MEBT, very close to the performance goal for the front end in this category, and in spite of the fact that the extraction gap in the ion source is still degraded to accommodate beam currents of about 30 mA from the ion source. The MEBT rebunchers were not being used during these measurements, but they are now fully functional.

The RFQ 402.5 MHz RF system suffers from very large phase excursions, and closure of the stabilization loop in the associated LLRF system is currently being worked on, in preparation for optimizing the rebuncher settings.

All diagnostic elements have been giving usable signals, except for the fourth Beam-Position Monitor; LBNL staff is in contact with LANL specialists in this matter, and latest indications are that the issue might be resolved. The Beam-Current Monitors work well, and their signals are consistent with the current readings from the beam stop behind the MEBT (entrance slit of the emittance device).

The wire scanners suffer from persisting LabView/EPICS interface problems, which slow down commissioning progress but can be circumvented in every case by rebooting the processor. Measured rms beam profiles agree with simulations within 10%, a very good result.

The emittance application now works well, mostly due to E. Williams' work, and first measurements have been taken over a wide range of beam currents, up to 36 mA.

Commissioning Phase B (semiautomatic) has already been started by Sasha Aleksandrov; he was able to shift the rebuncher phases over their full range, using his higher-level commissioning software under Matlab.

Preparations for the transfer of the front end to Oak Ridge and its re-installation there are continuing through interactions between LBNL and SNS-ASD staff.

Last week R. Keller attended the ICFA workshop on High-Intensity Ion Beams at Fermilab and gave a presentation on the SNS ion source and LEBT.

An STL presentation for next week's dry runs at Oak Ridge has been completed and transferred to the SNS file server, in preparation for the semi-annual DOE Review.

ASD/LANL: Warm Linac

We conditionally accepted the second 402.5-MHz klystron. Marconi will ship after satisfying a few action items, including improved x-ray shielding. (WBS 1.4.1.1)

Titan-Beta will ship the first 805-MHz, 5-MW klystron transmitter to LANL this weekend. (WBS 1.4.1.1)
The first 5-MW 805-MHz window was vacuum baked this week. It is ready for RF conditioning and testing. (WBS 1.4.1.1)

We placed the order for the medium-beta SRF linac waveguide. (WBS 1.4.1.1)

A winning bidder for the high-beta SRF linac waveguide was selected. Award is imminent. The accelerated delivery schedule seems doable and affordable. (WBS 1.4.1.1)

The prototype high voltage converter modulator crowbar tests were successfully performed. Using an 8-joule test wire, we completed over 50 test events without fusing (separating). We have tested to the limits of the crowbar gap, which self breaks at 130+ kV. The spark gap and test wire was operated directly at the end of the

HV cable, without dI/dt limiting inductors. The peak current was still about 280 amps with very low action ("I ^2 t"). (WBS 1.4.1.2)

LANL and ASD staff continued work at GSI for copper plating. Work on DTL Tank #1 is well underway, as seen in Fig. 1. (WBS 1.4.2.2)

Fig. 1: Copper plated DTL tank 1 section at GSI.

We were at AVANTech this week to review progress on the resonant control water skid, and functionality acceptance testing. (WBS 1.4.2.5)

LANL and ASD have been getting started on the low-power RF tuning of DTL tank 3 (Fig. 2). This week, we measured the tank frequency with all 12 slug tuners at their minimum penetration and with no post couplers installed. The measured frequency of the TM010 mode, converted to a temperature of 70 F under vacuum, was 401.526 MHz. The computed frequency effect of the post couplers is +0.130 MHz and the range of the slug tuners is 2.05 MHz. Based on these results, we need about 40% of the slug tuner range to achieve the design frequency of 402.5 MHz. When we inserted the post couplers, the frequency increased by 0.115 MHz. There would probably be better agreement with the computed result if the initial field distribution were closer to the design. Before we started tuning the post couplers, the field distribution was not very flat. (WBS 1.4.2.7)

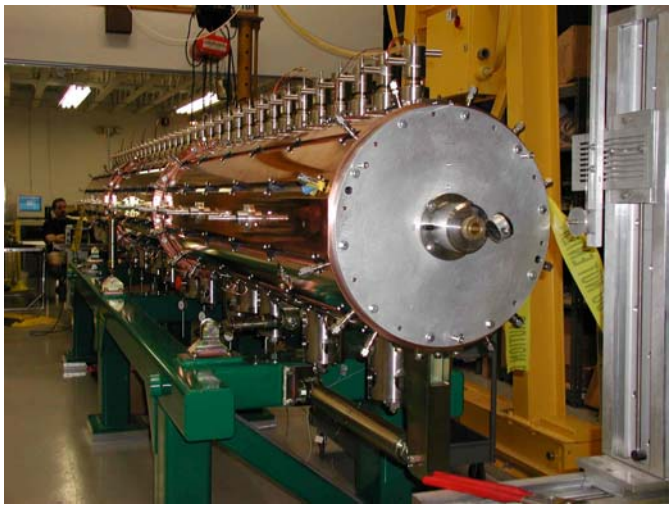


Fig. 2: Bead pull measurements through DTL Tank #3

After installing DTL Tank 3 post couplers and adjusting the slug tuners to get the design frequency (about 402.4 MHz under current atmospheric conditions), we made a number of tilt sensitivity measurements, adjusting the post coupler lengths between measurements. We have nearly flattened the tilt sensitivity curve and the relative value of the average axial field E0 in all cells is within ~3% of the design. (WBS 1.4.2.7)

We are working with the engineering team to improve some of the tuning measurement hardware before continuing. The last adjustment of post-coupler lengths was only 10 mils and is near the limit of our ability to measure with the present setup. It looks like we will need 2-to-4-mil adjustments of the lengths to fine-tune the stability. With 3.2 lbs tension on our 6-lb-test nylon monofilament, the bead (a ~0.3-gram hollow aluminum sphere) sags about 17 mils in the middle of the tank. This is about 9% of the bead radius and ~1.5% of the bore radius. We will try replacing the nylon line with a 5 times stronger material of the same diameter. We ordered some of this super monofilament. Operating with over 15 lbs tension will reduce the sag to negligible levels. (WBS 1.4.2.7)

LANL received and accepted a transmittal to consider CCL BPM design modifications. (WBS 1.4.5.2)

Thom Mason and Norbert Holtkamp were at LANL this week to see first hand recent progress for SNS (Fig. 3). Tours and discussions with our high-power RF, converter modulator, low-level RF, EPICS, and DTL teams were productive, as were meetings with LANL Deputy Director Bill Press and the SNS Division management team. (WBS 1.4.6.1)

Fig. 3: ORNL SNS Leadership at DTL Tank 3.

ASD/JLAB: Cold Linac

Assembly of the end cans onto the cryomodule is complete, and the leak check of the process piping was successful. Final alignment of overall cryomodule length is underway, to be followed by installation of the bridging rings that close the insulation vacuum envelope. Rollout of the completed cryomodule is scheduled for Monday, April 22.

ASD/BNL: Ring

Controls

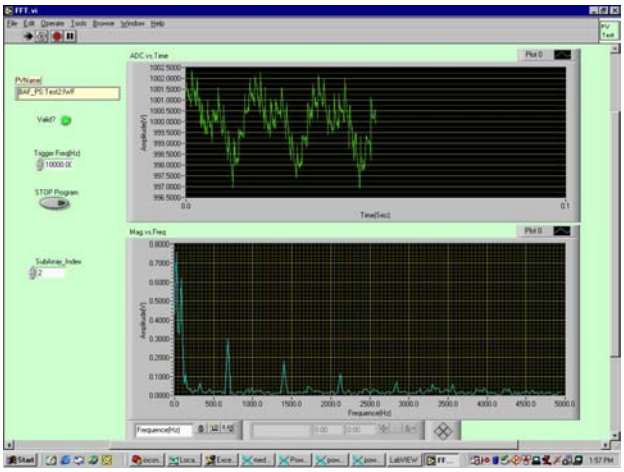
Hamid Shoaee started work as the Group Leader for SNS-4 (Controls) at LANL.

Conventional Facilities controls cabinets (first controls and first technical equipment) have been delivered to the site.

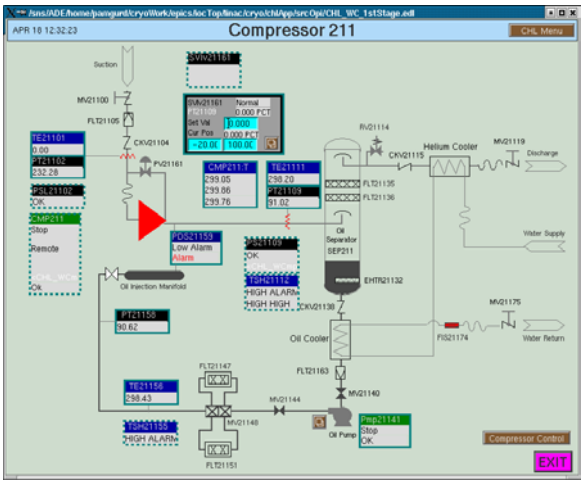
The controls team continued to contribute to the MEBT runs at Berkeley. Ernest Williams is there and helping in particular with the emittance scanning. The bridge between EPICS and the Front End Low-level RF system is

operational, as are the timing master and slave modules. The BCM, BPM and Wire Scanner diagnostics modules are also integrated with EPICS

BNL has used a Labview/EPICS system to collect data on power supply stability, using the SNS standard power supply controller, interface and software. An FFT produced from this data is shown below. Harmonics of 60Hz are clearly visible:



EPICS screens now display live data from the warm compressors in the RATS building. A sample live screen is shown below.



The first Control Racks constructed by Innovative Controls for the Personnel Safety System have arrived on site. Below are two racks to be used for “Phase Zero.” These racks provide PPS control of the Front End during commissioning. The right rack is an Operator control rack that includes the Operator interface hand switches, status lights, and the PLC hardware. The right rack provides PPS control of the 480 VAC power to the 65KV power supply and the Plasma RF power supply.

Norbert Holtkamp visited the controls team at LANL, where he viewed especially the EPICS interfaces to the low-level RF control system and continuing work on the Klystron Conditioning sequence. Below is a snapshot of a demo run: The sequence is trying to ramp the RF Drive (yellow trace) from -10dBm to 13dBm and then hold High Power for some time. Depending on the klystron vacuum (vac ion current – blue trace), the ramp is fast, slow, stopped or even going backwards. At the same time, another sequence checks for "No RF" -> halt or "Saturation": Klystron gain drops -> end the ramp there. In simulation mode, the vac ion current is a saw tooth and simple fits are used to the RF Drive-> SSA Output and Klystron Input->Klystron Output functions. The snapshot was taken after the ramp ended because of Saturation.

Installation

The ASD Sub Project Schedule has been completed integrating the ASD installation schedule; the RATS work schedule, the component delivery schedule, and ASD commissioning schedule and field coordination and installation activities. This schedule with about 300 tasks will supply ASD milestones and in turn link to and support the Project Office IPS. Several recommendations from the previous DOE Review were centered on this task.

Accelerator Physics

An analysis by S. Kim was completed for the material selection for a slit to be used in the MEBT in-line emittance device. The carbon-composite material looks most promising. It appears likely to handle 50 micro-sec pulses at up to 30 Hz.

Notes were posted on the SNS post-it page on the mechanical analysis for the SCL warm section stand and also on the Fundamental Power Coupler Dimensional Error Allowance.

Operations

Ion Source Group

The 13.56 MHz amplifier has been tested with a resistive load to full power.

The LBNL capacitive matching network has been accurately re-tuned with a network analyzer after the RF shield was put in place.

Unfortunately we have experienced substantial problems with our turbo pumps and therefore are currently unable to produce the vacuum needed to generate plasma.

Martin Stockli visited LANL to be updated on their ion-source and update plans and to gather other information. Martin presented "An introduction to the SNS ion source" as an "orange box" seminar, which was attended by approximately 20 people. Discussions with Dan Fitzgerald focused on possible collaborations as LANCE and SNS share a mutual interest in reliable high-current H- sources.

RF Group

Mechanical Group

Review and updating of the vacuum labor estimates for site installation for FES were completed, and an internal review of the installation estimates for the complete vacuum system was conducted. Assessment by ASD management was that the estimates were lean and it was recommended that 1,000 hours be reinstated for training of vacuum technicians and an allowance added for the vacuum testing (pressure distribution and pump down time) at RAT's of Ring chambers assembled in an as installed configuration with representative vacuum equipment.

The final pricing of a low cost configuration of leak test station develop to support field installation of the cryo system is awaited. A leasing option to reduce capital expenditures this FY is being discussed with the SNS Procurement team.

The ion pump test set-up was commissioned and testing of the first ion pump completed at RAT's. Testing of the balance of ion pumps received to date will be conducted over the next several weeks.

The end plates needed for leak testing of the remaining flight tubes were re-machined to accept the larger flight tube diameter.

Support was provided to the ASD ion source group and equipment furnished for leak testing the ion source.
Bar coding of accelerator equipment continued.
Vacuum equipment required by LANL for the DTL assembly was shipped.

Accelerator equipment received this week included two fast vacuum valves for the DTL/ CCL installation. Four HEBT dipole chambers arrived from BNL who had previously conducted receiving inspection from the vendor prior to shipment to RAT's.

Cryogenics Group

Electrical Systems Group

Survey and Alignment Group

As you are all aware, most of our efforts have been directed to our Site Network Measuring Campaign. I am pleased to report that it is progressing well and slightly ahead of schedule.

By cob today, the laser tracker measurements through the FE/Linac/ will be completed. The re-verification of the exterior site monument network and the tying of three FE/Linac Penetration points into that network is 90% complete.

Updated elevation measurements are now in progress and should be completed in the next few days.

Epoch 3 of our Linac Floor Settlement is scheduled for the latter part of next week. Since the Linac Backfill is in full swing, this data should prove most interesting.

Beam Diagnostics Group

LANL Beam Diagnostics Progress Report:

BPM pickups: The CCL and SCL BPM drawing modifications are complete, including checking. In addition to the

electrode modifications, we also modified the fiducial holes according to Joe Error's specification. We are now working to renegotiate the fabrication contract with the vendor. Fabrication continues on 8 ea. DTL BPMs.

BPM electronics: The BPM system is performing well at LBL for measuring beam positions, but the phase measurements are noisy. Investigations continue into the source of the noise.

WS actuators: Vendor fabrication continues on the prototype 3" and 6" DTL&CCL actuators. Work continues at JLab to test and qualify the SCL actuator and beam box. Modifications to the SCL beam box are on hold while details are resolved on the modifications necessary for the laser profile monitor. However, we are working with a local vendor to estimate the cost and delivery schedule.

WS electronics: We worked to duplicate and solve the timing problems at LBL. The problem is unresolved at this time.

ED/FC: The drawing package was handed off to Dan Richards for fabrication of the prototype pickup.

D-plate: Final detailing continues. We received permission to borrow a spare IPF steering magnet for use on the D-plate. This will save us several thousand dollars.

BNL Beam Diagnostics Progress Report:

General: Group members prepared information for the DOE review dry run. Work is in progress on BIW 2002 papers

1.5.7.1 BPM: Setup of the BPM PUE production facility in the new lab is complete.
The question of the use of BPMs as clearing electrodes is resolved for the moment, with the conclusion that the existing hardware can hold off the requested +/- 1KV if the decision to implement this is made at some time in the future.

1.5.7.2 IPM: Hardware for the prototype luminescence monitor was installed in the AGS Ring and vacuum was restored. The optics, multi-channel PMT, cables, shielding, and electronics were not installed. Oscillation problems in the preamps were resolved with improved grounding (especially in the HVPS), but we were not yet fully satisfied with overall noise characteristics and chose to keep the electronics accessible for further testing. Operations procedures for the nitrogen bleed gas were developed, and the problem of photon emission from the ion gauge in the bleed gas feedback circuit was resolved. Plan is to complete the installation within a week.

1.5.7.3 BLM: Still seeking resolution of the new (better linearity) vs. old (lower cost) ion chamber design. This requires input from AP and Operations.

1.5.7.4 BCM: The question of calibration of the MEBT system was resolved when damaged signal cables were replaced. Fabrication of Rev 2 circuit board is underway. LANL is working on shroud resonance calculations

1.5.7.6a Carbon Wire Scanner: Dimensions were provided to LANL for cost estimates for HEBT, Ring, and RTBT scanners.

1.5.7.6b Laser Wire Scanner: A two-page operators manual for the MEBT laser wire was written and sent to Berkeley. Laser wire measurements at 200MeV were attempted with fresh optics, with the following chronology: (1) a new LabView data acquisition, which was written for the MEBT, was implemented on the 200 MeV line. The author (Sheng Peng) is in China as such the progress was limited. (2) Attempted to see the differential signal using the analog differencing circuitry we not successful, for reasons which are not yet understood. (3) Signal was finally seen by doing the difference measurement and averaging in the scope. This worked very well, and a very clean signal was observed with over 20dB CMRR. (4) The first (and only) manual scan revealed the problem with beam width and location. Present plan is to work on the software bugs, then take data again in about one week.

ORNL Beam Diagnostics Progress Report:

Work continues on high level LabView programming to analyze the wire scanner data. We prepared the cable listing and rack specification for the ORNL, EE group. We have made requests to EE (Paul and Scotty) to proceed in ordering the cables and racks for the diagnostic group. Craig is in LANL working on tuning DTL tank-3. We are preparing a poster for the open house. Tom attended the PAC2003 program committee meeting and spent an additional day meeting with LANL personnel. The following items were discussed: SCL beam box modifications, plans for producing additional DTL Tank 3 BPMs, and rack/cabling layout. Warren prepared a conceptual design and cost estimate for a laser room, optical transport line, and final focus optics for the SCL.