

# THE ADVANCED PHOTON SOURCE

## MICROANALYSIS FOR HIGH THROUGHPUT AT BEAMLINE 8-BM

The Advanced Photon Source (APS) recently added to its suite of beamlines a dedicated hard x-ray microanalysis facility for high-throughput approaches at X-ray Science Division (XSD) beamline 8-BM. The facility, currently accepting user proposals, was designed to address increasing user demand for x-ray fluorescence (XRF) microanalysis techniques. By supporting microscopy at low to medium resolution, and providing cutting-edge XRF techniques, the facility will complement existing and oversubscribed hard x-ray microprobes.

Planning for the facility began in 2007 as a project proposal through the APS, and a potential home for the project was found at 8-BM. The project was reviewed and endorsed by the APS Scientific Advisory Committee in early 2008. A final design report was prepared in the spring of 2009, and first light was brought into the redeveloped 8-BM station in the fall of 2009.

The beamline is remarkable in its re-purposing of existing equipment. Over a dozen major components of the beamline, including both the double-multilayer and double-crystal monochromators, were reutilized from other APS sectors. These components now comprise a beamline with an energy range of 7 to 22 keV, focused by a toroidal mirror to deliver  $4 \times 10^{10}$  ph/s in a .5-mm beamspot at the entrance of the 8-BM research station.

The current facility plans call for support of three separate experimental stations within 8-BM. To complement imaging data on cellular metals, a pinhole imaging instrument has been commissioned to enable metallo-proteomic studies. This instrument provides microanalysis at the 0.15-0.5 mm length scale. The double-crystal monochromator adds the ability to probe chemical state, and possible coordination environment, using x-ray absorption near edge structure. The wet methods for this technique were developed by beamline staff [1] with the goal that a high level of support for this technique would be available to the users. This instrument is now completely commissioned and available through the APS General User Proposal System. This unique capability is enabling new research that connects science at multiple length scales, pushing questions from the organism level down to that of proteins.

Additionally, work is currently under way to commission a medium-resolution microprobe (10-100  $\mu\text{m}$ ) using a Kirkpatrick-Baez mirror pair to provide focus. By ensuring that the system is entirely cross-compatible with existing



In the 8-BM-B research station, l. to r.: Stefan Vogt, Evan Maxey, Lydia Finney, Sophie-Charlotte Gleber, Christian Roehrig, and Jesse Ward. (Photo by Evan Maxey)

high-resolution x-ray microprobes, this instrument will complement those capabilities and allow users to place their high-resolution images into a larger context. It is anticipated that this instrument will become available to APS general users in the fall of 2011.

Finally, a flow cytometer is also planned for 8-BM, and is expected to run simultaneously with other instrumentation; it holds great promise for improving throughput and sample statistics for XRF microanalysis.

The commissioning of 8-BM owes its successful completion to many people, including Mark Erdmann, Try Leng Kruiy, Mohan Ramanathan, Joe Sullivan, and the Mechanical Operations and Maintenance Group, all in the APS Engineering Support Division; and Christian Roehrig, Rick Spence, and Ed Wrobel (all XSD), among others. The continued commissioning of instrumentation, and user support, is being carried out by Lydia Finney, Evan Maxey, Jesse Ward, Stefan Vogt, and Sophie-Charlotte Gleber (all XSD).

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### References

[1] L. Finney et al., "Imaging Metals in Proteins by Combining Electrophoresis with Rapid X-ray Fluorescence Mapping," *ACS Chem. Biol.* 5(6), 577 (2010), as well as a highlight by Nathan Zahler in the same issue.

## CALL FOR APS GENERAL-USER PROPOSALS

The Advanced Photon Source is open to experimenters who can benefit from the facility's high-brightness hard x-ray beams.

General-user proposals for beam time during Run 2011-3 are due by Friday, July 8, 2011.

Information on access to beam time at the APS is at [http://www.aps.anl.gov/Users/apply\\_for\\_beamtime.html](http://www.aps.anl.gov/Users/apply_for_beamtime.html) or contact Dr. Dennis Mills, [DMM@aps.anl.gov](mailto:DMM@aps.anl.gov), 630/252-5680.

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