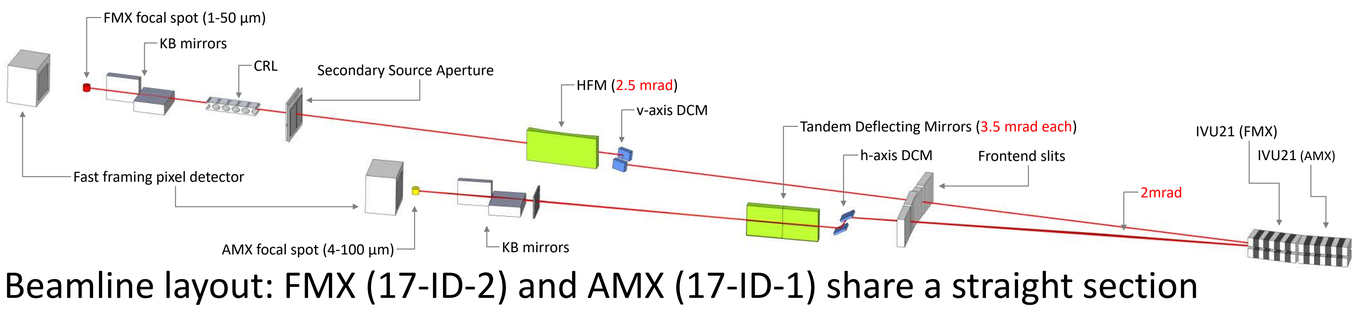
FRONTIER MACROMOLECULAR CRYSTALLOGRAPHY (FMX)

BROOKHAVEN NATIONAL LABORATORY

NATIONAL SYNCHROTRON LIGHT SOURCE II

SCIENTIFIC SCOPE

Frontier macromolecular crystallography (FMX) is an undulator beamline at sector 17-ID-2 for structural biology investigations with micro-focusing macromolecular crystallography (MX), optimized for challenging bio-crystallographic problems. Its flux density is unmatched by MX facilities world-wide. Beamline operation is funded by the DOE BER and the NIH through the Life Science and Biomedical Technology Research Center (LSBR).



Beamline layout: FMX (17-ID-2) and AMX (17-ID-1) share a straight section

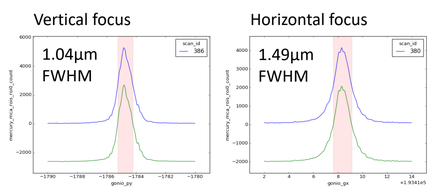
BEAMLINE CHARACTERISTICS

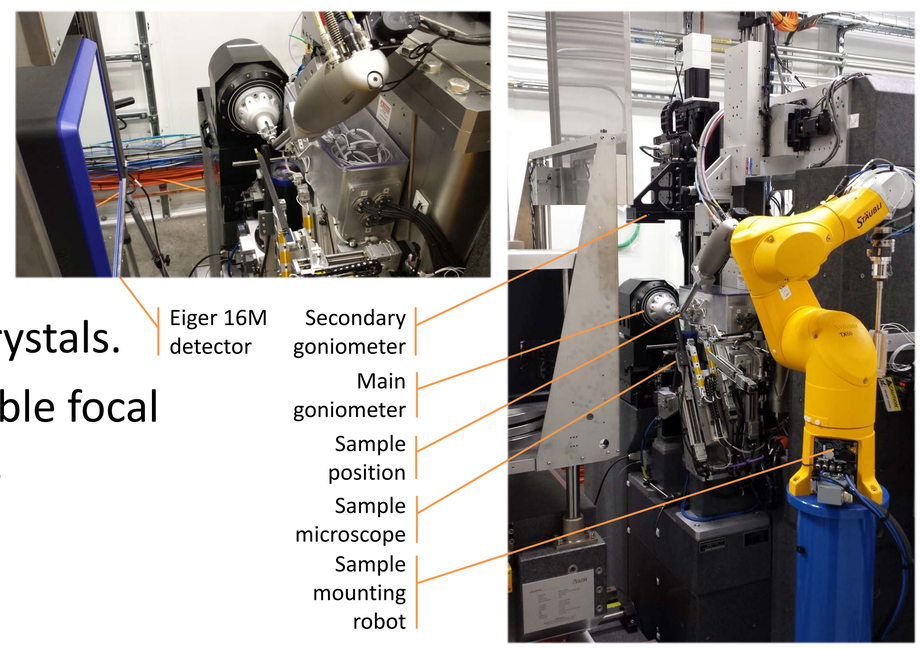
FMX at NSLS-II:

- Elucidation of structure and function of macromolecular complexes from small, weakly diffracting heterogeneous or especially radiation-sensitive crystals.
- High flux, tunable energy, variable focal spot size and beam divergence.

TECHNIQUES:

- Microfocus Macromolecular Crystallography
- Serial crystallography
- Cryo- & room temperature data collection





ENDSTATION DETAILS:

- Eiger 16M detector
- 100 nm precision goniometer
- Secondary goniometer
- High resolution sample microscope, fluorescence imaging
- Robotic sample mounting with 384 specimen storage dewar

Overview

PORT: 17-ID-2

SOURCE: Undulator (IVU21)

ENERGY RANGE: 5 – 30 keV

ENERGY RESOLUTION: $\Delta E/E = 1.6\times10^{-4}$

BEAM SIZE: 1×1.5 µm^2, expand to 20 µm

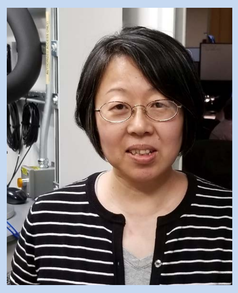
FLUX: 5×10^{12} ph/s at full ring current

BEAMLINE PHONE: 631.344.1617

BEAMLINE WEBSITE: www.bnl.gov/nsls2/beamline/17-ID-2

Beamline Staff

Martin R. Fuchs
Lead Beamline Scientist



Wuxian Shi
Partner Beamline Scientist

Apply for Beam Time

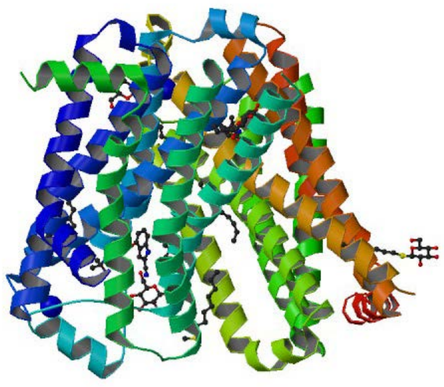
Beamlines at NSLS-II are available to all scientific researchers through a peer-review proposal process. For more information, see the NSLS-II Users' Guide at:

www.bnl.gov/ps/userguide/

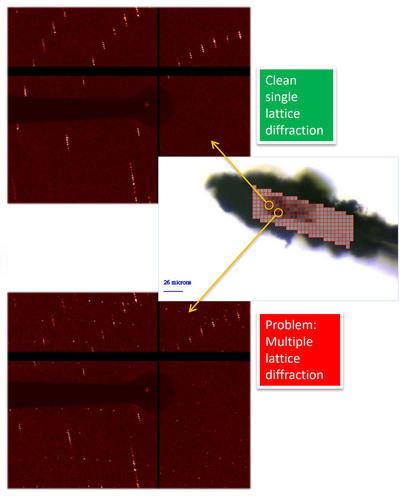
and the LSBR website at:

www.bnl.gov/ps/LSBR/

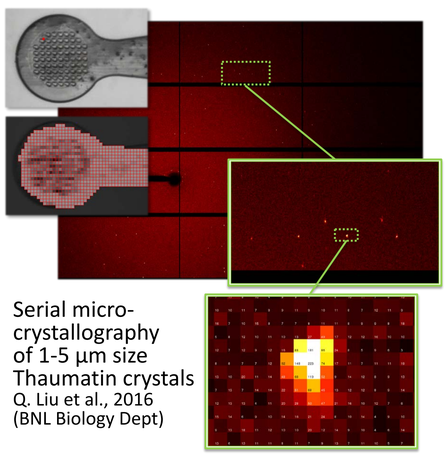
SCIENTIFIC APPLICATIONS



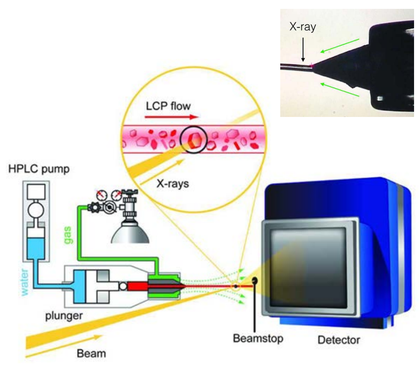
Structure of a ß1-adrenergic G-protein coupled receptor
T. Warne, G.F. Schertler, et al., *Nature* (2008) **454**, 486-491



Microbeam rastering of Fe/S cluster containing protein from *Clostridium scindens*
J. Bonanno et al. (Einstein School of Medicine), 2016

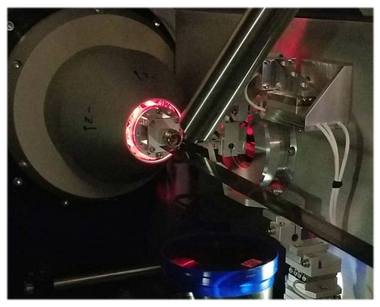


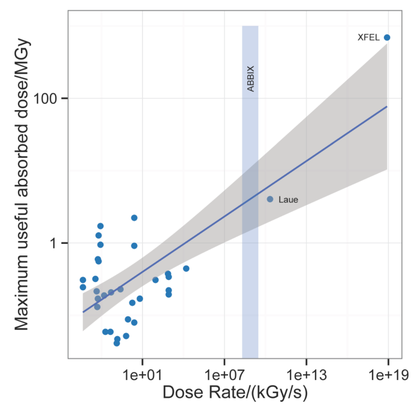
Serial micro-crystallography of 1-5 µm size Thaumatin crystals
Q. Liu et al., 2016 (BNL Biology Dept)



Lipidic cubic phase serial millisecond crystallography using synchrotron radiation
P. Nogly, et al., *IUCrJ*, (2015) **2**, 168-176
2.4 Å structure of bacteriorhodopsin at ESRF beamline ID13

Ultrafast piezo scanner for fixed target raster serial crystallography
Gao, Nazaretski, Fuchs et al.
LDRD FY16





Data compiled from literature courtesy J. Holton

Micro crystal diffraction often required to yield structures: Membrane protein (L)
For larger crystals: Use micro beam to find best diffracting regions and mitigate impact of radiation damage (R).

Serial Crystallography:
Frozen suspension (L): Combine elements from serial fs crystallography with helical scan approach of micro-crystallography
Room temperature (R): LCP Jet

Very high dose rates MX:

- Time resolved & rapid serial measurements
- Outrunning radiation damage?