

Accelerator Systems Division Highlights for the Week Ending June 8, 2001

ASD/LBNL: Front End Systems

A series of tests is being performed to facilitate a decision on the final RF matcher layout for the ion source. The layout will include a 13.56-MHz-based ignition device.

RFQ Module #2 was conditioned to full RF amplitude at 3% duty factor (with one window only) and will now be connected to Module #1 for new bead-pull measurements. Module #3 is being installed for a last bead pull with the proper end caps and subsequent power conditioning. The four vanes that will make up Module #4 have been ground to final thickness after applying all vane-modulation cuts.

Two more RFQ power-coupler windows have been conditioned to full power at full 6% duty factor and are ready to be installed in the next modules.

The first MEBT rebuncher cavity arrived at LBNL on Thursday and is now being prepared for power conditioning. Preparations include dealing with the possibility of x-ray generation at high power levels. All eight newly fabricated Beam-Position Monitors have passed the vacuum-leak and electrical tests. The two lids for MEBT chopper and anti-chopper beam boxes have been completed and are ready to be shipped to LANL as soon as it will be requested. The boxes themselves are complete as well. The MEBT support frame has been fabricated and is currently undergoing load tests to qualify it for installation of the loaded rafts. Installation of components on the three rafts will start soon.

ASD/LANL: Warm Linac

The CCL Hot Model continues to receive daily attention. The vendor has completed e-beam welding of flanges that cover the new cooling channels in the end walls. Pieces are being shipped to New Mexico where they will be stacked over the weekend. Next week we expect to perform the final pre-braze tuning check, to clean the parts, and to ship them to the vacuum furnace brazing vendor. (WBS 1.1.2.2)

The 402.5-MHz circulator for SNS is being installed onto the LANL RF test stand. (WBS 1.4.1.1)

The high-voltage converter modulator is up and running again, now with the new high-average-power electrical power feed. The 402.5-MHz BMEWS klystron is being routinely operated at 1-Hz. (WBS 1.4.1.2)

The FELK SRD is being reviewed with Dan Stout coordinating linac changes. For example, following discussions with C. Garren, the LLRF system operation is being based on the following local temperature variations: Gallery: +/- 5 deg F over a 24 hour period; Chase: +/- 2 deg F over a 24 hour period; Tunnel: +/- 2.5 deg F over a 12 month period. These numbers have been sent to Dan to be incorporated in the SRD. (WBS 1.4.1.3)

The tank end walls have been modified to integrate the wires for the beam current monitors. This modification will simplify installation of the beam boxes. (WBS 1.4.2.2)

Competitive bids for the fabrication of the DTL tanks are have been received and we have selected a vendor. Contract award is expected next week. The tank drawings have been modified to include additional features for plating. We have also modified the location of the EMD bus bars to reflect the suggestions made during the DTL FDR. (WBS 1.4.2.2)

In response to issues raised at the DTL FDR, we are considering the use of flow sensors or RTDs in the water system to detect a loss of flow in the drift tubes. Both alternatives will be presented to ORNL early next week. (WBS 1.4.2.3)

The DTL support stand struts have been modified to include a differential screw. This modification addresses a recommendation voiced at the DTL FDR. (WBS 1.4.2.6)

Tom Shea (ASD) visited LANL this week to review the status of the wire scanner electronics and to work with LANL in the preparation of the diagnostic system PCR. (WBS 1.4.5.2)

We have performed beam dynamics simulations to estimate the magnitude of the beam steering caused by misalignment of SRF cavities up to the allowed maximum of +/- 2 mm. The maximum excursion of the beam centroid is slightly less than that expected from the EMQ misalignment. Adding these two effects increases the maximum excursion by about 0.5 mm, which is within our ability to correct. Consequently, the SRF warm section design may be simplified by placing the cryostats, as defined by their end flanges, on the linac axis, as long as the cavity alignment tolerance is no worse than +/- 2mm. (WBS 1.4.5.3 and 1.4.9)

LANL SNS electrical safety information, policy, and hazard control plans were sent to ASD in response to their request. (WBS 1.4.6)

Mike Skonicki visited LANL for two days this week to assess the LANL QA program for SNS. (WBS 1.4.6)

Five PCRs were submitted to return unneeded escalation budget for procurements with locked in price (PCR number LI 01 051), to reduce burdening rates at LANL (LI 01 052), to recover CEDB scope that was omitted when preparing MPM (LI 01 059), to correct mistakes in resources (LI 01 063), and to move budget across level-4 WBS, commensurate with the work (LI 01 064). The net effect of these PCRs is to return \$713K back to project contingency. (WBS 1.4.6)

ASD/JLAB: Cold Linac

Fabrication on the Warm Compressor Skids, Cold Compressors, and 4.5K Coldbox continues. The PCR for 4.5 K Coldbox spares was approved. The contract should be placed next week.

The first shipment of bayonet / valves to ORNL should be next week. The second article returns Y-valve was received.

The MB cavities #2-4 are in final welding. The He vessel is being attached to cavity #1. The calculations continue for stiffing the MB He vessels. The detailed test plan is complete.

The second pair of fundamental power couplers is in customs.

The EP parts bid is being awarded. Work on the specification for the EP cabinet is complete. The Cavity vendor 2nd phase bids are being evaluated.

The remaining two of three PCR's for R&D to improve the HB performance from 27.5 to 35.0 MV/m in the horizontal cryostat have been submitted and have a drop-dead date of 1-Jul-02 (LI 01-017 & 018)

PCR LI 01-058 for JLab's increased cost of testing the first 5 pair at LANL is in draft form, \$275K (FY99\$); this brings the total work-a-round cost of testing the first 5 pair to about \$600K. Together with the fact that for the most optimistic scenario for the 1MW RF system we will need to test another 10 pair at LANL, this leads to a totally unacceptable cost. Therefore we are discussing with LANL the concept of composite crews in order to reduce inefficiency and travel costs.

The last remaining major procurement should be released next week. We could productively use an additional \$3M of BA if the first \$1M became available on 1-Jul-01. Preparations for supplemental procurements are proceeding. The first of these supplemental RFP's was released. In addition we will have \$8M of phased contracts that can be forward funded.

JLab has proposed to provide a 6 FTE crew (1 FTE Eng, 1 FTE SEA, & 4 electro-mechanical techs) to help assemble at JLab an additional SNS modulator under the direction of Reass or Anderson.

A second-generation installation of a set of three SNS 550 kW klystrons is also being considered. This would accelerate by ~21 months the first system test of the LLRF (1-Jul-02 vs. 1-Apr-04).

The immediate approval of these PCR's (or alternates) and Key people identification is required. The work-a-round costs continue to increase by one FPC pair every 2.5 weeks.

ASD/BNL: Ring

Controls:

The controls team welcomed technician David Van de Griff (on loan from the Cryo team) and students Rachelle McCord and Chin Chan this week. All are busy on an assortment of projects.

Linux-based console equipment has been set up at SNS/ORNL, and shipped to Berkeley for installation there. This will make the Front End system more prototypical. Similarly, several consoles, workstations and associated equipment have been configured for shipment to Sverdrup Tullahoma, where EPICS training will begin in two weeks.

Sverdrup Tullahoma submitted drawings of the standard PLC cabinets to be used for Target controls. They also submitted drawings of I/O modules using templates for those standard modules. These drawing templates will be used for all the PLC I/O modules.

The Warm Compressor and Gas Management Control review has been rescheduled for July 11 at JLab.

Signals for the Cryogenic Gas Management system have been updated in the access database to use the revised convention for naming PLC and IOC components. Approximately 50% of the signals for one of the warm compressors have been added to the database. The database schema was modified so that there is an association between a signal name and the source/destination of a signal.

Testing of the display board for the MPS chassis has started. There is a problem with thermal connections to the ground and power plane. These will be fixed in a future revision. The problem does not interfere with the functionality of the board.

Personnel Protection System (PPS) design issues were presented to the Radiation Safety Committee. In general the committee gave a favorable response to strategies and resolutions presented for the various subjects. Subjects discussed included:

- PPS software development
- PPS lab
- New operating modes proposed for the Ion Source and the Target
- Control of critical devices
- Linac phase 0 and 1 issues
- Target specific PPS issues
- General PPS instrumentation design concepts

Prototypical PPS equipment is being assembled and tested in the controls laboratory. In addition to simulation panels (see below), the door that joins the two rooms of the controls laboratory area is a prototypical "tunnel entry" door. If the imaginary beam is on (magenta light flashing), one must "crash the beam" in order to enter the adjoining room. (See photo below.) Works a treat.



PPS development lab simulation panels representing:

- Top panel represents four Beam Shutdown Stations, final Sweep switch, and switch for tunnel doors other than normal personnel entry doors.
- Control Room Operator panel for Linac segment operational status and personnel entry.
- Control Room Operator panel for Front End.



Typical personnel entrance door viewed from entry side (outside tunnel). Message display panel overhead, rotating magenta light indicating “Beam permit” or “Power Permit” status of tunnel. Door position switches are also visible.

ASD/ORNL: Integration

Installation Support

ASD staff participated in the Conventional Facilities 60% Design Review of the Target. Several changes had occurred in the RTBT, namely the addition of two shear walls and the reconfiguration of shield blocks. The shear walls were modified slightly to accommodate ASD concerns. Remaining issues include: the thickness of the shielding wall between the last two sets of quads in the RTBT, since this can affect replacing the target window flight tube, and the coordination of installation of RTBT components with target installation and facility status (i.e. hatch openings and crane availability).

ASD Engineering Change Notice 001 was approved to revise the quad position between the CCL and DTL by 2 mm and to correct a 3 mm discrepancy between the ASD global coordinates and the site surveyor's coordinates. These changes have no impact on ASD or CF design efforts. Drawings SNS 100000000-G8E-000-A001 and 100000000-G8E-8000-A002 were revised.

Hand-off planning is proceeding. Detailed acceptance criteria are being developed for JLab and LANL. A videoconference will be held June 14 with BNL to discuss the next steps.

Accelerator Physics

S. Cousineau, M. Doleans, and E. Tanke attended the USPAS School in Boulder Co.

A three-dimensional space charge routine is being written for the ring-tracking model. Initial benchmarks were begun. This model will be important for correct treatment of the impedance effects.

An initial look at the effect of nonsymmetrical injector kicker magnets on the closed orbit deviation was performed. For 1% shot to shot errors, about a 1-2 mm closed orbit deviation results.

Operations

Mario Gianella accepted the SNS offer to become the Operations Deputy. He will join us from Cornell.

I worked on the ASD Spares and Consumables list.

I continue to work on the RAM Analysis.

Preliminary plan for the ERAMS system was presented at the ASD Staff Meeting.

A Front End Commissioning Team Meeting was held on Thursday

Ion Source Group

We are pleased that Sonali Shukla joined us. She will be working on several ion source projects until fall, when she will return to UT to resume her physics studies.

The analysis of the thermal loads and resulting temperature excursions of the ion source antenna has been refined. As long as the antenna is water-cooled, the average thermal load produces only small temperature rises, mostly dominated by the thermal conductivity of the porcelain coating. As expected, the failures must be caused by processes, which dump a significant fraction of the power in to a very limited area of the antenna.

On Thursday and Friday Martin Stockli visited Frankfurt University's Institute of Applied Physics, and talked to Profs. Ratzinger, Klein, Becker, and Schempp, and Drs. Volk and Kleinod. Discussions focused on our ion source as well as on the Frankfurt H-source, the ESS, and the new West European initiative for a coordinated development of reliable, high-current H- sources. A proposal requesting European funds will be submitted in the near future. In

addition, many unpublished details regarding the Frankfurt high-current H⁻ source were learned. Additional discussions focused on the modeling of the formation of negative ion beams, an unsolved challenge, which we plan to address during the next ion source conference.

Using the ORNL-supplied two-channel rotational fluid coupling to cool the antennas during coating, Thermal Spray Technology successfully coated several antennas with layers of Al₂O₃ and Cr₂O₃, using HVOF and plasma spray techniques. After the antennas arrived at ORNL, they were tested by Sonali Shukla in saltwater. The obtained resistance values in the range of 0.7 to 5 kohm indicate substantial number of pores which link the outer surface to the copper substrate. This is consistent with the results obtained by Thermal Spray Technology using optical microscopy on polished cross-sections of control samples, which indicated porosities in the range between 5 and 20 %. Although these results are disappointing, we plan to test the antennas at LBNL.

Tuesday, Wednesday, and Thursday, June 5-7, Martin Stockli visited the University of Freiburg to collaborate with Prof. Ullrich, and Drs. Moshhammer and Crespo. Discussions and experiments focused on the ion extraction from their newly constructed Electron Beam Ion Source. Several tests were completed to assess the performance, which can be expected after modifying one known problem, which limits the ion extraction in the current setup. The results revealed no other serious problems and indicated that a complete extraction can be expected when the current problem is eliminated when the ion source will be installed in Heidelberg.

On Friday, June 8, Martin Stockli visited PSI to consult with Dr. Schmelzbach and Morenzoni, and Mr. Eienkel. Discussions focused on their efforts to develop a reliable high power RF volume source to increase the ion source lifetime. Having a copy of the LBNL RF volume ion source, their efforts focused on the antenna problems and they tried numerous antennas and numerous coating techniques, including plasma sprayed Al₂O₃. Unfortunately their success was somewhat limited. More details will be available in the trip report.

RF Group

Since BOD of the RF shop is scheduled for Aug. 02 and delivery of the converter/modulator will be in July 02 it make no sense to develop the Rats building for RF testing earlier (\$350K). We will start setup of RF equipment as soon as possible in the RF Shop and do our tests there. We will test about 40 Klystrons, more of the circulators, and loads.

David Anderson is on his way to Los Alamos for his summer stay, helping Bill Reass.

We succeeded in creating a heartbeat record, which displays an animated heart when the IOC is running (like the JLab guard screen.) We loaded an EPICS cryo database created by Access onto the IOC and displayed the records on a screen. This proves that we can create most of the EPICS databases that we need for the cryogenic system.

We continued working on a script to translate MEDM screens to edm (the display manager to be used in SNS) and translated several JLab screens, except for the device names. We started working on a widget for edm to allow us to display portions of our device names, since the whole names are too long to fit within the translated screens, and only a part is needed to identify the device in context.

JLAB received second shipment of parts (ceramic windows and antennas, etc.) for two fundamental power couplers from Toshiba Thursday (6/7/01). They will start to prepare the parts for assembling.

Cryo Transfer Line Group

We are installing the permanent pipe seals on the 8 large helium gas storage tanks that are in storage at the site. We will add a slight positive pressure of argon to each vessel. Each vessel pressure will be monitored weekly.

We have finished reworking the component travelers for the transfer lines and will begin assembly on Monday.

The large dryers that were attached to the purifier at Y-12 are being mounted on a permanent skid and will be used to dehydrate the CHL refrigerator during the primary charging of the system.

Mechanical Group**Magnet Measurement Group****Power Supply Group**

Scott Fisher has joined the SNS Ring Electrical Systems group as an electrical engineering associate. Scott has 15 years experience from SLAC in a variety of accelerator electronics/electrical systems.

Ken Rust met with a Labview representative who demonstrated software leading to automation of power supply testing.

Roy Cutler attended a teleconference review of the ring injection chicane with BNL and attended an SNS standardization meeting at SNS.

Survey and Alignment Group

We have just completed updating our lattice coordinates. 157 points distributed throughout the site are completed both in the SNS/ASD Coordinate System (meters) and also the Site Surveyor's/CF System (Feet).

Installation of the first three and possibly as many of five of the external survey monuments will begin on Monday, 18 June.

We have completed a technical briefing on grouting and settlement issues that has been sent to the SNS hub. Several people have already sent us their comments and we welcome more.

Beam Diagnostics Group

BNL:

1.5.7.1 BPM: BNL has received all parts for the two 12cm HEBT BPMs from the shop. BPM assembly will start soon. ANSYS model for the structural analysis of the RTBT 36cm BPM is complete. We reviewed quotations from central shop and an outside vendor. We have requested a re-quote from the vendor to get the quote more consistent with the one from central shop.

1.5.7.2 IPM: Two electron detectors are ready for assembly.

1.5.7.3 BLM: Discussions continued this week to plan activities to resolve issues with BLM polarity, response flatness, x-ray signal contribution, and interfacing with the MPS system. Front-end circuit design and component selection is in process.

1.5.7.4 BCM: A parts kit for board stuffing was prepared. Additional artwork errors have been found, and board stuffing has been delayed. At present a more careful review of the artwork is planned.

1.5.7.5 Tune: Prototype tune measurement efforts continue

1.5.7.6a Carbon Wire Scanner Finger springs, ball plungers, copper strips, and carbon fibers are being installed on the fork.

1.5.7.6b Laser Wire Scanner: Shop drawings are being prepared for the MEBT Laser Profile Monitor (LPM) (Laser wire scanner). The mirror mounts for the MEBT LPM are ordered. Manny has a platform design, which clears all known obstructions. Jim Cullen is going to order the NAI stages with the National Instruments PCI control card. Tom Shea says this will be completely compatible with SNS control system. The SCL beam profile box is not compatible with the BLIP line requirements (the aperture is too small). Pete has proposed to Tom that we build a simple LPM based on the LINAC needs and get operational experience. The SNS specific details can be built into the SNS LPM. This is now the plan. Mike Plum has been given details of the laser beam stop and window sizes

required for LPM in SCL. The profile boxes are being designed with access for LPM. The 200mJ laser head has been returned with the pointer HeNe laser installed.

LBNL:

A justification for the ongoing development of offline diagnostics has been prepared. It is being reviewed at ORNL. Work continues on the timing industry pack.

LANL:

Matt and Lisa continue work on software infrastructure for the PC based instruments. Acquisition from the PCI card was demonstrated during Tom Shea's visit. Architecture of the PCAS, shared memory pool, and Labview code was also discussed with Matt and John Power. A PCR was prepared to mop several loose ends in diagnostics. Bob Hardekopf and Paula reviewed the details with Tom.

ORNL:

Dave and Craig are the USPAS. One of Saeed's students (Khaleelah Straman) is learning and writing Labview codes. Saeed reported that Pentium IV CPU is not compatible with Matlab but there is a patch (JAVA Runtime Environment 1.1.8_006) that can resolve the problem. The NI-high resolution digitizer is installed in a Rack mountable PC and is working reliably under Win-NT 4.0. Tom visited LANL and reviewed the details of handoff activities, an upcoming diagnostics PCR, and progress on LANL diagnostics systems. Dave and Craig are attending USPAS this week and next.