UNICAT Newsbriefs
Issue 27
December 17, 1998

On behalf of the entire UNICAT staff, we want to extend Season's Greetings and a wish for a prosperous New Year to everyone!

NEWS FROM THE UNICAT X-RAY FACILITY

◊ **Sector 33** (Paul Zschack)

• 33ID

Commissioning activities on the UNICAT Insertion Device Beamline continue to bring us closer to operations. Recently, our two 800 mm mirrors were installed and have provided focusing and harmonic rejection using the Pt stripe. In the next run, we'll be able to safely use all three stripes, which will further improve our performance. Although the control of the mirror bender is currently achieved with a manual controller, this does not severely impact the use of the mirror system. (We are currently moving toward integrated control of the focusing mirror).

Improvements in the DCM cooling scheme have led us to a better understanding of some instabilities. Additional improvements are planned for the current shutdown period. With a gap of approximately 20 mm, we are operating with excellent stability. As the gap closes to about 16 mm, we observe some drifting, but generally stable operations. Improved water cooling of the second crystal stage will hopefully yield stable operations with a fully closed gap.

The Newport Kappa-geometry goniometer has arrived here in Sector 33! A small team of Newport/Micro-Controlle staff has been working for the past two weeks to assemble and adjust the goniometer so that it meets our specifications. After acceptance testing, the goniometer will be installed into the 33ID-D station. (This is currently scheduled for Thursday, 17 December). At that time, we will begin to interface this instrument with UNICAT controls. If all the software control is installed and working, we might have the new goniomter available for users toward the end of the next running period. (Look for updates on the Newport status).

• 33BM

Significant progress is also being made on the UNICAT Bending Magnet Beamline. Components for the beamline (white-beam slits and Bremsstrahlung collimator) and endstations (XAFS) have begun to arrive. Although the DCM remains the time-critical component, the PSL design & fabrication teams continue to make progress.

◊ **Sector 34 News** (Ian Robinson and Curtis Benson)

Since submitting the technical specification for the five hutches of sector 34 in November, there have been several rounds of discussion concerning certain details. The operation of the PSS system has been reviewed and is now acceptable to APS. We decided to include all of the electrical wiring in the request for quotation, expecting that this would be cheaper than adding this afterwards. Since the hutches will be the only permanent structures on the floor for the foreseeable future, we included a good

supply of electrical outlets on the external walls, so that the floor space will be usable.

We have almost completed the detailed design for the mirror positioning system. The moving parts are about to be delivered. The vacuum parts and mechanical parts are out for bid, and the mirror itself will be sent out for bid by the end of December. The next goal is to put together a package of standard component drawings so that they can be sent out for bidding. The technical specification for the CXD diffractometer is also being drafted.

◊ **Building 438E (Sector 34 LOM)** (Paul Zschack)

Plans have been submitted to the APS for the build-out of office space in the Sector 34 LOM. The APS Facilities Group is carefully laying out the office walls, doors, lighting, utilities, HVAC, fire-protection sprinklers, etc. Once a final layout is complete, we can expect construction to begin. The build-out should provide UNICAT member institutions with 11 additional offices in which to locate staff, post-docs, visitors, etc.

UNICAT already occupies the Chemical lab in building 438E with the Excimer Laser program. This joint effort between the ORNL and UIUC has now been moved to this location to free space in the 438D Chemical Lab.

◊◊ APS WARNING ◊◊

APS USERS Take Heed to the following information received from the APS Users Office. Although this notice was received a short time ago it bears passing on.

"The following message was sent to Argonne employees today by laboratory-wide email. We're forwarding it to our on-site users and want you also to be aware of this incident. You may share it with your CAT members as you think appropriate.

Everyone on the Argonne National Laboratory site should be extra alert in moving around the Laboratory, especially after dark.

About 10:30 PM Tuesday, a Security Officer checking a gate on Railroad Drive on the southeast side of the site was attacked and stabbed. Fortunately, the Officer's injuries were relatively minor. He is expected to return to work today.

The DuPage Sheriff is investigating and you will be kept informed when there are further developments. This incident requires that we all be alert to any suspicious individuals anywhere on site and immediately report anything of concern to 911. For the present, be especially alert when walking or jogging on the trails or other remote areas around the site."

If you have any further questions, please feel free to call me (630/252-5981).
Cordially, Susan (APS User Office)"

ANNUAL HECA REPORT

We recently submitted our annual report on the HECA grant. Following is an abbreviated version of that report.

◊ **Activities**

In FY98, UIUC-MRL received 2 new grants from the NSF: The 1st for the periodFY1998-2000 for the development of a coherent x-ray diffraction experimental station on sector 34-ID, and the 2nd for the acquisition of a CCD Detector for Material Research, both grants will be used at APS. In addition, UIUC has assured continuing support for the UNICAT sector 34 construction project from DOE BES through FY2002.

◊ **Beamline Construction**

Highlights of FY1998 activities are described as follows for three UNICAT beamlines.

33-ID Beamline:

- All beamline components are installed.
- Achieved designed parameters of focused beam cross section and energy bandwidth using the double crystal monochromatic with

saggital focusing optics.

- Beam conditioning Table and USAXS equipment commissioned.
- Surface diffraction station commissioned.
- Laser ablation chamber commissioned.
- Commissioning experiments began in August 1997 (see a following section for details).
- Full operation of 33-ID is anticipated in March 1999.

33-BM Beamline

UNICAT received APS approval for the 33-BM beamline construction. The construction phase is expected to end in December 1999 followed by

UNICAT 33-BM Beamline
Procurement and Responsibility Schedule
(as of October 1998)

Procurement Item	Person(s) Responsible	Time Frame
1. Hutches	Zschack	***Beneficial occupancy(6/98)*** Safety integrity test (A, B - complete 7/98)
2. Utilities & Conventional Facilities	Zschack	(ANL T&L) Start (5/98) ***Complete (8/98)***
3. Personal Safety System (PSS)	Zschack	Design complete (4/98) ***Complete (8/98)***
4. Beamline Components:	UNICAT Staff	
• Mask	Zschack	August '98 (design ready)
• L3	Ice	***Order out (3/98)*** Oct. '98 (Delivery)
• K2	Hong (MRL Shop)	May '98 (Design start) September '98 (Complete)
• Mirrors	Ice	***Order out (7/98)*** 9 month delivery time
• DCM	Ice	***Order out (5/98)*** 12 month delivery time
• D1 (beam stop)	Tischler	Oct. '98 (Design ready)
• P7 (modified)	Zschack	Oct. '98 (Order out)
• Beam Stop (Hutch B)	Hong	Nov. '98 (Complete)
• Shielded Transport	Hong/Zschack	Sept. '98 (Order out)
• Be Window	Zschack	July '98 (Order out)
• Vacuum Components	Hong	Jan. '99 (complete
• Tables & Stands	Zschack (L3 and P7) Ice (Mirrors)	Oct. '98 (complete)
5. EXAFS/Topography:	NIST & UOP	
• Topography (slits, fast shutter)	Black	Most Procured by Dec. '97 June '99 (Complete)
• EXAFS/XANES	Bare & Woicik	July '99 (Complete)
6. Diffuse Scattering:	UNICAT Staff	
• Beam Conditioner Table (slits, Io, etc.)	Hong, Zschack	Dec. '98 (Complete)
• Diffractometer	Kappa	***Order out (8/97)*** Delivery indefinite
• Detectors, electronics	Hong, Zschack	Oct. '98
7. Controls	Jemian	Ready when needed

commissioning tests and experiments in early 2000. The following table lists the procurement and responsibility schedule for this beamline.

34-ID Beamline

With combined support from IBHE-HECA, Department of Energy and the National Science Foundation, UNICAT Sector 34-ID is under development for dedicated microfocus and coherent x-ray diffraction applications. A major milestone was achieved with the signing of a Memorandum of Understanding between UNCIAT and APS in August 1998. Subsequently, a Preliminary Design Report was submitted to APS in September 1998 which included an innovative mirror design to split the undulator beam into two parts for x-ray microprobe and coherent x-ray diffraction stations, respectively. Several beamline components have been ordered. The construction phase is expected to end in December 2000.

◊ Computer Controls and Software

The EPICS control system for the UNICAT Sector 33 is now operational and the same system has also been installed at NIST for use in conjunction with the construction of sector 33-BM experimental station equipment. The system is capable of operating diffraction or scattering experiments with up to 16 stepping motors and reading data from 12 single-channel detectors simultaneously, controlled from any of several networked computer workstations. The menu-driven features have been recently utilized to perform testing and checkout experiments on the beamline optical components and the Huber 4-circle diffractometer. All systems have been tested in real operation condition on beamline 33-ID. Current focus is to complete support to beamline 33-BM by December 1999.

◊ Education, Research and Outreach

In addition to commissioning experiments being conducted on UNCAT 33-ID beamline (see section III.2), a number of synchrotron radiation experiments have been carried out by students and staff from the University of Illinois at beamline X-14A, X-16C and X-18A of the National Synchrotron Radiation Light Source, Brookhaven National Laboratory. Specific experiments include surface roughening studies of semiconductors, thermal diffuse scattering of perovskite relaxor ferroelectrics, interfacial structure of Cu on sapphire, texture of TiN hard coatings, etc. Several graduate and undergraduate students are also involved in assembly, testing, electronic equipment check-up and alignment of beamline components.

A graduate level course on synchrotron radiation instrumentation and advanced x-ray diffraction is offered in the Department of Materials Science and Engineering. A CD-ROM and web site-base distance learning class is being implemented in the "Microstructure Characterization" course in the Department of Materials Science & Engineering. One Ph.D. degree supported by the HECA grant was awarded at UIUC in May 1998, and a second Ph.D. student is expecting his degree in February 1999.

Outreaching to high schools, junior colleges, universities and industries in the state of Illinois APS is a major goal of UNICAT to enhance education and promote use facilities at APS. Special exhibitions, including video presentations and Internet access to APS and UNICAT web sites, were presented in March 1998 during the annual Engineering Open House at UIUC, to familiarize high school and college students with science-based higher education in synchrotron radiation instrumentation and research. Efforts were also made in outreach to industries such as Motorola Co. in Des Plaines, and Cabot Corp. in Tuscola, by presenting seminars and conducting joint R/D collaborations utilizing UNICAT facilities at APS and CMM facilities at UIUC-MRL.

◊ Commissioning Experiments on 33-ID

In August 1997, UNICAT beamline 33-ID entered into the commissioning phase. Following commissioning experiments have been carried out in FY98 by UNICAT members and their associates.

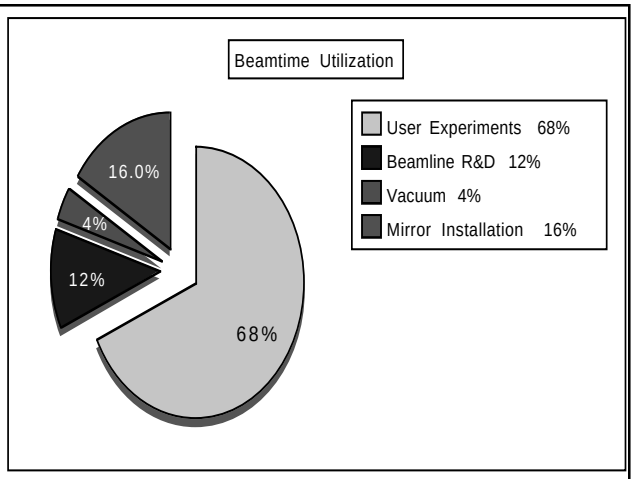
- Surface reconstruction/interface structures - T. C. Chiang and Z. Wu, UIUC

- Diffuse scattering in $Ag_{50}Pd_{50}$ solid solution - C. J. Sparks, G. E. Ice and W. Schweika,

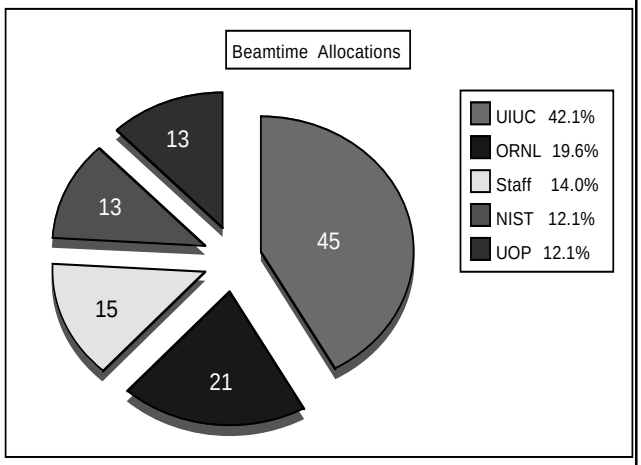
ORNL

- Phonon Imaging - H. Chen, T. C. Chiang, and Z. Wu, UIUC
- Zeolite and metal phosphate structures - powder methods - R. Broach and R. Kirchner, UOP
- Thin-film domain structures using CXRS - I. K. Robinson and J. Pitney, UIUC
- Induced magnetic moment in Co/Ir thin-film multilayers - M. Salamon and K. O'Donovan, UIUC
- Strain distribution and defect structures in implanted Si - B. Larson, J. Tischler, G. E. Ice and M. Yoon, ORNL
- Ultra Small-Angle X-ray Scattering (USAXS) - A. Allen and G. Long, NIST
- Surface/Interface Diffractometer commissioning (Surface reconstructions) - H. Hong and Z. Wu, UIUC
- Laser Ablation Chamber commissioning (ZnO film growth) - J. Tischler, ORNL
- EXAFS Experiments - S. Bare, UOP
- Anomalous Scattering - P. Zschack, UIUC
- Phase Transitions - T. C. Chiang, H. Chen, Z. Wu, UIUC

During this FY98 commissioning period sector 33-ID is oversubscribed by 46%. The distribution of beamtime utilization is shown in the first pie chart below; more than two thirds of beamtime were utilized for experiments with the balance for component installation and beamline R&D.



Among the 68% beamtime utilized by UNICAT members, the allocation percentages to each UNICAT member institution is listed in the following pie chart.



NEXT OPERATION PERIOD PROPOSALS DUE

To interested members of the UNICAT User community:

It is once again time to begin planning commissioning experiments for the next operations period at the APS. Paul Zschack would like to schedule commissioning experiments for the ID beamline for the period between 21 Jan 1999 and 9 Mar 1999. The UNICAT Member Beamtime Request Form can be found at http://www.uni.aps.anl.gov/unireq.htm or as a link from our home page. Please submit your requests as early as possible, but no later than 4

Jan 1999. You must also complete a safety approval form. It is particularly important to submit this form early for new experiments and for those that pose hazards that need to be controlled.

Although the new Newport diffractometer is here, it is unclear at this time whether it will be available for use. This depends mostly on the time that will be required to integrate the controls to do useful scanning. For those of you who are interested in using the diffractometer, I'll keep you up-to-date on the status of this effort.

We have made improvements to the DCM that provide stable operations for certain gap settings. Further improvements are planned, but good stability has been achieved for gap settings of about 16 mm and larger. Hopefully the improvements we have planned for this shutdown will permit stable operations with a fully closed gap.

We have also demonstrated good vertical focusing and harmonic rejection. A vertical spot size of approximately 100 um has been achieved using the Pt stripe on the 800 mm mirrors. The other stripes should be available in January as well.

PUBLICATIONS

In order to have up to date records for reporting to our funding sources it is imperative that you forward copies of all publications resulting from UNICAT funded research to Ramona in the main office at UIUC. Abstracts, articles, book chapters, invited talks, symposium proceedings and supported thesis research all need to be reported. If you have any questions contact Ramona Simpson.

UNICAT NEWS BRIEFS

Edited by H. Chen and R. Simpson