

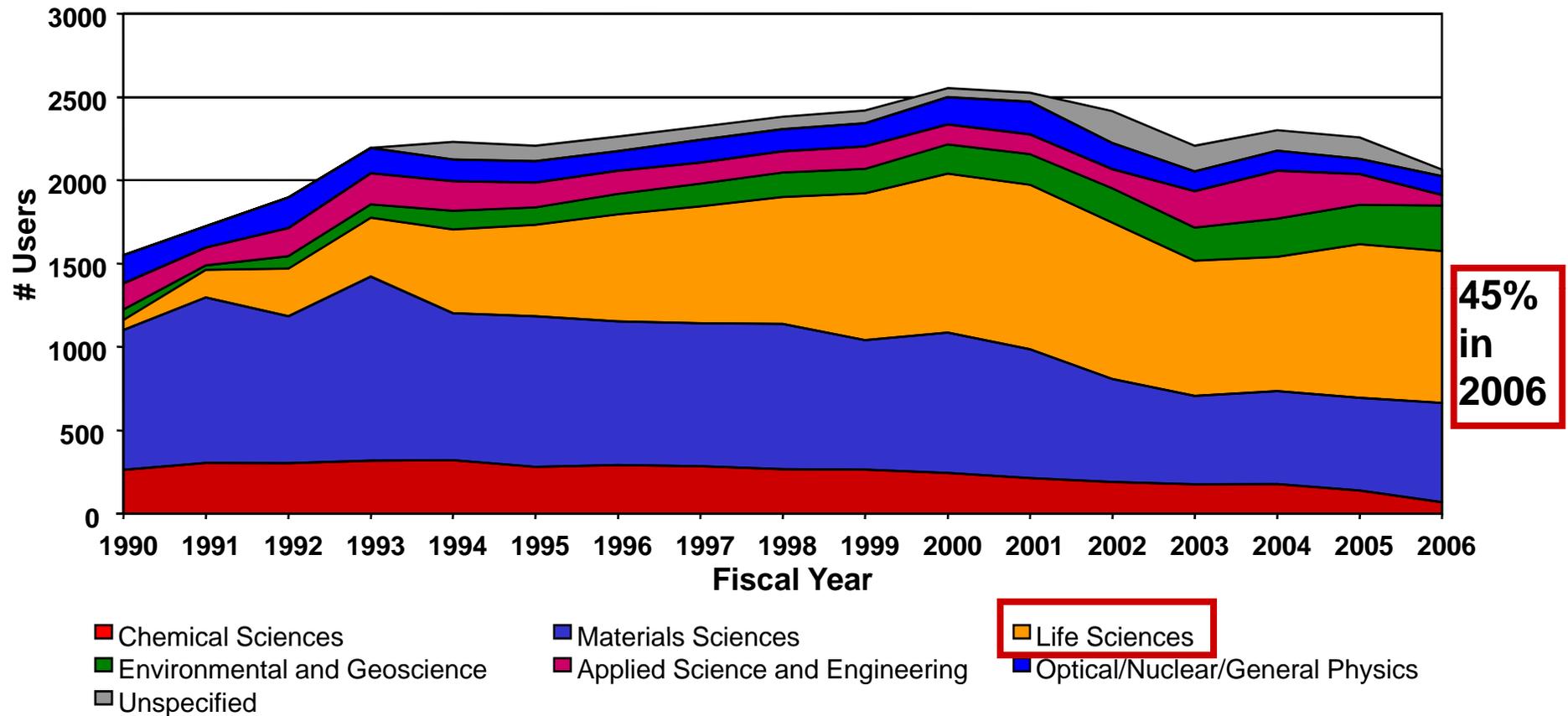
SCIENTIFIC STRATEGIC PLANNING

Life Sciences

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BNL-NSLS

Life Sciences Programs Today



Two major research communities:

1. Structural and Molecular Biology
2. Biomedical Spectroscopy and Imaging

Life Sciences Strategic Planning

- 1. Short-term planning for the growth and expansion of current NSLS programs**
 - For world-class science today
 - For the transition to NSLS-II
- 2. Develop the vision of the scientific program for NSLS-II**
 - What beamlines and facilities will be needed?
 - How will the impact on the user community during the transition be minimized?

Life Sciences Strategic Planning

Orient the scientific programs toward NSLS-II

- Scientific Strategic Planning Workshops
- Long range white papers to translate the scientific challenges to an overall plan for
 - Beamline upgrades at NSLS
 - New beamlines at NSLS (e.g. X5 insertion device port)
 - New beamline proposals for NSLS-II
- NSLS DOE review (Apr 08) and SAC meeting (May 08)
- Revision of the NSLS 5-Year Plan

Life Sciences Strategic Planning

Transition Research Resources, Consortia, PRTs

- Research Resources and PRTs are responsible for many scientific programs at the NSLS
- Work with research resources (e.g. PXRR, Case Center for Synchrotron Biosciences, COMPRES, Catalysis consortium) on their program renewals
- Work with PRTs on their long term plans and transition plans
- evolution of their scientific programs and their role in operating beamlines

Beamline / Endstation Transfer

Rationale

- Ensure significant capacity for NSLS-II at the commencement of operation to accommodate the large number of users from NSLS
- NSLS-II large gap dipoles (for far-IR), soft bends, and three-pole wigglers are world-class sources for many experimental techniques
- Many NSLS beamlines, with proper upgrades funded by DOE and other agencies, will be state-of-the-art for these sources
- Commissioning and use of the upgraded hardware at NSLS prior to transfer to NSLS-II will save valuable commissioning time
- Recommended by Lehman CD-1 review and NSLS-II Experimental Facility Advisory Committee (EFAC)
- Supported by DOE/BES

Beamline / Endstation Transfer

Proposed Mechanism

- A letter of interest (LOI) will be required for transfer of any PRT or facility beamline
- NSLS-II Experimental Facilities Advisory Committee (EFAC) will perform review
- Upon EFAC approval, form Beamline Advisory Team (BAT) and planning for beamline upgrades, including seeking funding

Beamline / Endstation Transfer

Beamline transfer working group (BTWG)

- Established at NSLS and led by S. Hulbert
- Representation from NSLS, NSLS PRTs, NSLS UEC, and NSLS-II
- Scope of work:
 - **Identify** the types of beamlines and endstations which are most suitable to be transferred, and to which type of NSLS-II source (ID, bend, 3PW, IR)
 - **Perform** detailed analysis of the performance of these beamlines/endstations; **determine** necessary upgrades for these beamlines to match NSLS-II sources
 - **Coordinate** major NSLS facility beamline/endstation upgrades
 - **Perform** detailed analysis of cost and schedule for all beamline transfers, after EFAC approval

Possible Distribution of Transitioned Beamlines

Technique	NLS-II source	# at NLS-II	# at NLS (FY2007)
Far-IR spectroscopy	large gap IR	2	2
Mid-IR spectromicroscopy	standard IR	2	2
Soft x-ray MCD	soft bend	1	2
Soft x-ray spectroscopy	soft bend	1	6
Soft x-ray imaging (STXM)	soft bend	1	2
X-ray macromolecular crystallography	3-pole wiggler	3	8
Tender x-ray spectroscopy	soft bend	1	3
X-ray spectroscopy	3-pole wiggler	2	7
X-ray powder diffraction	3-pole wiggler	2	6
X-ray micro-diffraction	3-pole wiggler	1	1
X-ray scattering	3-pole wiggler	2	8
X-ray imaging	3-pole wiggler	2	4
X-ray microprobe	3-pole wiggler	1	3
SAXS	3-pole wiggler	1	3
Very hard x-ray	SCW	2	4
Totals		24	61

Beamline Transition Plan Summary

- ~20 beamlines will be transferred, covering techniques:
 - Far-IR spectroscopy; mid-IR spectromicroscopy; soft, tender, and hard x-ray spectroscopy; MCD; soft and hard x-ray imaging; microprobes, powder diffraction; microdiffraction; scattering; SAXS; macromolecular crystallography; and very hard x-ray scattering.
- Cost includes (no operating costs)
 - New optics required to match NSLS-II source and/or layout (e.g. mirrors, crystals, gratings)
 - Disassembly, moving, and reassembly
 - Front end, First optics enclosure, control systems at NSLS-II
 - Design support
 - Additional hardware (e.g. beampipes, cabling, photon shutters)

Total transition cost = ~\$45M (direct, FY07 dollars)

Scientific Strategic Planning Workshops

Life Sciences	Jan. 15-16
Materials Science and Engineering	Jan. 17-18
Earth and Environmental Sciences	Jan. 22-23
Chemical and Energy Sciences	Feb. 1
Hard Condensed Matter and Materials Physics	Feb. 5-6
Soft and Biomolecular Materials	Feb. 11-12

Goals of Scientific Strategic Planning Workshops

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Workshop Strategy

Life Sciences “Village” Environment

Structural/Molecular Biology:

For the same protein or complex:

- small-angle x-ray scattering: low-resolution structure, static & dynamic
- EXAFS: metal active site environment, static & dynamic
- MX: atomic-resolution structure, static & dynamic

Chemical/Structural Imaging:

In a single biological cell:

- infrared imaging: chemical imaging of biological cells
- full-field, soft x-ray TXM: nanoscale 3D sub-structure
- x-ray spectromicroscopy: 3D nanoscale chemical imaging of organic components
- x-ray fluorescence microprobe: 3D trace element mapping

To promote synergy between life sciences users
and explore interactions with other communities

Deliverable of the Workshop

A **white paper** that will be submitted to:

1. NSLS management for short-term scientific planning and preparation for the transition to NSLS-II
2. NSLS-II management as a vision for life sciences at the new facility

Topics discussed:

- The Growth, Expansion, and Transition of NSLS Scientific Programs
- Proposed Suite of Beamlines
- Beamline Specifications and R&D Needs
- Recommended Transition/Construction Sequence
- Facility Infrastructure at NSLS-II
- Synergy with other Communities
- Possible funding mechanisms

Life Sciences

Date: January 15-16, 2008

Location: Berkner Hall

Attendees: 72

Organizers: Lisa Miller, Bob Sweet, Mark Chance, Vivian Stojanoff, Marc Allaire, Lin Yang, Chris Jacobsen, John Sutherland



Agenda:

- Preliminary plans for each research community (MX, SAXS, XAS, FTIR, STXM, DEI, CD, CDI, MRT)
- Lab space, ancillary facilities discussion
- Breakout sessions (MX, SAXS, Imaging)
- Synergy among groups
- Funding
- Report writing

Workshop Outcomes

Synergy

- clear overlap in interests with environmental sciences (XAS and most imaging techniques) and soft and biomaterials (SAXS/WAXS)

Beamlines:

- SMB: 5 MX (2 TPW, 2U), 1 SAXS/WAXS (TPW), 2 XAS (DW, TPW), 1 FP (DW), 1 CD (SB)
- Imaging: 3 XRF microprobes (2U, TPW), 3 IR (SB), 1 STXM + 1 CDI (U), 1 TXM (TPW), 1 DEI (SCW)
- First phase of new beamlines: MX, SAXS, XRF microprobe (2)

Laboratory Office Building (LOB)

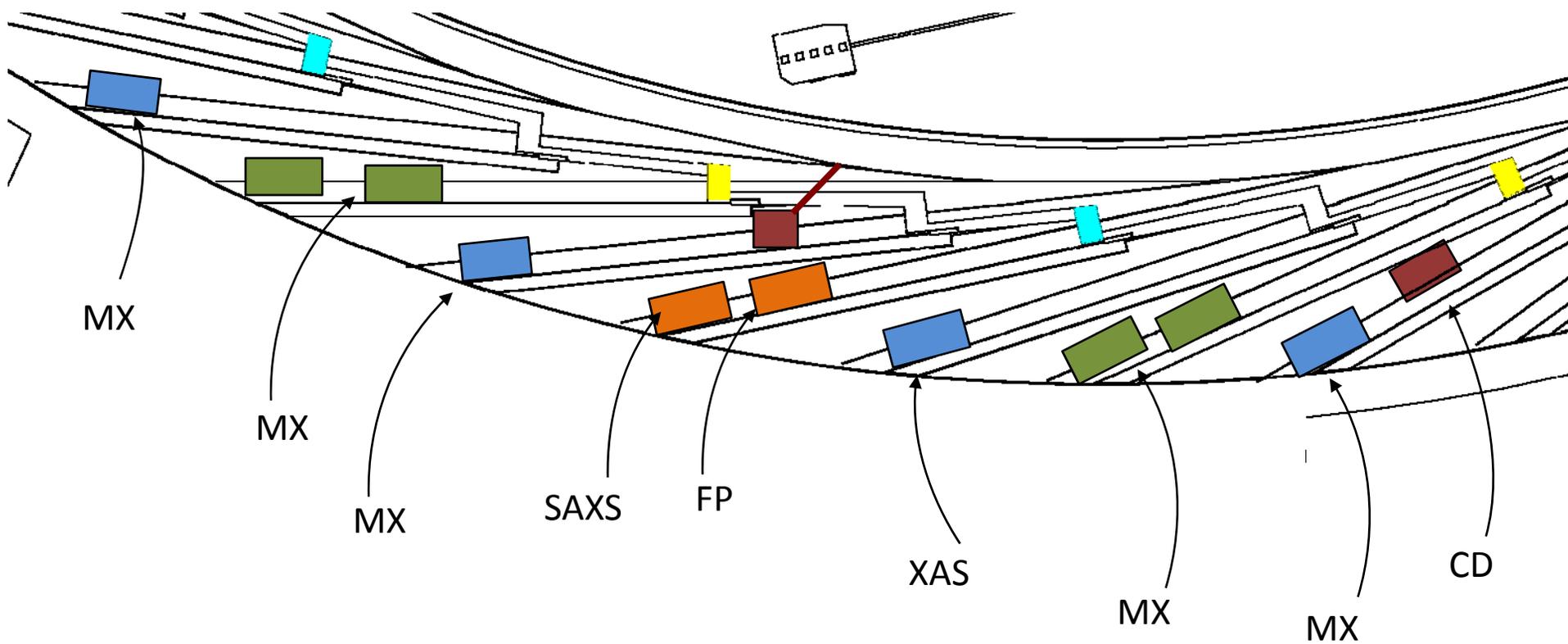
- Extensive discussion: community would like 2 LOBs, one shared with enviro, soft materials communities
- Cryogenic sample prep, Sample manipulation, Microscope room, Cell culture, Crystallization, Spectroscopy room, Dishwasher, autoclaves, Cold rooms, hoods
- Also strong interest in larger adjacent facility, i.e. Structural Biology and Imaging Center

Building a Life Sciences Village Environment

Multidisciplinary Research

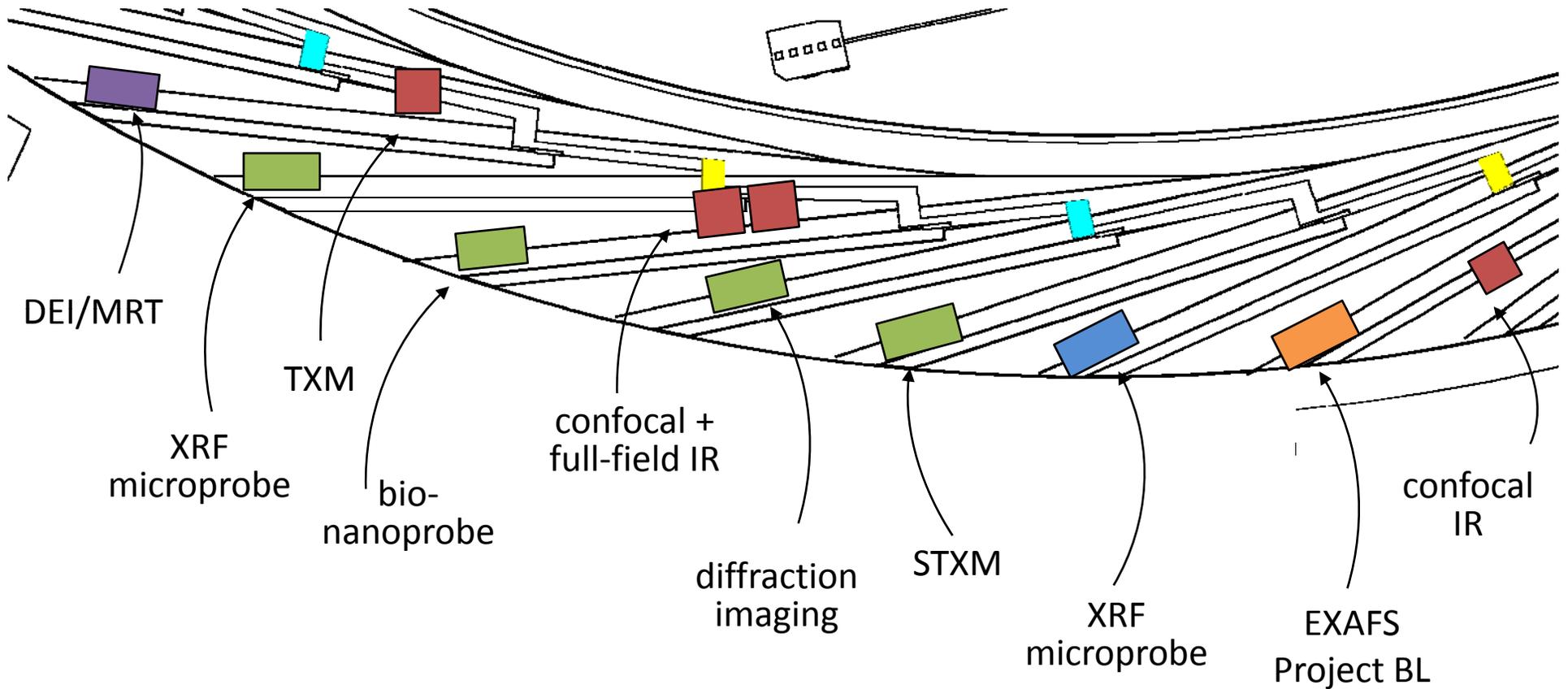
- Include related synchrotron disciplines: enviro, soft matter, biophysics
- Include non-synchrotron techniques: Vertically integrated research laboratory with facilities for cell growth, macromolecule purification, crystal growth, and characterization by other methods than light-based ones – NMR, mass spectrometry, and electron microscopy.

Structural Biology Beamlines



-  3-pole Wiggler
-  Damping Wiggler
-  Undulator
-  SC Wiggler
-  Bending magnet

Chemical & Structural Imaging



-  3-pole Wiggler
-  Damping Wiggler
-  Undulator
-  SC Wiggler
-  Bending magnet

Building a Life Sciences Village Environment

Adjacent Sectors and a Laboratory-Office Building (LOB)

- Align life sciences beamlines on adjacent sectors for strong scientific interactions
- Identify funding and construct a laboratory-office building (LOB) for life sciences staff and users

Building a Life Sciences Village Environment

Structural Biology & Imaging Research Center



Something like the Partnership for Structural Biology at ESRF

<http://psb.esrf.fr/>

Building a Life Sciences Village Environment

Development Research

- Create long-term funding for personnel in Joint Photon Science Institute (J-PSI) building.
- Could improve x-ray detectors, x-ray optical systems, and automated systems for specimen manipulation.

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Short-Term Planning for X6A

- Synergy with new high-throughput SAXS, CD, and XAS program
 - Give X6A users opportunity to run solution-state structure techniques
 - Eight X6A users have contributed proteins for CD neural network
 - SAXS postdoc to be hired for full-time effort (X9, X6A)
- User access to insertion device beamlines (e.g. X25)
 - X25 is also a facility beamline; timeshare would be beneficial for NIGMS Resource
- Mail-in MX, remote access (w/wo automounter)
- Construction of a new MX beamline at NSLS (X5)

Transitioning of X6A

- As a facility beamline, we plan to transition X6A to NSLS-II
- Endstation equipment will be kept state-of-the-art
- Questions to be answered:
 - Will the beamline move to a 3PW?
 - Will enstation be moved to a new ID?