Accelerator Systems Division Highlights for the Week Ending August 17, 2001

ASD/LBNL: Front End Systems

The 'Blue Box' re-arrangement work is proceeding well and on schedule; the new 80-kW/2-MHz rf amplifier for the Ion Source is installed, as well as both equipment racks on high potentials. Work now concentrates on rerouting cables and arranging interlock relays and other smaller subsystems.

After its 16-hour run, the first Cherokee Porcelain (CP) ion-source antenna was inspected, and one tiny damaged spot was visible, emerging from one of the many lateral cracks, but it does not appear to be serious enough to stop this antenna from producing plasma. More serious was a substantial coating on this antenna whose origin is not understood at this time. We sent this antenna back to the SNS ion-source group for an analysis.

We are preparing a systematic antenna lifetime-test, and in the course of this work a second CP-coated antenna was operated in the same ion source for 3.5 hours at 8% duty factor (4.7 hrs equivalent at nominal 6% duty factor); again considerable coating was found. We are further investigating an ignition-impeding effect that occurs with this ion source at the second (B-16) test stand and seems to be associated with the 13.56-MHz amplifier that is supposed to sustain a cw discharge between the main pulses. This issue has to be resolved before the lifetime test can start because at present we have to operate the ion source at three times the optimal gas pressure.

RFQ Module #4 has been mounted on the conditioning stand for full-power conditioning. The temperature-rise problem with the first two new RFQ power-coupler windows has been linked to a thin TiN layer with which the windows are coated. We are working with the vendor to identify a way to overcome this problem.

The first MEBT rebuncher cavity is now radiation-certified to enable us starting full-power conditioning. In short pulses, the full RF amplitude could already be applied. The vendor's subcontractor is working at cavities # 2 - 4 in parallel.

MEBT raft #3 (the first one of three) has been completed and fiducialized, and its four quadrupoles have been mounted on it.

We have been assured by BNL that the wire scanner profile monitors are on track for delivery by October.

Mike Hechler of ASD visited LBNL to discuss hand-over, installation, and checkout sequences with FES staff. He brought a copy of the RFE conditions for the FE Building and showed photographs documenting the construction progress with this building at the SNS site.

ASD/LANL: Warm Linac

Several significant goals were achieved with the CCL hot model. After seven days of RF conditioning, the CCL hot model vacuum levels look very good. The vacuum manifold is at 3E-8 Torr, while the RF window area is at 5E-8 Torr and the cavities and beam tube are at 8E-8 Torr. Early RGA scans show little or no hydrocarbon contamination. (WBS 1.1.2.2)

The CCL hot model water-cooling and resonance control system is operating successfully. All three operational modes (manual control, temperature control, and resonance control) work as planned. (WBS 1.1.2.2)

The SNS prototype high-voltage converter modulator (HVCM) is reconnected (see below) enabling CCL hot model operation, to date, up to ~400 kW at 50 Hz. The entire system is operating under amplitude and RF control (*i.e.*, the water system received the RF error signal from the low-level RF control system (LLRF) and it adjusted the water temperature to keep the cavity resonant frequency within the range where the LLRF remains locked at 805.000 MHz. The parameters were: peak power 420-440 kW, repetition rate 30 Hz, pulse length 1 ms. The system is very stable. When we abruptly changed power levels between 425 kW and 35 kW, the control system maintained the set point amplitude and resonant frequency without ever losing lock. We repeated this test several times, allowing the temperature to stabilize for a few minutes at each new amplitude set point. (WBS 1.1.2.2)

The cooling of the hot model coupling cavities is well balanced with the cooling of the accelerating cavities and the stop band in the dispersion curve is not sensitive to the power level. At two CCL hot model power levels (35 and 425 kW), we used the last 50 microseconds of the pulse to switch in a different generator whose frequency we could control. By observing the reflected power during this part of the pulse, we measured the frequencies of the two nearest modes to the pi/2 mode that are observable. Remarkable agreement in these frequencies is obtained; furthermore, there is little difference in these mode frequencies with values scaled from low-power measurements during cavity tuning. (WBS 1.1.2.2)

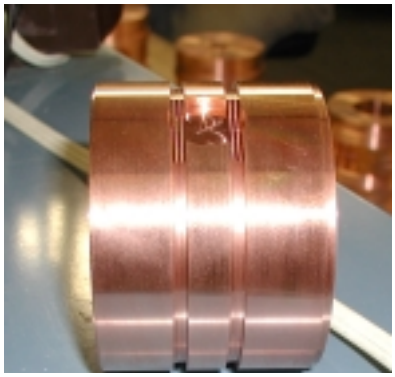
The second pair of SRF linac RF couplers arrived from JLab and are installed. High-power operation will begin next week. (WBS 1.4.1)

The SNS prototype transformer substation with harmonic filters is now being used with the HVCM. (WBS 1.4.1.2)

The contract for the DTL EMD drift tubes is awarded. Manufacturing of the PMQ and BPM drift tubes is progressing well, as illustrated by Fig. 1. (WBS 1.4.2)

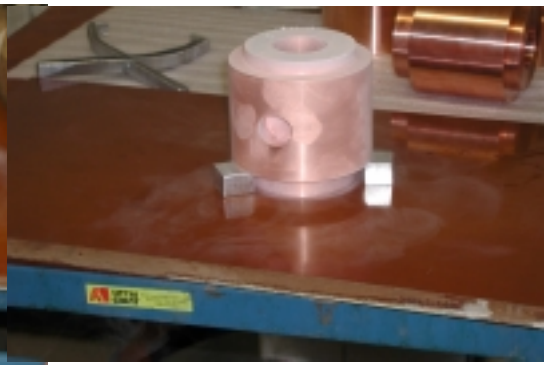
The RFP packages for the DTL post couplers, slug tuners, vacuum ports, access ports, support stands, and seals have been issued. (WBS 1.4.2)

Progress on the ETC exercise is being made. The high-power RF system (WBS 1.4.1.1) is complete and has been submitted to ORNL into the MPM system as a test to develop the mechanics of data submission. (WBS 1.4.6)



Drift Tube Inner Body

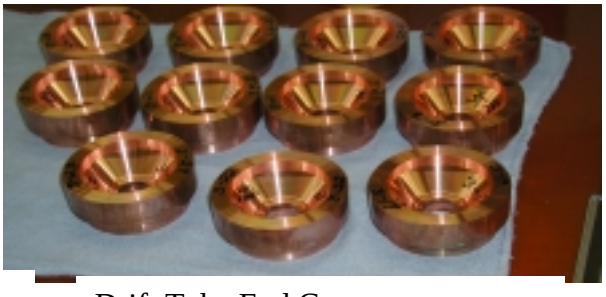
Drift Tube Freeze Fit



Drift Tube Diverters

Drift Tube Manifolds

Drift Tube Bodies



Drift Tube End Caps

ASD/JLAB: Cold Linac

ASD/BNL: Ring

Work continues on the "ETC" for all WBS 1.5 systems, year-end planning for the FY01/02 fiscal year closeout and transition, and the upcoming ASAC review.

BNL participated in a PO videoconference on Installation conducted by Cutler, Holik, Hunter, et al. During this meeting, BNL was asked to obtain bid options for the medium range power supplies at 1.3 GeV as well as the baseline of 1.0 GeV. Efforts are underway to reach all bidders and have them include this option in their bid package. Timing is already tight for award of this package in FY01 - any change to the existing design package is likely to result in a delay of the award of this contract. Currently, bids are due at BNL on Friday, August 31. Other 1.3 GeV considerations include high field power supply, cabling/buss, etc…

Other topics covered in the Installation videoconference included: power supplies, rack layout effort, cables/buss responsibilities, cable and support handoff, cable plant, RF handoff, and status of the injection/extraction PS tests at BNL.

Reliability issues, including design considerations and Booster failure history, related to MTBF (mean time between failure) and MTTR (mean time to repair) for specific WBS 1.5 systems were sent to George Dodson.

Vacuum chamber #2 for the Ring arc dipole magnets has been received at BNL and is undergoing QA inspections.

The spec package for the ion pump controllers was released for RFQ. Bids are due back September 12.

Design effort continued on the RTBT line. Changes include collimator relocation, fine tuning of extraction magnets, design of the extraction dump line and vacuum window.

Danfysik reported that they plan to ship a 27CDM30 prototype to BNL today.

Joe Tuozzolo wrote a trip report on his recent visit to Stangenes, Quest, and Allied Engineering. W. Birkholz and T. Hunter accompanied Joe on this trip.

The first four pre-production HEBT BPM/PUEs (two 12cm and two 21cm) are back from the braze shop and have been successfully leak tested.

Negotiations continue with our vendor, SDMS of France, on contract issues to produce a first article collimator for the RTBT. We expect to award this contract in August.

Figure #1 – Assembled Ring Dipoles

Controls:

A worrisome technical concern was resolved this week with the successful integration of the Machine Protection System (MPS) interface board and our MVME2100 IOC. This had not worked at first, and was causing both technical and schedule concerns. We had very satisfactory response and help from the vendor of this board. Manufacturing and driver development can now proceed. Whew….

All prototype boards are now at SNS for the MPS system. With the PMC module now working, testing can begin on the MPS prototype. The MPS hardware Final Design Review has been scheduled for September 11.

A GPIB-based delay generator and RS232 support has been integrated with the 2100 IOC. These will be used for MPS testing, and the integration of lab test equipment.

Matlab Channel Access software from SLAC was installed and integrated. This software is now in use by the Diagnostics team.

A draft Statement of Work for the CF Instrumentation & Controls Installation Contractor was completed, reviewed, and has been sent to procurement for preparation of the Request for Proposal.

A first draft of ETC for WBS 1.9 was completed and submitted to project controls.

The front-end control system is being reconfigured as required to keep up with ongoing significant reworking of the electronics for the Ion Source and LEBT.

Material from the Tullahoma EPICS Training Course was assembled into a notebook, and will be copied for distribution to participants. Highlights of its contents include:

- Introductory EPICS documentation
- Latest documentation for users of EDM, including a listing of the color.list file and corresponding screen shot of the color palette
- A set of suggested top level screens for SNS control systems, including one example four-level "drill-down" for Conventional Facilities (CF)
- Initial documentation for a Chilled Water Pressure Control Loop example to be used as reference IOC application for all CF development work
- Documentation of the CF application development environment (hardware, networks, and software)
- Basic documentation on the Ether-IP driver

ASD/ORNL: Integration

Installation Support

Accelerator Physics

D. Jeon visited LANL to work on commissioning schemes for the CCL linac RF phase and amplitude settings.

S. Aleksandrov and E. Tanke have constructed initial commissioning plans for the Front End and Linac respectively. Initial feedback has been received for both plans.

An interface for the Java based application programming environment under development, with the Jython scripting capability was tested, and worked. This capability will facilitate on-the-fly application development.

Operations

Dodson participated in and support work for the 07 Budget Review

Included Conventional Facilities and Ring equipment in the RAM Analysis Continued with the preparation of the Commissioning Program Plan

Ion Source Group

The contract to fabricate a duplicate blue box for the hot spare stand has been awarded to DCS of Knoxville. We expect to receive it in the RATS building by end of October.

Several quotes have been received for the ion source vacuum chamber and the diagnostics chamber for the hot spare stand. A number of changes were necessary and the packages were sent out again for new quotes.

RF Group

Cryo Transfer Line Group

Mechanical Group

Magnet Measurement Group

The 8D533 coil/mapping frame has been received, and assembled. Today we start winding the search coil that will be used for mapping the HEBT 8D533 dipole.

Power Supply Group

A 750 A, 30V dc precision power supply has been delivered to RATS to support magnet testing.

Stripping Foils Progress (From Bob Shaw, ORNL):

Nano-textured diamond via hot filament reactor growth: Reports have appeared where high argon contents have lead to nano-textured diamond films; Growths under these conditions at UT have produced films that are fine grained and exhibit a band at 1140 cm-1, characteristic of nano-diamond. The UT growth chamber has been re-configured for more reliable operation; samples may now be replaced without disturbing the filament or substrate heater.

Nano-textured diamond via microwave reactor growth: RWS and CSF visited the University of Cincinnati Materials Science Department to see a microwave powered growth reactor to assess the best means to convert the ORNL reactor from hot filament to microwave. A quote has been received for a commercial microwave system.

Substrate preparation for enhanced nucleation density: A summer student (Adam Hopkins) spent several weeks examining the growth of diamond films on substrates prepared by a variety of means: mechanical scratching with fine diamond paste, ultrasonic bath treatment with diamond slurry, and chemical etching. The substrates were characterized using SEM and AFM; films were grown and the products examined by the same means; much of the summer effort entailed re-start problems with the reactor.

Micro-machined silicon substrates for growth of ribbed diamond foils: The eximer laser ablation system has been brought back into service. It was moved to our labs and the laser itself was refurbished. Patterns have been written on substrates and a growth conducted on a patterned substrate.

Gas phase conversion of SiC to diamond structured carbon: A report has appeared where a mixture of H2 and F2 at 1000 C was used to convert SiC to diamond structured carbon of very high hardness. We are establishing a furnace flow tube set-up to re-produce this process for a CVD SiC wafer we have secured.

Characterization of BNL/Goodfellows commercial diamond foil: The BNL foil has been characterized using SEM and micro-Raman spectroscopy; The SEM shows an unfaceted character (<0.5 micron); Raman shows a high graphitic content; the foil has also been submitted for TEM analysis

Characterization of LANL carbon foils: Carbon foils prepared at LANL using the mCADAD process and supplied by Mike Biorden have been examined using SEM and Raman spectroscopy. The SEM shows untextured (amorphous) material. The Raman experiment failed, as we have not been able to find laser conditions where the foil survives the photon flux. Sample assembly is underway for a beam test of this material at BNL.

For a micron-textured diamond film that was released from its Si substrate and examined using Raman spectroscopy, a spectral shift of the characteristic diamond line was observed for the two film faces; this is an indication of a diagnostic for film stress.

Survey and Alignment Group

Beam Diagnostics Group

LANL and BNL were both working on ETC. LANL continues testing of the BPM/phase front end and they have prepared a schedule for delivery of acquisition boards for MEBT diagnostics. Berkeley has identified commercial off the shelf components for the emittance scanner. ASD diagnostics will review the proposed design the following week.

Craig is at LANL working on CCL hot model. The entire group has been working on installation planning. We also have a Matlab based Parmila working. This GUI interface can take data from the EPICS and run Parmila. It can also send the calculated corrections to the EPICS to simulate the setting of the MEBT correctors.

.