UNI-CAT 34-ID Beamline Up & Running

The University-National Laboratory-Industry CAT has declared the sector 34 undulator beamline operational.

The 34-ID insertion device beamline is a dual-purpose beamline that supports coherent x-ray diffraction and x-ray microprobe techniques. This beamline is designed and constructed in a tandem configuration (not to be confused with the canted undulator configuration) based on a single APS undulator A and uses a horizontally deflecting mirror to split the beam into pink- and white-beam branches. The pink beam supplies a coherent x-ray diffraction (CXD) experiment with a general-purpose diffractometer. A diamond-crystal monochromator may be inserted to permit studies with monochromatic radiation. The white-beam branch provides a microfocus diffraction (MFD) experiment and includes an optional monochromator in the third optics enclosure. Both experiments are brilliance limited and can accept only a fraction of the divergence from the source. For this reason, the beam-splitting mirror, which divides the undulator beam, does not compromise the flux in either experiment.

Fig. 7. Wenjun Liu (University of Illinois) aligns a sample and prepares for a differential aperture scan in the 34-ID-E microbeam station.

The coherent x-ray diffraction experiment station, 34-ID-C, contains a specialized goniometer, which permits both vertical and horizontal scattering geometries and accommodates an ultrahigh-vacuum chamber to permit studies at clean surfaces. A Kirkpatrick-Baez (K-B) focusing mirror system provides micron-scale beams that preserve the beam coherence.

The microbeam station at 34-ID-E, as shown in Fig. 7, produces x-ray beams that are routinely 0.4 μm x 0. 4 μm or better for use in diffraction or fluorescence techniques using K-B focusing mirrors. The specially designed micromonochromator allows the selection of either white or monochromatic conditions with a fixed focal spot on the sample. Diffraction techniques with this small spatial resolution permit careful examination of the stress-strain state of materials. Newly developed differential aperture microscopy techniques permit the microprobe to reveal diffraction information in order to determine the structure and/or orientation of small volumes within a solid sample and to provide spatial resolution of better than 1 μm in all three dimensions.

The development of the CXD instrument was funded by the Major Research Instrumentation program of the National Science Foundation, while the microbeam experimental capabilities were sponsored by the DOE Office of Basic Energy Sciences. In addition, through the Illinois Board of Higher Education, the State of Illinois has provided considerable support for construction and continuing operations. *(Contact P. Zschack, zschack@anl.gov.)* ❍

User Support

New User-Support Personnel

The **Beamline Technical Support Group (BTS)** works from the premise that each sector need not require its own complement of specialists. The BTS Group applies technical and administrative expertise to user instrument and facility engineering and design, the spare-equipment pool, and a dedicated material handler, and facilitates user access to a variety of APS resources, such as AutoCAD.

The **User Technical Interface** is the person empowered as the primary contact point between users and the three APS divisions in matters related to beamline technical information. This person assures the quality and availability of the huge storehouse of documentation needed by APS operations staff, as well as the users, for successful beamline operations in accordance with APS policies and procedures.

User Policy and Planning is the responsibility of the individual who works in close cooperation with users to establish the policies and procedures that govern researchers' access to the APS and their workplace activities while they're here. This person also coordinates user support activities that require interaction between APS organizations, including records and material handling; interdivisional beamline construction schedules; exchanges between users and APS technical staff regarding the installation of beamline shielding, utilities, personnel safety systems, front ends, and insertion devices; and reviews of beamline design and management and safety plans.

As the first APS ombudsman, this person is also a conduit to APS management for other issues raised by users.

Minimizing Beamline Downtime

Causes (and duration) of user-beam downtime at the APS due to accelerator equipment problems have been tracked and analyzed dating back to the inception of operations. Beginning in 2003, the Experimental Floor Operations (EFO) Group maintained statistics on downtime incurred by beamlines due to systems failures.

Floor coordinators catalog downtime as it occurs, recording details about each event and its resolution. Floor coordinators and systems personnel may access this information online while troubleshooting problems. Systems managers also analyze patterns in the data in order to preempt systems failures before they occur. Members of the EFO Group are also responsible for reviewing downtime events on a weekly basis and providing a report for APS management.

Minimizing the possibility of power interruptions at the APS beamlines was a priority in 2003. The first phase of emergency-power capability for the beamlines consisted of installing additional transformers and electrical panel boards for distribution of beamline-specific electricity throughout the experimental hall. During the second phase, each beamline's specific needs are assessed, and emergency power distributed accordingly.

Enhanced Sample Oversight & Experiment Capabilities

In order to allow users more freedom to study a wide variety of soils, the APS applied for and received a U.S. Department of Agriculture (USDA) permit to receive and manage regulated soil samples.

All foreign soils are regulated, as well as domestic soils from the Southeastern United States and a few other locations. Because of the many environmental dangers involved with transporting regulated soils and the organisms that they may contain, the USDA issues permits only to those organizations that can demonstrate safe handling, storage, and disposal of regulated soils. The APS has established protocols that meet and exceed the USDA standards.

There are presently 11 APS beamlines that have had and continue to schedule experiments involving radioactive samples. As the number of experiments at the APS involving radioactive samples continues to increase, the responsibilities of Material Balance Area (MBA) custodians, who track and monitor radioactive samples from arrival at the APS through use in an experiment and then removal from the facility, have been expanded to include all radioactive samples that arrive at the facility, not just those designated by DOE.

In order to expand APS experimental capabilities, beamline 10-ID was equipped with an exhaust system consisting of a roof-mounted chemical/radioisotope exhaust fan with and outside air bypass damper and intake, and HEPA filter. The exhaust system provides ventilation for the 10-ID-B experimental enclosure and for adjacent specialty gas cabinets. Experiments using flammable gasses such as 100% hydrogen and ethylene can now also be performed by making use of this exhaust system but bypassing the HEPA filters.

Computing

LOM Network Upgrade

The network switch/router providing network services to each laboratory/office module (LOM) was upgraded to a Cisco Catalyst 4507R switch/router, which provides redundant supervisor engines in case of hardware failure of the primary supervisor. This switch has a 64-Gbps switching fabric with a throughput of 48 Mpps. This configuration gives all ports gigabit connectivity and each sector now has an additional six copper ports and eight fiber ports. The gigabit uplinks to these switches are connected redundantly to a pair of core switches. If one core switch should fail, then the LOM switch will continue to operate from the other core switch with no downtime. The 4507R delivers integrated resiliency, and non-blocking Cisco Express Forwarding-based layer 2/3/4 switching is built in.

Cyber Security

Keeping the APS and its users in compliance with DOE and Argonne cybersecurity regulations and policy requires maintenance of security on more than 700 Windows-based workstations and servers, 200 Macintoshes, and nearly 400 Sun workstations and servers, plus 110 Linux workstations and servers. Toward this end, a new server was installed for patch monitoring and deployment. This server allows the latest patches to be pushed out to client machines outside normal work hours. This reduces downtime and keeps users' computing systems safe from attacks. Computing systems at APS sectors were configured to conform with network security requirements, and user access to APS servers and data was secured using encrypted connections such as VPN. Network security scans are continually reviewed, and new issues are resolved as they are discovered. Security for remote users is increased via patches, virus scanners, and firewalls so that accessing the ANL network does not compromise network security.

New Application Servers

The installation of three new Citrix MetaFrame servers replace the aging Carbon, Copper, and Calcium servers, and provide a new Web interface for secure access to APS Citrix servers. Users can access the Web Interface internally and externally. These servers will run the latest ANL-wide applications such as Paris, AMOS, Comet, and other business applications. The new servers provide users and sectors with more flexibility in accessing ANL business applications through a browser from anywhere by using secure channels with minimal configuration. The browser interface facilitates ease of use with any computing platform, allowing Apple, Sun, and Linux systems to run Windows applications as needed. The user sectors in the APS experiment hall will not be required to set up VPNs or other methods to traverse the APS firewall to access these systems.

Other upgrades during 2003 included SunFire 3800 servers for hardware redundancy and dynamic reconfiguration for central computing services, controls development work, accelerator operations, and ORACLE database services; and two Veritas NetBackup servers for remote Sun server backup.