

Accelerator Systems Division Highlights for the Week Ending April 27, 2001

ASD/LBNL: Front End Systems

With support by Sasha Aleksandrov of the SNS Accelerator Physics group, a number of beam measurements were performed, utilizing RFQ Module 1. The only remaining topic for this part of the Front-End commissioning work is the verification of full LEBT-chopper functionality.

The purchase order for fabrication of the remaining MEBT-rebuncher cavities # 2 - 4 was released. Cavity #1 has been copper plated.

A video conference on equipment handoff issues, led by Dan Stout, was held on 4/23.

The first in a bi-weekly series of video conferences on Front-End commissioning, led by George Dodson, was held on April 26.

The Front-End group prepared contributions to the upcoming DOE-Review dry runs; Rod Keller and Ron Yourd will attend the dry runs.

ASD/LANL: Warm Linac

JLAB visitors continue to work at LANL this week with their KEK prototype couplers. Hardware is installed and under vacuum at 10^{-9} Torr. The equipment rack is installed, powered, and controls the LANL RF test stand. (WBS 1.4.1)

The first electromagnetic dipole magnet was potted (Fig. 1), and successfully hi-potted to 1 kV. In addition to the vapor deposition, we will also investigate Kapton and Dacron as an alternative for coil insulation. (WBS 1.4.2.)



Fig. 1: EMD mold and cast magnet

The DTL tank forgings are complete, and we are reviewing the inspection data. The results to date are satisfactory. The plating bend tests on the prototype DTL tank were conducted. The plating surface looked good after the bend test and we saw no evidence of cracking, peeling, or poor adhesion. Test pieces and samples of the plated material will be available for the DTL FDR. (WBS 1.4.2.2.)

We tested the equipment for mapping the magnetic center of a prototype drift tube to the fiducials that will be used to align the drift tubes in the DTL tank sections. The measured offset between the magnetic center and the geometric center for the tested prototype drift tube was approximately 0.007 inch. (WBS 1.4.2.3)

Initial testing on the type 310 stainless snap ring for the drift tubes confirms that the snap ring is nonmagnetic. We modified the PMQ drift tube drawings to include this snap ring and an additional feature for the alignment fiducial. The drawings for the BPMs are currently in checking. We are planning to have the bid packages for the remaining drift tubes out soon. (WBS 1.4.1. and 1.4.5.)

The RFP for fabrication and tuning of the CCL structure was issued. (WBS 1.4.4.2)

The vendor reconfigured the CCL prototype EMQ and first field maps were performed by SNS personnel stationed at LANL. The apparatus will be shipped to ORNL next week for further tests there. (WBS 1.4.4.)

PCR LI 01 035 (Change of station of LANL engineers at JLab) was approved by ASD. (WBS 1.4.6)

Thom Mason, Carl Strawbridge, and Norbert Holtkamp visited LANL, where they met with LANL Deputy Director, Bill Press, and held an all-hands meeting with LANL SNS Division. Thom and Norbert also met with LANL Director John Browne in Washington.

The new SRF linac design is based on the expected distribution of peak surface electric fields shown in Fig. 2. We used the average values of these distributions (27.5 & 35.0 MV/m) to generate a reference design, shown in Fig. 3-4. The phase is adjusted to assure 1 GeV in 81 cavities, 33 low beta and 48 high beta. The longitudinal motion is matched by adjusting the phases and field amplitudes of cavities while maintaining the energy gain, thereby preserving final energy. The quadrupole gradients are selected so that the transverse & longitudinal phase advance don't cross, thus avoiding any risk of a parametric resonance. The transverse motion is matched by adjusting some quads at the interfaces. We are now ready for end-to-end simulations. (WBS 1.4.5.)

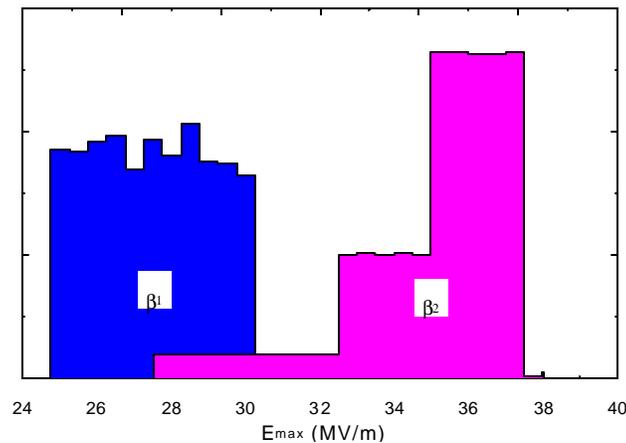


Fig. 2: SRF surface E-field distribution used in determining the new reference design.

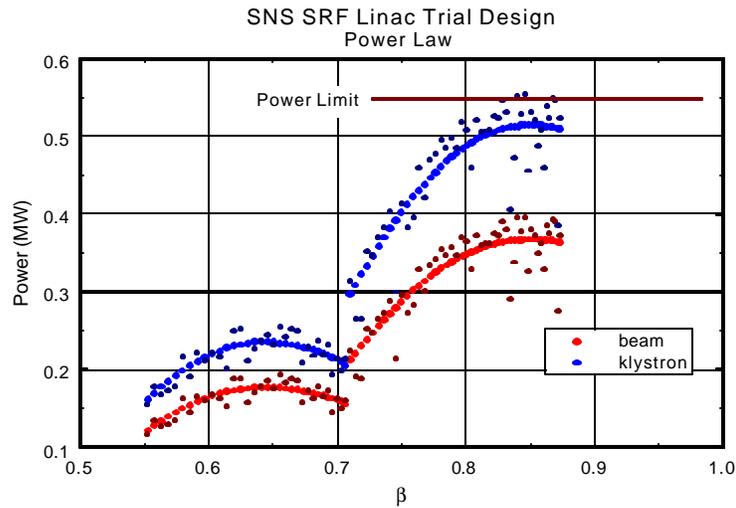


Fig. 3 SRF power distribution.

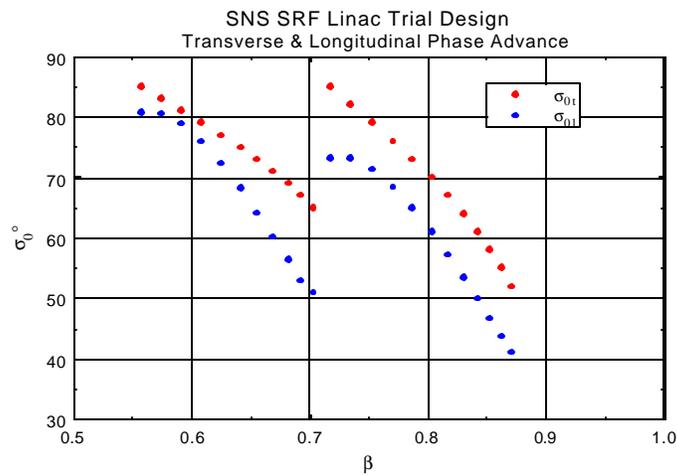


Fig. 4 SRF phase advance.

ASD/JLAB: Cold Linac

Fabrication on the Warm Compressors, Cold Compressors, and 4.5K Coldbox continues. The Warm Compressor Control panels are complete. The Oil removal C-D's are complete and should be shipped to ORNL next week, photo of internals attached.

The first four tunnel female bayonet / valve assemblies are complete. The other 124 are in various stages of welding and brazing.

The MB single cell cavity will be tested for HOM performance next week. The final machining of the MB dumbbells for cavities #2-4 is complete.

The 60 hr bake of the couplers was started on Mon at LANL but had to be canceled since the heater controls had not had a LANL safety review. The baking will be omitted on the first pair of couplers so that the check out could proceed. 600 kW has been run thru the wave-guide to calibrate the power meters and check out the interlocks.

Activities continue for the three high beta HOM modes considered dangerous for power generation if not sufficiently damped. Two harmonic modes have been found. The final 7th harmonic mode, does not propagate into the beam tube and must be damped. This is the mode that could produce 473w of power with a $Q=10^8$ (see Sundelin's ASAC talk). It has been found in the cold cavity but not warm.

The EP parts bid was received and evaluated. Work on the specification for the EP cabinet continues.

The Vacuum Tank bids have been evaluated; a BCR was prepared. Reactor grade Nb bids were received and are being evaluated. Cavity ends bids are due back by 30-Apr. The Cavity vendor Qualifications were received; final bids are due 16-May.

The three PCR's for R&D to improve the HB performance from 27.5 to 35.0 MV/m. are waiting for approval (LI 01-016, 17 & 18)

There is only one remaining \$250K procurement to release this year. We could productively use an additional \$2-3M of BA if it became available. In addition we will have \$9M of phased contracts that can be forward funded.

The LANL 1MW RF system plan for JLab testing needs to be approved (LANL LI 01-035 & JLab LI 00-068). 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 2ndQ FY02 to test the Prototype CM at full power. If the PCR is approved now, the best LANL can do is deliver a system 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 these PCR's is required to get started working on this. LANL requires a minimum funding of 20% of LI 01-035 to get started planning, and JLab requires a minimum funding of 25% of LI 00-068 in order to procure long lead items (vacuum circuit breakers, heat exchangers, pumps, pipe, and valves). We want to have the system installed and checked out when the Klystron arrives.

The CHL BOD has slipped 8 months; it is now after the last of the refrigeration equipment has been delivered. The installation, commissioning, and burn in schedule has been compressed by 4 months to recover half of this slip, but the sub-system acceptance test deadlines and most of the warranties will have expired. The A&E has supplied an RFE date 6weeks before BOD, which matches the delivery date of the 4.5 K Coldbox. Discussions are continuing.



ASD/BNL Ring

BNL participated in a video workshop called by Tony Gabriel to address the extraction beam dump and drift tube issues in the RTBT line. BNL agreed to provide a layout of the area for identification and agreement on equipment responsibilities. Initial pass will be based on Damm's suggestion that BNL will take "Lead" on machine vacuum and machine windows, ASD will take "Lead" on the concrete embedded drift tube, and the Target Group will "Lead" on drift tube/dump interface and dump windows.

Kathlyn Boudwin and Jama Hill were at Brookhaven this week to meet with John Hauser, Mike Nekulak, Mark Israel, Fred Benjamin and Mary Faith Healey. The purpose of the meeting was to discuss Administration issues, Property Management and Receiving, and spare parts.

Jon Sandberg sent a memo to P. Holik, SNS/PO, reiterating his concerns about the elimination of the wiring alcoves.

BNL is in receipt of Dan Stout's meeting notes and revised worksheets generated during the BNL Handoff meeting that was conducted at BNL on April 10. The notes and worksheets reflect the agreements and plans that were outlined by the SNS and BNL working group. Copies have been distributed locally for a more thorough review.

Systems Integration - "DCD" for Ring Vacuum Systems has been signed off and submitted to DCC. The DCDs for the Ring RF System is being finalized.

Systems Integration - Deepak Raparia has completed a draft of an "ICD" for Linac to HEBT lines.

Preparations are underway for the upcoming DOE Review, dry run and technical breakout sessions.

The assembly of the first RF cavity and power amplifier is continuing:



Assembly of 1st RF Cavity



RF Power Amplifier

Controls:

The controls private network at 701 Scarboro now uses the prototypical Cisco switch and VLANS for Channel Access network development and testing. One more VLAN will be added to simulate the final control system architecture.

The controls teams at ORNL and BNL are working together with Target, ASD and Operations to refine the interfaces needed to install and monitor thermocouples in the passive beam dumps. BNL will provide equipment to monitor the thermocouples, and Target Systems will provide the thermocouples in the beam dumps. We are working with Mike Hechler to specify the penetrations for the thermocouples, and with George Dodson to specify operational requirements for these thermocouples.

At LBNL, all Group3 hardware has been received. The modular interface for the first modules of the RFQ vacuum system is ready for test. The display editor in use for the front end now runs under Linux, and the group at LBNL is participating in requirements setting for EDM, the display editor selected for SNS.

A faulty disk was replaced in the RAID system for the file server to be used for the conventional facilities controls development work.

An annotated list of useful tools to facilitate the transition from Solaris or Windows environments to Linux is being prepared.

At BNL, a Power Supply Interface board with modified input resistors was tested. Changing the input impedance improved the linearity and accuracy of the board. Accuracy measurements were started – results will be placed on the web shortly. The BNL team is in the process of testing calibration procedures with the goal of coming up with a fast calibration method.

Software and hardware to check out the injection supply at the factory is required by June. We will need delivery of first article PSC/PSI's early to meet this schedule.

The controls team submitted Approximately ten abstracts for the International Conference on Accelerator and Large Experimental Physics Control Systems (ICALEPCS '01), which will be held in San Jose, CA, in November 2001.

ASD/ORNL: Integration

Several ASD engineers and scientists attended the LLRF/controls for SC linacs workshop @ JLAB this week. The workshop was flawlessly organized and had an excellent program.

SNS-ORNL will host the next of these workshops in about two years, with collaboration between ORNL/LANL/JLAB on the program, choice of topics, organization, etc.

A Front End Systems turnover videoconference was held with LBL. No significant issues resulted, although there are follow-up actions. A conference call was held with LANL to review the SNS RF systems estimate for installation and turnover. A summary turnover chart, which defines the hand-off points and resulted from the BNL turnover meeting, was sent to BNL for review and comment.

Reduced-length dump locations will simplify the CF design. New locations were calculated by the Physics Group, and the recently issued ASD transmittal updating the global coordinates will be amended with these new locations.

Conventional Facilities has developed a technical systems one-line diagram for Front End, Linac, and Klystron loads, based on revised load estimates. The A/E's detailed design submittal will reflect an earlier panel distribution system, as power installation beyond the sub-station for technical equipment loads is the responsibility of ASD. The one-line diagram will be transmitted to ASD for subsequent detailed design and installation.

Accelerator Physics

The accelerator parameters were reviewed and updated for Revision 5 of the Parameter List.

D. Jeon and E. Tanke visited LANL to discuss linac commissioning issues and develop commissioning schemes.

S. Aleksandrov visited LBNL and participated in the RFQ work with beam.

A new space charge model for the ORBIT code, which includes conducting wall boundaries, is complete and initial benchmarks are favorable.

Operations

Ion Source Group

LBNL fabricated nine bare copper antennas, which Alexander Aleksandrov carried to Oak Ridge. After being inspected and cleaned by the ORNL Metals and Ceramic Division, the antennas are now shipped to Thermal Spray Technologies. This company will add coating of Al₂O₃ and Cr₂O₃, using the HVOF (high velocity oxy fuel) technique.

The simultaneous extraction of electrons is a fundamental problem of negative ion sources. The SNS ion source uses a magnetic dipole field in the extraction region to steer the escaping electrons towards the electron dump where they impact before gaining excessive energy. Evidence, however, keeps pointing to a substantial fraction of electrons missing the e-dump, hitting and damaging the extraction electrode. In order to improve model calculations for this type of problems, Robert Welton is currently exploring the application of PIC (Particle in cell) codes.

RF Group

The next generation IGBT test stand continues to operate after a short shut down to repair a faulty fiber optic driver. Older generation devices (Eupec FZ1200R33KF2) are currently being tested at a continuous rep rate of 900 Hz. At this rate, 1 year's equivalent operation is shortened to 24 days, allowing for accelerated testing. Very soon we will be upgrading the load resistor to allow anticipated operation of up to 2 kHz (11 days = 1 year). In approximately 4 weeks, the IGBTs will be changed to the new FZ1200R33KL2. These new devices, called Low Loss, offer greater resistance to cosmic ray-induced failures and are the present baseline design for the HVCM.

Bottoms -up estimates for installation and RF program support were completed this week.

HVCM reliability, recommended maintenance schedule, and MTTR analyses are being updated in preparation for the FDR. More detailed system models, reflecting present prototype designs, will be presented by ORNL staff at the design review.

Cryo Transfer Line Group

Installation and RATS Building

We're in the process of building two tunnel mock-ups (Linac DTL and Ring RF area) in the RATS building, the tunnel shells will be complete by 4/27/01. We'll be installing the utilities next week and building mock-ups of a DTL tank and an RF cavity soon after.

All utilities have now been provided to the transfer line group for their equipment. We have utility plans from the ion source, RF and survey groups and will start work soon to get these utilities ran to their areas.

The Danfysik magnet measurement stand arrived this week from Fermi Lab.

The DI water skid and cooling tower (for the magnet & power supply groups) will be installed next week.

Final lift of asphalt, striping and landscaping at RATS should be complete by the end of next week.

Met with SNS Procurement to discuss the Davis Bacon contract for the installation of technical components.

We're loading the installation schedule with the assembly and installation tasks and holding weekly meetings, keying on a system i.e. HEBT component placement, power supplies, etc. to discuss task sequencing and installation labor with the responsible engineers and technicians for that particular system.

Magnet Measurement Group

Mechanical Group

The updated SRD's for the FELK and the Ring were reviewed and comments given to the CF task managers. This revision includes changes agreed to at the SF review in March and recent design changes to the klystron building and HEBT and Ring service buildings.

The current version of the LANL-SNS hand-off planning spreadsheet for mechanical systems (DTL and CCL systems) has been updated and sent to LANL for comment. In addition to resources, this version includes a summary of activities that will be performed by each discipline. This activity list will be used to help assess and correct resource allocations.

Power Supply Group

Survey and Alignment Group

Drawing Extraction Program--We have just completed a program that allows for the rapid extraction of data from AutoCAD drawings.

Assisted Barge Warner in planning construction of SNS Global survey control network.

Completed statement of work for permanent monument installation

Generated installation document to facilitate and stream line installation and alignment. Document will be sent out for review today.

Continued work on installation and setup of survey & alignment calibration and alignment lab in RATS Bldg.

Assisted Cryo Group with the leveling of equipment in RATS Bldg.

Beam Diagnostics Group

BPM: LANL: Design work on the new PCI motherboard started last Friday (20/Apr). We plan to fab the new card next week. The layout of the DFE PC card should be completed today (27/Apr). Work continues on fabrication of the DTL BPM pickups. The CCL pickup drawing package is ready for checking as soon as resources become available. BNL: Received all of the machined parts for the production 21cm HEBT BPMs. The shop continues machining the striplines for the pre-production 12cm HEBT BPMs. Expedited cost estimate of all the BPMs from the shop. Signed off the design drawings for the 26cm Ring BPM. Signed off the ECN for the 21cm Ring BPM for design drawings update. Preparing ECNs for the 21cm and 12cm HEBT BPMs. More material is being ordered for the increased number of HEBT BPMs.

BCM: BNL: Initial component placement for the analog front end electronics is being reviewed. A set of "real-time" timing signal requirements is being prepared to assure proper industrial pack design. A method of using differential current measurements of upstream and downstream current transformer signals is under investigation as a fast MPS interrupt to protect the low energy MEBT and Linac area where the BLM sensitivity may be inadequate. A change to the current resolution requirements to 0.5% from 0.1% reduces the number of required gain changes prompting an investigation into simplified circuitry. This work is underway. LANL: To simplify the design of the SCL inter-segment region, we plan to change the number of inter-segment sections with current monitors from five to zero. There will now be one current monitor upstream of the first SCL module, and one downstream of the last SCL module. The commissioning and operating requirements can still be met with this arrangement.

BLM: Discussions continue on BLM interface with the MPS, and operational requirements. Preparation for a meeting first week in May at LANL to discuss Linac BLM issues.

IPM: Drawings for the electron detector are in the shop. Initial measurements at the AGS Booster indicate the electron detector is being flooded by other interfering signals, perhaps image currents. Shielding is being considered to resolve this. We will contact other users of this design for comparison with their experience.

Tune: Work continues on the prototype tune meter system. The phase shifter design has been tested and tuned, and included with a band pass filter, and RF splitter. Testing is underway.

Carbon Wire Scanner: BNL: New ME continues to familiarize himself with the system, reviewing calculations, concepts, and design. Drawings for the MEBT wire scanner are in the shop.

LANL: ECAD work continues on the wire scanner electronics. The Huntington actuator order still has not been placed due to vendor interface problems.

Laser Wire Scanner: The first laser has been returned for installation of a pointing diode to ease alignment. Started to investigate motion control of the cross-slide actuators. A presentation was made to the BNL-AP meeting on Monday, and again to the SNS team during a video conference on Tuesday. An engineer has been assigned to look into the costs associated with the Laser Wire. In addition to Laser Wire measurements, interest appears to be growing in using photo-neutralization for bunch length measurements.

D-plate: Design work continues on the first beam box. We have decided to proceed with the IPF design for the 4-inch BPM pickups.

Energy degraders and Faraday Cups: Work continues on the design of a unified Faraday Cup / energy degrader design.

Global: Discussions on warm section design continued. Tom investigated issues concerning diagnostics in this region and distributed a summary. Material has been collected for presentation at the May DOE review. Saeed visited JLab to attend the LLRF workshop and to arrange for loss monitor tests. A meeting on data correlation included participation by controls, AP, and diagnostics personnel. Tom attended the Front Commissioning videoconference. Dave Purcell collected information on ring diagnostics layout and developed a prototype web-based data entry tool for the diagnostics information in Oracle. The layout of the diagnostics/RF/controls lab in the RATS building was refined and some small equipment orders were placed.