brookhaven national laboratory

newsletter

national synchrotron light source

Summer 2006

Energy Secretary, Under Secretary for Energy Tour NSLS

Liz Seubert, Peter Genzer and Kendra Snyder, BNL Public Affairs Office

On Friday June 2, BNL welcomed Energy Secretary Samuel Bodman and Raymond Orbach, newly named Under Secretary for Science at the Energy Department.

During a whirlwind visit, the Secretary and Under Secretary met researchers at the NSLS, where they talked about current and future research. While discussing applications of synchrotron soft x-rays, NIST physicist, Dan Fischer, gave Bodman and Orbach a tour of beamline U7A. NSLS biophysical chemist, Lisa Miller, showed the Secretary and Under Secretary infrared beamline U10B and described her group's work on skin melanoma while Steve Dierker, Associate Laboratory Director for Light Sources, highlighted the prospects for NSLS-II.

Bodman and Orbach also met researchers at the Relativistic Heavy Ion Collider's (RHIC) PHENIX and STAR detectors and the molecular beam epitaxy system laboratory, where they heard about the Lab's nanoscience efforts.

Later, the Secretary gave a standing-room-only talk in Berkner Hall to an audience of employees and other guests, including Shirley Strum Kenny, President of Stony Brook University and Chair of the Brookhaven Science Associates (BSA) Board; Carl Kohrt, Battelle President, CEO, and BSA Vice-Chair; and other members of the Board. His purpose in coming to the Lab, the Secretary said, was to support the same level of quality in BNL's future work as that of the greatness of its past — ensuring that "from RHIC to the new Center for Functional Nanomaterials to the preferred siting for the NSLS-II, history will be repeated at the Lab."

Energy Secretary Samuel Bodman (front, center) stands at beamline U7A with (from left) NIST physicist/group leader Dan Fischer, Under Secretary Raymond Orbach, Battelle President and CEO Carl Kohrt, Associate Laboratory Director for Light Sources Steve Dierker, BNL Interim Director Sam Aronson, and NIST scientists Faisal Alamgir and Sharadha Sambasivan.

DOE/BNL Partnership Requires Safety and Science

In committing to maintaining that tradition, DOE "requires a partnership between you and us," Bodman said. "We look to this laboratory for excellence in management as well as science."

"The most important asset the Department has here . . . is all of you," he continued. "The personal safety of all departmental employees and contractors is a top priority for me." The Secretary emphasized that Brookhaven can be proud of its history of scientific achievement and contributions in many fields, "but, in my judgment, your safety record requires improvement," he

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said. "We ask you to take care of each other and think of yourselves. Small accidents are the precursors to serious accidents."

Investing in Science

The President understands that we must make investments to ensure that America retains its world pre-eminence in science, Bodman said. "That is why he has proposed the American Competitiveness Initiative (ACI), the Alternative Energy Initiative, and the Global Nuclear Energy Partnership (GNEP). The Energy Department has a major role in all three programs."

Through the ACI, the Office of Science budget is expected to increase by 14 percent in 2007, to $4.1 billion. This initiative is especially important to the NSLS, as the Office of Science will direct additional funds to sectors promising breakthroughs, including supercomputers, nanotechnology, energy from biomass, nuclear fusion, and high-intensity light sources like the NSLS.

Another reflection of Washington's growing awareness of the importance of science, the Secretary pointed out, is Congress' recent confirmation of Ray Orbach as "the first Under Secretary for Science in the history of our Department. The symbolism involved expresses a role for science in our country's government that it has never had before, and we will take maximum advantage of it." Over the next 10 years, even more funding will come from the ACI — $136-plus billion — to invest in research and development, improved math and science education, and incentives to encourage entrepreneurship and innovation, Bodman said.

GNEP, meanwhile, is a collaboration among several countries, Bodman said. The aim is to develop new technologies to recycle spent nuclear fuel in a way that cuts proliferation risks while reducing the volume of waste for disposal. Nine DOE labs, including Brookhaven, are playing a role in this program.

The Alternative Energy Program is also focused on developing new technology. With a 22 percent increase for FY07, this will translate into more support for work on cellulosic ethanol, lithium ion batteries for hybrid vehicles, and hydrogen fuel cells.

All this effort depends on people, Bodman said, and pointed to the ACI call for $380 million to improve mathematics, science, and technical education in U.S. elementary and high schools. He cited the work being done by BNL's Office of Educational Programs as an example of the type of program needed to "assure that future generations of scientists and engineers will step forward to carry on the work that all of you are doing so ably here today." In conclusion, the Secretary reiterated the "tremendous respect" he had for BNL's achievements and what he expected the Lab to achieve in the future. He ended his formal comments by urging Lab employees to e-mail him with their concerns at any time.

NEWS

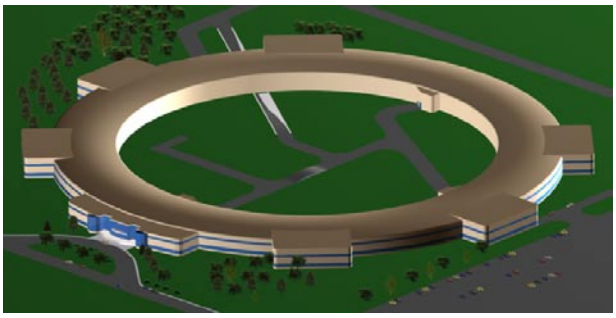
NSLS-II Update

Steve Dierker, Associate Laboratory Director for Light Sources

Last fall, DOE granted "Critical Decision Zero" (CD-0) status to the National Synchrotron Light Source II (NSLS-II), the planned world-leading successor to the NSLS. Later this year, Critical Decision One (CD-1) will approve a construction plan and a definite site decision will be made.

At May's first-ever joint meeting of the user communities for the NSLS and the Center for Functional Nanomaterials (CFN), Interim Laboratory Director Sam Aronson said that the Lab's highest priority is the design and construction of NSLS-II, which together with the CFN will give BNL a unique and powerful set of research tools.

"In looking forward, the NSLS-II will allow our science to continue to flourish and expand, and keep the U.S. in the forefront of light source science," Aronson said.



The latest NSLS-II rendering

"The completion and operation of the CFN and NSLS-II will profoundly change the balance of research here."

The CFN will be producing materials that will be crying out to be characterized, and NSLS-II will be brighter than any light source in existence. None of today's light sources were designed to probe materials with one nanometer spatial resolution and 0.1 milli-electron-volt energy resolution. The changes that NSLS-II brings will be transformative. The NSLS-II will be essential for energy security, and important for U.S. industry. It will enable 'grand challenge' science in many diverse fields.

A companion project, the Joint Photon Sciences Institute (JPSI), is intended to foster development of new techniques and capabilities. JPSI will serve as an intellectual center for development and application of the photon sciences and as a gateway for NSLS-II users.

Chairman's Introduction

Chi-Chang Kao, NSLS Chairman

Spring and early summer have been filled with a flurry of activity at the NSLS. In mid-May, the first joint NSLS-CFN Users' Meeting was carried out successfully, thanks to the efforts of both Users Executive Committees, as well as the meeting and workshop organizers. The highlight of the meeting was the presentation by Pat Dehmer, Associate Director of DOE's Office of Basic Energy Sciences (BES). Pat outlined the chain of events that led to the large increase in funding for physical sciences, in particular BES, in the president's FY07 budget request. Pat also was very optimistic about the NSLS-II project and concluded her remarks by urging employees and users to contact their congressional representatives to thank them for the support. Users from both facilities also heard updates about the status of the CFN, NSLS-II, and the Lab in general, as well as a presentation on the NSLS five-year strategic plan.

In parallel to the Users' Meeting, a large number of NSLS staff worked hard in order to complete several major machine maintenance and upgrade tasks within a relatively short shutdown. In particular, one of the klystrons was replaced to improve the injection system. The new tube replaced a 1970's vintage model that frequently arced and interrupted injection for a few minutes while the tube recovered. With the new klystron, linac performance has been restored, and the trips have been eliminated. In addition, with the collaboration of the Case Center for Synchrotron Biosciences, the existing X9 beamlines were moved to X3 to make room for the construction of the new X9 undulator beamline.

During the past six months, we have worked to implement an Electrical Equipment Inspection (EEI) program at the NSLS. The goal of the program is to review and inspect electrical equipment and installations to ensure that equipment is free from reasonably foreseeable electrical risk of shock or fire. Equipment brought to the NSLS is to be well grounded, must have all conductors covered and inaccessible, and must be adequately fused. Users who plan to bring electrical equipment that is not labeled and listed with a Nationally Recognized Testing Laboratory (NRTL), e.g. Underwriters Laboratories (UL), should indicate this on their Safety Approval Forms. This equipment will be inspected by one of our Electrical Equipment Inspectors before it can be used at the NSLS. We are particularly interested in heating equipment and other systems capable of delivering significant voltage or current. Our inspectors will check your equipment, identify any concerns, and help determine what is needed for approval. Once approved, they will place a bar code on your system and enter it into our database. As long as you do not modify the equipment, it need not be re-inspected at future visits. This program is important, and with your help, these inspections will ensure that all the equipment brought to the beamlines is well assembled and electrically safe.

On the scientific programs front, we are delighted that the funding for the East Coast Structural Biology Research Facility, beamline X6A at the NSLS, has been renewed by the National Institute of General Medical Sciences (NIGMS). Dedicated to macromolecular crystallography, beamline X6A provides beamtime access to the structural biology community and, in particular, to young scientists in the process of establishing their research groups. This grant from NIGMS has enabled the NSLS to significantly expand its structural biology program, as well as to develop rapid access to beamtime and a remote user program.

Finally, recently the NSLS and BNL's Instrumentation Division were awarded a multi-year project to construct two fast-area detectors for the Linac Coherent Light Source (LCLS) project at the Stanford Linear Accelerator Center (SLAC). This is a very challenging project and an important milestone for the detector development effort at the NSLS. It will significantly expand the expertise of the detector and control group at NSLS, led by Peter Siddons. This group has successfully delivered a wide range of detectors to users during the last several years, including fast photon counting detectors and linear array detectors. The detectors developed for LCLS will also benefit many scientific programs at the NSLS.

2006 NSLS and CFN UEC Members and SpIG Representatives stand with DOE and BNL management.

Quite a Remarkable Spring: Notes from the 2006 NSLS-CFN Joint Users' Meeting

Kay Cordtz and Laura Mgrdichian, BNL Public Affairs Office

A rosy future was forecast for Brookhaven's user facilities at the first-ever joint meeting of the user communities for the National Synchrotron Light Source (NSLS) and the Center for Functional Nanomaterials (CFN), held May 15-17, 2006.

Sam Aronson

At the main meeting on May 16, held in BNL's Berkner Hall, officials from the Laboratory, the Department of Energy's (DOE) Office of Science, and the New York State congressional delegation painted an optimistic picture for an audience of several hundred current and prospective users of Brookhaven's cutting-edge science facilities – those that are currently in operation, planned and under construction, or eagerly anticipated. The Laboratory's interim director, Sam Aronson, welcomed the participants and outlined Brookhaven's "extremely strong science agenda in terms of ongoing research and new facilities that will maintain Brookhaven as a leader in world science." He said meetings like this are important places in which to foster new research collaborations and get updated on the status of work at the Lab. He said that the Laboratory's highest priority is the design and construction of the NSLS-II, which, along with the CFN, will give Brookhaven a powerful combination of cutting-edge research tools.

Robert McGrath

Following Aronson, Stony Brook University provost Bob McGrath gave an update on the search for a new Laboratory director. The search committee has created a list of potential candidates and is contacting key individuals of interest. McGrath said that the committee has a list of 40 people and will begin serious interviews with 10 of those candidates. The committee expects to have a recommendation to Brookhaven Science Associates in September.

The American Competitiveness Initiative

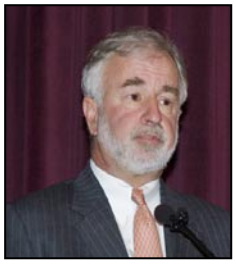
Pat Dehmer, director of DOE's Office of Basic Energy Sciences, outlined the chain of events that led to the Laboratory's bright future outlook, which she termed "a quite remarkable spring." Focusing on the rollout of the American Competitiveness Initiative (ACI) which she called "great news for the physical sciences," Dehmer explained that the ACI doubles funding for DOE's Office Science over the next 10 years. One of the ACI's focus areas is the tools of science, described as "unique, expensive, large-scale tools beyond the means of a single organization."

Patricia Dehmer

Dehmer said that she had anticipated that funding for Office of Science programs would be flat or would decline slightly, but that when the ACI was announced during the President's State of the Union speech in January, "a miracle occurred." Projected funding for the Office of Basic Energy Sciences has increased by 25 percent, in large part because the Office's work "aligns almost 100 percent with the ACI goals."

While Dehmer was optimistic about the construction of the NSLS-II, she cautioned that the project would have a long construction life, which will be filled with unanticipated challenges.

"You are embarking on a wonderful journey," she said. "You should be euphoric…and frightened. And you will vacillate between the two."



Tim Bishop

She concluded her remarks by urging employees and users to contact their congressional representatives to thank them for the support that resulted in this "completely unexpected" funding picture.

Speaking after Dehmer, Congressman Tim Bishop said that he is "so proud of this Lab, the people who work here, and the work that's moving America forward in so many different ways." To see the administration's proposed investments in science is "encouraging indeed," he said. Citing the FY06 budget language stating that it is the "sense of the Congress" that NSLS-II be built at Brookhaven, Bishop pledged to continue pushing for that result.

NSLS-II Update

The morning's next speaker, Steve Dierker, BNL Associate Director for Light Sources, is leading the effort to bring the NSLS-II to BNL. Noting that "the CFN will be producing materials that will be crying out to be characterized," he said that development of nanoscale materials will be critical for the development of future energy technologies.

"NSLS-II will be brighter than any existing light source. None of today's light sources were designed to probe materials with one-nanometer spatial resolution and 0.1 meV energy resolution," he said.

"The changes that NSLS-II brings will be transformative."

Dierker briefly described plans for the Joint Photon Sciences Institute (JPSI), intended to foster development of new techniques and capabilities. He thanked Stony Brook's Bob McGrath for helping to secure a $30 million commitment from New York State for a building to house the proposed institute.

Steve Dierker

The Center for Functional Nanomaterials

Doon Gibbs, Associate Laboratory Director for Basic Energy Sciences and Interim Director of the CFN, said that an active search is underway for a permanent CFN director, and he urged attendees to bring promising candidates to the attention of the search committee. He said a broader search effort will begin this fall, with an eye to have a permanent director on board by October 2007. Gibbs observed that the CFN building's structural shell is complete, and that more than half of the Center's equipment will be ordered by the end of May.

Doon Gibbs

The CFN, whose focus will be energy security, has added nine new scientific and technical staff members, bringing the total full-time staff to over 20. He added that the staff is becoming more collaborative and using bigger teams.

Gibbs said that along with NSLS-II, the CFN will "enable the nanoscience revolution," and he said that the joint user meetings should take place every year or two.

NSLS Update

An update on the work of the NSLS was given by Chi-Chang Kao, Interim NSLS Chairman. He said that FY06 was a "tough year," but observed that no layoffs were necessary, and he said that funding prospects for FY07 remain very good.

Kao said the NSLS continues to serve some 2,300 users per year, and announced plans for a BNL User Center to give users "one-stop shopping," for functions including check-in, badging, and housing. The user center will also have extended hours on nights and weekends. He said the NSLS hopes to continue to add more staff on the floor, which he termed important for both science and safety.

Kao addressed the issue of orbit stability at the facility, noting that the staff running the 65 operating beamlines is not the same staff that built them.

Chi-Chang Kao

"There has been some lack of understanding of the sensitivity of beamline optics to electron beam motion," he said. "The beamlines need regular alignment and performance calibration."

In conclusion, Kao promised both an aggressive upgrade plan for the facility and close NSLS-CFN coordination.

Building Safe Nanomaterials

As science ventures into the nanoworld, concerns will arise over the potential risks involved in producing and working with materials with properties that may not have previously been observed. Vicki Colvin, a chemistry professor from Rice University, spoke about developing nanomaterials with low environmental impacts.

The future of nanotechnology promises answers to key questions in science, she said. But in considering such advances in technology, scientists must deal with what Colvin termed the "Wow to Yuck Trajectory," in which the environmental impacts of new technology are only revealed after the technology is in wide use. Examples include DDT, which cured malaria but endangered birds, and refrigerants, which cooled our houses but led to a hole in the ozone layer.

"Early examination of nanomaterials' effects will create a responsible technology," Colvin said. "Scientific data and analysis should take the debate about the risks of nanotechnology to the highest possible technical level."

"It will be necessary to map out basic structure-function relationships for nanomaterials and biological impacts," she said. "Fundamental nanostructure will include both chemical and physical properties."

NSLS User Science Talks

Following a lunch break, users heard from several scientists who have conducted research at the NSLS.

Henry Chapman, a staff scientist at Lawrence Livermore National Laboratory, spoke on "Ultrafast Coherent Diffraction Imaging with a Soft X-Ray Free-Electron Laser." This vacuum ultra-violet free-electron laser is located at the Deutsches Elektronen-Synchrotron (DESY) in Hamburg, Germany. It generates pulses just 25 femtoseconds in duration with more than a trillion photons per pulse, and is the first free-electron laser to produce soft x-rays. It is ideal for high-resolution holography and imaging, Chapman said, and he showed this by displaying diffraction images and measurements.

Next, a talk on the "Engineering of Carbon Nanotube Structures" was presented by Pulickel M. Ajayan from the Department of Materials Science and Engineering at Rensselaer Polytechnic Institute. His talk focused on recent developments in his laboratory to fabricate carbon-nanotube-based structures that are tailored for various applications. Specifically, he discussed how he and his group create branched nanotube and nanotube-hybrid structures for applications such as sensors, electrical interconnects, and filters.

Before the afternoon break, Lawrence Shapiro, an associate professor at Columbia University, spoke on "Decoding Cell Adhesion with Protein Crystallography." Cell adhesion – connections that allow cells to stick together – is critical to the formation of tissues and complex cel-

(continued on page 11)

One User's Perspective

Chris Jacobsen, Users' Executive Committee Chair
Stony Brook University

These are exciting times for users of the National Synchrotron Light Source, as evidenced by the recent joint user meeting between the NSLS and Brookhaven's Center for Functional Nanomaterials (CFN). The NSLS now has a scientific vision for its continued operations and development, as outlined by Chi-Chang Kao (Interim Chair of the NSLS) in an extended presentation and discussion at the Users' Meeting. The Center for Functional Nanomaterials building is rising in front of our eyes, and promises to provide capabilities and research foci that are wonderfully complementary to those at the NSLS. The NSLS-II project has received CD0 approval from DOE, and in the last few months a planning effort involving a number of NSLS staff members has been launched. These developments promise to make Brookhaven *the* place to be for future research using synchrotron radiation.

We are grateful to have the opportunity to think of the challenges of moving from the present-day NSLS to its planned successor NSLS-II! In the short term, this puts strain on those staff who must balance responsibilities for NSLS science and operations with planning and R&D activities aimed at developing NSLS-II. In the long term, the payoff is clear, since Brookhaven has laid out ambitious goals for the capabilities NSLS-II is to provide. We can expect NSLS-II to open new doors for the programs of present-day NSLS users, as well as draw in new users with research programs that require the ultrabright beams expected from NSLS-II. For this reason, the User's Executive Committee has added to our group an NSLS-II special interest group (SpIG), and Paul Evans (UW Madison), a user of nanofocus capabilities at Argonne, has been elected as its first spokesperson.

At the outset of NSLS-II planning two years ago, the user community contributed heavily to a number of workshops to define new science opportunities and the capabilities needed to realize them. Since that time, the user community has heard less of the evolution of the plans for the facility, including important changes such as the possible loss of the infrared ring and the multiple changes in machine circumference. There was also considerable anxiety at the Users' Meeting concerning the inclusion of only five beamlines in the NSLS-II construction plan, while there are more than 60 beamlines now operating NSLS. The UEC recognizes the anxiety this has caused in the user community, and will continue to push Brookhaven to keep communication on NSLS-II plans central to its partnership with the user community in synchrotron radiation research. In many cases, answers can be provided already to the user community; as an example, we have heard a clear statement from DOE that they fully expect NSLS-II to change from a construction project to an operating facility with a much more complete suite of beamlines, and of course, the five-year strategic plan for NSLS emphasizes those beamline upgrades that can be transferred over to the NSLS-II.

We in the user community have our work cut out for us! Foremost for all of us is the fun we have in carrying out our research programs, and doing so with full vigilance for safe and secure operations. We also have an obligation to communicate both the joy and the usefulness of our research to our neighbors, our political representatives, and our colleagues; it is only by keeping the scientific achievements of synchrotron radiation research visible in the community-at-large that we are able to buttress support for our work. We also have the privilege and duty to keep up the dialog on the ongoing development of NSLS, and the future capabilities and access modes of NSLS-II. These are not just the responsibilities of the UEC, but of all of us who benefit from synchrotron radiation research facilities at Brookhaven!

I'm very fortunate to be in the same department as Peter Stephens, the outgoing chair of the UEC, so that I can track him down for advice as we move forward! Peter has brought incredible energy and humor to the job of steering the UEC in the past year, and he has earned our thanks. And now it's my turn to take the helm of the UEC, continuing in a path of involvement at the NSLS that began when I did research here as a graduate student 22 years ago (yikes!) and started as a faculty member at Stony Brook 15 years ago (yikes again!). I look forward to working with all of you as we work together on new science using NSLS today and NSLS-II and the CFN in the future!

I encourage all users to contact me with any questions or concerns at *Chris.Jacobsen@stonybrook.edu*.

Update on the X27A Micro-Spectroscopy Facility Beamline

James M. Ablett, BNL-NSLS

We are now into the third cycle of general and contributing user operations at NSLS hard x-ray micro-spectroscopy facility beamline X27A. A smooth transition from commissioning to operations during the fall of 2005 provided immediate implementation of a wide and diverse research program involving an extensive range of institutions: Stony Brook University, Rutgers University, BNL Environmental Sciences Department, Miami University, Institute of Nuclear Physics (PAN) Poland, University of Western Ontario, Natural Resources Canada and IMEC of Belgium. Ongoing research areas include the study of manganese and arsenic speciation/distribution in a range of environmental sensitive samples; the nature of titanium incorporation through applied creams into human skin layers; plutonium and uranium distribution/speciation in contaminated soils; polarization-dependent thorium EXAFS measurements on small apatite single crystals; understanding strontium incorporation in osteoporotic bone; and determining trace-metal distribution in diseased brain tissue. The success of implementing these research areas, and the high-quality data being collected at this facility, is largely due to the good stability of the NSLS x-ray ring, which is especially important for microprobe beamlines. Further details and an extensive description of the X27A micro-spectroscopy facility can be found in Nucl. Instrum. & Methods in Phys. Res. A 562(1) 487-494, 2006 and at: *http://www.nsls.bnl.gov/beamlines/x27a/*.

An example of an area of research initiated at X27A is the investigation of tantalum and tungsten thin-film diffusion barriers that are used in copper interconnect technology. Using the x-ray microbeam, buried thin-film layers beneath copper are investigated using fluorescence x-ray absorption spectroscopy. The ability to characterize these films, which are often amorphous and cannot be studied using x-ray micro-diffraction, is an important area of applied research within the semiconductor industry. Currently, preliminary experiments on thin-film interconnect test structures have been conducted and analyzed, and these encouraging results have initialized the fabrication of 'real' systems for future in-situ measurements. Preliminary measurements on passivated 10 μm wide, 120 nm thick Cu interconnects, separated by 40 μm and 90 μm 'field' regions, and with a 4 nm thin ALD Ta_3N_4 barrier layer have been performed. Cu Kα fluorescence recorded at an incident x-ray energy of 9.5 keV, and Ta $L\beta_1$ fluorescence recorded at the peak of the Ta white-line at ~11.142 keV, are shown in **Figure 1**. The Ta L_2 XANES on a PVD Ta_2N (5 nm)/Ta (20 nm) blanket film and a 4 nm ALD Ta_3N_4 barrier used in a copper interconnect test structure are shown in **Figure 2**. As can be seen, the nitrogen content within the Ta_2N barriers is clearly evidenced by the spectral signature of the near-edge region and the shift in the absorption edge towards higher x-ray energies, compared to the Ta_2N (5 nm)/Ta (20 nm) blanket film, which is of predominantly Ta character.

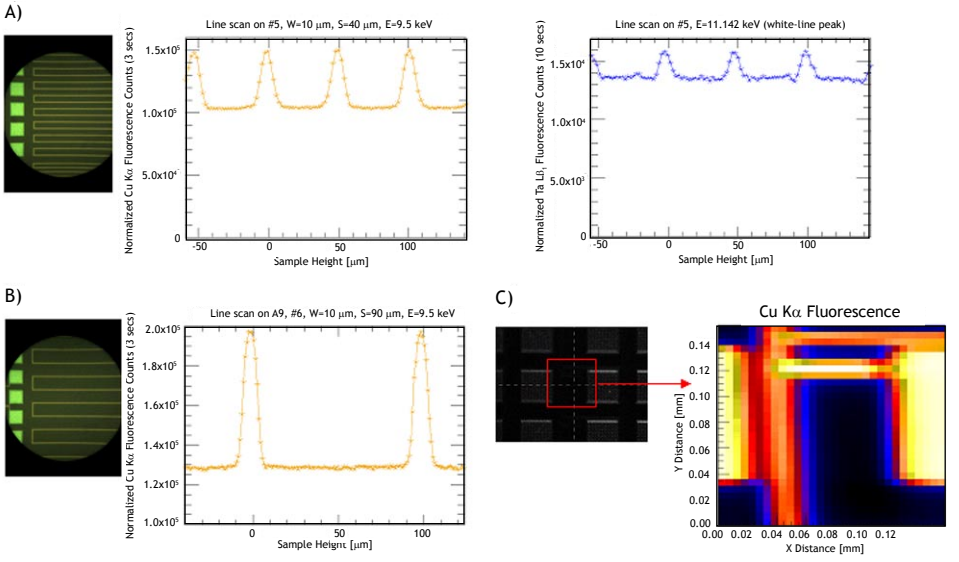


***Figure 1**. X-ray fluorescence line scans across 10 μm-wide copper interconnects spaced at (A) 40 μm and (B) 90 μm. (C) Cu K_α fluorescence image of a pad structure.*

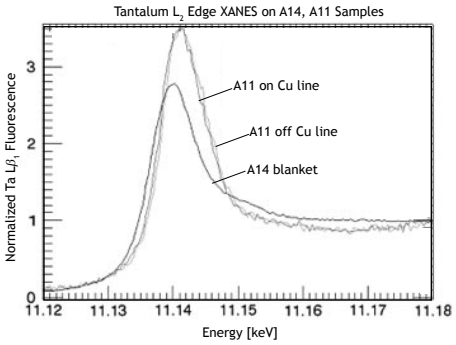
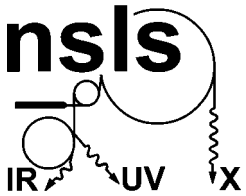


***Figure 2**. Ta L_2 absorption-edge XANES on Ta_2N (5 nm)/Ta (20 nm) blanket film and the Ta_2N barrier on a Cu interconnect patterned sample, both on and off the interconnect lines.*



X-Ray Ring Long-Range Schedule

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VUV-IR Ring Long-Range Schedule

September 2006

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3 0000 Ops.	**4 Lab Holiday** 0000 Ops.	**5** 0800 Maint.	**6** 0000 Maint.	**7** 0000 Ops.	**8** 0000 Ops. 1800 Timing	**9** 0000 Ops.
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October 2006

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November 2006

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December 2006

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NSLS Accelerator Complex Update

Erik Johnson, Associate Chair for Operations and Engineering

As of June 1st the reliability of both the VUV and X-ray rings continues to exceed 95% for FY06. The brief spring shutdown was primarily focused on transferring the Case Western X9 beamline to its new home at X3 and the replacement of klystron 3, but there was also a lot of the nuts-and-bolts-type maintenance that keeps things running.

The power substation maintenance revealed three trip coils which did not function properly when tested. These were either repaired or replaced to keep the circuit protection function of the substations operational. Other 'utility' work included the rebuild of the liquefier for the X17 cryogenic system and the replacement of the heat exchangers for x-ray RF system 1.

We also made significant progress with the Electrical Equipment Inspection (EEI) during the shutdown. The goal of the program is to review and approve electrical equipment and installations to ensure that approved equipment is free from reasonably foreseeable risk due to electrical hazards. As of the end of May, we had 1200 pieces of equipment on lists awaiting inspection and have successfully inspected 250 pieces.

All equipment, either on hand or acquired in the future, owned by either users or the facility, which operates or is powered by voltages outside range A, is included in the program. Visit the EEI website *http://www.nsls.bnl.gov/organization/OpsEng/ElectricalSys/EEI/* to learn more about the program and how it applies to your equipment. The full implementation of the program is expected to take some time, but start early; there's a lot of equipment out there!

Looking ahead, in the upcoming winter shutdown the major planned installation is a new vacuum chamber for the X9/X10 dipole magnet. This will provide the aperture and cooling protection required to operate the new X9 insertion device presently planned for installation in December 2007. The Winter 2007 schedule for operations after the shutdown will be set in September 2006. If there are any special scheduling considerations please let me know by late August.

The 'new' X3 beamline under construction during the Spring 2006 shutdown.

Beamline Safety System Configuration Control

Andrew Ackerman, NSLS Safety Officer

There has been much effort directed toward improving control of the configuration of beamline shielding and exclusions zones during the last several years. All of our "Safety Checklists" have been reworked, new photographs have been taken and attached to the beamlines and new labels have been affixed to the synchrotron scatter shielding. The NSLS Operations Group has been working with the staff at each beamline on this project and the result is a much improved system for assuring that the components we all rely on for radiation protection are where they belong before the safety shutter is opened on any beamline.

There is more to come. A group has been assembled and asked to review our current procedures for this configuration control to determine what can be improved. A report is expected soon and it will likely recognize the recent work completed and call for even better labeling of scatter shielding and rework of the accelerator and beam line safety system work authorization permits. These

permits are already required whenever Bremsstrahlung shields, exclusion zones, or synchrotron scatter shielding is removed from a line to help ensure that these components are properly returned and to provide a mechanism to trigger needed radiation surveys. By the time this article is published, we will have more detail from the review group, so I will wait until then to explain the suggested improvements to this program.

NSLS use of permits, labels, pictures, and checklists to ensure that beamline safety components are properly assembled before allowing user access to the safety shutter is a mature and effective program that will be made even better, but no matter how well organized, this aspect of the NSLS safety program remains an administrative control and so relies on the careful and attentive action of our staff and visitors. The risks under control here are noteworthy. Synchrotron scatter from an unshielded optical component on an x-ray line can result in radiation levels close to that component in the Rad/hr range. The Bremsstrahlung cone generated when the electron beam 'dumps' in either storage ring can deliver between 50 and 100 Rads. There are many variables for both circumstances, making it difficult to predict exactly what radiation levels could result, but it is clear that serious radiation dose risk can be generated and that the position of synchrotron scatter shielding and Bremsstrahlung collimators, backstops, and exclusion zones is important.

The safety of everyone at the NSLS relies on attention to these issues. Our record has been excellent, with no person ever receiving a significant radiation dose at the facility. Shielding and exclusion zones must be moved for beamline maintenance and adjustment. That is expected and requirements are in place to assure the needed oversight. Please remember how important those requirements are and ALWAYS call the Operations Coordinator (Op Co) when there is the need to make ANY change to the beamline safety configuration or for vacuum bleed up. The Op Co provides impartial oversight to these activities and he or she may help you avoid making a significant mistake. They are always available and prefer that you call.

Notes from the 2006 NSLS-CFN Joint Users' Meeting

(continued from page 5)

lular networks, such as those that make up the nervous system. These connections are made possible by a few cell-surface protein families. Shapiro discussed how, at the NSLS and other synchrotrons, high-resolution protein-crystal structures are beginning to reveal the atomic-level mechanisms of cell adhesion.

Other Notables

Each year, the NSLS Users' Executive Committee (UEC) presents one user with the UEC Community Service Award, which honors hard work and dedication toward bettering the experience of users and the user community. At the main meeting, UEC Chair Peter Stephens presented this year's award to Bob Sweet (BNL-Biology). More details on this year's award can be found on page 12 of this Newletter.

At the conclusion of the main meeting, participants attended the annual poster session and vendor exhibition. Hors d'oeuvres were served as attendees mingled and talked, making for a lively, enjoyable event. Awards were presented to the top student and postdoc posters, which were on display in the NSLS lobby during the month of June. The winners were: Elena Loginova (Rutgers University), Seo-Young Kwak (BNL-NSLS), Shuguo Ma (BNL-Chemistry), Minhua Shao (Stony Brook University), Jae-Hyuk Her (Stony Brook University), and Ariane Kretlow (Robert Koch Institute, Germany). Each winner received a BNL certificate and a $50 American Express gift certificate. Additionally, the Synchrotron Catalysis Consortium gave out two poster prizes of its own. First prize went to Shao, and second prize was awarded to Wen Wen (BNL-Chemistry).

Poster winners (from left) Shuguo Ma, Minhua Shao, Ariane Kretlow, Elena Loginova, Seo-Young Kwak, and Jae-Hyuk Her.

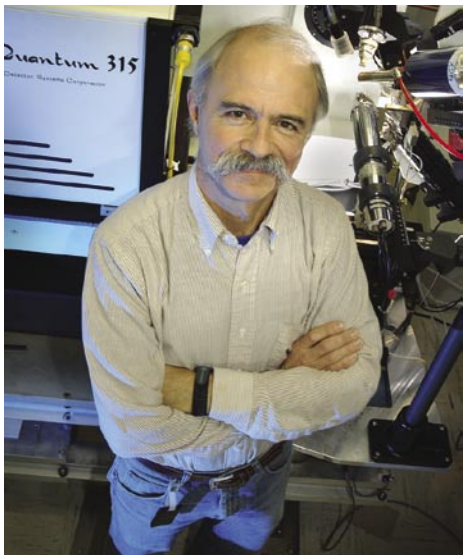
During the two days after the main meeting, workshops were held at locations across the Laboratory. They were *"Synchrotron Catalysis Consortium: New Opportunities for in-situ XAFS Studies of Nanocatalysis,"* organized by Simon Bare (UOP) and Anatoly Frenkel (Yeshiva University); *"Soft Matter and Biomolecular Materials: X-ray Scattering Enabled by High Brightness Beamlines,"* organized by Ben Hsiao (Stony Brook University), Lin Yang (BNL-NSLS), Elaine DiMasi (BNL-NSLS), and Ron Pindak (BNL-NSLS); *"Nanoscale Correlations and Heterostructures,"* organized by Jim Misewich (BNL-Material Sciences) and Tony Heinz (Columbia University); *"Chemical and Biological Applications of X-ray Emission Spectroscopy,"* organized by James Penner-Hahn (University of Michigan) and Trevor Tyson (New Jersey Institute of Technology); "*Platforms for the Integration of Biological Systems into Nanomaterials and Interfaces,"* organized by Oleg Gang (BNL-CFN), Daniel Van Der Lelie (BNL-Biology), and Molly Frame (Stony Brook University); and *"VUV Radiometry,"* organized by Jeff Keister (SFA, Inc).

Bob Sweet, the 2006 UEC Community Service Award Recipient

Peter Stephens, Past Users' Executive Committee Chair
Stony Brook University

For his extraordinary service, the User Executive Committee has chosen Robert M. Sweet for the National Synchrotron Light Source (NSLS) Community Service Award.

Biological crystallography has emerged as an extremely high profile research area with synchrotron radiation, and Bob has made numerous contributions to create and sustain a vibrant community of users at the NSLS. Bob is the Principal Investigator of the Macromolecular Crystallography Research Resource (PXRR), which provides facilities and support at the NSLS for the benefit of outside and in-house investigators. The PXRR is supported by the NIH's National Center for Research Resource and the DOE Office of Biological and Environmental Research in its mission to create optimal facilities and environments for macromolecular structure determination by synchrotron x-ray diffraction. With a staff of about 24, the PXRR innovates new access modes such as FedEx crystallography, builds new facilities, develops remote participation software, collaborates with outside groups, teaches novice users, and supports visiting investigators with seven-day, 20-hour staff coverage.



Bob Sweet

The PXRR now includes six beamlines at X8C, X12B, X12C, X25, X26C, and X29. Bob's work on developing macromolecular crystallography at the NSLS helped in a continual push toward improved performance for NSLS beamlines. The X25 wiggler provided an early demonstration of the potential for insertion devices at NSLS, and the minigap undulator at X29 has added to that innovation, and inspired upgrades to minigap undulators for other beamlines, notably X25.

Bob's efforts have led to the development of sample loading automation techniques at NSLS, software that enables easy user experimental interaction, and the scope of the PXRR has established standardization across many NSLS beamlines, enabling users to move easily from one beamline to the next.

Bob is warm, easy to talk to and accessible to regular users in the community. Through all his efforts, Bob has likely been the single most important factor in keeping the NSLS on the cutting edge of macromolecular synchrotron crystallography.

It is thus with great pleasure that we give Bob Sweet the NSLS Community Service Award for 2006.

Current UEC Members and SpIG Representatives

Term May 2006-2007

Users' Executive Committee

Chair	Chris Jacobsen (Stony Brook Univ.)
Past Chair	Peter Stephens (Stony Brook Univ.)
Vice Chair	TBD
Member	Steve Almo (AECOM)
Member	Chris Cahill (George Washington Univ.)
Member	Joe Dvorak (Montana State Univ.)
Member	Daniel Fischer (NIST)
Member	Howard Robinson (BNL-Biology)
Ex-Officio	Chi-Chang Kao (BNL-NSLS)
Ex-Officio	Kathy Nasta (BNL-NSLS)
Ex-Officio	Lisa Miller (BNL-NSLS)

Special Interest Groups

Bio. Scattering	Alexei Soares (BNL-Envi. Sci.)
High Pressure	Jiuhau Chen (Stony Brook Univ.)
Imaging	Jeff Gillow (BNL-Envi. Sci.)
Industrial	Simon Bare (UOP LLC)
Infrared	Jiufeng Tu (City College of NY)
NSLS-II	Paul Evans (Univ. Wisconsin-Madison)
Nuclear Phys.	Mahbub Khandaker (TJLab)
Students/Postdocs	Dean Connor, Jr. (BNL-NSLS)
Time-Resolved	John Sutherland (BNL-Biology)
Topography	Michael Dudley (Stony Brook Univ.)
UV Photoemission	Jeff Keister (SFA, Inc.)
XAFS	Paul Northrup (BNL-Envi. Sci.)
X-Ray Scattering	Cecilia Sanchez-Hanke (BNL-NSLS)

News from the User Administration Office

Kathleen Nasta, NSLS User Administrator

Some highlights since our last update:

• We completed the first Joint NSLS/CFN Users' Meeting successfully. Although there are always improvements to be made, most of the 416 participants of this year's meeting were pleased with the joining of the two user communities, the main meeting and workshop programs, and logistical arrangements. There were six workshops offered, 34 vendors in exhibition, and 47 posters displayed. New ideas for next year that were put forward include holding workshops and/or special times for NSLS/CFN technical staff to meet with vendors for product discussions, and holding a working luncheon to gather Proposal Review Panel members.

• In early May, a proposal was made to the management of BNL to create a new "Visitors' Center" at the new Research Support Building (to be opened in Fall 2006). The intention of the new Center would be to allow all users and guests to complete their check-in process there. The Center would be open for extended hours (including the weekends) to accommodate users and guests that cannot arrive during normal working days and hours. At press date, endorsement of this proposal was not confirmed but is expected. However, at the very least, the new Research Support Building will contain most user services all in one place: housing, transportation, badging, banking and more.

• We are establishing a new Proposal Review Alternative Panel group. This group will be comprised of a small number of scientific personnel with broad subject-matter expertise. Face-to-face meetings of the group will be held in order to review proposal issues such as appeals based on score differentials.

• Finally, please take a look at the new website for users on the NSLS homepage entitled "User Information." We have given considerable thought to making it appealing, utilitarian, and organized so users can find all the information they need. If there is anything missing, or to make a comment, as always, please contact User Administration at: nslsuser@bnl.gov or 631-344-8737.

Future Crystallographers Attend RapiData 2006 at NSLS

Liz Seubert, BNL Public Affairs Office

Forty-eight future crystallographers from around the world gathered at BNL this spring for RapiData 2006, a course intended to introduce students to the best people, equipment and techniques in the macromolecular x-ray crystallography field.

The students and instructors, RapiData class of 2006.

The annual course is offered by BNL's Biology and NSLS departments and funded by the NIH's National Center for Research Resources and DOE's Office for Biological & Environmental Research.

This year's program ran April 23-28 and began with lectures and tutorials. Then, students were guided through a marathon, 60-hour data-collection session on six NSLS beamlines.

Organizers included Bob Sweet, Denise Robertson and Alex Soares (BNL-Biology), with additional help from members of the PXRR (the Biology and NSLS Macromolecular Crystallography Research Resource), NSLS staff, and outside teachers.

The International Union for Crystallography and the US National Committee for Crystallography provided a grant to help half a dozen Latin American students attend the course. Additional supporters included Brookhaven Science Associates, the NSLS, and several equipment vendors and drug companies. For more information, go to: *www.px.nsls.bnl.gov/RapiData2006/*.

NSLS' Youngest Scientists Learn from Light on "Take Our Daughters and Sons to Work" Day

Lisa Miller, BNL-NSLS

On April 27, more than 30 daughters and sons of NSLS users and staff learned about some of the scientific programs at the NSLS, and even performed their own scientific experiments. The one-day visit was part of the national "Take Our Daughters and Sons to Work Day."

Upon arriving at the NSLS, the children learned that the facility produces many types of light, from microwaves to x-rays, and that this light has many applications in many fields, including electronics, catalysis, microscopes, and medicine. Then the fun started!

Participants in the 2006 "Take our Daughters and Sons to Work Day" at the NSLS

This year's program focused on liquid nitrogen, which is used by most scientists at the NSLS. The children were taken down to the NSLS experimental floor, where they were given 30 minutes to count the number of beamlines that used liquid nitrogen. They questioned beamline scientists and learned that liquid nitrogen is used for cooling samples, detectors, magnets, and monochromators. Upon summing the beamlines at the end of the tour, the children were amazed to find that more than 40 beamlines use liquid nitrogen on a daily basis.

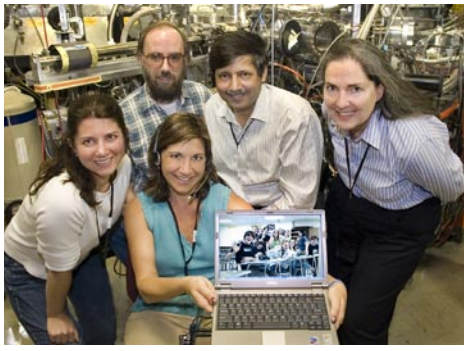
Next, the children experienced the wonders of liquid nitrogen first-hand. By immersing an inflated balloon in liquid nitrogen, they discovered that the air inside of the balloon contracts, and then re-expands when warmed up. The children also learned that a tiny pinhole in a ping pong ball will cause the ball to spin wildly after being removed from liquid nitrogen. Other experiments included making a liquid nitrogen banana-hammer and an "ice egg" with a water balloon. They also listened to a "boiling" tea kettle and learned about the wonders of superconductivity, a phenomenon that becomes possible when certain materials are cooled to very low temperatures using liquid nitrogen.

But perhaps the most memorable experiment was the "grand finale": The students mixed cream, sugar, and strawberries with liquid nitrogen to make the fastest (and perhaps tastiest) ice cream ever.

Students Experience the NSLS Via Webcast

Laura Mgrdichian, NSLS Science Writer

Recently, more than 20 chemistry and earth-science students from Sayville High School participated in a unique data-analysis project at NSLS beamline X15B — without ever entering the NSLS. Via webcast, they watched as their teachers, assisted by scientists from Stony Brook University's (SBU) Geosciences Department and Brookhaven Lab's Environmental Sciences Department, analyzed soil samples from a creek near the school. This arrangement, which could become a model for other schools nationwide, allowed an entire classroom of students to remotely observe and interact with their teachers in real time. Thus, they were able to share in the research experience without being present.



Participants in the X15B webcast, from left: Janet Kaczmarek, Paul Northrup, Adriana Adler, Mirza Beg, and Jen Clodius.

The soil samples were taken from various locations along the creek, from wetlands to uplands, and from various depths. The students have studied water and soil samples from the creek in past work, but this exercise provided the first molecular-scale information about the soils.

On April 25, as the students watched over the web (using VRVS, the Virtual Room Videoconferencing System), teachers Adriana Adler and Janet Kaczmarek analyzed the samples at the NSLS to determine what types of sulfur compounds are present in the soils, and in what amounts. Adler and Kaczmarek (who teach chemistry and earth science, respectively) mounted the samples into the "hutch box" located at the beamline and scanned each sample with a beam of x-rays. This resulted in a set of x-ray absorption "spectra" for sulfur — measurements that show how the sulfur compounds in the soils absorbed the x-rays. Since every compound absorbs x-rays differently, this analysis uncovered the identity and relative amount of each sulfur compound present. The proportions of these compounds reveal important information about the soil samples and the wetlands ecosystem, such as how organic matter decays in soils at different depths and under different conditions. The sulfur compounds can also indicate how environmental contaminants will behave in the wetlands.

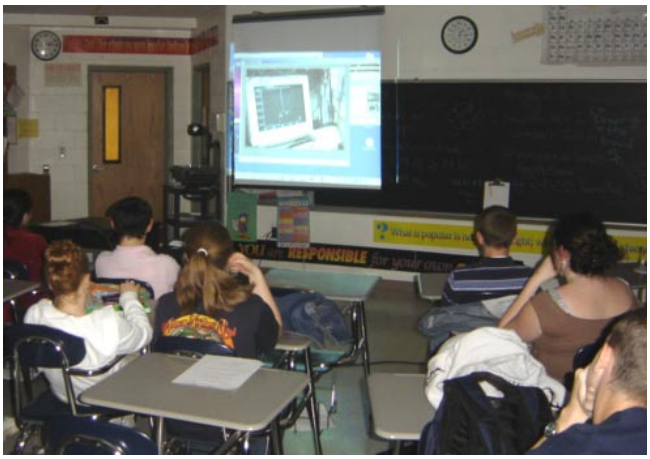
As Adler and Kaczmarek worked at the beamline, they were able to see their students. Simultaneously, their students could see them. Thus, the webcast provided valuable two-way interaction.

"The webcast was a fantastic experience for students," said Adler. "We attempt to provide many opportunities for hands-on laboratory exercises for our students. Bringing the NSLS beamline 'into the classroom' and allowing students to direct experiments at NSLS from the classroom opened a valuable teaching tool for us at Sayville High School."

Kaczmarek commented, "This was an invaluable experience both for myself and the high school students involved with the webcast. I don't think many high school students can say that they were part of an experiment run at world-known BNL. I see much potential with this type of educational outreach and the benefits to all parties involved. It is all very exciting!"

The webcast stems from a Research Experience for Teachers (RET) project called "High School Teacher Training in an EMSI: Bringing First-Hand Research Experiences from the Lab to the Classroom," which is being conducted at the Center for Environmental Molecular Science (CEMS) at SBU. This project is a collaboration between CEMS and an initiative within the Brookhaven Lab Office of Educational Programs (OEP) called "Building Leadership to Expand Participation in Environmental Molecular Science." Both programs are funded through National Science Foundation (NSF) supplements to CEMS, which is a collaboration between SBU Geosciences and BNL Environmental Sciences departments and is co-funded by the NSF and the U.S. Department of Energy. As part of the RET program, both Adler and Kaczmarek have undergone research training at CEMS, focused on the integration of molecular-scale approaches for studies of environmental chemistry. Both teachers also attended an NSLS-sponsored introductory seminar on x-ray absorption spectroscopy applications. The CEMS personnel who enabled this project include Richard Reeder (Director of CEMS and Professor of Geoscience at SBU), Mirza Beg (Environmental Education Specialist at CEMS), Paul Northrup (CEMS Principal Investigator from BNL's Environmental Sciences Department), and Marianna Kissell (a CEMS graduate student conducting research at NSLS beamline X15B). The project was also enabled by OEP personnel, including Ken White (OEP Manager), Jen Clodius (Senior Educational Programs Representative), and Scott Bronson (Educational Programs Administrator). OEP provided guidance on the use of the VRVS technology and made the broadcast successful. Clodius coordinated the webcast at the beamline, while Bronson managed it at the school.

Northrup, a beamline scientist for X15B, devoted beam time, as well as his own time and expertise, to the project. His efforts were critical to the project's success. Northrup, along with Kissell, also provided scientific support to the teachers. Administrative support was provided by the chair of the Science Department at the Sayville High School, Brian Vorwald. Mike Tabor, head of the school's Technology Department, provided computer and network support.



Students tune in to the X15B webcast.

The outcome of the webcast was very positive. It generated considerable interest among the students. During the experiment they asked questions about x-ray absorption spectroscopy, beamline operation and safety procedures, the results of the analysis, and the NSLS in general. The organizers of the webcast are hopeful that this event could serve as a pilot for other scientific facilities and schools across the country.

Northrup and beamline X15B are supported by the Office of Biological and Environmental Research (Environmental Remediation Sciences Division) within the U.S. Department of Energy's Office of Science, through the BNL EnviroSuite initiative.

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NSLS Building 725B
P.O. Box 5000
Upton, NY 11973-5000

Call for NSLS General User Proposals

For Beam Time in Cycle	Deadline
January - April 2007	Monday, October 2, 2006

General User Proposal and Beam Time Request Forms with instructions can be found at:
http://www.nsls.bnl.gov/users/usersguide/BT-gu.htm
Proprietary Proposal Forms with instructions can be found at:
http://www.nsls.bnl.gov/users/usersguide/BT-proprietary.htm

Safety Approval Forms

Safety Approval Forms (SAFs) are required for every experiment. Your SAF must be submitted online **at least one week before** your scheduled beam time. To submit, go to:

https://pass.nsls.bnl.gov/

NSLS User Administration Office

User Information, Registration, and Training:
Phone: (631) 344-USER Fax: (631) 344-7206

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http://www.nsls.bnl.gov/