

Accelerator Systems Division Highlights for the Two Weeks Ending June 6, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) LANL approved the factory acceptance data of CPI SC linac klystrons S/N 023 and S/N 024. (2) In preparation of resumption of CCL klystron factory acceptance tests this month, LANL loaned Thales a 10-in transition, a 30-in transition, and a WR1150 sweep; Thales received all three items. (3) We began factory acceptance testing on SCL transmitter S/N 5 at Titan. (4) We made ORNL RF personnel aware of high reflected power being observed on DTL-3 conditioning runs at ORNL, and warned them that continued operation with a coated window might result in the window failing. We made recommendations on which archived data to evaluate in order to better diagnose the problem, and reminded them of the vacuum interlock level recommended by Thales.

Concerns & Actions: (1) An E2V representative was at LANL this week to tune DTL klystron S/N 10. Objectives were not met due problems with the SCR controller and input AC switchgear that feeds the prototype converter modulator. We rescheduled the tuning of this tube for the 6/16 - 6/20. (2) Thales is still on schedule for the factory acceptance tests of CCL klystron S/N 1 on 6/23-24, and S/N 3 on 6/26-27. The S/N 4 tube which was scheduled to be tested in 6/19-6/20 developed a filament short at the factory and the gun will need to be replaced. This will likely delay its test date. (3) Two Thales representatives are still scheduled to come to LANL 6/9-6/13 to tune the SCL klystron. The factory acceptance tests for S/N 5 scheduled for this week were cancelled because the tube was not meeting the voltage and current specifications. Thales is speculating that this is due to changes in the oil temperature and investigating the situation. Mack, Rees, and Rej are scheduled to meet with CPI management next week to discuss a backup strategy for SCL klystron deliveries to support the start of SCL commissioning on 10/1/04.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) We accepted production high-voltage converter modulator (HVCM) IGBT Assemblies S/N 17, 18 and 19. (2) We submitted acceptance test revision suggestions for the driver board waveforms on the IGBT assemblies to Dynapower. (3) We worked with Dynapower to come to agreement on the types of AC cable to use on the IGBT Assemblies and in the safety enclosures.

Concerns & Actions: The LANL SCR controller and input AC switchgear failed and are being serviced. We communicated to Dynapower a problem we found with the wiring between the input lines and the potential transformer inputs on the production SCR controller at LANL. The wire insulation appears to be degrading in places where it runs in contact with another wire. At this point we are not sure if this is a voltage or heating related issue, or perhaps a bit of both. At present we have been having trouble with irregular triggering of the SCRs as we go up in power. This may or may not be related to what we see in the potential transformer wiring. The phase reference to the SCR firing card is derived from one of the outputs from these transformers. Whatever the cause of the insulation degradation, we believe that in time it could likely cause a complete phase-to-phase short at the inputs to the SCR controller. Dynapower is working the problem and will send us their ideas on how to plan rectify the problem.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: Tank-1: Final machining of the slug tuners and post couplers are well underway. We are performing final tests and cleaning at LANL through the weekend. The first four slug tuners and ten post couplers were shipped to ORNL today.

Tank-4: (1) We have restarted drift tube production following the discovery of leaks in 10% of the water channel welds (see below).

Concerns & Actions: (1) One T-1 post coupler appears to have developed a vacuum leak following the final e-beam weld and machining. We are evaluating it further. If the preliminary observations hold, we will localized the position of the leak and ship the post coupler to ESCO today for repair on 6/9. (2) We have concluded that the cause of the water channel weld leaks in the three (of 29) T-4 drift tubes is weld zone contamination. We believe that copper oxides formed (due to contamination) and these were left at the last e-beam weld "tail-out". When the drift tube body was subjected to the hydrogen furnace brazing conditions, these oxides were converted to copper and water and the water flashed to steam producing fractures which resulted in a leak at the tail-out zone. Hanford has taken numerous additional sections around the leaking weld and has not found any other evidence of additional cracking. Our conclusions are supported by analyses performed by LANL MST-6 metallurgists and welding engineers who have experience with these types of problems in copper. In addition, we are proceeding with the machining of two non-leaking tank 4 empty drift tubes to near final profile to see if this operation will uncover leaks

and or fractures. We have restarted work with new procedures in place that will include elimination of some of the contamination source (*e.g.*, machining fluids used during the weld prep), H furnace cleaning step prior to e-bam welding, interchanging the diverter stem braze furnace braze step with the e-beam weld step, and a repair weld on already processed drift tubes that will occur during the cap weld stage. The impact on schedule is being evaluated in detail; preliminary indications infer a 2 week delay in T-4 drift tubes.

COUPLED CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) Accel brazed 2 more module-1 segments this week. Eight are complete, and 9 tuned. (2) We received the quadrupole magnet cooling manifolds.

LATE-BREAKING NEWS: This afternoon we stopped the shipment of the tank one post couplers. We have had three failures: two leaking joints (one repaired at ESCO and one detected during final leak checking at Los Alamos) and now a joint that fractured during final tip machining due to inadequate weld penetration. It is believed the common cause for these leaks is a failure to track the joint properly during electron beam welding. All intact tank one post couplers are being shipped back "overnight" to ESCO (today and tomorrow) for repair. In addition, a new unit is being prepared to replace the fractured (weld fractured) # 1 post coupler. The Los Alamos contract welding engineer will return to ESCO and be there for the post coupler weld repair on Monday, June 9th. This weld repair will result in shrinkage which will require compensation by either machining the body flange or plating the post coupler tip. We are projecting a delivery delay of up to two weeks if the shrinkage requires plating of the tips.

ASD/JLAB: Cold Linac

Cryomodule M-1 has been loaded on the truck and will be shipped to Oak Ridge June 9 (see photo). Testing of M-2 continues, but has been hampered by problems in the refrigerator, now thought to be resolved. Assembly of M-3 and M-4 continues.



ASD/BNL: Ring

BNL/SNS are working closely with the project office to develop an end-game plan that partly alleviates the BA pressure of the project. Estimated commitments at fiscal year end were forwarded to ORNL this week.

End Game Plan: "what ifs", and the ramifications of moving funds/scope from FY04 to FY05 continues. A meeting was held on Thursday to brief BNL Lab Director Praveen Chaudhari, Asst. Director Peter Paul, and Collider Accelerator Chairman Derek Lowenstein on the findings.

21Q40 shimming for the family of twelve Ring magnets: seven have been shimmed and measured; two will be re-shimmed and re-measured. Five others are acceptable as-is without any shimming.

New England Technicoil (NETC) has started assembly of four 27CD30 magnets in support of ASD's HEBT installation plans. They will ship these units direct to SNS/OR on 6/11/03.

The first four production 36CDM30 magnets, shipped by NETC, were received at BNL earlier this week.

The last three 26Q40 (8) quadrupoles, from Stangenes, are now at BNL Receiving awaiting pick-up and inspections.

A 21S26 first article production magnet arrived from Alpha Magnetics this week along with another 41CDM30 (#4).

Work on the Ring RF Junction Box is underway at BNL. Design work has begun and long-lead materials ordered.

An error was found in the polarity of some ring corrector magnets. Mechanical corrections will be completed within a week by exchanging the magnet jumper connections.

Half-cell #11 is being used for single point lift testing to simulate handling in the south section of the ring.

The production of HEBT/RTBT magnet stands was completed at BNL Shops and sent out for painting. The stands will be at ORNL by mid June.

A revised design and cost estimate for an optional set of radiation hardened coils for the Extraction Lambertson Septum magnet are being finalized.

Controls

Work continues on preparations for the upcoming ARR. Test plans are being submitted, and action items completed. All Personnel Safety System action items from the previous ARR have been completed.

The first stand-alone oxygen monitor has been installed in the cold box room of the CHL. Integration testing was successful. Eight chipmunks have been received; calibration is complete on seven. Preparations have been made for the transition from the phase 0.0 PPS (Front End) to the phase 0.4 PPS (DTL1). Reconfiguration of the system will begin next week with Certification planned for Monday, June 16.

The BNL power supply test application to control current to the D-plate quad and one of the steerer magnets has been implemented. The same test will be repeated next week using the applications prepared at LANL. Martin Pieck will be here from LANL to assist.

Work continues on implementing all hardware and software required for the upcoming D-Plate and DTL1 beam run. MEBT rebuncher power amplifier controls were checked out.

Yury Eidelman arrived from BNL to assist with the further implementation of the alarm handler.

At BNL, LabView software was developed to assist in vendor tests of injection kicker power supply performance. The LabView software uses the Yokogawa function generator that is slated for operational use. The software creates the desired waveform, and also an expected output waveform (with factors such as propagation delays built in), which can be used for comparison and verification of proper operation.

A Functional System Description (FSD) for the SCL Vacuum (including system block diagram) was drafted.

Agreement was reached with ASD Safety personnel on improving procedures for rack installation and testing to reduce the likelihood of electrical incidents.

Installation

Craft Snapshot 6/4/03

ASD craft workers	80.0
Foremen, ES&H, etc	12.0
Less WBS 1.9 etc	4.0
Less absent	4.0
TOTAL	84.0

The Power Supply and Magnet Measurement Test Area equipment were relocated from RATS 1 to the Klystron Hall. A large effort remains for these test areas to become operational again. Bringing the Magnet Measurement Area back into operations is critical as new DTL EMD magnets are expected this week from the vendor. These new magnets must be tested quickly and shipped to LANL for assembly into drift tubes.

There will be a walk thru of the 10-Plex with CF at 1:00PM on June 9, 03. If that is acceptable, testing for mold will begin. The initial, Blue Stage, move is now planned for June 17, 03.

The DTL #1 Tank Assembly was moved into place on the beam line.

DTL 1 terminations for the RCCS and VAC cables on the beam line interface were completed. Thermocouple cabling will be completed next week.

The movable steel shield door at DTL #1 was completed.

Initial feedback on DTL #4 drift tubes with leaks is that their delivery will be delayed several weeks (~Aug). This is important to installation as the available time for assembly and installation of DTLs 456 & 2 now bring into question if DTL commissioning in Dec, 03 can be met.

A study of the ASD Sub Project Schedule was completed to support the End Game Plan.

Work continued on the planning and development of the selection process for ASD Research Mechanics. A meeting will be held with two shop stewards on June 10, 03 to brief them on the outline of the plan. The goal for the selection process is the initial Research Mechanic- Mechanical and Research Mechanic-Electrical selected early in July 03.

Receipt of the first Medium Beta Cryomodule was reset for June 9, 03.

A major reconfiguration of the temporary chiller system is planned during the FES system shut down starting on June 9, 03. This shut down is required to re-configure and certify the PPS.

Accelerator Physics

AP group is staffing shifts for Front-End turn on.

The MEBT trajectory seems to be much improved with less than 1 mm trajectory ripple with no MEBT correctors powered.

Sang-ho Kim is organizing plans for warm cavity testing here at ORNL in preparation for receiving the first cryomodule from JLAB.

J. Holmes is studying the impact of delaying the energy corrector and spreader cavity installation by simulating the ring dynamics and studying losses. He finds using 1.5 MW as the baseline that the losses in the absence of the ECC and ESC are about 0.4%, a factor of about 4 above nominal expectations. However, for CD-4 beam there is no issue.

Operations Group

Ran RF Processing studies on DTL Tank 3

Prepared for DTL Tank 1 operation

Working on the "End Game" proposal

- Recalculated the electrical power use and cost for the SNS Project from FY 03 through the March 06

- Reviewed the ASD Spares list

Preparing for the ARR

- Met Wednesday with the Group Leaders on their:

 - System Status

 - Testing Plans

 - Schedule to Complete

 - Maintenance Plans

- Wrote and processed procedures

- Worked to clear "to do" lists from Front End ARR

- Created an agenda for the DTL Tank 1 ARR meeting

Investigated possible LOTO violation, found no violation

Investigated chain of events following HVCM and DI Water System failures

Worked with MIS on the Maintenance Management System implementation

Worked with CF on coordinating the details of the chilled water outage for the site.

Created a new stopgap E-Log logbook for Maintenance Requests

Conducted a BOD walk-around of the Linac Beam Dump

Ion Source Group

The MEBT quadrupole alignment problem has been understood and corrected: Last summer quadrupole #2 had to be removed to install beam position monitor #2. When the quadrupole was reinstalled, the horizontally locking setscrew was apparently not sufficiently retracted. This caused the horizontally shimming bracket never to line up with the right edge of the girder as it was designed to, locating the quadrupole 0.54 mm to the right of quadrupoles #1 and #3. After this problem was corrected the Survey and Alignment group found the first three quadrupoles to be vertically within ~0.001 mm and horizontally within ~0.01 mm of a straight line. This straight line is still ~0.12 mm to the right of the beam axis, which is much better than the alignment during the last run. The rather small scatter of the quadrupole positions found by the Survey and Alignment group suggests to re-normalize the MEBT fiducials to the quadrupole positions before using them for realignment. It may even be worthwhile to add on all three rafts new fiducials that are easy accessible and can be used for survey and alignment after they have been fiducialized against the quadrupole positions.

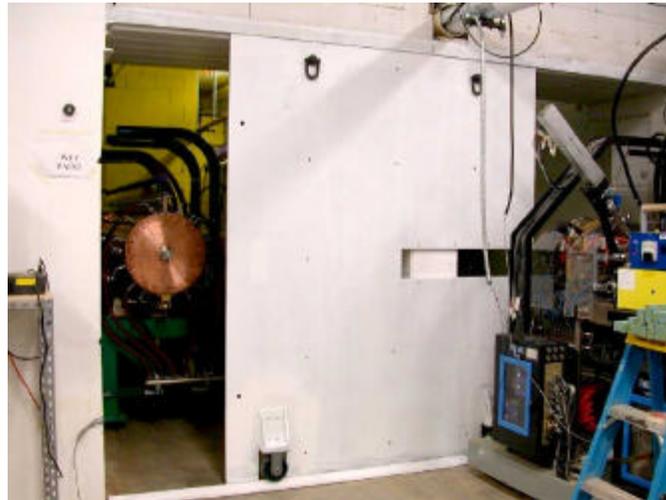
Survey and Alignment Group

Mechanical Group

Vacuum leak testing of DTL-1 with DT's in place was completed today (6-3). All 59 top hats and DT's are leak tight. Final integrated leak testing will be done next week after the slug tuners and post couplers have been installed.

DTL-1 has been moved back on the beam line and anchored in place. Alignment checks of the DT's are in progress.

The 1" thick shield door that is located between DTL-1 and the MEBT has been installed.



DTL-1 / MEBT Interface Shield Door

The sections of DTL-4 have been bolted together and mounted on the support stand. Blanking off the ports in preparation for vacuum leak testing has begun.



DTL-4 in RATS

Water System

- Piping installation completed on DTL 5 Klystron.
- Flushed DTL-1 system using a filter canister to remove any particulate residue.
- Resistivity probe replaced on RCCS-2.
- The replacement of the hoses on the DI filter skid is in process.

HEBT-Ring-RTBT

- Cable pulling in the HEBT is proceeding.
- All the HEBT magnet stands have been placed and their elevation alignment is proceeding.
- Procurement of materials and preparation of forming activities for grouting of all the stands was started.
- Installation of the RING cable tray is proceeding.
- The mounting location for installation of the first half-cell was surveyed.

Magnet Task

We have spent the week moving to the site.

Electrical Group

The Electrical Systems group lab is in the process of moving from the RATS building to the Klystron Gallery. This week, all equipment was packed up and moved out of RATS to the klystron gallery. Next week, unpacking and set up of the lab in the Klystron gallery will continue.

The RF Test Facility Modulator has been successfully tested into a resistive load at low duty (1 Hz). Much rework was done on this modulator this week - there were 15 incomplete solder joints in the high voltage rectifier assembly that were discovered and resoldered. There were transformer connections that were discovered to be stripped - there were redrilled and tapped. The beam stick is being mounted for high average power tests starting next week.

The high voltage rectifier power supply for DTL modulator ME-1 (RFQ, DTL1, DTL2) arced over on 6/4/03, causing considerable internal damage to the SCRs, snubber assemblies and SCR firing cards. A brass water fitting on the SCR assembly was melted also, causing an internal power supply water leak that drenched the supply. The power supply was repaired and dried out by 1400 on 6/6/03 and testing will start.

The D-plate power supplies were connected to the D-plate this week. Testing will resume next week on the repaired quadrupole magnet.

HEBT tunnel large magnet cable pulls completed up to the ground break

Embedded floor conduits for pulls from the ring service building to the HEBT tunnel ground break have been cleaned, dried out and pull ropes inserted for next week pulls from the ring SB

DC bus for main dipole for the injection section has been cut, water fittings soldered, so the installation in the injection section will commence next week.

Tray installation in the ring tunnel injection section completed

HPRF

LLRF

Cryo Systems Group

The installation of the LN2 transfer line is complete and has been helium leak tested. The gas nitrogen from the LN2 trailer is also complete and will be leak tested on Monday. The charcoal heater on the absorber bed is at 238 deg F and is holding. Water is still obvious in the discharge gas purge stream from this vessel. Work has started installing the warm compressor couplings between the motors and the compressors.

All the 10" lines on the down stream return modules in the tunnel have been welded. Cold shocking and leak testing will begin starting on Monday. Work on the warm gas piping continues.

Beam Diagnostics

LANL Beam Diagnostics Report:

BPM electronics: Work continued to prepare new PCI card assemblies to replace the prototype units in the MEBT. The resistor packs have been successfully soldered on to the Digital Front End (DFE) cards, and the inductors with the incorrect values have been replaced. The DFE card design should be revised to use resistor packs that can be more easily soldered.

WS actuators: Layout work for the HEBT WS actuators is complete. Detailing will commence soon.

WS electronics: Eight signal processor PC boards have now passed preliminary testing. Work continues to finalize the rear panel design.

Harp: Work continued on the mechanical layout for the target harp. Thermal calculations indicate that 4-mil diameter tungsten wire will not present a heating problem for the board design. We successfully tested the concept of using little ceramic beads to stagger the signal wires. We are waiting for the OK from ORNL on the harp aperture.

ED/FC: We are experiencing problems obtaining the proper type of Glidcop for the ED/FC heads. We are working with the Glidcop vendor to resolve this issue.

CMs: The remainders of the DTL current transformers have been modified to solve the out gassing problem where the wires exit the body of the device. These units are now ready to install into the DTL.

D-plate: The maximum beam stop flow rate, using the D-plate water-cooling system, has been measured to be 9 gpm. The design value was 10 gpm. Steve Ellis and Snezana Konecni have reanalyzed their design calculations, and have determined that 9 gpm is an adequate flow rate. The transient temperature rise is almost independent of the flow rate, and it is this temperature rise that concerns us the most. The average temperature is directly related to the flow rate, and this temperature only increases by about 2 deg. C with the lower flow rate.

Software: Work continued on merging the drivers for the LLRF and BPM systems.

Misc: The PCR submitted last week, to transfer \$1.001M of work to ORNL, has been approved.

BNL Beam Diagnostics Report:

General: Working on Project Office request to move Diagnostics spending into FY05 to cover civil construction cost over-runs.

1.5.7.1 BPM: Developing a test set-up for the SNS RF BPM electronics. The LANL PCI card is now operating properly. FIFO problems were due to unsoldered pins and solder bridges. We will order FIFOs for the remaining 5 blank boards. The BNL PCI/timing decoder card is running, interfaced to a BCM IFE. Communication with the IFE is established (it is no longer locking up the computer), gain setting works fine. We are now working on data transfers

1.5.7.2 IPM: An order for 22 8-channel 25MSPS digitizer cards has been submitted, as well as an order for another PCI crate with processor. Magnet design for a 30cm gap to accommodate a detector with a 20cm clear aperture has been submitted to the shops for estimate. Both of the above items may be put on hold due to initiative by the Project Office to defer expenditures to 2005.

1.5.7.3 BLM: The ion chamber purchase order, sole source document, and specification have been submitted for necessary approvals. Remaining parts have been ordered for the end-caps of the remaining 8 BLM detectors that we have in-house. We continue the effort with Controls to generate a remote control application to test the AFE module. We are writing a AFE module initial test and offset adjustment procedure. Parts have been assembled for construction of the second AFE. Construction to begin next week. Further improvements have been made to the AFE backplane design. Routing of the next rev to begin next week. Visited the SNS magnet assembly area to evaluate detector-mounting options. Progress has been made on the prototype moveable BLM stand, and we are awaiting delivery of signal and bias cables from ORNL to complete the assembly. We continue with performance testing of the MPS interface module in our test IOC. We will also optimize the input lowpass filter response circuit. We have started to investigate the Burle gated MCP/PMT 85104. They have agreed to conduct some preliminary tests at their engineering lab using the SNS application parameters.

1.5.7.4 BCM: The Ring BCM FCT toroid from Bergoz has exhibited saturation problems at high current levels. It appears there was a mistake in the design at Bergoz, although they have not yet accepted responsibility (and it is not

clear that they will). A few alternative transformers have been proposed as a solution. The most expensive transformer will meet the Ring requirement with no magnetic biasing programming, while two smaller transformers will cost less but require some special "reset/bias" techniques to return the core magnetization to a preset value allowing the core to handle the I^2t product limitation. This matter is presently under discussion. Waiting for a decision on the Ring transformer to continue the Ring BCM design. A second BCM electronics package has been under test and is "burning-in". This assembly is ready for shipment, and in the interim is being used for calibrator and transformer high current testing. A second calibrator driver amplifier is undergoing trouble-shooting. The digital design effort continues for the calibrator. Working on the ECN to update the changes in the final assembly of the HEBT BCM. Continued working on production drawings for the RTBT BCM.

1.5.7.6 Carbon Wire Scanner: Working on ECN to update the changes in the final assembly of the WS Beam Box.

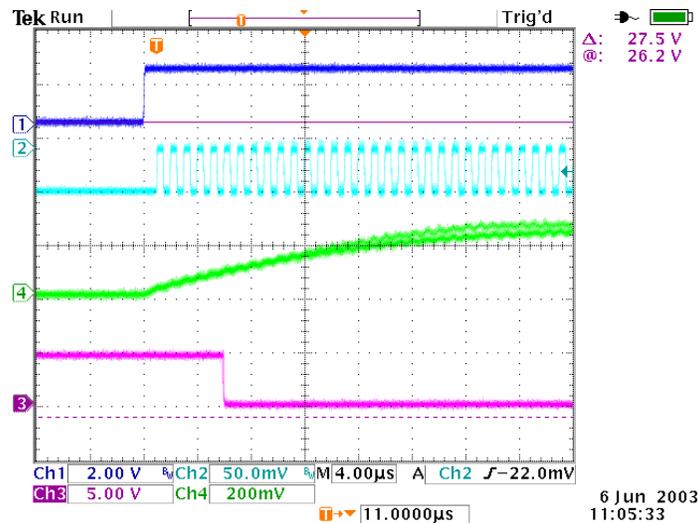
ORNL Beam Diagnostics Report:

D-plate: We remove all cablings to the actuators to allow us to move the whole D-plate assembly for Tank-one installation and alignment. This will add an extra four days of vertical integration time and realignment of the D-plate. Quad and the power supply were tested at low currents. All electronics are ready for commissioning.

MEBT Startup: Every member of the diagnostic group supported the startup. All systems worked with the exception of the BPM phase measurements. LANL team with new MEBT BPMS are coming to the ORNL starting June-10th.

D-Box: The ORNL designed actuator and a slow Faraday Cup/Beam bump is installed to support the MEBT re-commissioning. The remainder of the actuators is ready for installation. We hope to install three actuators next week.

Beam Accounting Electronics: Jim Pogge and Craig Deibele have designed and built the version-0.1 of the Diff BCM. They are testing and integrating the system. Figure below shows the response of the circuit.



In this picture, the light blue trace shows that we are chopping beam, with an average current of 38 ma (the worst case of a differential current trip). The magenta trace shows that at 5 usec after the start of beam, the mps signal trips if all beam is lost between the first and the second BCM. The green trace is the output of the integrator.

Software: Wim and company are working on shared memory performance tests, new software for the laser vibration test-studies and LEPT DAQ.

SCL Laser System: We are testing the laser beam diagnostics such as the quad-sensors and preparing for the first phase of the vibration tests in the tunnel. We expect to start these tests toward the end of June. We will start installing the HEBT pre-fabricated laser room on June-16-2003.

General: Luke Roseberry, our summer intern has started working on his automated 3-D laser magnet-mapping project. The goal is to map the dipole field using a single axis Hall probes and 3-D actuators. The automated system will run under LabView program.

We have been investigating tools and techniques to track design and configuration of diagnostic devices. Over the next few months, we will be evaluating an XML Schema for test data, and the Oracle Internet file system for automated versioning.