brookhaven national laboratory

newsletter

national synchrotron light source

April 2004

NSLS-II Workshop Lights Brookhaven National Laboratory

Laura Mgrdichian, NSLS Science Writer

On March 15, 2004, approximately four hundred registered attendees participated in the NSLS-II Workshop at Brookhaven National Laboratory to support the proposed facility, a world-leading synchrotron light source that will facilitate cutting-edge research in the biological, material, chemical, environmental, and physical sciences.

The current National Synchrotron Light Source is one of the world's most widely used scientific facilities. Each year, about 2,400 researchers from more than 400 universities, government laboratories, and companies use its bright beams of x-rays, ultraviolet light, and infrared light for research. The scientific productivity of the NSLS user community is very high and has widespread impact, with approximately 800 publications per year, of which some 130 appear in so-called premier scientific journals.

Though the current NSLS has been continually updated since its commissioning in 1982, today the practical limits of machine performance have been reached. In order for the productivity of its user community to continue, and in order to tackle the 'grand challenge' scientific problems of tomorrow, plans to upgrade the NSLS are under way. The centerpiece of the proposed "NSLS-II" will be a state-of-the-art, medium-energy electron storage ring designed to deliver world-leading x-ray brightness and flux, more than 10,000 times brighter than the current NSLS. This facility, which will also include full-energy injection for constant intensity as well as a dedicated infrared ring, is expected to have profound impact on a wide range of scientific disciplines and initiatives and lead to many exciting discoveries in the coming decades.

Speakers at the NSLS-II Workshop at BNL included: (from left) BNL Director Praveen Chaudhari, Battelle President and CEO and current BSA Chair Carl Kohrt, Nobel Prize-winner Roderick MacKinnon of Rockefeller University; DOE Brookhaven Area Office Manager Michael Holland; DOE's Office of Basic Energy Sciences Associate Director Patricia Dehmer; Associate Laboratory Director for Light Sources and National Synchrotron Light Source Department Chair Steven Dierker; and IBM Senior Vice President and Director of Research Paul Horn.

The NSLS-II workshop kicked off with opening remarks from Steve Dierker, the Associate Laboratory Director for Light Sources, Chair of the National Synchrotron Light Source (NSLS), and the workshop's host. "The design of NSLS-II has surpassed anything that has ever been built," said Dierker, setting the tone for the enthusiasm and interest

INSIDE THIS EDITION

Associate Laboratory Director for Light Sources and NSLS Chair Steve Dierker enthusiastically welcomed the workshop participants and speakers.

that NSLS-II has generated. "The science that will come out of this will be very, very exciting."

Dierker then introduced the morning's first speakers: Brookhaven Lab Director Praveen Chaudhari and the Department of Energy's Brookhaven Area Office Manager, Michael Holland, who matched Dierker's enthusiasm for the days ahead. The stage was then turned over to the workshop's invited distinguished guests.

Addressing a packed auditorium, the morning speakers at the NSLS-II Workshop

Patricia Dehmer, Associate Director of the Office of Basic Energy Sciences, gave an inspiring and positive speech in support of NSLS-II.

– including NY Congressman Sherwood Boehlert, Chairman of the House Committee on Science, Patricia Dehmer, Associate Director of the DOE Office of Basic Energy Sciences, NY Congressman Tim Bishop, and Battelle President and CEO Carl Kohrt – praised and pledged their support for the proposed NSLS-II facility, a world leading synchrotron light source to be built at Brookhaven.

In addition, the two scientific speakers, the 2003 Nobel Prize in Chemistry recipient, Professor Roderick MacKinnon of Rockefeller University, and Dr. Paul Horn, the Senior Vice President and Director of Research at IBM, gave stimulating talks that hinted at the new, exciting science NSLS-II will enable.

NY Congressman Tim Bishop spoke about the importance of NSLS-II to Brookhaven Lab and the scientific community.

Their enthusiasm was shared by Boehlert, the keynote speaker, who said, "One doesn't need a degree in physics to understand the value of a scientific tool that furthers human understanding of matter while answering practical questions in materials science and biology; a tool that is of use to both academic and industrial researchers; a tool that attracts the best researchers from throughout the world."

"The U.S. simply must invest to upgrade its capabilities in this area, building on the expertise that Brookhaven and the researchers who use its facilities have developed over the last few decades," he continued.

"NSLS-II is something we need to do," Dehmer agreed in her talk. "I want you to know that I give you my commitment that NSLS-II will happen. Never doubt my resolve, never doubt your own power, never doubt the power of a great idea."

Bishop imparted a similar message. "We have such confidence in what this Lab can do and what the scientists in this Lab can do. And the best scientists in the world deserve the best equipment," he said.

Kohrt, who is also the Board Chair of Brookhaven Science Associates, the company formed by Battelle and Stony Brook University to manage Brookhaven Lab, also spoke enthusiastically about the new facility. "Thank you to the DOE and the visionaries that started this," he said of NSLS-II. "The journey has just begun."

But Boehlert also reminded the workshop participants of some very real issues, including the financial constraints that are involved. His main message: Nothing is certain in politics, and the realization of NSLS-II largely depends on the ability of its potential users to express why the facility is necessary. "I will do everything I can to help you, but I can't do it alone," he said. "Lawmakers need to hear from you, and especially from those of you in industry and your CEOs, why a light source, or any other piece of equipment or area of research, is important. They - we - need to learn from you what the nation will actually be giving up if you aren't able to succeed."

Carl Kohrt, the President and CEO of Battelle and the current chair of Brookhaven Science Associates, also offered his support for NSLS-II.

Seeming to answer this challenge, Horn gave a specific example of how his company would benefit from NSLS-II. In his presentation on nanoscience, Horn discussed why progress in improving the performance of silicon transistors, the tiny circuit elements that make comput-

Keynote speaker NY Congressman Sherwood Boehlert (left) gives an enthusiastic hello to NSLS-II Workshop participants: Marge Lynch, Associate Lab Director for Public Affairs; Praveen Chaudari, BNL Director; Steve Dierker, Associate Lab Director for Light Sources and NSLS Chair.

NY Congressman Sherwood Boehlert, Chairman of the House Committee on Science, the workshop's keynote speaker and distinguished guest.

ers work, has slowed, and how NSLS-II could open doors to new materials that may replace silicon transistors.

The silicon transistor, Horn explained, has developed into a nanodevice. But any further miniaturization has all but halted because researchers can't solve the problem of transistor cooling – the devices are so small that they conduct a relatively large amount of current and produce a lot of heat even when they are

IBM Vice President for Research Paul Horn, who gave an excellent talk on how NSLS-II could help revive the silicon transistor industry.

"turned off." Using bulky cooling systems isn't an option because it negates the goal of making silicon transistor-based devices smaller.

As a result, technology development companies have moved in a different direction, and are trying to gain better transistor performance without scaling them down. This involves researching new materials, which, Horn said, is where NSLS-II would step in as a valuable research tool.

"We are at a paradigm shift, where the physics that comes from synchrotrons like NSLS-II is absolutely critical," he said. "We can use x-rays to look at new materials and their features at an incredibly fine scale."

Carbon nanotubes – cylindrical carbon molecules only a few nanometers in diameter and up to several microns in length – are an example of a material with the potential to replace silicon transistors. At present, however, many more silicon transistors can fit onto a computer chip than carbon nanotubes, and more research on carbon nanotubes needs to be done to make them practical. Synchrotrons like NSLS-II, Horn said, are "designed to do this type of physics."

Horn hailed NSLS-II as a gateway into cutting-edge nanoscience research, a field that is expected to become a major engineering discipline that will integrate many fields – physics, materials science, chemistry, and biology – reduce the cost of manufacturing, ultimately reducing costs for the consumer, and generally revolutionize the information technology and electronics industries.

In his talk, MacKinnon also clearly explained how NSLS-II would further his work, which he said would be "impossible" with the current NSLS. He described his Nobel prize-winning research on the structure of a cell membrane protein, called an ion channel, which was performed, in part, at the existing NSLS. His results are very important, as they will help researchers better understand many essential cellular functions.

In the meantime, however, there are still many other membrane proteins to study, which, according to MacKinnon, make up between 25 and 30 percent of all proteins. "We know almost nothing about this important class of proteins," he said, and emphasized the role that NSLS-II would play in changing that fact. "There is no other way to study these proteins at the level a synchrotron allows."

Roderick MacKinnon, winner of the 2003 Nobel Prize in Chemistry, discussed how NSLS-II would enable further research on ion channels.

"We're behind," he added. "Our need is getting severe."

MacKinnon also stressed the importance of the facility's Northeast location. NSLS-II would service the many research institutions in the region, he said, and it is essential for researchers whose work requires frequent visits to have local access to the facility.

During the afternoon, the workshop participants divided into seven breakout sessions, giving them a chance to provide input and feedback on the design and parameters of NSLS-II. The topics were spectroscopy, scattering, small angle x-ray scattering and x-ray photon correlation spectroscopy (SAXS/XPCS), nanoprobe/imaging, macromolecular crystallography, infrared, and inelastic x-ray scattering.

Over 400 registered attendees spilled out of Brookhaven's Berkner Hall auditorium for the NSLS-II Workshop on March 15, 2004.

Notes from the UEC

Tony Lanzirotti, Users' Executive Committee Chair
University of Chicago

This will be the last newsletter I write to you as UEC Chair. As of May 19th, I'll pass on the mantle to Larry Shapiro. It's been a distinct pleasure to represent the NSLS user community in a very exciting time in our history, as we being to take a hard look at our future.

I believe it's clear to all of us that the future of the NSLS looks bright and that the prospects of NSLS-II coming to fruition are very good indeed. But it's perhaps in these times of elevated expectations that it's most important for the user community to make its desires and concerns clear - not only to ensure that NSLS-II becomes a reality, but also to guarantee that the current NSLS continues to operate at its maximum potential in the interim period.

In terms of NSLS-II, many of you are probably aware that the project was included as part of DOE's "Twenty Year Outlook of Facilities for the Future of Science," which I feel speaks highly of DOE's commitment to see this project become reality. But I also know many were disappointed to see that the project was listed as a far-term priority. It's been my experience while serving on the UEC that users can have a strong impact on how such projects are prioritized by participating in education and outreach efforts to our representatives and community.

As an example of the impact such efforts can have, I quote from the February 2004 issue of Physics Today: "Congressional awareness of the DOE's Office of Science has grown in recent years, thanks in part to an ongoing educational effort on Capitol Hill by the American Physical Society and several other scientific organizations. At an October meeting of a DOE advisory committee, Office of Science Director Ray Orbach said the attitude toward his office has never been more positive and that 'there was a real understanding of science at all levels' of government."

As we look to the future of NSLS-II, we also want to ensure that there are adequate funds and staff to upgrade and improve the current facility and keep many of the aging systems that can't be easily replaced running optimally. It's a pleasure to see that new beamlines are in the process of coming online. The X29 insertion device beamline is in commissioning and a new hard x-ray microprobe beamline operated at X27A in collaboration with SUNY Stony Brook's Center for Environmental Molecular Sciences and BNL Environmental Sciences should begin construction soon. But many of the issues related to upgrading and maintaining the existing facility are not as obvious as the appearance of a new beamline. They include maintenance of the aging infrastructure, upgrades to beamline control and computing systems (particularly as older systems fail to be supported by manufacturers), detector upgrades, and adequate staffing of scientific and technical staff at beamlines. I think these are all areas where an increased level of dialog is needed to keep the NSLS vibrant and that some hard questions must be asked about how both the NSLS, PRT, and Collaborative User groups support these issues.

As we move into spring, another major endeavor for the UEC is the planning of the Annual Meeting, which will be held this year from May 17-20. There are a number of very high quality workshops planned, in my opinion always the highlight of the meeting each year. This year they include "Better ways to see the light: advanced detectors for synchrotron radiation," "Anatomy of a virus," "Graz-

UEC Nominees

Gary P. Halada
Associate Professor
Dept. of Materials
Science and Engineering
Stony Brook University

Peter Stephens
Professor
Dept. of Physics & Astronomy
Stony Brook University

Troy Rasbury
Assistant Professor
Dept. of Geosciences
Stony Brook University

Trevor A. Tyson
Professor
Department of Physics
New Jersey Institute
of Technology (NJIT)

Bruce Ravel
Research Physicist
Naval Research Laboratory

Hao Wu
Professor
Department of Biochemistry
Weill Medical College of
Cornell University

Please vote online at: http://www.nslsuec.org/elections/uec-vote.asp

ing Incidence Small Angle Scattering," "Synchrotrons in pharmaceutical science: physical pharmacy," "Advanced Optical Systems and Metrology for High Power and Coherent Beamlines," "Applications of Synchrotron-Based Methods to Hydrogen Storage Materials," "Nanoprobes for Nanoscience," and "Crystallization, Membrane Proteins." Wow, perhaps the broadest array of workshops I've seen in a while. Of course we'll also have our yearly poster session, a myriad of vendors for you to shop and chat with, our main meeting, lunch, and banquet (with a reggae theme this year). I personally can't wait and I'm sure all of you will try to attend. Last year we had 398 registered attendees and it pained me that we didn't top the 400 mark. But I'm confident that we will this year. Before the meeting, however, we also ask for your support in voting for new SPIG and UEC representatives and in the nomination of this year's UEC Community Service award recipient. This is your opportunity to acknowledge an individual from the NSLS user community in recognition of his/her service, innovation, and/or dedication to NSLS users.

NSLS UEC Website:

http://www.nslsuec.org

for information on all ongoing Users' Executive Committee activities

SCIENCE HIGHLIGHT

Developing a Safer Way to Make One Class of Superconductors

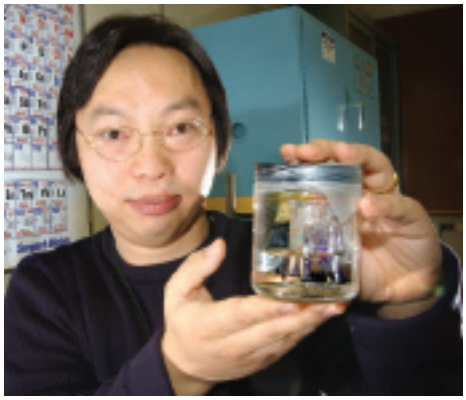
Laura Mgrdichian, NSLS Science Writer

A scientist at Brookhaven National Laboratory has developed a safer, more environmentally friendly way to create an experimental superconductor. This new process facilitates the study of superconductors, which are used in medical imaging machines and are expected to improve computer chips, electrical transmission lines, and many other devices. The findings appeared in the November 19, 2003, issue of *Physical Review B*.

Previously, creating the superconductor, called sodium cobalt oxyhydrate, required working with volatile and flammable liquids and created chemical waste. Now, BNL chemist Sangmoon Park has devised a cleaner synthesis method using plain water. Park works in the Physics Department's Materials Synthesis and Characterization group with his advisor, physicist Tom Vogt.

"We prepared the superconductor using an alternate route that does not require the special precautions necessary to handle hazardous substances," said Park. "Also, this method allows us to synthesize large amounts of the material, which will make it easier for us to further analyze its properties."

Unlike metal-based superconductors,



Sangmoon Park holds a sample of a superconducting compound

sodium cobalt oxyhydrate contains water. In 2003 researchers discovered that adding water to the initial cobalt-oxygen compound, called cobalt oxide, induced its superconductivity. This discovery, coupled with Park's method, may open a door to new superconductor research.

To synthesize the superconductor, Park dissolved a sodium/sulfur/oxygen compound into water, which caused sodium ions and sodium/oxygen (sulfate) ions to separate from it. This solution was mixed with a sodium/cobalt/oxygen compound. The resulting no-waste reaction created the superconductor. The material's structure and the amounts of its components, particularly the sodium and water, impart its superconducting properties. This was confirmed by measurements performed by chemist Arnold Moodenbaugh in the Materials Science Department.

The superconductor consists of hexagon-shaped layers: Cobalt oxide forms one layer and the sodium and water, together, form another – like a stack of pancakes and waffles, with each pair of thin cobalt oxide "pancakes" separated by a thick sodium/water "waffle." After surrounding it with an alcohol/water mixture, the material was subjected to pressure that distorted the layers by forcing alcohol or water molecules between them. This may further alter the material's behavior.

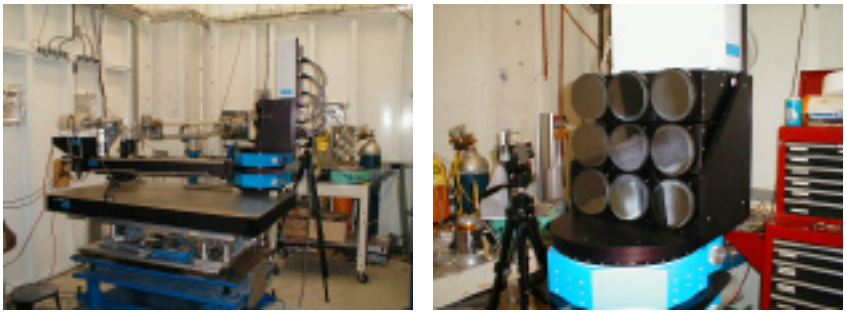
This distortion was studied using x-ray diffraction at NSLS beamline X7A by Yongjae Lee of the Materials Synthesis and Characterization Group. This revealed that, even at very low pressures, the superconductor's structure changed significantly. Park and his colleagues plan to investigate how these changes affect its superconductivity.

This research was funded by a BNL Laboratory Directed Research and Development (LDRD) grant.

A Unique Spectrometer for High-Resolution Inelastic X-ray Scattering

Trevor A. Tyson, New Jersey Institute of Technology

A nine-element, two-dimensional crystal array analyzer system for inelastic x-ray scattering (IXS) has been designed and built at the NSLS. Each individual crystal analyzer is aligned with an inverse joystick goniometer. The energy of the scattered photons is measured with a conventional double-circle goniometer mounted on a translation stage, which allows the maintenance of the sample, analyzers, and detector in a Rowland-circle geometry. The spherically bent crystal analyzers play the key role in this spectrometer. We chose a diameter of about 10 cm for a 500 μm thick Si(440) wafer, and bent it to radius of 1 m. We realized an adequate compromise between energy resolution (1.5 eV) and the solid angle (about 4% with nine analyzer crystals). At a Bragg-angle close to backscattering ($\theta = 88^{\circ}$), we obtained an energy resolution of 0.5 eV.



(Left) Picture of the IXS-spectrometer. The nine individual inverse joystick goniometers for each analyzer crystal are mounted on a two-circle goniometer, which in turn is mounted on a translation stage. The detector mounted on the two theta can move along the two-theta arm to stay on the Rowland circle. (Right) A close-up picture of the nine-crystal (10 cm each) analyzer array.

The instrument can be used to probe the metal site valence, spin polarized charge density, and local magnetic ordering in transition-metal systems. In addition, it can be used to obtain light-element x-ray absorption spectra by the use of inelastic scattering with bulk sensitivity without the need for vacuum conditions. The light-element sensitivity utilizing a hard x-ray incident beam makes the spectrometer useful for studying in-situ processes. The multi-element analyzer development was funded by a National Science Foundation Instrumentation for Materials Research (NSF-IMR) Grant.

For more information on applications of this instrument see: Qian, Q., Tyson, T., Savrassov, S., Kao, C., and Croft, M., *Phys. Rev. B*, **68**, 014429 (2003).

Ultrahigh Resolution Infrared Spectroscopy Moves in at Beamline U12IR

Laszlo Mihaly, Stony Brook University

In a collaboration between Stony Brook and UCLA researchers and funded by DARPA, a new high-resolution infrared spectrometer has been acquired for the U12IR beamline. It is hard to miss the long vacuum box next to the entrance to the NSLS VUV-IR floor, running approximately parallel to the walkway.

The key component of the instrument is a mirror that is mounted on a high precision motion stage and runs inside the box. The exceptionally long range of motion results in a high spectral resolution (on the order of 0.001 cm^{-1}); in fact, this Bruker Instruments spectrometer (Bruker IFS-125HR) has the highest possible resolution available today.

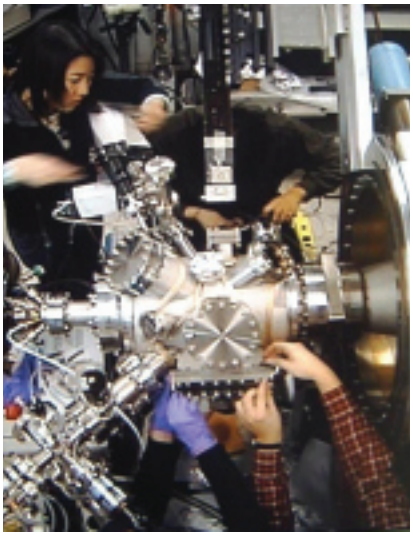
The ultrahigh resolution infrared spectrometer at beamline U12IR.

The spectrometer will be used to investigate low energy (<1 eV) vibrational and electronic excitations in gases, liquids, and solids. A particularly unique application is the study of electron spin resonance (ESR) with infrared light; this becomes possible when the light from the spectrometer is fed to the 16 Tesla superconducting magnet at the beamline, purchased earlier with NSF support.

A New Facility for Real-Time X-Ray Studies of Materials Processing

Karl Ludwig, Boston University

Formation of the advanced materials that are at the forefront of science and technology requires increasingly sophisticated thin film growth techniques and surface modification regimens. To better understand in real time the atomic-level changes occurring during such processing, a new facility is being developed at beamline X21 – the X-ray Studies of Materials with Analysis in Real Time (XSMART) facility. Funded with the National Science Foundation (NSF) Major Research Instrumentation (MRI), and Instrumentation for Materials Research (IMR) support to Boston University (K. Ludwig and T. Moustakas) and the University of Vermont (R. Headrick), the XSMART collaboration also includes C. Eddy of the Naval Research Laboratory. To promote flexibility, the x-ray spectrometer is designed so that modest-sized processing/vacuum chambers can be rolled onto a base diffractometer system. This design allows multiple specialized chambers to be constructed, optimized for processing, and then moved onto the diffractometer for x-ray experimentation. Thus, the base diffractometer system will be available for scientists in the community to design processing chambers to meet their individual needs.



Real-time sample characterization is now available at beamline X21.

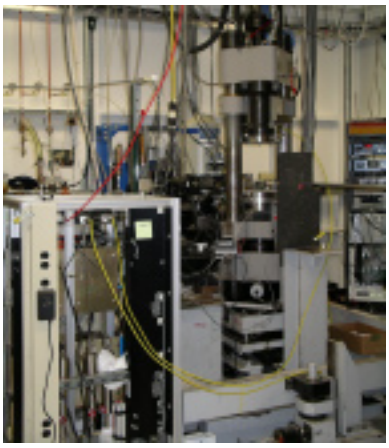
Initially, two UHV chambers have been constructed. First studies with these are focusing on surface evolution during several distinct processes: ion bombardment and plasma processing, growth of novel thin films by pulsed laser deposition (PLD), formation of ultra-thin silicide films, and growth of III-V nitrides by molecular beam epitaxy (MBE).

Two New Facilities for High-Pressure Research

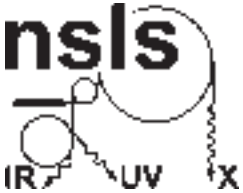
Zhong Zhong, NSLS-BNL

The X17 wiggler is the only high-energy x-ray insertion device at the NSLS. Over the years, user demand in high pressure, materials, and medical research has increased significantly. In order to meet the needs of these growing user communities, two new experimental hutches (X17B2 and X17B3), funded by the NSLS and NSF through COMPRES (Consortium for Materials Properties Research in Earth Sciences), were built and commissioned this year. In addition, a beam splitter/filter unit was installed in the upstream X17 transport hutch to allow x-ray beams to be relayed through the B1, B2, and B3 hutches in a manner that allows experiments to run in the three hutches simultaneously.

The new hutches are dedicated to high-pressure, earth, and mineral science research. The X17B2 hutch is utilized by the COMPRES consortium from Stony Brook University, led by Professor Don Weidner, to accommodate a multi-anvil large-volume press. White beam is currently used for experiments on this press. A multi-element Ge detector is used to collect energy-dispersive x-ray diffraction data. Radiographic imaging of the sample in the press can also be taken during all experiments. The development of a sagittal-focusing, side-diffracting Laue monochromator and a separate new large-volume press is underway for angle-dispersive diffraction. The X17B3 hutch, downstream of X17B2, is utilized by the diamond anvil cell group led by Dr. David Mao (Carnegie Institution of Washington, also a member of COMPRES). In this beamline, white beam is focused by Kirkpatrick-Baez mirrors onto the sample in the diamond anvil cell. Ongoing projects include the commissioning of an in-hutch, sagittal-focusing, 30 keV monochromator at X17B1 to provide monochromatic beam to X17B3, and safety and interlock approvals to include laser-heating capabilities.



High-pressure, high-energy research occupies beamlines X17B2 and X17B3.



X-Ray Ring Long Range Schedule

May 2004

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June 2004

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July 2004

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August 2004

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VUV Ring Long Range Schedule

May 2004

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June 2004

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July 2004

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1 0000 Ops.	**2** 0000 Ops. 2000 Holiday	**3 Lab Holiday** No Beam
4 Lab Holiday No Beam	**5 Lab Holiday** No Beam	**6 Lab Holiday** No Beam	**7** 0000 Cond./Ops.	**8** 0000 Ops.	**9** 0000 Ops. 1800 Studies	**10** 0000 Ops.
11 0000 Ops. 1800 Studies	**12** 0800 Maint.	**13** 0000 Maint.	**14** 0000 Ops.	**15** 0000 Ops.	**16** 0000 Ops. 1800 Timing	**17** 0000 Ops.
18 0000 Ops.	**19** 0000 Ops. 1800 Timing	**20** 0000 Ops.	**21** 0000 Ops.	**22** 0000 Ops.	**23** 0000 Ops. 1800 Studies	**24** 0000 Ops.
25 0000 Ops.	**26** 0000 Ops.	**27** 0000 Studies	**28** 0000 Studies	**29** 0000 Ops.	**30** 0000 Ops.	**31** 0000 Ops.

August 2004

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 0000 Ops.	**2** 0000 Ops. 1800 Timing	**3** 0000 Ops	**4** 0000 Ops	**5** 0000 Ops.	**6** 0000 Ops. 1800 Studies	**7** 0000 Ops.
8 0000 Ops. 1800 Studies	**9** 0800 Maint.	**10** 0000 Maint.	**11** 0000 Ops.	**12** 0000 Ops.	**13** 0000 Ops. 1800 Timing	**14** 0000 Ops.
15 0000 Ops.	**16** 0000 Ops. 1800 Timing	**17** 0000 Ops.	**18** 0000 Ops.	**19** 0000 Ops.	**20** 0000 Ops. 1800 Studies	**21** 0000 Ops.
22 0000 Ops.	**23** 0000 Ops.	**24** 0000 Studies	**25** 0000 Studies	**26** 0000 Ops.	**27** 0000 Ops.	**28** 0000 Ops.
29 0000 Ops. 1800 Studies	**30** 0800 Maint.	**31** 0000 Maint.				

Escorting at the NSLS and Open to the Public Events

Mary Anne Corwin, NSLS User Administrator

Historically, the NSLS has permitted non-users to be escorted onto the experimental floor provided certain safety requirements have been met. In October 2002, a new directive was issued by Brookhaven National Laboratory to come into compliance with the Department of Energy (DOE) Order pertaining to requirements for unclassified visits, assignments and activities by foreign nationals to DOE facilities. This directive resulted in changes to laboratory accessibility and in escorting procedures, especially for our foreign national users and visitors.

As a result of this directive, the interpretation of "open to the public" events has received a great deal of attention over the last year and requires some understanding. BNL's Standard Practice Instruction (SPI) 5-09 (*https://sbms.bnl.gov/ld/ld12/ld12d251.htm*), Section III, describes "open to the public" events as meetings, tours, concerts, lectures, and, when advertised as publicly open, certain conferences and seminars. Section VI(C) provides information as to what events qualify as "open to the public."

BNL management has indicated that foreign nationals attending "open to the public" events may tour other facilities while on site provided the tour is part of the event (not a separate event). There is no provision to permit any foreign national to be escorted onto the NSLS experimental floor unless the visitor (1) has a valid BNL ID badge, or (2) is attending an "open to the public" event that specifically includes a tour of the experimental floor, or (3) has registered in the BNL's Guest Information System (also known as GIS, located at: *https://fsd84.bis.bnl.gov/guest/guest.asp*) and has received approval for the visit prior to arrival at BNL. Additionally, foreign nationals performing any type of work or observing experiments at the NSLS must register in GIS and receive approval prior to arrival at BNL.

Please be aware that approvals are taking about 30 days for citizens of non-sensitive countries and about 45 days for citizens of sensitive countries. A list of the sensitive countries can be found at URL: *https://sbms.bnl.gov/ld/ld12/ld12e061.htm*. The Secretary of Energy must approve all requests for visits from citizens of, or persons born in, Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria. Please note that the process for these countries may take about nine months.

Thank you, in advance, for your co-operation in helping the NSLS to maintain compliance with DOE requirements. If you have any questions, please contact User Administration at (631) 344-8737.

Announcement of NSLSUSERS.ORG Network

The NSLS has created a separate users network (NSLSUSERS.ORG) which provides an option for users that find it difficult or are unable to comply with BNL cybersecurity requirements. The network has been created in the following fashion:

1. The NSLS registered the domain NSLSUSERS.ORG.
2. ITD has configured NSLSUSERS.ORG as a class C virtual network using ports on the existing network switches at the NSLS.
3. The BNL firewall will be configured to treat NSLSUSERS.ORG as an external network. It will be isolated from any BNL computers and information that are not available to the general public. ITD may monitor NSLSUSER.ORG for intrusions but will not attempt to restrict traffic on it through the use of firewalls, proxies, or similar devices.
4. Each beamline currently has at least one connection to the BNL network. The beamlines can request to have an additional physical connection (jack) installed for the NSLSUSERS network by contacting Alan Levine X4707 (alanl@bnl.gov). Beamlines that connect devices to the BNL network will have to make sure that all computers meet BNL security requirements. Beamlines that connect to NSLSUSERS.ORG must accept that they are largely responsible for their own security and that they will be isolated from BNL. They will not have ready access to the Exchange Mail server, to network printers, or to the various BNL computing clusters.
5. To avoid cross connections between BNL.GOV and NSLSUSERS.ORG, no computer will be permitted to connect to both networks simultaneously.
6. Each beamline will normally receive only one permanent IP address on NSLSUSERS.ORG. It may be possible to assign a second address to a beamline in exceptional cases. We will also reserve a block of addresses for a DHCP pool to meet the needs of transient users. Beamlines that need a larger number of permanent addresses will have to purchase their own routers and implement a private network using the Network Address Translation (NAT) protocol.
7. No BNL-owned computer will be permitted to connect to NSLSUSERS.ORG except for network administration and diagnostic purposes by qualified ITD and NSLS computing staff. Any BNL employee who attempts to use NSLSUSERS.ORG to circumvent BNL cybersecurity policy will be subject to disciplinary procedures.

Safety Improvements in 2004

Bob Casey, Associate Chair for ESH/Q

As a part of a larger Laboratory-wide effort, the NSLS has identified a number of steps that we will initiate to improve safety performance within our facilities. These steps are intended to reduce the frequency of injury and occurrences among the NSLS staff and user community. Although the NSLS safety program is strong, the statistics are clear that incidents occur in which people are injured or risk the possibility of injury (**Figures 1 and 2**). Praveen Chaudhari, the BNL Director, has stated that excellence in science requires excellence in safety, and has specifically noted that the importance of science is significantly diminished if we fail to protect our staff.

A quick review of the types of injuries experienced at the NSLS shows that all are common to any work environment (slips, falls, cuts, over-exertion, etc.) Although our workplace is very complicated and unusual, our injuries are not. Most frequently, they result from a momentary lack of concentration on the activity. On the other hand, we have had a number of reportable occurrences that did not involve injury, but clearly had the potential for more serious consequences to involved personnel. These occurrences have involved fire, spills, and electrical, laser, and cryogenic incidents. It is obviously important that we take safety very seriously in every thing we do.

Our safety performance in 2004 will require commitment and involvement from our users and staff. Some important points for our user community to focus on include:

- The definition of ESH responsibilities for PRT members and general users issued last year (*http://www.nsls.bnl.gov/organization/ESH/safety/r2a2.htm)* is very important. Make sure that you understand your responsibilities and abide by them.
- Additional training was required for PRT beamline staff working routinely at the NSLS throughout the year (*http://www.nsls.bnl.gov/training/Requirements/Resident-User-Training.htm)*. General users and other non-frequent visitors have less training (*http://www.nsls.bnl.gov/training/Requirements/User-Training.htm*), but it is very important that all personnel working on the floor keep their training current and abide by the requirements described within them.
- An important cornerstone of the NSLS safety program is work planning, i.e. the process for evaluating work to ensure identification of hazards and the establishment of appropriate controls. The work planning process for experimental research has worked well for many years and is implemented through the Safety Approval Form (SAF) (*http://130.199.76.84/safety/default.asp)* process. However, many beamline staff are involved in routine activities that are not reviewed as a part of the SAF process (e.g. day-to-day work in maintaining a beamline; modifications or additions to beamline components). Work planning requirements based on the level of training of beamline staff and users were established last year and are described here: *http://www.nsls.bnl.gov/newsroom/publications/manuals/eshguide/*.

Our user community has responded well to the high level of expectations for safety performance at the NSLS. I think our ESH program is strong, and the improvements of last year and this year will serve us well. However, a successful safety program requires an ongoing awareness, involvement and commitment from everyone. One problem can quickly override and out-shine many successes. Whether at your home institution or at the NSLS, keep an eye on the workplace around you and the people working with you. Make sure that all requirements are respected and that work is conducted safely. We all have a stake in safety performance.

Please let me know if you have any comments or suggestions.

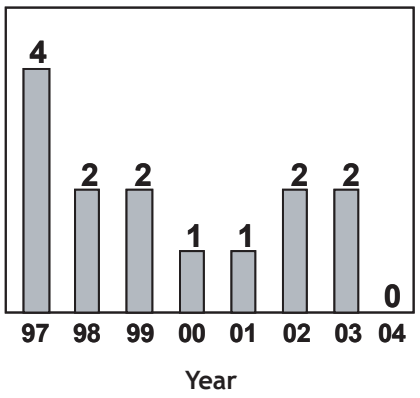

Figure 1. *Lost Work Case Injuries per year from 1997-2004.*

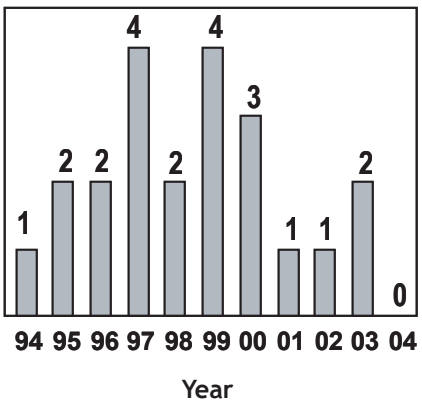

Figure 2. *Reportable Occurrences per year from 1994-2004.*

NSLS Accelerator Complex Update

Erik Johnson, Associate Chair for Operations and Engineering

During the first quarter of fiscal year 2004, the NSLS achieved reliability (availability) of 93% (108%) on x-ray and 99% (119%) on the VUV ring. These figures actually represent only two months of running since the winter shutdown spanned all of December. Operations in January showed comparable performance. The shutdown is certainly the major story since the last newsletter. On the VUV ring, the main activity was the successful repair of the U4IR mirror assembly. On the x-ray ring, several projects were undertaken.

The controls and power system for the X17 Superconducting Wiggler were upgraded. The problem with our overheating sextupole was also identified and corrected. It turned out to be a partially solder-clogged fitting on the magnet, which was replaced. There was a significant amount of utilities maintenance as well. Perhaps the largest item was a series of jobs to support the new X29 insertion device beamline.

This project was in fact the culmination of several prior shutdowns that included the installation of a new ring vacuum chamber, new cavities to make space for an insertion device, the construction and installation of the insertion device itself, a Mini Gap Undulator (MGU) identical to that already at X13, and modifications of the shield wall to allow construction of the beamline. During the December 2003 shutdown, the installation of the MGU controls, active interlock electronics, and beamline front-end was completed with commissioning starting in January of 2004. The success of the X29 MGU project depended upon significant contributions from every NSLS division and the collaboration building the beamline, making it an achievement for the entire NSLS community.

Looking ahead to the May 2004 shutdown, we are anticipating a relatively short interruption in operations. The most visible activities planned include the addition of a third pump for the low pressure copper cooling system to supply additional cooling water to meet increased demand, and the addition of strainers to one of the central site chilled water lines that provides cooling for the machines. Both of these upgrades are intended to improve reliability and operating margin on our utilities systems. A series of other, less visible upgrades are also continuing, including magnet power systems, and injection control and diagnostic systems. These 'quiet' improvements are all essential to maintaining the performance and reliability of the NSLS.

Finally, thanks again to all who provided input for the Summer 2004 schedule. Some adjustments were made to satisfy user requests including uninterrupted operations to coincide with the 2004 EXAFS workshop in June. Just a reminder that the Fall 2004 schedule firms up in May. If there are any special scheduling considerations please let me know as soon as possible.

CFN Users' Meeting

May 19–20, 2004

The Center for Functional Nanomaterials (CFN) at Brookhaven National Laboratory is one of five national Nanoscale Science Research Centers operated by the U. S. Department of Energy to provide state-of-the-art capabilities for the fabrication and study of nanoscale materials. As a premier user facility for conducting interdisciplinary research on a variety of functional nanomaterials, the CFN will serve as a focal point and enabler of advanced materials research in the northeastern United States.

The annual CFN Users' Meeting provides a forum for CFN Users' to make contacts, share results, and most importantly, help to shape the operation and capabilities of the CFN. It is anticipated that researchers interested in all aspects of nanoscience, ranging from nanoscale imaging to nanobiotechnology, will want to participate in the CFN Users' Meeting. Attendees will:

- Hear from experts about new scientific results on topics ranging from nanobiotechnology to nanomagnetics
- Learn about advanced nanoscience capabilities at the CFN
- Learn how to apply for user time at the CFN
- Meet one-on-one with nanoscience vendors
- Have the opportunity to interact with fellow nanoscientists from throughout the U.S.

For more information about the meeting, visit the CFN website: www.cfn.bnl.gov/user/meeting

NSLS Facility Report

Gerry Van Derlaske, NSLS Building Manager

Safety First:

Longer than normal sub-freezing temperature cold spells and recent large accumulations of snowfall have prompted many inquiries to the NSLS Building Managers and Plant Engineering referencing on-site conditions after such inclement weather events. Staff and users are reminded that we are exempt from grievances when distributing Snow-Melt from the 5 gallon buckets found at the most common exit and entrance ways of NSLS buildings. We appreciate your efforts to "spread a little safety" that others will benefit from. Feel free to contact one of the building managers to:

1.) report any slippery surfaces that need attention beyond the act of spreading the ice melt and,

2.) have the buckets re-filled by the Maintenance Department.

Remember to use every common precaution necessary to prevent slips and falls, both inside and outside of the buildings. In the event of a Laboratory-wide closing or delayed opening, please check the BNL INFO hotline for the most up-to-date information.

Dial (631) 344-INFO (4636).

Outlying Areas of the Facility:

The cold weather snap has taken its toll on many of the portable structures and modular buildings across the Lab site. For those with offices in the outlying areas - Bldg. 535 M, 728M, 129 or the NSLS trailer park - please follow the necessary protocol to keep your office and hallway areas warm enough to prevent pipes (heating, sanitary, domestic water, and /or fire sprinkler systems) from freezing. Close all outside windows and leave the electric baseboard on a setting that will keep areas warm enough to prevent problems when you are away from your office, either for the evening, weekend, or extended holiday.

Custodial Highlights:

Various activities are accomplished during the yearly scheduled winter shutdowns. Packaged around these jobs is the annual stripping and waxing of perimeter labs, hallways, and beamlines on both of the experimental floors. The NSLS custodial crew, along with help from the BNL Plant Engineering custodial pool, work in parallel with other shutdown and maintenance tasks being performed. This is a well-orchestrated event, planned by the NSLS Alternate Building Manager, and completed by the Custodial Supervisor and the Custodial Lead person assigned to the facility. We extend our thanks to all the beamline personnel who lent their support when replacing and moving assigned equipment to their particular area. Cooperation between all the involved parties made the effort move along swiftly and efficiently.

The salt and sand tracked into the facility has had its effect upon the entrance rugs and mats throughout the facility. On inclement days when the snow is unavoidably brought into the buildings, be extremely sensitive to the slippery puddles the melting snow creates on the stairwells and in the hallways.

Assigned Trades:

Requests for services delivered by the carpenters, electricians, HVAC techs, or any of the skilled trades in general are generated by contacting the NSLS Building Managers. As a reminder, in order to meet building configuration requirements, all cables being pulled within the facility and placed within a cable tray will need to have a cable identifier attached to each cable origin and termination. An exception to this requirement is the case when signal cables are run at a beamline for a specific experiment.

Identification and Tagging of Equipment

The Department of Energy requires that all non-expendable property at BNL have bar codes or tags to indicate ownership. If your organization does not have tags (logos, etc.) we will supply blank tags (see sample on bottom).

Tags are available at the NSLS stockroom free of charge. Please obtain tags, fill in your organization in the space provided and apply to all unidentified equipment belonging to your organization. The serial numbers on the blank tags are for your optional use in recordkeeping.

BNL's Supply & Material Division will be conducting periodic inspections to ensure proper identification of all equipment.

If you have any questions or need assistance, please call Wendy Morrin at (631) 344-4884.

$30 Million in Funding Expected for Life Sciences to Support Six NSLS Beamlines

Laura Mgrdichian, NSLS Science Writer

The BNL Biology Department recently announced that it expects to receive more than $30 million over the next five years to support structural biological research, including studies of disease and genomics.

The funding, administered by the Office of Biological & Environmental Research (BER) within DOE's Office of Science and by the National Center for Research Resources within the National Institutes of Health, will support a group of six beamlines at the NSLS.

Ari Patrinos, BER Associate Director of Science, welcomed the renewal of funding for the beamlines. "The Brookhaven scientists are addressing two major objectives of the Lab's structural biology program: developing state-of-the-art technologies for solving the most difficult molecular structure problems, and providing access to this major facility, which is used by more than 2,400 scientists each year," he stated.

"The large size of the grant is a tribute to the strong infrastructure within the NSLS and BNL," said Biology's Robert Sweet, the spokesperson for the research group that maintains the structural biology beamlines. "It also reflects how valuable we are to a large number of powerful Northeastern U.S. research groups that use our facility."

For example, researcher Roderick MacKinnon of the Rockefeller University recently received the Nobel Prize in Chemistry for his research, performed in part at the NSLS, on how nerve signals are propagated through the body.

"We're very proud of our ability to identify and support Nobel-quality projects like MacKinnon's work," said Sweet. "These funds will allow other important projects to move forward."

A research group from Yale University has used NSLS light to study the structure of ribosomes — cellular "machines" that assemble the proteins cells need to function. Also, scientists from Harvard University determined the structure of a type of tiny opening on the surface of cells that allows proteins to pass in and out of the cell. Their results may provide valuable insight into several basic cellular activities. The grants will also further the work of scientists from local Long Island institutions, such as Stony Brook University and Cold Spring Harbor Laboratory.

This type of research is part of a field of biology called macromolecular crystallography, which uses x-rays to determine the structures of various proteins and nucleic acids, the molecular engines that control the functions of all living cells. Because abnormalities and malfunctions in macromolecules, especially proteins, are often the root of many diseases, learning about these molecules' structures is an important step toward developing drug treatments.

The funds will cover the expenses of improving and maintaining beamlines X8C, X12B, X12C, X25, X26C, and X29. This work is carried out by a team of nine scientists and 14 engineers and technicians. Also covered will be the costs of training and assisting researchers in performing their measurements.

One of the beamlines supported by the grants, X29, is brand-new, and will produce the brightest x-ray light at the NSLS. Another, X25, the beamline where MacKinnon performed his research, will be upgraded to produce even brighter light. NSLS Scientist Lonny Berman will manage the upgrade.

In addition, the group will use the funds to develop techniques that allow experimenters to work more quickly and efficiently. They have already pioneered a sophisticated service managed by Biology's Howard Robinson, which allows crystal samples to be sent to NSLS researchers through the mail. In another project, managed by Biology's Dieter Schneider, they are building a robot that will automatically change the specimens that are studied during NSLS experiments.

Above are the staff of the Protein Crystallography Research Resource (PXRR), the Biology Department and NSLS Department scientists, engineers, machinists, and technicians who operate six NSLS beamlines for macromolecular crystallography.

The NSLS Information and Outreach Group

Lisa Miller, Section Head

Established in the fall of 2003, the Information and Outreach Office at the NSLS takes on the important task of communicating the scientific achievements and technological capabilities of the NSLS to several key audiences – its user community, other scientists, funding agencies, and the public. This is accomplished through numerous printed and online publications, as well as outreach activities.

The office is responsible for preparing numerous publications related to user science activities, including the annual NSLS Activity Report, tri-annual newsletters, monthly electronic news, and assorted promotional brochures. In addition, the office designs, manages, and provides content for the NSLS website, which regularly highlights user research, news, and events. This office also oversees a number of outreach programs, such as the Faculty-Student Research Support Program, topical and training workshops, seminars, and tours.

The Information and Outreach office consists of six staff members, most of whom share duties with other offices or departments at the Laboratory. Laura Mgrdichian is a science writer who splits her time between the NSLS and BNL's Media and Communications office. Steve Giordano manages the NSLS and CFN web sites, and is also involved in web design and database administration. Nancye Wright is in charge of the layout of the printed publications, and also takes care of the office's everyday administrative needs. Lydia Rogers is responsible for all of the travel reimbursements for the Faculty-Student Research Support Program, and also provides secretarial support to the office. Theresa Esposito, a graphic designer in BNL's Photography and Graphic Arts department, works closely with the office on the design and layout of all printed publications. Lisa Miller is a member of the NSLS scientific staff, and coordinates all of the activities of the office.

Information and Outreach Group (from left): Theresa Esposito, Nancye Wright, Lisa Miller, Lydia Rogers, Laura Mgrdichian and Steve Giordano.

If you have any questions or comments about information and outreach activities at the NSLS, please stop by room 2-102 (just down the hall from the User Administration office) or feel free to contact any of us at (631) 344-7818 or by email at NSLSinfo@bnl.gov.

News and Notables

Friday Lunchtime Seminars are a long-running tradition at the NSLS. Every Friday from 12 – 1 pm, two NSLS users present informal seminars about their ongoing research. The purpose of these seminars is to provide an informal forum for users and staff to discuss their latest results with fellow users. Participation is very important, especially now that the NSLS-II is under discussion. Why not volunteer to give a lunchtime seminar the next time you visit the NSLS? Please contact Kenneth Evans-Lutterodt (kenne@bnl.gov) or Vivian Stojanoff (stojanof@bnl.gov). All lunchtime seminar speakers receive a free lunch for their efforts!

The NIH-NIGMS East Coast Structural Biology Facility has been in operation at the NSLS for a year. This facility includes the X6A beamline and a well-equipped laboratory for sample handling, purification, and crystallization. Its mission is to provide resources to the biology, biochemistry, and biophysics community to address structural biology questions. Its goal is to provide fast access to beamtime for the targeted user community, and training for academic and professional users. For further information visit the Facility on the web at http://protein.nsls.bnl.gov, by email at x6ansls@bnl.gov or by phone at (631) 344-8375.

The Annual Hands-On Short Course in EXAFS Data Collection and Analysis will be offered again June 22 - 25, 2004 at the NSLS. This is the third year this popular course has been given. The course will cover all aspects of EXAFS data collection and analysis: from sample preparation to first shell fitting. The course is targeted towards new users and young scientists. Two afternoons/evenings will be spent collecting data on attendees' samples. For full details, and to apply for the course, please watch the NSLS homepage.

NSLS Information and Outreach Office
Brookhaven National Laboratory
NSLS Building 725B
P.O. Box 5000
Upton, NY 11973-5000

Call for NSLS General User Proposals

For Beam Time in Cycle	Deadline
September-December 2004	Tuesday, June 1, 2004

General User Proposal and Beam Time Request Forms including instructions can be found at:
http://www.nsls.bnl.gov/users/procedures/proposals/general_user.htm
Proprietary Proposal Forms including instructions can be found at:
http://www.nsls.bnl.gov/users/procedures/proposals/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:

http://130.199.76.84/safety/default.asp

NSLS User Administration Office

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For additional information about the NSLS (including this Newsletter in electronic format) see the NSLS Home Page on the World Wide Web at:

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