

Accelerator Systems Division Highlights for the Week Ending December 13, 2002

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments this week: (1) Paul Tallerico and Roy Przeklasa were at ORNL to support klystron repair, installation, operation, and conditioning. The RFQ klystron was up and running again by the end of the week. (2) The first CCL 5 MW klystron (Fig. 1) was shipped from Thales. (3) Two more SRF linac 550 kW klystrons from CPI arrived. A tested CPI tube was removed from the LANL transmitter and one of the new ones inserted and made ready for test. (4) S/N 8 DTL klystron is operating well at the E2V (Marconi) factory and will be factory tested next week.

Concerns & actions: (1) Testing at LANL is on hold pending resumption of converter modulator operations (*cf.* Sec. 1.4.1.2). (2) While at ORNL, LANL personnel helped with the repair of two 402.5 MHz klystrons at SNS last week. S/N 1 leaked water because of poor brazing and quality control at the factory. A second klystron had arcs at the coax to waveguide transition, and this may be a design error, or an assembly fault. We cleaned the transition, replaced three parts, and reassembled it. We ran for an hour at 1 MW, 1.33 ms pulses, and saw or heard no arcing. ORNL has good procedures for installing and testing klystrons. Besides a written procedure that is read by all riggers involved, they also show the crane operators a video of two 402.5 MHz klystron installations from Los Alamos.



Fig: 1: First 5-MW klystron for the SNS CCL

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: (1) Bill Reass was at ORNL this week to support RFQ high-voltage converter modulator (HVCM) operation. The IGBT that failed last week was replaced and the unit was back up and running to generate first RF delivered to the RFQ cavity on 12/12.

Concerns & Actions: (1) The IGBT failure on 12/6 was diagnosed by LANL and ORNL personnel, in consultation with the manufacturer (Mitsubishi). It is suspected that local heating occurred, possibly induced by inconsistent or inadequate torquing during assembly. Results were communicated to Dynapower. (2) QA of the cast 140-kV HVCM transformers is being addressed by Dynapower. Partial discharge testing is about to begin. (3) A DOE walk through of the LANL HVCM 13-kV AC substation revealed inadequate procedures at the interface between utility and programmatic work. Work was performed on 13-kV switchgear feeding the HVCM with the main 13-kV breaker racked out with all systems de-energized. The situation resulted in a reportable occurrence. Work on the substation has been suspended, pending adequate review of procedures and roles and responsibilities between the linemen, the facility management unit, and SNS personnel.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments: (1) Two additional water channel weld coupons required for the weld qualification were e-beam welded. Micrographs of the welds indicated the desired weld characteristics, concluding this part of the weld certification program. Welding of 20 Tank-1 drift tube rebuild units begins next week, as scheduled. (2) Machining of Tank-3 drift tubes for weld ring repair began. 15 units will be ready for welding next week. (3) Post coupler weld coupons were welded for qualification of the water-to-vacuum post coupler welds. Three sets of coupons have been sent to LTI for evaluation. (4) We decided to hydrogen furnace braze the drift tube diverter stem. Work began on qualification of the braze.

Concern & actions: (1) Evaluation of sectioned and micrographed Tank-1 drift tubes indicate a significant probability that portion of the bore tube weld in PMQ drift tubes may not be bonded. The cause of the inconsistent welds is inadequate shunting of the PMQ magnetic field during the e-beam weld. Consequently, all Tank-1 PMQ drift tubes will be rebuilt. (2) There is a concern about the long-term effectiveness of the thermal joint between the water channel cooling tubes and the DTL tanks. Consequently, we decided to use thermally conducting epoxy rather than thermal grease. Development will begin immediately on this activity. (3) Our mechanical engineering group needs to be re-staffed to execute the DTL recovery plan. With considerable support from the LANL Senior Executive Team and advice from our Division Review Committee we now (12/13/02) have adequate, experienced staff identified and committed to execute this plan.

COUPLED-CAVITY LINAC (WBS 1.4.4)

Accomplishments: (1) Nathan Bultman, Dan Richards, and Lloyd Young are in Germany for two weeks working with ACCEL on the tuning and stack brazing of the first two CCL segments. All cavity frequencies (16 half-cell, 8 full cell & 15 structure modes) were measured for segment no. 2. Initial cuts were made on half-cell tuning rings to calibrate the tuning algorithm. Target frequencies have been derived for all half-cells and final tuning (ring machining) will commence next week. They are using the new endwalls that now meet dimensional requirements after modifications to the fixturing hardware. (2) A status check on cavity machining shows that the internal cells for all segments up through segment 9 (of 12 for module 1) are completed. (3) Our engineers are also working with ACCEL on finalizing a system to document "in-process" nonconformance.

Concerns & Actions: (1) The flange copper-plating difficulties have been resolved and the production rate is being accelerated to match the endwall production rate. (2) We must stay on top of the support stand fabrication to insure no schedule slippage.

LINAC PHYSICS (WBS 1.4.5)

Accomplishments: The *PARMILA* code was converted to Fortran-90 and version 3.00 issued. Pre-released versions have been installed and are under test at KEK, Fermilab, Frankfurt and SNS/ORNL. Formal release of ver. 3.00 is awaiting its integration with the install shield set-up program for windows.

ASD/JLAB: Cold Linac

All cavities for the first production cavity string (M-1) have been qualified. String assembly is complete. It is under vacuum and ready for transfer to the cryomodule assembly group.

Assembly of three cavities for the second production cryomodule (M-2) is complete. Qualification testing will begin next week. A total of 13 medium- β cavities have been received from the vendor. Six more are scheduled to be shipped December 21.

Vendor commissioning of the electropolish cabinet is complete. A short punch-list of minor corrections needs to be dealt with before first acid tests take place.

ASD/BNL: Ring

Engineers returned from their visit to IE Power where they reviewed production progress / testing on the medium range power supplies and participated in a design review of the Ring dipole power supply. No major issues uncovered but several minor items (i.e., some noise and interface cabling) need to be resolved by IEP before they ship first article production units to SNS/OR, in January.

Viorel Badea and Bill Birkholz are on travel this week to meet with two of our magnet vendors; Alpha (1st articles 21S26 (12) and 41CDM30 (9)) and Stangenes (26Q40 (8)). Their last field report indicated:

- Alpha is making good progress on the 21S26 and the 41CDM30 contracts. They are behind schedule on both but close to delivering the 21S26 first article; they will probably ship it January 2.
- Stangenes is experiencing problems with their sub-contractor who is machining the magnet steel cores for the 26Q40 quadrupoles (indications are that the sub-contractor has stopped work). A meeting between BNL Contracts and Engineering is scheduled for next Monday morning when the engineers are back with the "facts".

Tom Shea is at Brookhaven this week to meet with Peter Cameron and the Diagnostics Group to review status and schedule of the diagnostic systems.

IPM – profiles have been observed and recorded during RHIC startup. The new shielding grid appears to work fine; awaiting higher intensities to fully evaluate the performance.

An ICD has been formally submitted to DCC thru Karen Cox this week. The ICD covers Beam Collimators, Beam Dump Thermocouples and the Control System.

Bids for the 26S26 (8) quads are in and being evaluated.

A proposal for Ring vacuum spares is under review by ASD and BNL.

J. Tuozzolo held a half-cell production meeting this week. Component selection for the Ring half-cell assembly, Serial No. RA1-2, in the B1 position, has been completed and recorded in our database spreadsheet. Assembly of half-cell #2 is underway.

Ten (10) of the 27CDM30 (28) correctors have been measured. The measuring rate is approaching 4 per week.

The last of nine HEBT dipoles has been received at SNS/OR from Tesla Engineering. We will work with Tesla to close out this contract.

Budker Institute of Nuclear Physics – BINP reported that they are finished with their production tooling for the large aperture quads. Production deliveries are expected in the spring.

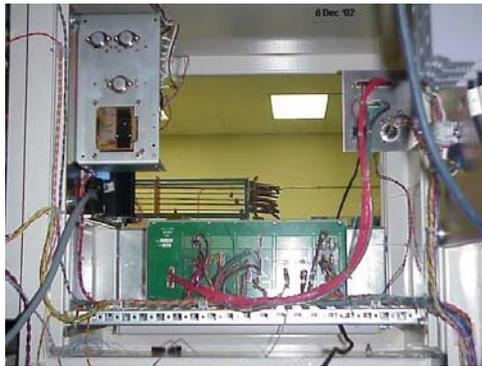
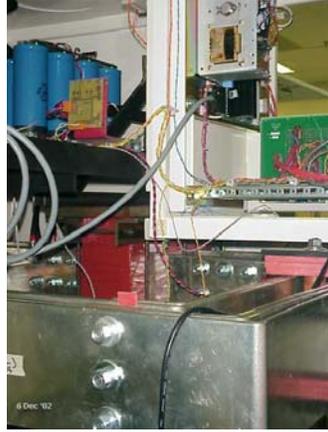
The RFQ for Chicane #1 is being prepared.

Tesla is preparing their last six (Ph. I) production magnets for shipment to BNL today. All material for Phase II production is in house. An updated production schedule is due soon.

Starting next week, Danfysik will start delivering LFPS to SNS/OR in satisfaction of the BNL PS contract (to date, 136 units have been delivered to SNS/OR in satisfaction of the LANL contract).

Assembly work continues on power amplifier #2 for the Ring RF. Testing is planned for January.

Photos from IE of medium power supplies



Controls

Mike Thuot from LANL came to ORNL to assist with site noise measurements. The largest source of noise was found to be the connections between the SCR and converter modulator. The ground return sheet on the floor and the power cables from the SCR to the converter together make a noise emitting current loop, which is somewhat directional as installed. A report on these findings will be sent out next week, along with recommendations for cleaning up the sources of noise and reducing the susceptibility of equipment in the affected areas. Thanks also to the High-Power RF Team for their cooperation and interest.

The Machine Protection System is installed and will be handed over to operations on Monday when the final checkout can be performed. After the MPS checkout, a short operator training session will be held.

Most of the cable required for the installation of the cryogenic control system in the Central Helium Liquefier Building and Klystron Building Medium Beta Cryomodules has been received and placed in storage at the RATS II building. Below is one of the larger rolls of control cable. Most of this cable will be installed between the ICS racks in the Klystron building and the Cryomodule Junction boxes in the tunnel.



Certification of the entire front end Personnel Protection System was accomplished on Thursday, December 12. The PPS is now controlling the Ion Source, as well as the RFQ RF and the MEBT rebuncher RF supplies.

The first five production Chipmunk radiation detectors have been tested at RSCAL to verify that the units properly measure gamma radiation. Testing will be performed next week at the vendor's site to verify other functional requirements. When these tests are completed, we will accept the first five units. The remaining five units to be produced under the initial order should be completed by the end of the year.

Ninety percent complete drawings have been received from SvT for phase 1 of the PPS (LINAC segment) PLC equipment. Comments have been assembled and will be returned to SvT early next week for production of CFC drawings. Plans are to stage the PLC equipment in the front-end building for test and checkout prior to assembly.

The design for CCL network and timing system communications cables was issued for construction this week.

It was a big travel week for the BNL Controls Team. Yury Eidelman went to the APS to confer on his alarm screen configuration tool. Xiasong Geng is at ORNL working on global vacuum issues, and learning PLC-5 to ControlLogix conversion. Tom Shea from ORNL is at BNL to discuss various Controls/Diagnostics interface issues.

The LANL Controls effort was presented by the team lead to the LANL SNS Division Review Committee.

Installation

Craft Snapshot 12/11/02

ASD craft workers	49.0
Foremen, ES&H, etc	8.5
Less WBS 1.9 controls	-2.0
Less absent	-1.0
TOTAL	54.5

ASD personnel visited the HEBT/Ring/RTBT crane supplier on 12/10/02 to inspect a mock up of the hook spacing mechanism and to discuss installation scheduling.

The crane installation can begin on 2/01/02 and will be completed in 6 to 8 weeks. The scheduled date for Blain to provide access to TA America, the crane supplier is 2/15/02. CF will work with Blain to gain early access.

In the Friday Morning Installation Meeting a new systems of tracking, updating and closing out Field SRO's was introduced.

A list of 32 Field SRO's on which work is currently being performed was distributed and discussed. One was closed out.

In the future this list of Field SRO's will be distributed with the Installation Meeting Notice. Individuals are expected to come to the Friday morning meeting ready to status and discuss their SRO's.

Janet Bolling will provide weekly cost updates on SRO's. These cost updates will include the appropriate budget for each SRO for progress evaluation.

The Division Director's Weekly Installation Meeting was a review of the requirements for additional installation of technical components in the Ring this FY and requirements for continued waveguide installation in the Klystron Hall beyond the first superconducting system SC-ME1. The plan is to complete all waveguide subsystem installation this FY.

Waveguide installation is efficient and provides good earned value for ASD.

It was decided that waveguide installation would be continued with a reduced crew size of four (4) electricians. The RF Group Leader will forward an e-mail request to the ASD Deputy Division Director for funds to support this activity.

The Ring review resulted in a plan to accelerate the number of technical components installed in FY03. Sixteen (16) Ring Girders will be available from BNL during this year.

With Ring Tunnel and Ring Service Building BOD forecasts for early April 03 followed by approximately 90 days of cable tray installation and cable pulling, girder installation can begin in all quadrants for the Ring in the July/Aug time frame.

Additional funding will be required by the Electrical Group for quantity cabling procurements to be placed shortly after the start of the calendar year ~ Feb.

The Electrical Group Leader will forward an email to the ASD Deputy Division Director requesting this additional funding for Ring cable procurement. Cable delivery is 6 to 8 weeks.

A study is underway to determine how the RATS Facility activities can be moved to the site and on what schedule. The study will be completed the first week

Accelerator Physics

I. Yamane visited SNS this week to discuss H-minus laser stripping injection schemes with AP group members, as well as possible collaboration in future laser-stripping experiments.

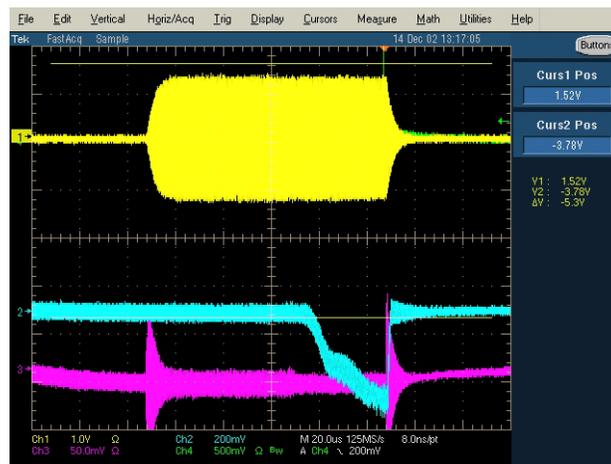
S. Kim attended a low-level RF workshop on modeling at LBNL.

S. Cousineau defended her Ph.D. thesis at Indiana University.

A. Shishlo and D. Jeon have developed a DTL commissioning application for the phase-scan technique and tested it with the virtual accelerator.

Operations Group

On Saturday, December 14th at 1:15pm first beam was injected from the Ion Source into the RFQ, accelerated to 2.5MeV and transported through the MEBT to the beam stop. The RFQ was operating at nominal power and without further effort approximately 10 mA of beam current was transmitted all the way to the end. The two operators on shift were Sam McKenzie and Rob Morton. Snapshot from the scope screen is attached. Blue trace shows current into the beam stop (4mA/div).



Conducted LOTO training for ASD

Conducted and participated in Operator Training

Worked on Preparation for the DTL ARR - Reposes to Committee for DTL

There was a Radiation Shielding Review Friday,

Continued work on the ASD Conduct of Operations

Started on the ASD Maintenance plan

Worked on assigning CLO Lab Space. Developed an access plan for exterior doors and interior labs

Computer Maintenance Management System

Participated in startup planning

Spares for Ring and HEBT vacuum chambers

Ion Source Group

Mechanical Group

The o-ring grooves on the last DTL-3 tank have been enlarged at Oak Ridge Tool. All DTL-1 and DTL-3 tank sections have been modified and are in the RATS building.

Corrosion protection testing for the carbon steel o-ring grooves has been completed. Several nickel-plating compounds and application procedures were considered. The best overall plating compound is called "Bright Nickel" and it is applied in the o-ring groove with the tank in the horizontal position. Plating of the o-ring grooves began today.

Magnet Systems

Vacuum Systems

Linac HPRF

At 6:10pm Friday, RF power delivered to the RFQ reached 650kW with 5-Hz 100-microsecond RF pulses. At 7:20pm conditioning geared for higher duty with 10-Hz 100-microsecond pulses and again reached to 650-kW by 8:00pm. Presence of Alex Ratti visiting from LBL has been greatly appreciated.

Sixteen operators will have been trained on the HVCM & the transmitter by end of today.

Alex Ratti is guiding the conditioning effort and training personal. We wish to thank all for the great work. Especially the LANL team, Paul for his help on the klystrons and Bill for his timely assistance in HVCM repairs.

Linac LLRF

ORNL

The RFQ Low Level RF control system was used for conditioning the RFQ on Thursday and Friday. Full field operation (~650 kW incident power) at 10 Hz, 100 us was achieved before shutting down Friday evening. The HPM performed as expected: it truncated the RF pulse many times during the conditioning. Several arcs were detected at the RFQ drive loop windows during the conditioning. Vacuum activity was observed on the drive loop ion pumps and the RFQ body ion gauges. Alex Ratti was at Oak Ridge for the conditioning. Larry Doolittle and Kay Kasemir assisted from Berkeley and Los Alamos, respectively, via telephone. Their assistance is greatly appreciated.

Testing and tweaking of the Rebuncher LLRF systems is ongoing. All systems were operated this week driving the rebuncher cavities with the 20 kW amplifiers. The PPS interface to the system was verified. This work will continue in parallel with the conditioning and commissioning of the RFQ.

The Oak Ridge team will provide 100% coverage in support of RFQ conditioning and commissioning Saturday and Sunday from 8:00 AM to 8:00 PM.

The system-modeling meeting (described in last week's report) was held at LBNL on Dec. 12.

The Initial Design Review for the Field Control Module will be held at Los Alamos on Dec. 17.

A Code Development meeting will be held at Los Alamos on Dec. 18.

Mark Champion, Hengjie Ma and Craig Swanson will represent the Oak Ridge team at Los Alamos on Dec. 17-18.

Champion, Ratti and Shoaee will work together on the detailed resource-loaded plan and estimate to complete next week at Los Alamos.

Craig Swanson has been working with the LBNL codes to confirm the portability of these codes. There is a problem in compiling the C code due to Microsoft's apparent lack of support for POSIX standards.

LBNL

Last week we completed two chassis, which after the delivery of the first unit to SNS in November completes the set of three we were asked to build at the beginning of September. However, all of these chassis are now using 402.5 MHz hardware due to the delay in the delivery of the 805 filters we ordered during the ASAC review at the end of September. The vendor now promised a shipping date if 12/17. Once this hardware arrives, we will be able to have a complete unit for the tests as JLAB.

Berkeley hosted a one-day meeting on LLRF modeling, where the Berkeley staff was joined by Sung-il Kwon (LANL) and Sang-ho Kim (ORNL). During the workshop we reviewed all existing models, with the exception of a few advanced routines unavailable behind the LANL firewalls, both in C and Matlab. A short and mid term plan of action was established. This plan will be refined during the upcoming meeting at LANL on Dec. 18.

Electrical Systems Group

DTL rack row 01-05 inspected, verification tests completed and klystron building up to row 05 will be declared AC distribution wise finished Monday

Dec. 16, upon craft workers return and unnecessary LOTO equipment removal.

Vacuum ion pump HV cable pulls completed in DTL

CCL rack row 02 started

Survey and Alignment Group

We performed a study of the precision of the laser tracker. A small, highly redundant network was observed and adjusted. Then observation sets were made on this precise network at successively longer distances from it. The resulting coordinates were compared to the precise coordinates and the results show the range-dependency of the system. Since there appear to be some substantial differences in precision from the manufacturer's specifications, further tests should be conducted to derive accurate measures of each of the tracker's four measurement types (IFM distances, ADM distances, horizontal directions, zenith angles). A report will soon be following shortly.

We prepared an observation schedule for the full re-observation of the global network and tunnel network, to be implemented 30 days after the end of all the tunnel backfill.

The group engineers independently derived global coordinates for several fiducialized magnets and compared the results to check the process. We also mathematically verified the internal consistency of BNL's three dipole magnet geometry sketches.

We reviewed a proposal for alignment of DTLs in the front-end building, in light of our requirements for the accurate use of the laser tracker, and provided feedback.

We attempted to perform some precise leveling between the FEB monuments, in preparation for checking the alignment of the front end, but were thwarted by the operation of a vibrating pad-foot roller outside.

The magnet measurement fixture is installed and operational. The first quadrupole was set using the fixture. The magnet was set close to ideal but not where we would like to see it. Changing steps for setting the magnet should result in a properly placed magnet.

Work is continuing on the vector bar for the DTL alignment of the drift tubes. If successful, this vector bar will allow the Survey and Alignment group the ability to check drift tube locations without having to remove the end caps of the DTL tank.

Cryogenics Group

CHL: Linde has passed the leak testing for the vacuum shell of the cold box. They will complete the installation portion of the contract by 12/18/02.

Tunnel: the west supply end box is welded in place and the vacuum jacket of the supply transfer lines will be started next week. This will complete all the supply transfer line installation in the tunnel.

Transfer lines: Return module HB11/12 is 80% completed and HB13?14 is 50% completed.

Beam Diagnostics

ORNL beam diagnostics report

ORNL beam diagnostics report:

Laser profile monitor design is progressing very well. We are in the QA phase of the laser and the optics prior to the MEBT tests.



Figure (1) Laser Room at RATS-1

Peter Ladd (lead ORNL vacuum expert) and Johnny Tang (SNS-Controls) will setup an RGA with the prototype SCL laser box under vacuum to test the laser interaction with the fused silica windows to monitor any impurities

liberated next week. Warren is analyzing the transverse and longitudinal laser profiles at different energies. We require a good knowledge of the photon distribution for our SCL and MEBT studies.

Matthew continues preparing the Laser DAQ and low-level applications under Wim Blokland's supervision. The diagnostic group worked on the MEBT instruments with beam. After a stable beam is established, we will commission the diagnostics. A lot of changes to the data acquisition of the BCMs are made since LBNL and require actual beam to verify the reported beam current. RAW signals from BCM11 (current transformer at quad-11) have a lot of noise. Craig Deibele is investigating. Wim worked with Dave Purcell on low-level BCM application and EPICS screens.

Sample quantities of those components missing from the third embedded timing circuit have been requested. This board will be sent to Joe Mead at BNL (the second board has already been sent to LANL). The CardBus version of the embedded timing circuit has been designed and the PC board layout is in progress. The original PCI design is now being revised to improve packaging and make it universal (5 or 3.3V).

Tom visited BNL and discussed designs of nearly all ring systems. Several BNL staff presented prepared overviews of BLM, BPM, and BCM systems. We could be ready for a Diagnostics Advisory Committee review by March. A phone conference with the LLRF Advisory Board was held in preparation for the upcoming LANL meetings.

LBNL beam diagnostics report:

BPM pickups: A total of 5 ea. DTL BPMs are now ready for installation into drift tubes, and 3 ea. are now ready to have the extension tubes welded on. One SCL BPM is ready to be shipped to ORNL, thus meeting our delivery goal of one SCL BPM in mid-Dec.

BPM electronics: Work continues on the next-generation analog front end (AFE), digital front end (DFE), and PCI motherboard. The DFE and PCI motherboard are in ECAD. The first two AFE's will be shipped soon.

WS actuators: Work continues to prepare the two units for DTL-1 and the D-plate. We just need the Kapton coaxial cabling from the vacuum feedthrough to the BNC connectors, and then they'll be ready for final testing. A Statement of Work is being prepared for our production batch order from Huntington.

WS electronics: The modifications to the schematic and the board layout were made this week. We hope to have the design to the board manufacturer by 13/Dec. The front panel pc board was ordered this week along with the front panel overlay. We have found some of the more hard to get parts and have ordered them.

ED/FC actuators: Work continues to prepare the two units for DTL-1 and the D-plate.

ED/FC electronics: Good progress was made this week. Assembly is almost complete on the first chassis, which will contain the interface for both the DTL-1 and D-plate units.

D-plate: Fabrication continues on the harp and slit actuators. We're mostly waiting for a few misc. parts needed to complete the assembly. Good progress was made this week on the halo scraper and beam stop electronics. Assembly is complete on the interface chassis and it is ready to be connected to a PC with the National Instruments NI-6110 PCI data acquisition card for testing. The D-plate shipment arrived at ORNL on 9/Dec, then moved to the RATS II building.

Misc: The SNS Division Review was held this week, and among the presentations was a status report on the diagnostics.

