

Oak Ridge National Laboratory Neutron Sciences Progress Report July 2009

Neutron Highlights

At HFIR, Cycle 422 ended July 17, 2009, and Cycle 423 began August 5, 2009.

At SNS, neutron production ended July 11, 2009, and will resume September 10, 2009.

Call for Proposals: Proposals for beam time at HFIR and SNS will be accepted until noon **Monday, August 31, 2009**, ET.

SNS target removed and placed July 20, 2009. [Video](#)

Neutron Sciences Career Development Program launched. See the Employment section below for more details.

Science Highlights

Thermal stability of nano-precipitates studied in advanced high-strength steel using SANS. Scientists used the General Purpose SANS at HFIR to study welds in nano-precipitate strengthened steel (NPSS). The auto industry is pursuing use of these advanced high-strength steels in vehicles. A concern associated with NPSS is how well it holds up to heat during welding. The SANS results showed that dissolution of the nano-precipitates causes significant degradation of the NPSS weld.

Variation of stratification observed in spin-assisted layer-by-layer assemblies. Scientists from Georgia Tech using The Liquids Reflectometer at SNS noted the first direct [observation](#) of the internal structure of spin-assisted layer-by-layer (SA-LbL) nanoscale polymer assemblies. The results showed that manipulating the ionic strength of the buffer solution during deposition tunes the degree of interdiffusion between layers of the material. Such insights will allow rational control of the internal structure and characteristics of these promising nanomaterials.

Instruments and Users

Call for Proposals. Proposals for beam time at HFIR and SNS will be accepted until noon **Monday, August 31, 2009**, ET. This call is for experiments to be run from December 2009 through May 2010 and includes 9 instruments at HFIR and 10 at SNS. [Details](#).

Sample environment capabilities are expanded. A 1 kBar gas pressure diffraction cell (TiZr null alloy) was recently commissioned at the HFIR. It is available for all instruments at HFIR and SNS. Additional cells (sapphire, TZM, and

aluminum) are being tested. Available sample environments are summarized: for [HFIR](#) and [SNS](#).

11th National School on Neutron and X-ray Scattering held. ORNL hosted 60 graduate students from 39 U.S. academic institutions during May 30-June 6, 2009. Five SNS and 7 HFIR instruments were used to enable each student to complete 3 experiments. Workshop lectures and notes are [available](#). Attendees are pictured right.



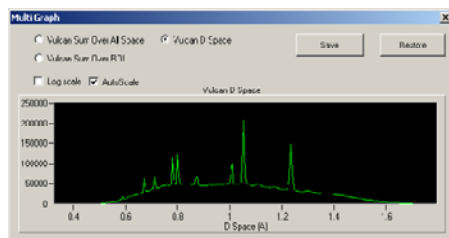
Casagrande receives Cryogenic Society Award. Fabio Casagrande, director of SNS cryogenic systems, received the 2009 Award for Excellence

in Cryogenic Operations and Support from the Cryogenic Society of America.

SNS-HFIR User Group (SHUG) holds teleconferences. Summaries of the discussions held during the SHUG Executive Committee meetings are available [here](#). Recent events and sample environment survey are discussed. Feedback is requested on proposed speakers in a session in the APS Forum on Industrial and Applied Physics.

Users surveyed about sample environment needs. The importance of accurate and reliable standard equipment was voiced in a survey of recent users. It was cited as the number one area in need of improvement, yet also the second greatest strength (behind staff). Also highlighted was the need to develop special environments (chemical, gas atmosphere, multi-technique). To this end, scientists are being engaged to identify and participate in specific projects that will bring new capabilities and new science. Both an internal "Sample Environment Working Group" and the SHUG are contributing several ideas. Contact [SHUG](#) or [Lou Santodonato](#) to join this effort.

VULCAN generates first diffraction pattern. The VULCAN engineering diffractometer completed its last safety checks, and it opened its shutter on June 26, 2009. The first diffraction pattern (below) was taken of Ni powder in a vanadium can, 10 min at high intensity mode with incident bandwidth ~ 0.9-2.3 Å. The net count rate is about 23,000 cts/s.



New detector design tested on SNS Liquids Reflectometer. A reflectivity curve of a standard nickel-on-silicon sample was recorded using a novel detection principle based on a solid layer of neutron absorber (B-10) in a gas-filled detector, developed by Thorwald van Vuure in the NScD Detector Group. The detector has an asymmetric spatial resolution of about 0.5 by 3 mm and recorded counts of up to 1 million per second without serious loss of linearity.

This count rate capability represents an improvement of two orders of magnitude over the currently installed detector, a much anticipated upgrade bringing a new class of time-dependent studies within reach.

New BioSANS detector installed. A replacement detector for the BioSANS (HFIR CG3) was installed.

Numbers of users grows. For fiscal year 2009, from October 2008 through June 2009, HFIR has 306 unique users and SNS has 288 users. Both neutron sources achieved goals of more 300 users for HFIR and 260 users for SNS.

Summer students arrive. The ORNL Neutron Sciences are hosting 57 summer undergraduate and graduate students and faculty.

Articles published on ORNL neutron activities. Articles on ORNL neutron activities were published in [Notiziario – Neutroni e Luce di Sincrotrone](#) and [Neutron News](#).

Congratulations to our users

The following are awards and honors received by colleagues who are also recent users of ORNL neutron scattering facilities.

Two ORNL neutron users receive Presidential Award. Gary Baker, ORNL Chemistry Division, and Jacob Jones, University of Florida materials science department with an ORNL summer appointment in the Neutron Scattering Science Division, will receive a Presidential Early Career Award for Scientists and Engineers. Baker studies ionic liquid functional

nanoparticles and Jones studies "Domain Wall Motion in Phase Transforming Oxides" using real-time neutron diffraction.

ORNL neutron user Penumadu named UTK Department Chair. Dayakar Penumadu, an ORNL neutron user from the University of Tennessee, has been named

permanent head and Fred M. Peebles Professor of the UTK Department of Civil and Environmental Engineering. He is a member of the VULCAN IDT, a user of the HFIR residual stress instrument, and a proponent of a proposed ORNL neutron imaging beamline. [Announcement](#)

Operations

HFIR

At HFIR, Cycle 422 ended July 17, 2009, and Cycle 423 will begin August 5, 2009. The FY 2009 goals for HFIR include operation for 6 cycles with >90% predictability. Cycle 422 was the 15th consecutive start-up on schedule since the cold source became operational 2 years ago this month.

SNS

The SNS began accelerator startup on March 3, 2009; neutron production began March 12, 2009, and continued through July 11, 2009. The maximum beam power delivered during this cycle is 870 kW. A new world record was set for the number of stored particles in an accelerator by accelerating 155 trillion protons in a single macro-pulse, injecting them into the accumulator ring, extracting the accumulated pulse, and

delivering it to the SNS mercury target. The test exceeds the SNS single pulse design intensity of 150 trillion protons in a pulse. If pulses of this intensity were delivered to the SNS target at the design repetition rate of 60 pulses per second, it would provide a beam power of 1.5 megawatts, or 100 kilowatts more

than the design beam power of 1.4 megawatts. The tests, which were performed at a rate of less than one pulse per second, confirm that both the SNS's accelerator and accumulator ring are capable of reaching the design beam power.

Employment Opportunities

Positions in the Neutron Sciences Directorate or related to neutron scattering. Click on "View Open Positions" at <http://jobs.ornl.gov/> and view Position Category noted as "Science—Neutron Science":

- Clifford G. Shull Fellowship Program [Applications will be accepted until December 13, 2009]

Neutron Sciences Career Development Program <http://www.ornl.gov/neutrons/>

The Neutron Sciences Career Development Program was founded to nurture the creative development of neutron scattering instrumentation at ORNL. This initiative is viewed as a critical part of keeping the neutron scattering instruments at ORNL on the cutting edge of design and scientific functionality, keeping them competitive worldwide. This program is designed to provide an environment in which early-career scientists and technicians can be a part of innovative concepts for neutron-related research and instrumentation, while helping end users develop proposals, conduct experiments, and analyze data.

- Neutron Scattering Instrument Scientist
- Neutron Scattering Instrument Associate
- Neutron Scattering Technician

Fellowship Positions with ORNL through Oak Ridge Associated Universities. Descriptions are available at <http://www.ornl.gov/orise/edu/ornl/postneeds.htm>. Recently announced open positions are

- Mechanical Engineering/Experimentalist—Post-Master's [ORNL09-99-NFDD]
- Scientific Computing Researcher [ORNL09-94-NSSD]
- Scientific Computing Associate [ORNL09-93-NSSD]
- Postdoctoral Research Associate for Developing the Spin-Echo Grazing Incidence Scattering (SERGIS) [ORNL09-92-NFDD]
- Postdoctoral Research Associate in Instrument Development [ORNL09-89-NFDD]
- Postdoctoral Research Associate in Neutron Scattering Studies of Fluids & Polymers Under Confinement [ORNL09-88-NSSD]
- Postdoctoral Research Associate for Neutron Diffraction on HB-3A Four-Circle Diffractometer Instrument [ORNL09-82-NSSD]
- Post-Master's or Post-Bachelor's Science Software Developer [ORNL09-75-NSSD]
- Post-Master's or Post-Bachelor's Neutron Scattering Instrument Associate [ORNL09-73-NSSD]

Educational and Research Experiences

ORNL has educational programs covering many scientific disciplines with the education continuum from pre-college through postgraduate, including teachers and faculty. The main link to all of these programs is <http://www.ornl.gov/orise/edu/ornl/>

Meetings of Interest to SNS and HFIR Users

August 26–28, 2009, [Long-Pulse Instrumentation Workshop](#), Villa Mondragone, Italy. [Registration closed]

November 4-5, 2009. [Neutron Spin Echo Workshop](http://neutrons.ornl.gov/conf/NSE2009/index.shtml), Oak Ridge, TN. <http://neutrons.ornl.gov/conf/NSE2009/index.shtml>.

June 13–18, 2010, 20th Annual VM Goldschmidt Conference, Knoxville, TN. This is the foremost meeting of the year for the worldwide geochemistry community. <http://www.goldschmidt2010.org>.

June 26–30, 2010, American Conference on Neutron Scattering, Ottawa, Ontario, Canada, <http://www.cins.ca/acns2010/>

Neutron Science in the News

[Spallation Neutron Source Sees First Target Replacement \(7/27\)](#)

Having outlasted all expectations of its service life, the original mercury target of the Spallation Neutron Source (SNS), the Department of Energy (DOE) Office of Science's record-setting neutron science facility at Oak Ridge National Laboratory, is being replaced for the first time.

[High Flux Isotope Reactor surpasses user goal \(7/24\)](#)

Ron Crone, the research reactors director at Oak Ridge National Laboratory, said the High Flux Isotope Reactor had passed its user goal—300 scientific users—with another operating cycle left to go in fiscal 2009. The reactor was shut down last Saturday for refueling and maintenance, and Crone said it was the 15th consecutive time that the operations schedule was met since a long down period for installation of the new Cold Source. The plan is to restart the reactor Aug. 5, and after that cycle, the research facility will be shut down for a long fall maintenance period, according to Crone.

[SNS replaces key component \(7/21\)](#)

Workers have replaced the target vessel, a key component of the Spallation Neutron Source, for the first time since operations began at the \$1.4 billion research facility in April 2006. Twenty tons of mercury is circulated continuously through the stainless steel vessel, which is zapped 60 times a second with a powerful proton beam—thus releasing zillions of neutrons for experimental studies with materials. Frank Kornegay, the operations manager at the SNS, said Monday that mercury had been drained from the old vessel, which was disconnected and moved into a storage cask in a heavily shielded hot cell. The new vessel, which cost about \$800,000, was brought into the cell and bolted onto its carriage, Kornegay said. Later this week, it will be locked into its fixed position, allowing it to be filled with mercury and readied for the return to operations, he said.

[Maxing the power at Spallation Neutron Source \(7/21\)](#)

Before it was shut down recently for a six-week maintenance period, the Spallation Neutron Source achieved a peak power of 850 kilowatts—about two-thirds of the way to the previously stated max of 1.4 megawatts. However, SNS operations manager Frank Kornegay said it now appears the SNS is capable of power levels greater than 1.4 megawatts. Maybe 1.5 megawatts or even greater, he said. Why is that? Well, according to Kornegay, tests were done to look at how many protons could be stored in the SNS storage ring before being released on the target in pulses (about 60 a second, I believe) "We set a record for proton storage in the ring . . . and demonstrated that the accelerator and ring are capable of levels greater than 1.4 megawatts," the SNS official said.

[Joint Institute for Neutron Sciences taking shape \(Atomic City Underground \(6/26\)](#)

The Joint Institute for Neutron Sciences is taking shape at the foot of the Spallation Neutron Source in Oak Ridge and, according to ORNL spokesman Billy Stair, construction should be completed in April 2010. Rouse Construction Co. of Knoxville is handling the project. The \$7.6 million for JINS was provided by the state of Tennessee. "The original idea for JINS goes back to before SNS was started actually," ORNL Director Thom Mason said this week. "It was part of the original commitment the state made as part of the effort to make sure that the SNS was built in Tennessee. We held off during the construction phase (of SNS) because you don't really need it. But now that the science program is up and running, we really do need it. So it'll be great to have that building occupied and humming with activity."

The most up-to-date news articles featuring neutron science performed at ORNL are available at http://neutrons.ornl.gov/news/current_news.shtml. You can sign up for an RSS feed [here](#) for ORNL Neutron Sciences. To receive ORNL news via twitter, use <http://twitter.com/oakridgelabnews>.