

NSLS-II Update

J.P. Hill, Director, NSLS-II

UEC Town Hall meeting August 5th 2015

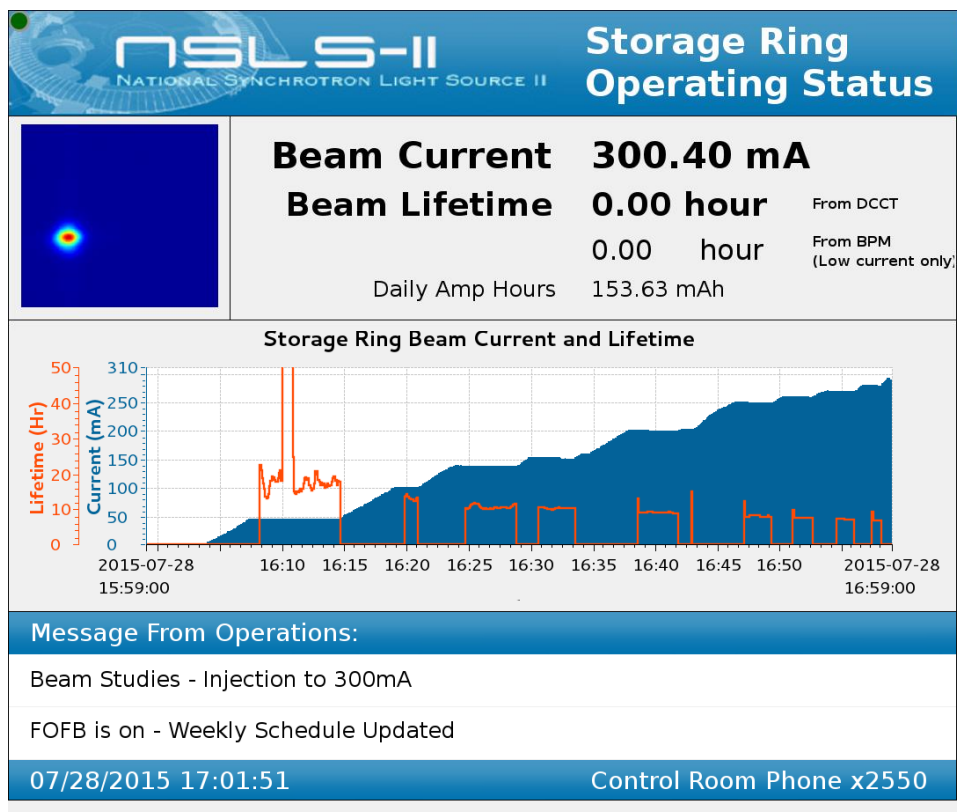


Outline

- Accelerator commissioning + Future plans
- Beamline commissioning + User readiness
- Beamline Construction activities
- Budget FY15 + projections forward
- Strategic Planning process and workshop
- Communications

NSLS-II Accelerator Commissioning

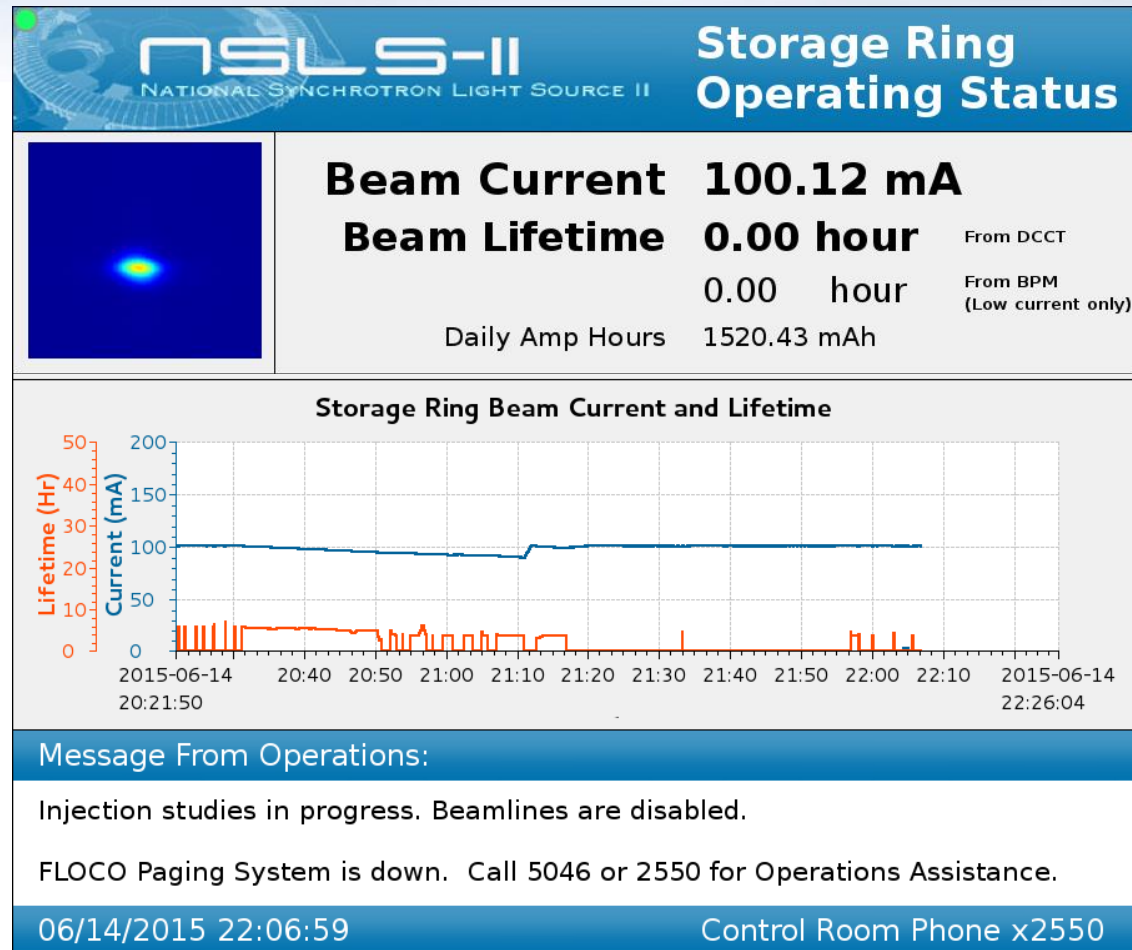
- NSLS-II Accelerator Systems have provided >2000 hours of SR operations in FY15.
- 85% reliability delivered. Met goal for FY15, expect to improve next year.
- Stored 300 mA



- **Stability:** Met specification:
< 10% of source size in
vertical and horizontal
- **Emittance:** Met specification
1 nm-rad horiz
0.006 nm-rad vert

5pm July 28th 2015

First Demonstration of Top-off Injection June 14th



- Initial top-off injection studies conducted June 14, 2015
- Injections every 30 sec for ~50 minutes, with beamlines shutters closed

Booster Power Supply Failure

- Booster dipole power supply, BD1, failed early Sunday morning, July 12
- Staff worked hard to diagnose and fix the problem. While the diagnosis of the root cause of the initial event was relatively quick, diagnosing the subsequent failures took many iterations
- SR beam returned Friday afternoon, July 24; Total loss in ops hours ~150 hrs
- We plan to schedule additional ops to gain back of some lost user hours



Original IGBT

Replacement IGBT

More on Booster Power Supply Failure

- Root cause of the failure was a damaged HV cable that arced & triggered the initial failure; Final repair was conducted with the help of DANFYSIK engineer who designed, built & commissioned the power supply
- Difficulty of recovering from the incident partly came from the fact that manufacturer of the high power switching element changed gate-current rating of the equipment without updating model identification and data sheet
- We are implementing improvement plans to check critical spares when they arrive, and that we have up-to-date documentation for all critical equipment



Failed BD1 Power Supply

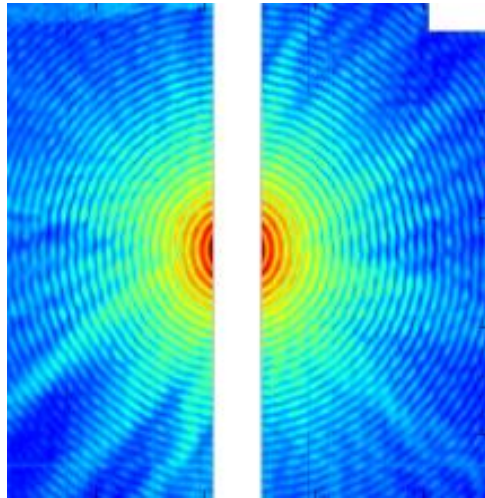
Accelerator: Look ahead

- August shutdown is a busy one:
 - Top-off installation and testing
 - Commission ABBIX IDs and FEs
 - 2nd SC RF Cavity installation (probably)
- Deliver top-off to users in Fall cycle
- Continue to ramp up current in machine: Goal is 400 mA in FY16
- Deliver more user hours next year: Goal is >3400 hours
- Deliver more reliable beam next year: Goal is 90%

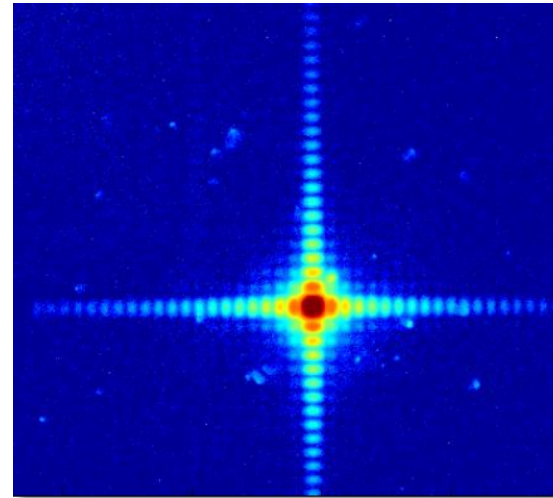
NSLS-II Beamline commissioning

- All 7 project beamlines routinely operating at 150 mA
- First paper already published (Appl. Phys. Lett. Mat. Feb 2015)
- 21 other beamlines currently under construction
- Early data looks very promising.

Coherent Diffraction patterns:



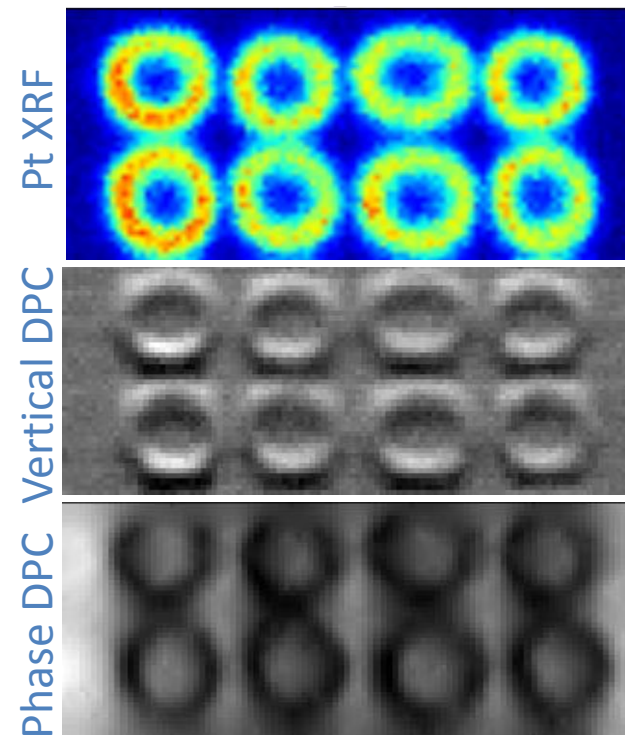
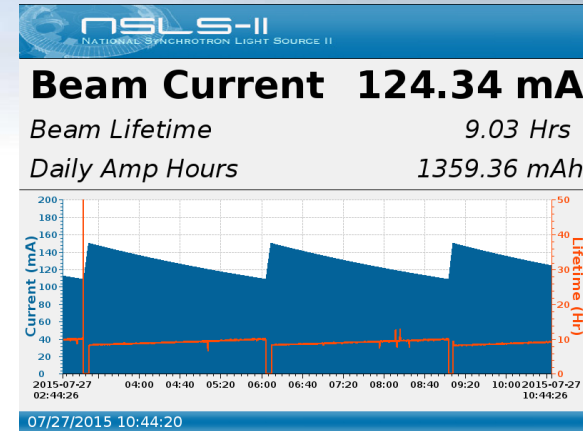
Soft X-rays: CSX



Hard X-rays: CHX

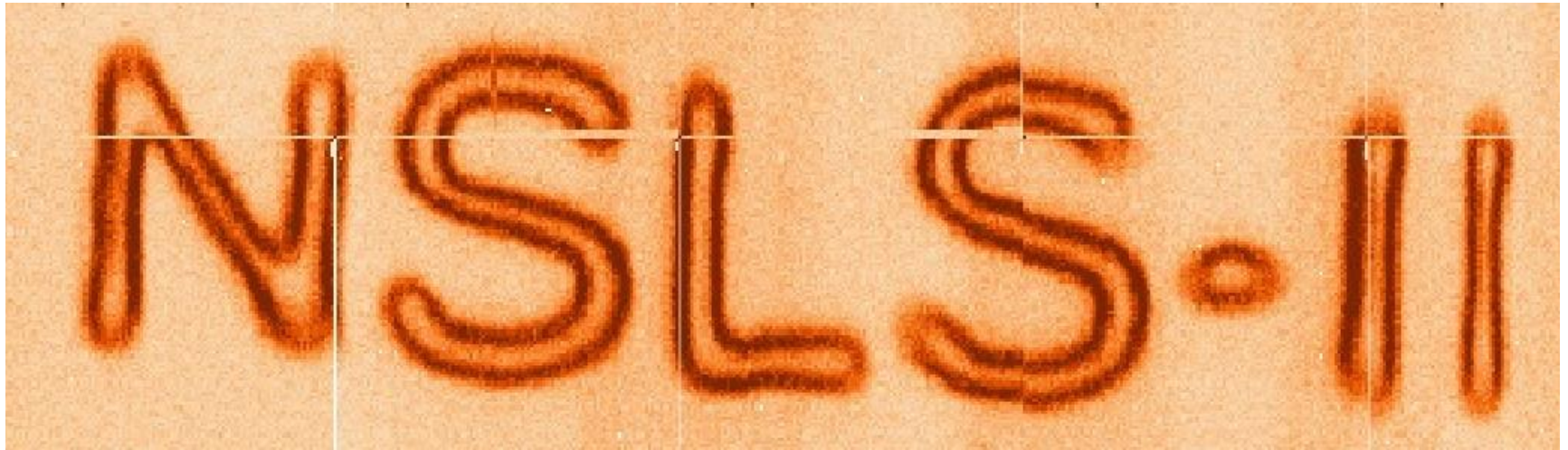
Beamline Commissioning Update

- All project beamline routinely operating at 150 mA
- All project beamlines (except IXS) now conducting user-assisted science commissioning or general user operations
- Snapshot July 27, 2015:
 - HXN – George Flynn (SUNY Plattsburgh)
 - SRX – Anatoly Frenkel (Yeshiva Univ.)
 - XPD – Meigan Aronson (BNL – CMPMSD)
 - CHX – Kevin Yager (BNL – CFN)
 - CSX – Sunil Sinha (UC San Diego)
 - IXS – endstation commissioning continuing
- All project beamlines continuing to commission additional capabilities
 - Example shown at right: Differential phase contrast imaging at 15 nm resolution at HXN



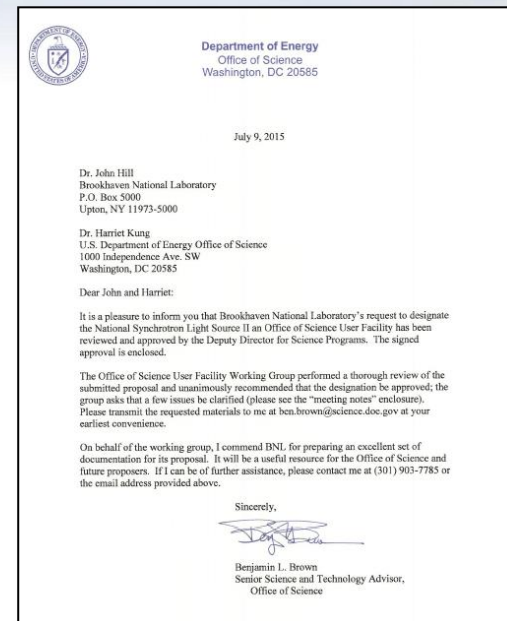
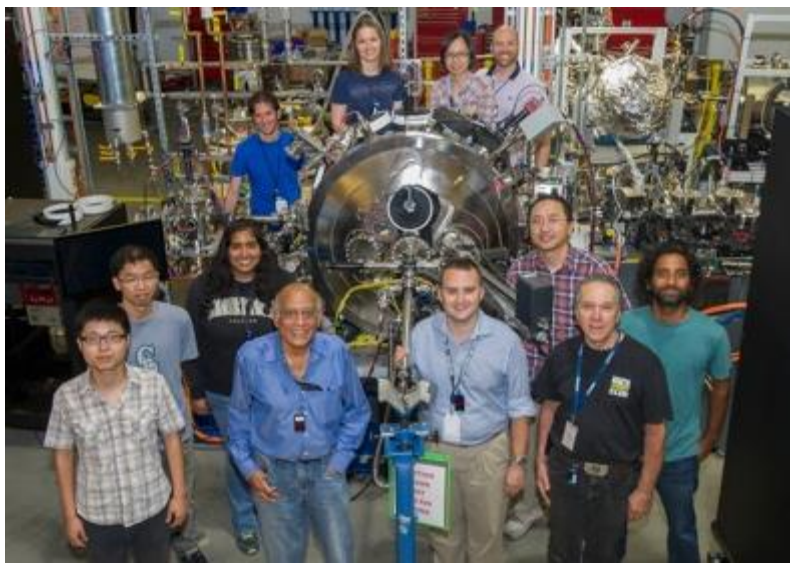
Tile Scan at HXN: Larger FOV & High Resolution

10 tiles (5 x 2): 141 x 461 pixels, 5 nm/pixel, 50 ms/pixel, 150 mA
~1.2 hrs (due to overhead for data transfer)



NSLS-II Designated as User Facility, July 9, 2015

- NSLS-II formally designated as a BES Scientific User Facility, July 9, 2015
- We welcomed our first official general user – Sunil Sinha's group from UC San Diego, July 24, 2015



General User Proposals

Run 2015-2

Beamline		# GUPs
28-ID	XPD	31
23-ID-1	CSX1	15
23-ID-2	CSX2	9
11-ID	CHX	3
10-ID	IXS	0
5-ID	SRX	16
3-ID	HXN	10
	TOTAL	84

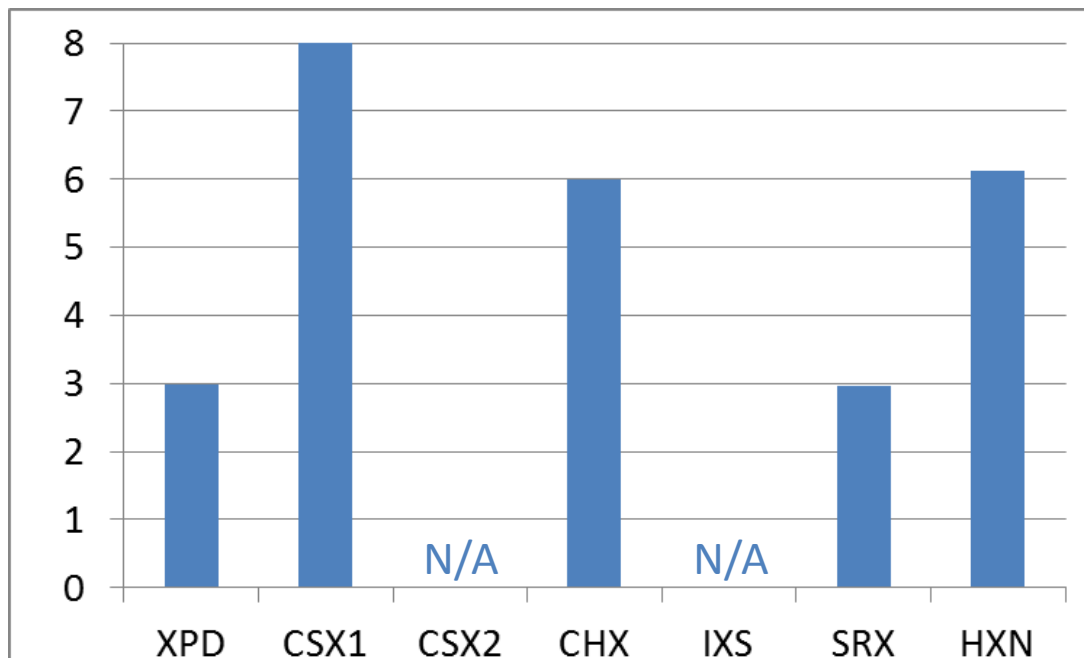
Run 2015-3

Beamline		# GUPs
28-ID	XPD	52
23-ID-1	CSX1	25
23-ID-2	CSX2	12
11-ID	CHX	6
10-ID	IXS	3
5-ID	SRX	25
3-ID	HXN	15
	TOTAL	138

- NSLS-II PRP review meeting Thursday, June 18, for GUP/PUPs for 2015-3. Next one will be mid-October for 2016-1
- NSLS-II Beamtime Allocation Committee (BAC) meeting June 30th for beam time allocation in Run 2015-3
- Notifications have gone out.

High User Demands at NSLS-II Beamlines

Minimum Requested / Allocated Shifts in Run 2015-2



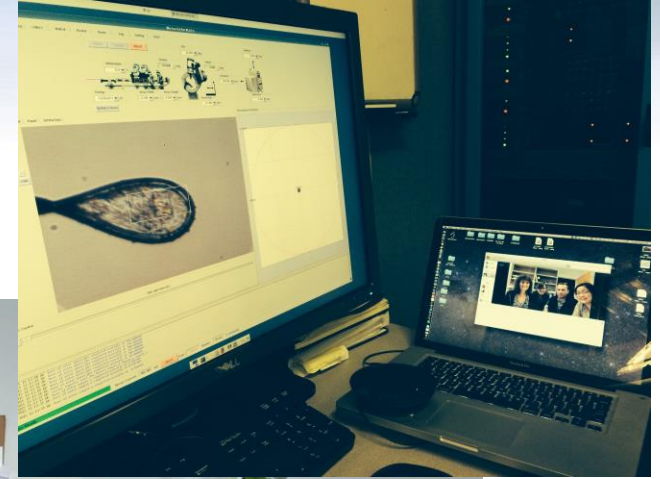
- User interest and demands are high from the scientific community
- Beamlines are many times oversubscribed, given the current state of beamline commissioning and availability of GU beam time at the beamlines

Update on User Support Programs at Other Facilities

- X-ray Spectroscopy: SSRL BL2-2 (~80% available beamtime)
 - User support staff: 0.5 FTE (NSLS-II), Case Western (NSLS X3A), SCC; Total support ~1.5 FTEs
 - Commissioning of BL 2-2 at SSRL completed (except for the quick-scan mono). User operations started March 15, 2015; **35 user groups supported so far**
- Protein Crystallography: SSRL BL14-1 (50%)+ ID beamtimes; BCSB at ALS
 - User support staff: 1 FTE (NSLS-II); small amount beam time at ALS
 - SSRL BL 14-1 operating; User operations started Dec 10, 2014, and ongoing through Aug 2015
 - >100 days of beam time for users; **74 user groups (~150 users) supported through May 2015**
- Energy Dispersive XRD: APS 6-BM (~58%), being operated as mini-CAT
 - User support through EDX collaboration: 1 FTE (COMPRES), 0.5 FTE (APS), 0.5 FTE (NSLS-II)
 - Former NSLS users go through APS proposal system, and PS/COMPRES staff allocate time
 - Equipment installation and being commissioned; **User operation delayed from mid July to end July 2015** due to delays in local shielding installation by APS
- Infrared Program: ALS 1.4 & 5.4 (~15%)
 - AP approved by ALS; User operations started Oct 2014, and ongoing; **18 user groups have been supported through Jun 2015**
- Transmission X-ray Microscopy: TXM relocates to APS 8-BM (40%)
 - User support staff ~1 FTE (NSLS-II, through offsite assignment); Former NSLS users go through APS system; NSLS-II staff allocates time
 - TXM installation and technical commissioning complete; **Science commissioning with commissioning users' samples started during run Jun 13 – Jul 14, 2015**

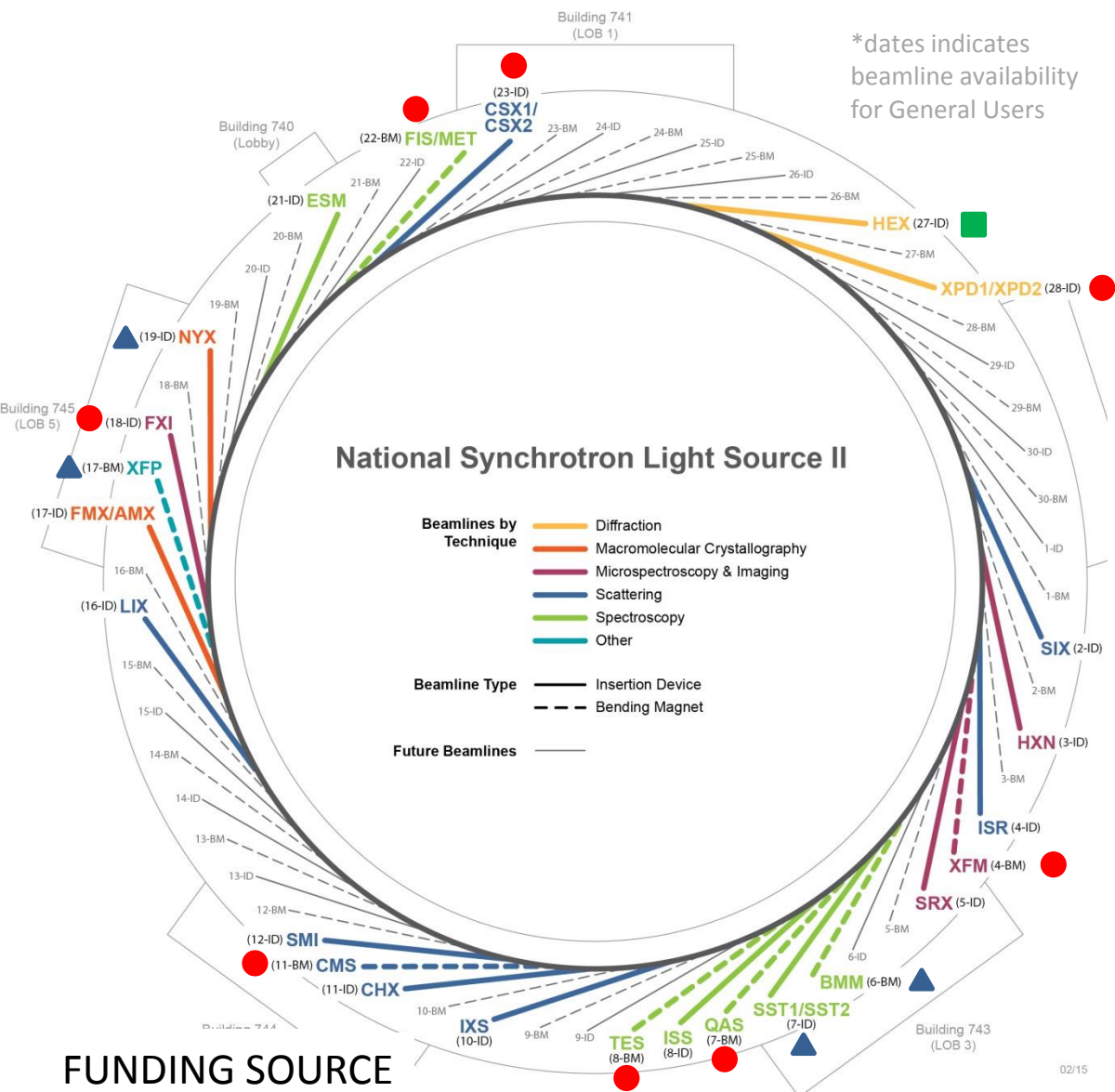
MX Transition Program at SSRL

- Almost all experiments conducted through remote access – valuable experience for our staff



Bartlomiej Blus, Yi Ren, Daria Zamolodchikov and Deena Oren, Rockefeller University, 14Apr15, and Vivian Stojanoff, NSLS II on the screen during a Skype session on data collection.

NSLS-II Beamline Portfolio



Soft X-Ray Scattering & Spectroscopy

23-ID-1: Coherent Soft X-ray Scat (2015)¹

23-ID-2: Coherent Soft X-ray Spectr & Pol (2015)⁷

21-ID: Photoemission-Microscopy Facility (2017)²

2-ID: Soft Inelastic X-ray Scattering (2017)²

22-BM: Magneto, Ellipso, High Pressure IR (2018)⁷

Complex Scattering

10-ID: Inelastic X-ray Scattering (2015)¹

11-ID: Coherent Hard X-ray Scattering (2015)¹

11-BM: Complex Materials Scattering (2016)⁷

12-ID: Soft Matter Interfaces (2017)²

Diffraction & In Situ Scattering

28-ID-1: X-ray Powder Diffraction (2015)¹

28-ID-2: X-ray Powder Diffraction (2017)^{1,7}

4-ID: In-Situ & Resonant X-Ray Studies (2017)²

27-ID: High Energy X-ray Diffraction (2020)⁶

Hard X-Ray Spectroscopy

8-ID: Inner Shell Spectroscopy (2017)²

7-BM: Quick X-ray Absorption and Scattering (2016)⁷

8-BM: Tender X-ray Absorption Spectroscopy (2017)⁷

7-ID-1: Spectroscopy Soft and Tender (2017)⁵

7-ID-2: Spectroscopy Soft and Tender (2017)⁵

6-BM: Beamline for Mater. Measurements (2017)⁵

Imaging & Microscopy

3-ID: Hard X-ray Nanoprobe (2015)¹

5-ID: Sub-micron Res X-ray Spec (2015)¹

4-BM: X-ray Fluorescence Microscopy (2017)⁷

18-ID: Full-field X-ray Imaging (2018)^{2,7}

Structural Biology

17-ID-1: Frontier Macromolecular Cryst (2016)⁴

17-ID-2: Flexible Access Macromolecular Cryst (2016)⁴

16-ID: X-ray Scattering for Biology (2016)⁴

17-BM: X-ray Footprinting (2016)⁵

19-ID: Microdiffraction Beamline (2017)⁵

NEXT Project Major Milestones, Schedule

Major Milestones

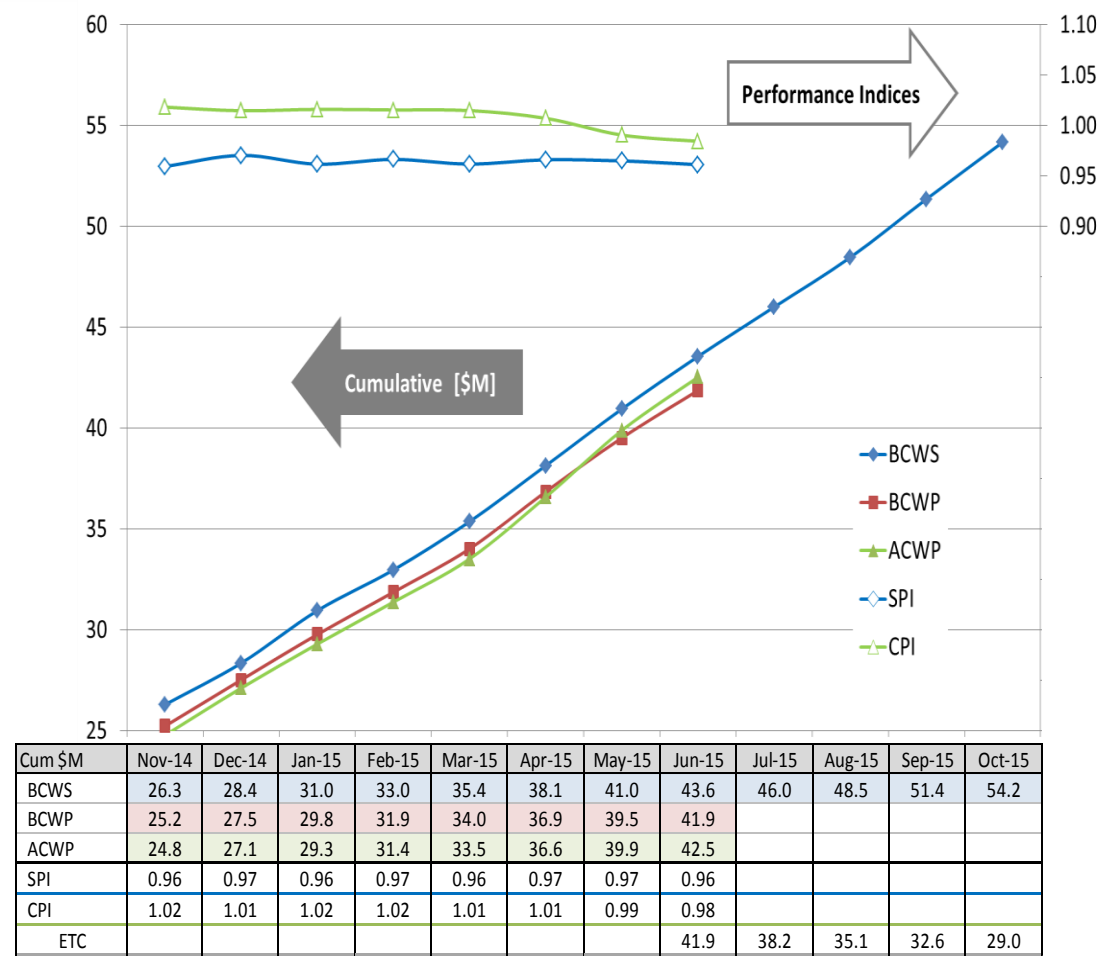
• CD-0 (Mission Need)	Actual: May 27, 2010
• CD-1 (Alternative Selection)	Actual: Dec. 19, 2011
• CD-3A (Long Lead Procurement)	Actual: Oct. 9, 2013
• CD-2 (Performance Baseline)	Actual: Oct. 9, 2013
• CD-3 (Start Construction)	Actual: July 7, 2014
• Internal Early Project Completion	Planned: Sept. 30, 2016
• Early Project Completion	Planned: Jan. 31, 2017 *
• CD-4 (Project Completion)	Planned: Sept. 29, 2017

Short term schedule

— BNL EVMS Surveillance Review	Actual: June 29 – July 1, 2015
• DOE/SC Review of NEXT	Planned: November 3-4, 2015

* PCR_NEXT_14_049 added IRR & project closeout activities (\$1.3M, 4 months), implemented in Feb. 2015 ; overall project schedule float is now 8 months

NEXT Cost & Schedule Status



as of 6/30/2014	Current Month	Cum-to-Date
Plan (BCWS) \$K	2,606	43,557
Earned (BCWP) \$K	2,352	41,870
Actual (ACWP) \$K	2,639	42,529
SPI	0.90	0.96
CPI	0.89	0.98
Budget at Completion \$K		81,392
Planned % Complete		53.5%
Earned % Complete		51.4%

Advanced Beamlines for Biological Investigations with X-rays (ABBIX)

FMX -- Frontier Macromolecular Crystallography Beamline

AMX -- Flexible Access and Highly Automated
Macromolecular Crystallography Beamline

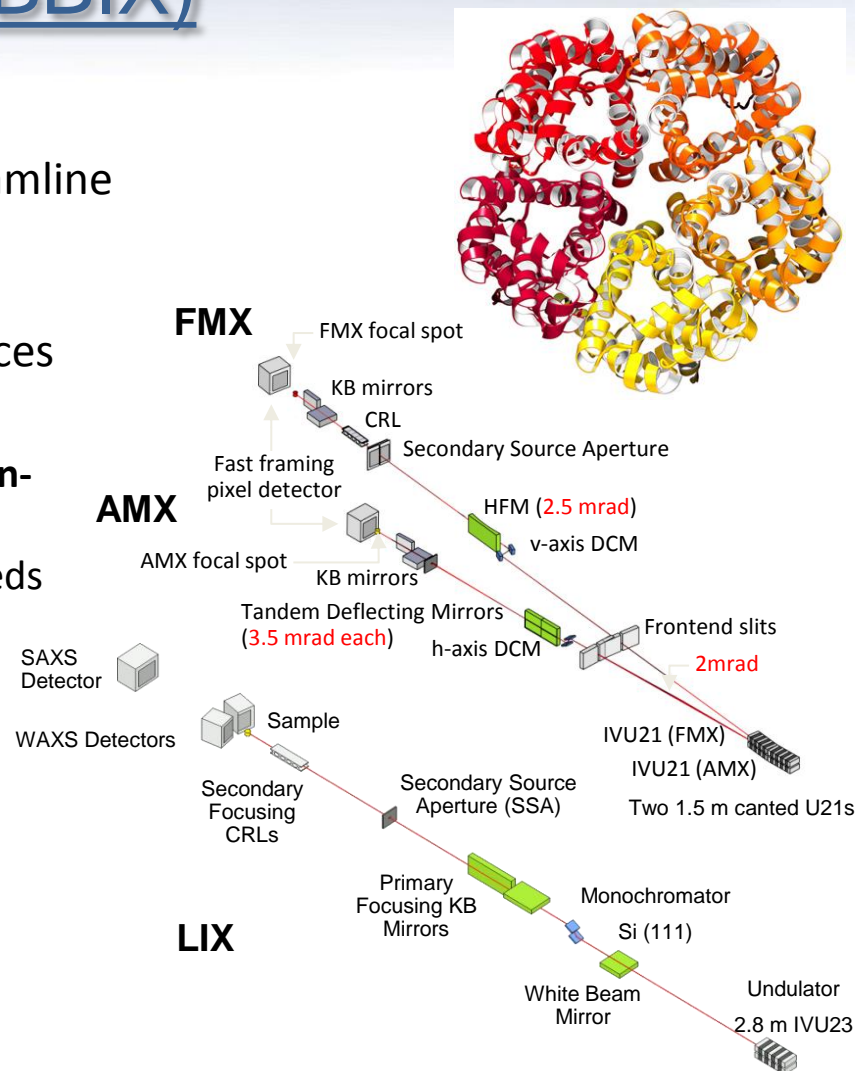
LIX -- High Brightness X-ray Scattering for Life Sciences

Project Goals

- Design and build 3 NIH-funded state-of-the-art insertion-device-based beamlines for NSLS-II
- Uphold scientific programs that address NIH mission needs
- Build first biological sciences beamlines at NSLS-II
- Increase usage of NSLS-II in early operations phase

Execution Benefits Derived

- Leveraged by extensive auxiliary supporting infrastructure developed by NSLS-II Project
- Timeline is similar to NEXT Project (but slightly more advanced), with symbiotic benefits (e.g. some shared procurements)



ABBIX Upcoming Milestones

- Commission ABBIX IDs and FEs Aug. 2015
- Complete Integrated Testing: LIX Sep. 2015
- IRR and Early Project Completion: LIX Oct. 2015
- Complete Integrated Testing: AMX/FMX Jan. 2016
- IRR and Early Project Completion: AMX/FMX Feb. 2016
- Project Closeout June 2016

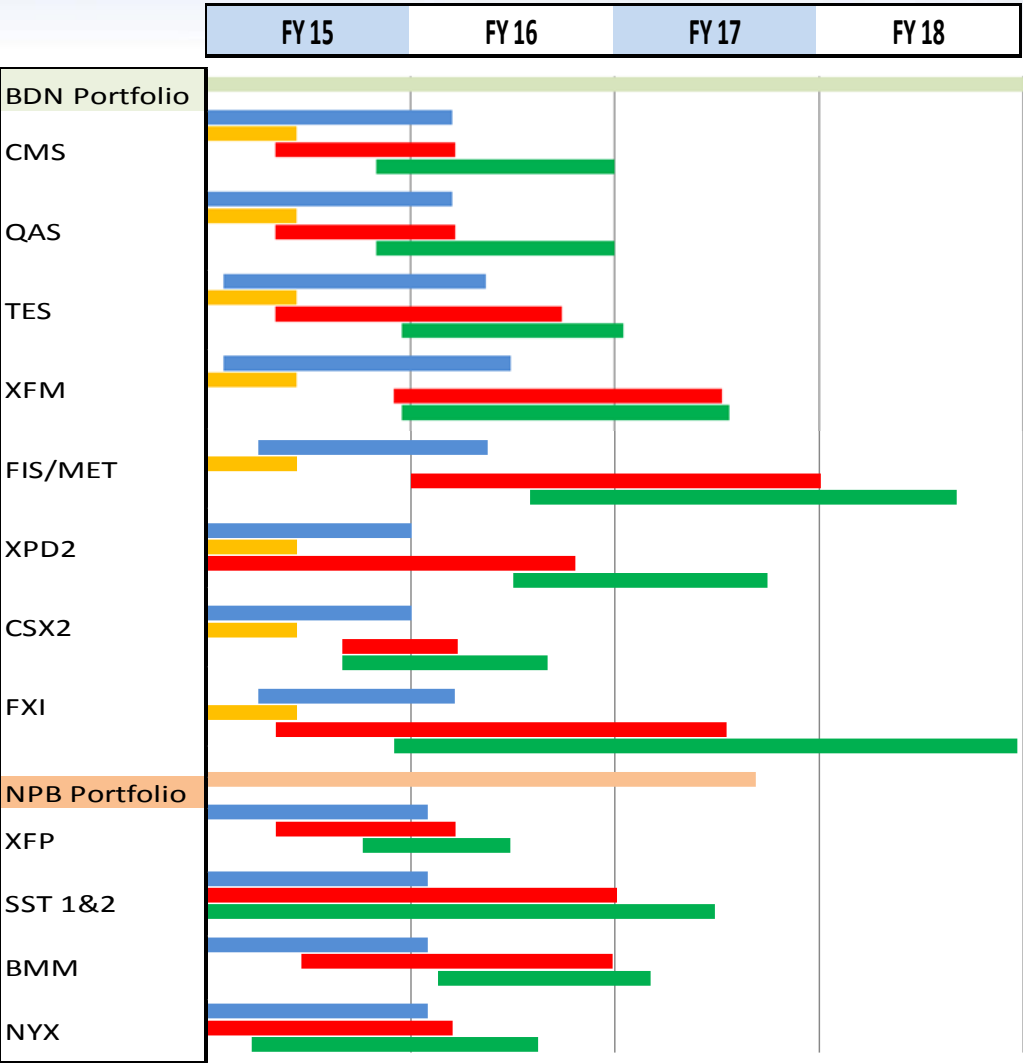
Performance on the project is good. EAC is ~ \$41 M, leaving \$3.5 M in contingency.

Expect to spend \$2.2 M of this now:

Hot commissioning (with beam)	\$0.3 M
Pilatus 9M for AMX	\$1.55 M
Advanced automation AMX,FMX,LIX	\$0.345 M

This would extend the *formal* project closeout to FY18 (but would not delay operations)

Summary Schedule for BDN and NPB Portfolios



- BDN= DOE BES Operations funding supported:
 - 11 beamlines into operation in FY17
 - 2 additional beamlines in FY18
- No schedule or cost contingency shown
- Changes in assumptions, arrival of funds, or realized risk will change schedule

	FY15	FY16	FY17	FY18
BDN Portfolio	11.04M	16.93M	10.52M	1.28M
NPB Portfolio	1.56M	2.16M	706.3K	
OPS Funding	12.61M	19.09M	11.23M	1.28M

- NSLS Equipment Recovery
- Design
- Procure/Fabrication
- Installation/Test

Summary Status

	Status	Operational
BDN Portfolio		
FIS/MET	Ready to Baseline	FY18
MID	Suspended	-
CMS	Ready to Baseline	FY17
IXD	Suspended	-
MPP	Suspended	-
QAS	Ready to Baseline	FY17
TES	Ready to Baseline	FY17
XFM	Ready to Baseline	FY17
XPD2	Ready to Baseline	FY17
CSX2	In Development	FY16
FXI	Ready to Baseline	FY19

NPB Portfolio		
XFP	Ready to Baseline	FY17
SST1/2	Preliminary Design	FY18
BMM	Preliminary Design	FY18
NYX	Preliminary Design	FY17

- Two portfolios for construction of the 13 projects currently under development.
- Projects are coordinating to gain economies of scale.
- Substantial leverage provided by partner investment, recovered equipment and prior project affordances.
- Significant support from the laboratory through Extraordinary Construction overhead rate.
- Working without cost contingency – carries schedule risk for both portfolios.
- Required funding is understood – partners that are presently short are working to close the gap.

Budget

- FY15 \$90 M in new funds, plus \$28 M in carryover
- Tough year, required painful choices.
 - Reduction in staff numbers
 - Halted construction of IXD, MPP and MID
- However, we did
 - Commission 7 project beamlines.
 - Reached 300 mA
 - Continued construction on 8 beamlines (“BDN”)
- Budget review completed in June 10th, 11th 2015
- FY16 President’s budget = \$110 M would allow us to continue with beamline development activities. (Cannot restart IXD, MPP or MID)
- FY16 Continuing resolution (at \$90M) would drive difficult choices, including possible slowing of some BDN beamlines.

Successful International SRI 2015 Jul 6-10



- 789 registered participants representing 23 countries
- Well attended oral and poster/exhibition sessions
- NSLS-II tour on the 1st day showcased the newest synchrotron in the world



Strategic Planning Workshop

- Workshop at BNL on **Sept. 24-25, 2015**
- Goal is to review and update NSLS-II strategic directions and to identify:
 - *Capacity gaps* in current beamline portfolio
 - New *beamline capability* opportunities
 - Highest priority beamlines with credible funding plans
- Workshop program will include:
 - Facility overview on the current strategic plan
 - Invited speakers from next-generation high-brightness synchrotrons and from the academic/industrial synchrotron user community
 - *Open call* for contributed talks on beamline concepts with funding plans
- Web site is live now. Announcements to go out to mailing lists this week.
- Thank you to the UEC for their generous support!



www.bnl.gov/nsls2spw

Communications

- Friday seminar series will restart in the fall. Larry Carr will take the lead in organizing it. Speaker suggestions welcome.
- Monthly newsletter to users will start shortly. Suggestions for content welcome. (Chelsea Whyte, Editor).
- Monthly newsletter to staff will start shortly also (Chelsea Whyte, Editor).

Conclusion

- It continues to be an exciting (busy!) time at NSLS-II. The accelerator is coming up beautifully, with performance exactly as predicted, and the beamlines are progressing well.
- The User program has officially started and our goal is to bring all 7 beamlines into the GU program as soon as possible.
- At the same time, we have an aggressive beamline construction program underway for another 21 beamlines which are on schedule to commission in FY 16-19.
- Major Goals for next 6 months:
 - Grow and mature the user program on the 7 project beamlines.
 - Advance planning for the next round of beamline construction.