

# 11-nm Focus Achieved

## Multilayer Laue Lens Developed for HXN Beamline at NSLS-II

### Scientific Achievement

A multilayer Laue lens (MLL), developed for the HXN beamline at NSLS-II, has achieved an 11-nm focus. This MLL has a 43- $\mu\text{m}$  aperture and will provide sufficient working distance for *in-situ* experiments.

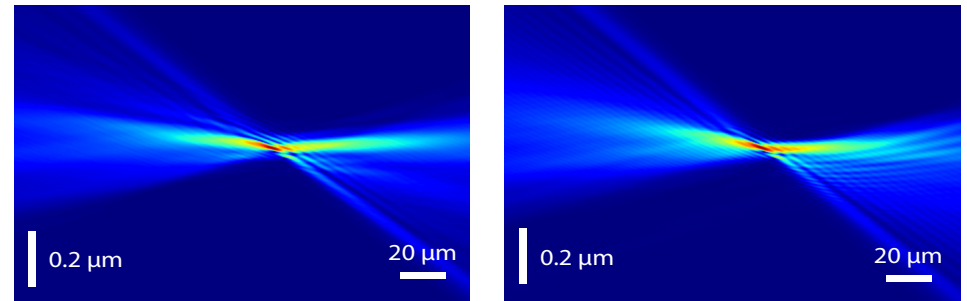
### Significance and Impact

Following this success, the HXN beamline team expects to have a set of 10-nm MLL optics ready for early science experiments by December 2013.

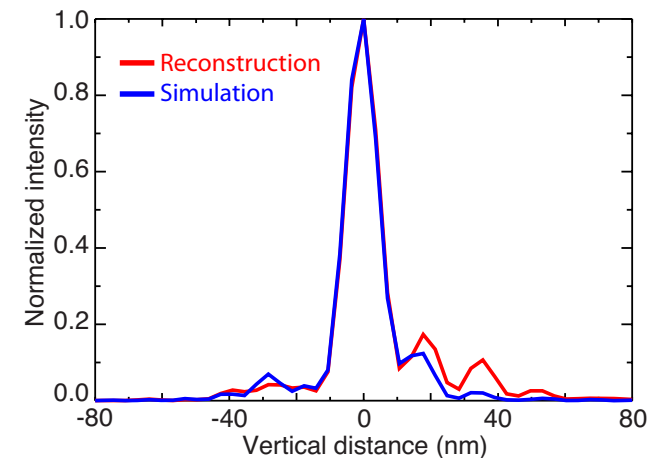
### Research Details

- The team used an established imaging technique called ptychography to obtain quantitative characterization of x-rays focused by an MLL.
- The experimental result agrees very well with theoretical simulation, which confirms the reliability of the method.
- The obtained wavefront is directly related to MLL quality, which provides critical feedback for refining a multilayer growth process that will achieve a 1-nm focus.

X Huang, H Yan, E Nazaretski, R Conley, N Bouet, J Zhou, K Lauer, L Li, D Eom, D Legnini, R Harder, IK Robinson, YS Chu, Scientific Reports, 3, 3562 (2013).



Above: The left figure shows the propagation of a reconstructed wavefront through the focus from the measurement. The measured wavefront is remarkably similar to the simulated wavefront propagation. Below: The line profile through the focus shows that most of the energy is under the central peak. The fitting error of the peak is  $\pm 0.1$  nm.



The experiment was performed on beamline 34-ID-C at Argonne's Advanced Photon Source and in collaboration with the NSLS-II Optics Fabrication Group.