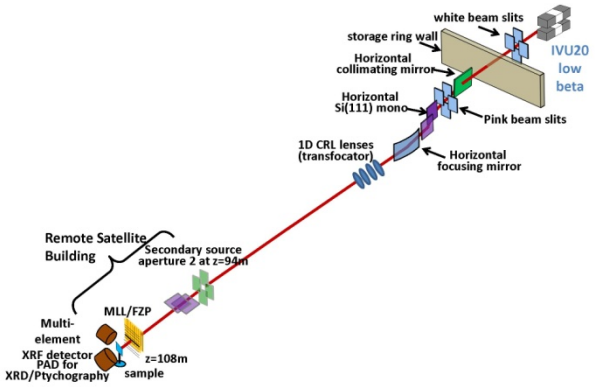
X-ray Nano-Probe (HXN)

Scientific Scope

The hard x-ray nanoprobe beamline and endstation instruments (HXN) will be designed and constructed to explore new frontiers of hard x-ray microscopy applications with the highest achievable spatial resolution.

Currently the available spatial resolution for scientific applications, provided by scanning x-ray microscopes in the hard x-ray regime, is limited to ~50nm, which is still insufficient for probing the nanoscale interfacial structures critical in determining properties and functionalities of material and biological systems. The HXN beamline aims to enable x-ray experiments at spatial resolutions ranging from 10 to 30 nm with an ultimate goal of ~1 nm.



Schematic layout of the beamline

Beamline Description

The beamline is designed to minimize all possible sources of vibration and thermal drift. The conceptual design of the HXN beamline is optimized with the physical boundary conditions required to construct a satellite building physically isolated from the potential noise sources from the NSLS-II storage ring, experimental hall, and the adjacent lab-office building. This stability is needed to produce the ultimate goal of a 1 nm spot size.

<Click here to see a 3D CAD view>

<Conceptual Design Report>

Techniques

- Nano-diffraction and fluorescence
- Differential phase contrast (DPC) and coherent diffraction imaging (CDI) {supporting techniques}

Current status:	preliminary design
Construction:	starts January 2012
Commissioning:	begins June 2014
User Operation:	begins June 2015

Beamline Performance

Source	U20 Undulator
Energy range (keV) Wavelength range (Å)	6-25 keV 0.519 – 2.597
Energy resolution @25keV	$\Delta E/E = 1 \times 10^{-4}$
Beam size at sample (nm^2 FWHM)	10-30(h) x 10-30(v)
Flux at sample @10keV ph/s	$> 5 \times 10^{8}$

Equipment in End Station

Nanoprobe

10-30 nm resolution science instrument
ZP and MLL focusing optics
1 nm positional stability and motion
0.01°C temp stability

High-resolution DCM (10^{-6}) (mature scope)

Detectors

Multi element SSD
Pixel-array detector for diffraction/ptychography
4k x 4k 16-bit CCD

Contacts

Y. S. Chu	ychu@bnl.gov
L. Margulies	lmargulies@bnl.gov

Signing of agreement between NSLS-II Project Director Steve Dierker and the Beamline Advisory Team. Front, left to right: Tonio Buonassis (MIT), Don Bilderback (Cornell University), Cev Noyan (Columbia University), Steve Dierker (BNL), Qun Shen (BNL), and Yong Chu (BNL). Back, left to right: Pete Siddons (BNL), Ray Conley (BNL), Andrei Fluerasu (BNL), Martin Holt (Argonne National Laboratory), Tony Lanzirotti (University of Chicago), Nick Simos (BNL), Stefan Vogt (Argonne National Laboratory), Ken Evans-Lutterodt (BNL), Hanfei Yan (BNL), and Andy Broadbent (BNL).