

# Photon Sciences

## UEC Town Meeting Update

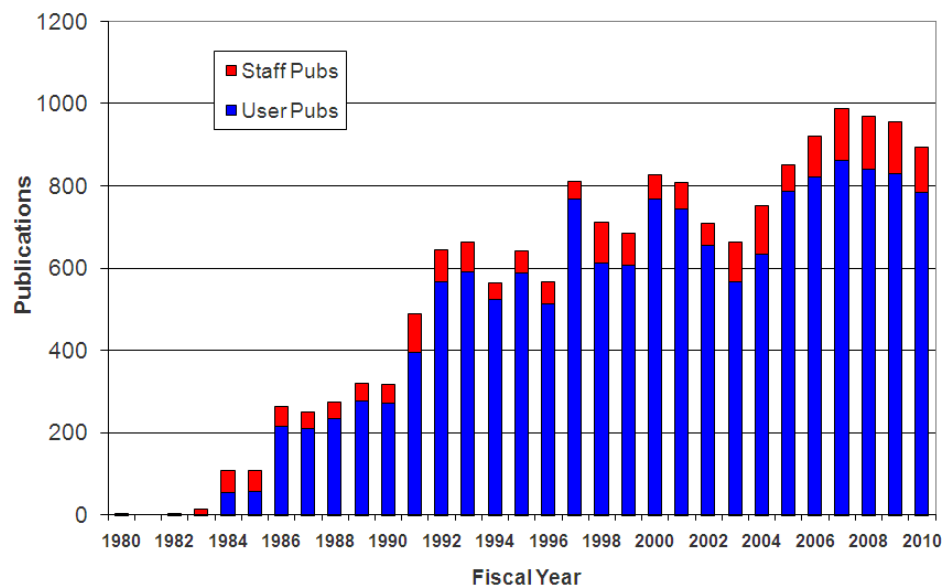
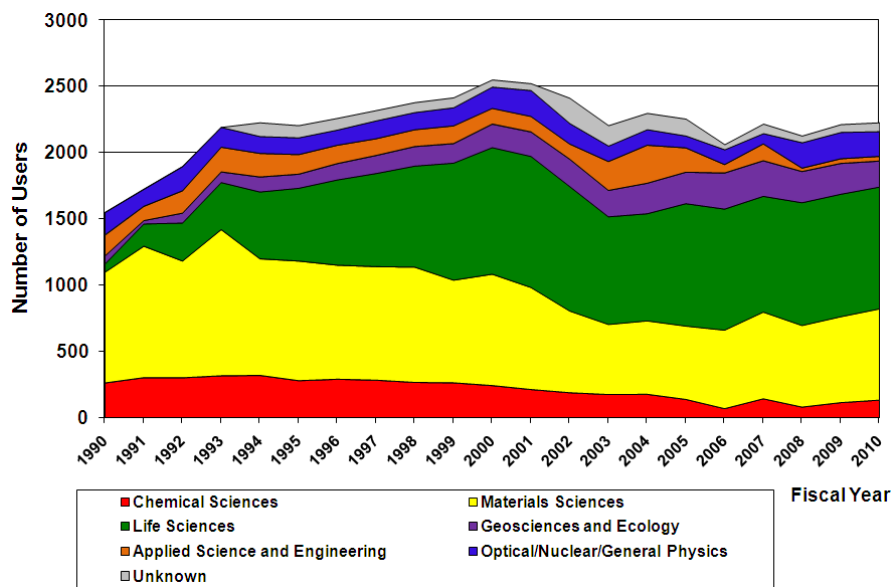
August 12, 2011

Erik D. Johnson  
Deputy for Programs  
Photon Sciences

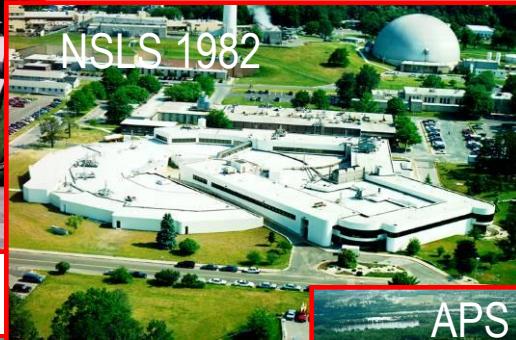


# NSLS Continues to be Very Productive

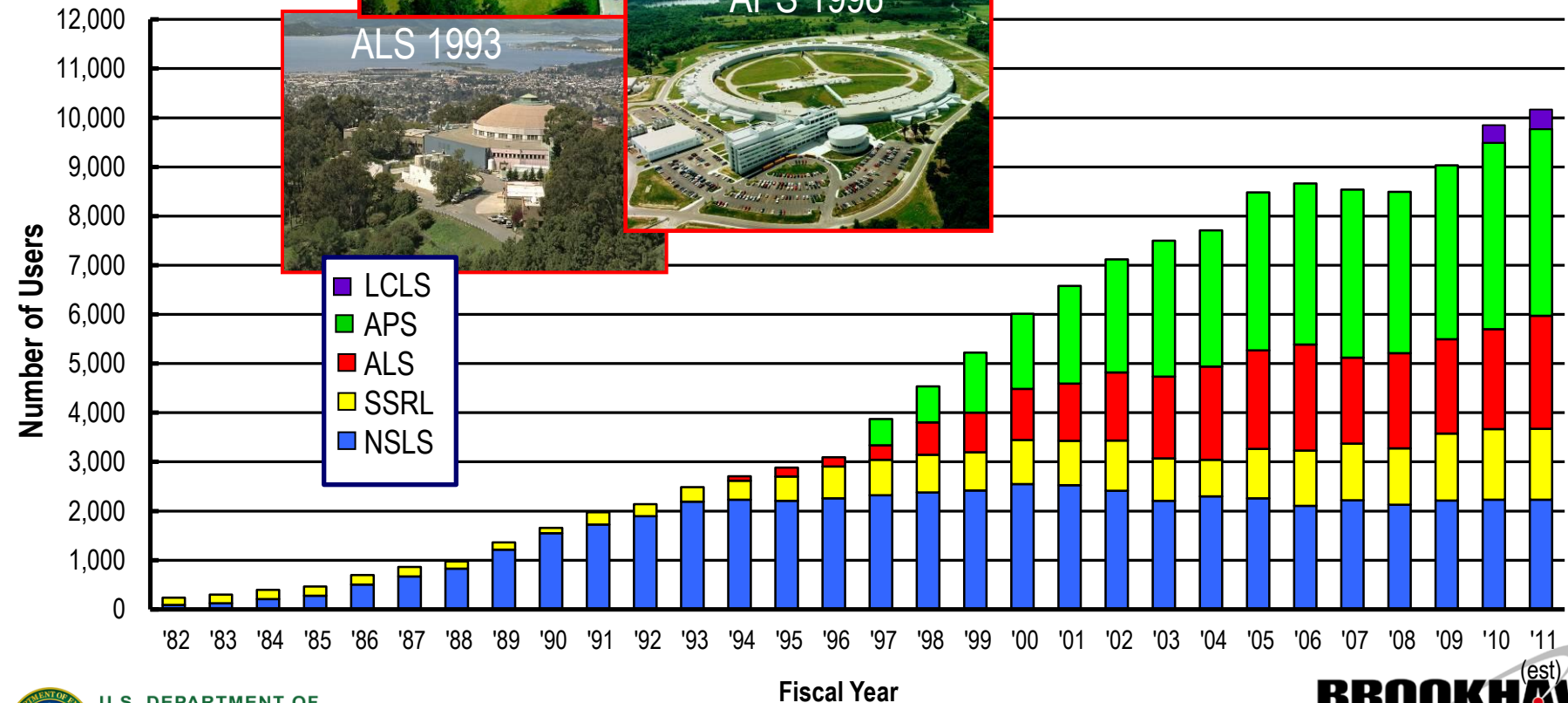
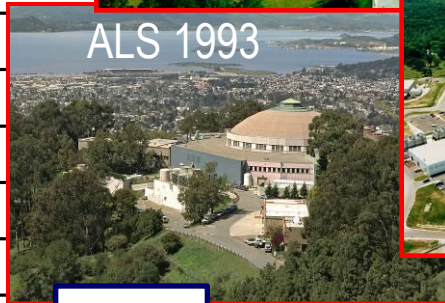
- Number of users stable at ~ 2200 users/year
- > 900 publications per year (> 160 per year in premier journals)
- Staff publications represent ~13% of total NSLS publications
- Accelerators are aging but continue to operate with high reliability



# BES Light Sources



Harriet Kung, BESAC March 17 2011

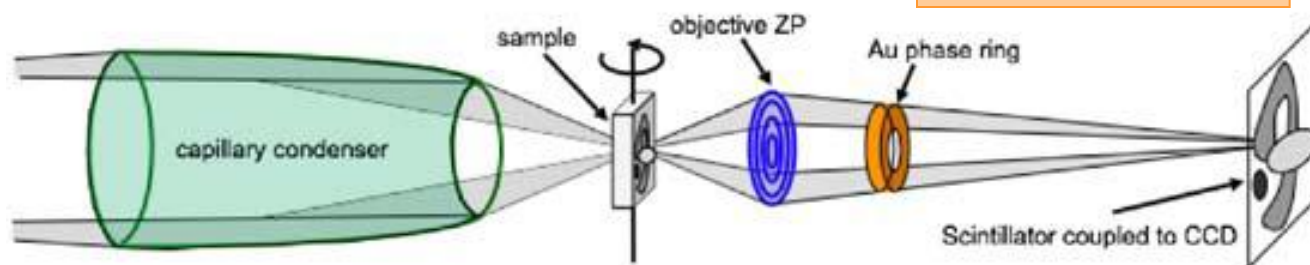


# New Beamline X8C

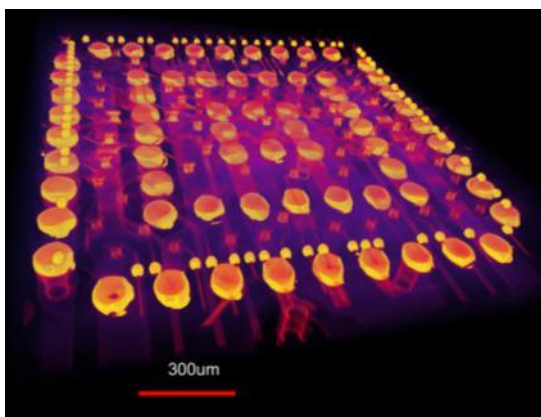
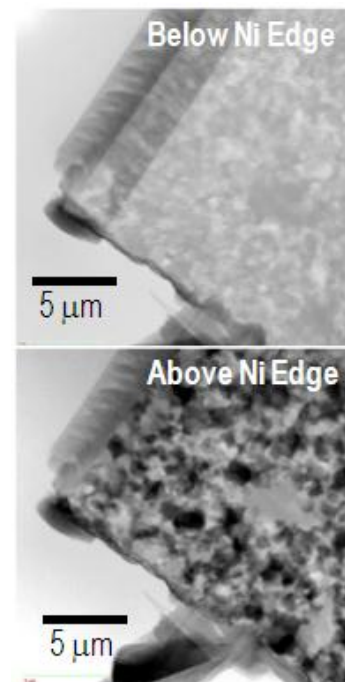
## New Full-Field Transmission X-Ray Microscope

- Funded by DOE-BES ARRA

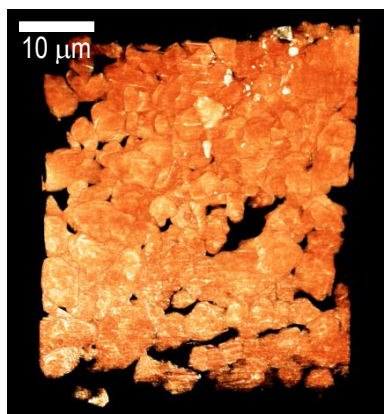
Plan to move to  
FXI on NSLS-II



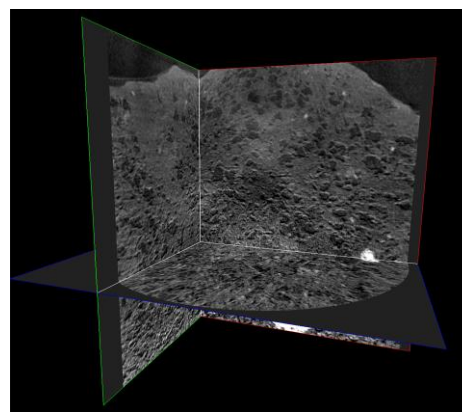
- spatial resolution:  $\sim 30$  nm
- energy range: 5 – 11 keV
- absorption & phase contrast
- XANES tomography



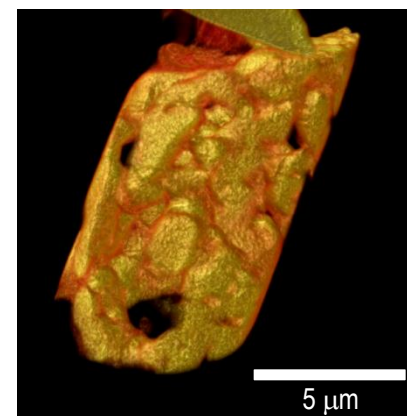
semiconductor failure analysis



Li-ion battery  $\text{LiVO}_2$  electrode

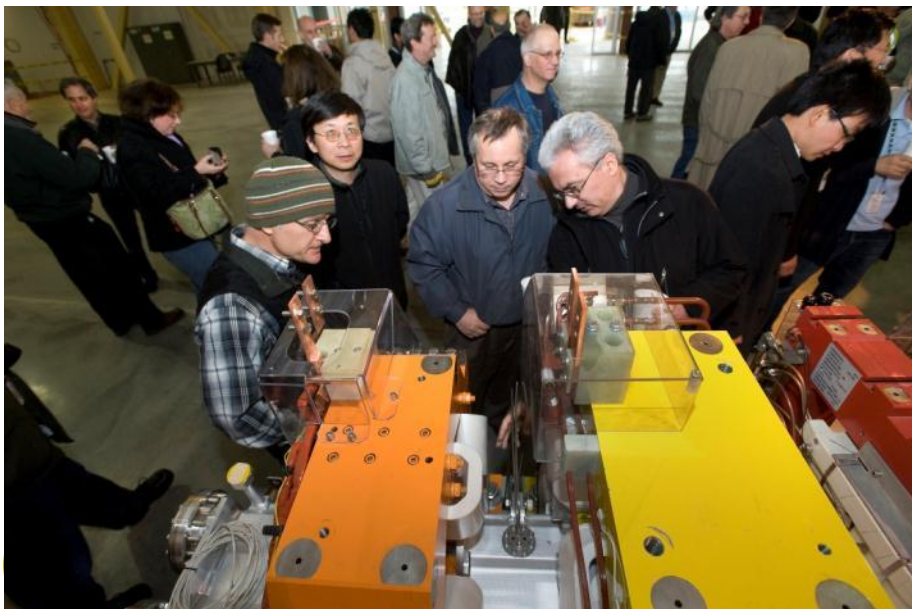


Catalyst sphere of Al/Si active matrix (UOP)



Ni-based SOFC anode

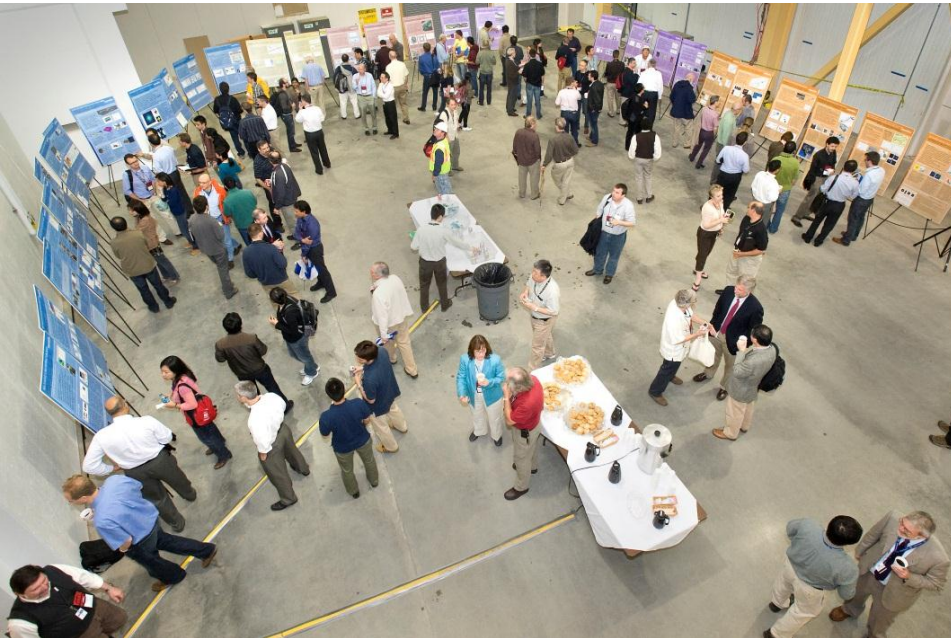
# Three Milestone Celebration – March 23, 2011



- 50% Complete
- Beneficial Occupancy of 1<sup>st</sup> Pentant
- 1<sup>st</sup> Girder Assembled

# NSLS-II Beamline Poster Session at Users Meeting

- The UEC & Photon Sciences sponsored a poster session on NSLS-II Beamlines at this year's Users' Meeting (May 24<sup>th</sup>)
- Poster session held on experimental floor of NSLS-II Ring Building
- Posters described 6 Project, 6 MIE, 3 NIH, 3 Type II, and 22 approved but not yet funded beamlines, as well as overall portfolio of capabilities and science these will enable
- User community is enthusiastically looking forward to NSLS-II !



# Happenings since February 2011

February Project Advisory Committee (8-9)  
UEC Meeting (16)

UEC in DC



7 April

March Electronic Annual report  
Three Milestone celebration (23)

April Science Advisory Committee (4-5)



Secretary Chu 21 April

INCREASE



23-26 May

May Spring NSLS Shutdown  
Accelerator Systems Advisory Committee (10-11)  
NSLS/CFN Users Meeting (23-25)



Thomas A. Steitz 24 May



25-26 May

June DOE Review of NSLS-II Project (21-23)  
ALD's Conceptual Design Review of NEXT (28-29)

July Review of NSLS-II Top-Off Safety Analysis (18-19)  
Photon Sciences Summer Sunday (24)



24 July 2011

August BES/ Facilities directors meeting (1)  
UEC Meeting (12)

Home

About

Facilities

Beamlines

For Users

Safety &amp; Training

Publications

News &amp; Events



## New Web Portal to Photon Sciences



### Rare Coupling of Magnetic and Electric Properties in a Single Material

Scientists have observed a new way that magnetic and electric properties can coexist in a special class of materials. [More...](#)

[1](#) [2](#) [3](#) [4](#)
Scientists &  
Facility Users

Teachers

Journalists

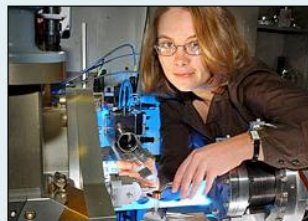
General Public

#### For Scientists & Facility Users

As a national user research facility funded by the U.S. Department of Energy's Office of Science, the National Synchrotron Light Source (NSLS) offers scientists from academia, government labs, and other institutions exciting research possibilities in a wide variety of fields. Infrared, ultraviolet, and x-ray light produced by NSLS allow scientists to examine materials and processes at a scale that is not possible at other types of research labs or facilities.

The successor to NSLS, NSLS-II is scheduled to be operating by 2015 as the world's most advanced synchrotron light source. The new facility will have extremely high brightness and flux; exceptional beam stability; and a suite of advanced instruments, optics, and detectors. Taking advantage of these new capabilities, scientists will be able to image materials with nanoscale resolution and determine chemical activity in fine detail.

At NSLS, guest scientists can choose from a range of research techniques and equipment. As an NSLS (and future NSLS-II) user, you will discover that Brookhaven Lab's synchrotron facilities can provide the tools to perform cutting-edge research that is not possible at your home institution. You will also have the support of a well-trained staff.

[More...](#)


#### Announcements

August eNews Online  
 The August issue of Photon Sciences eNews is online.

Call for NSLS General User Proposals  
 Deadline is September 30, 2011. [More information »](#)

Photon Sciences 2010 Annual Report Now Available  
[Read it here.](#)

#### Features

Summer Sunday of 7/24: Visit the NSLS, NSLS-II

Brookhaven Lab Awards \$7.8-Million Refrigeration Contract

Self-Cleaning Anodes: Researchers Develop Nanoparticle Technology That Could Facilitate Cost-Effective Coal-Powered Fuel Cells

#### Next Lecture

There are no upcoming events in the system at this time.

[All Photon Sciences Events »](#)

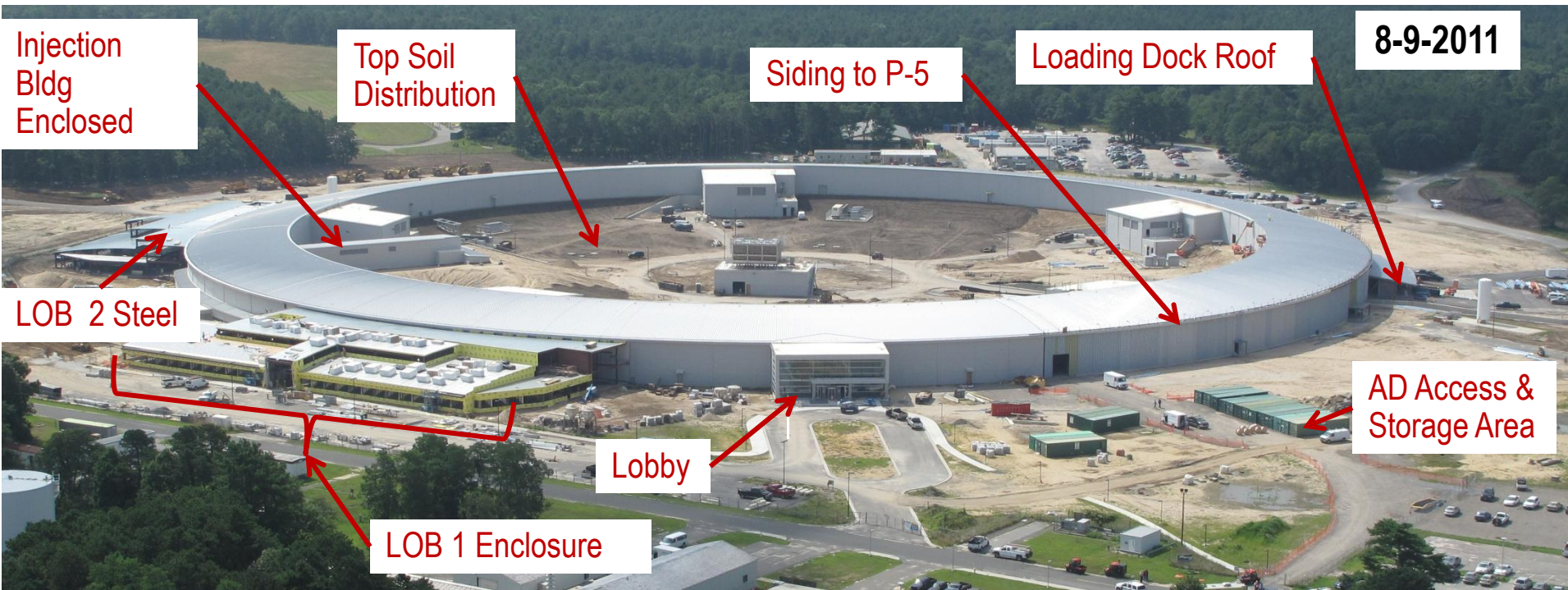
# http://www.bnl.gov/ps/

# Overall Status of NSLS-II Project

---

- Excellent progress
- Project is ~ 61% complete as of August 2011
  - Full construction phase with a burn rate of ~\$1M/day
- On schedule and on budget
  - Excellent technical, cost & schedule performance to date
  - Sound cost baseline with healthy remaining contingency
  - 15 month schedule float for CD-4
  - Risks well understood, tracked and managed
- 2011 is a crucial year with many challenges and much excitement

# Conventional Construction Progress

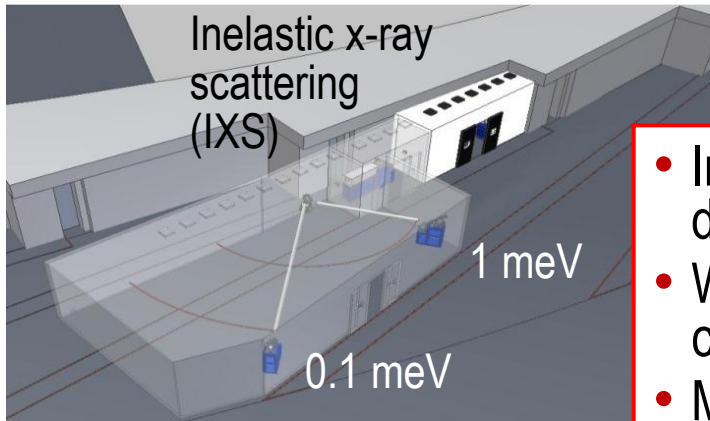


- Ring building construction progressing on budget and ahead of schedule
- LOB construction started
- Pentant 1 and 2 beneficial occupancy received
- Accelerator installation in progress

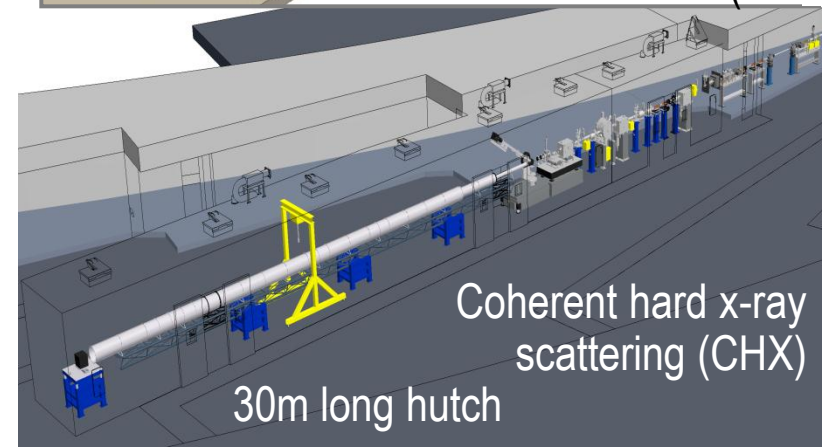
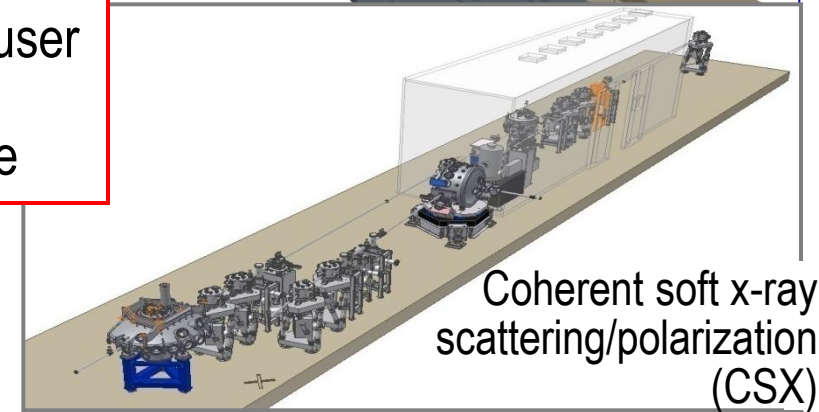
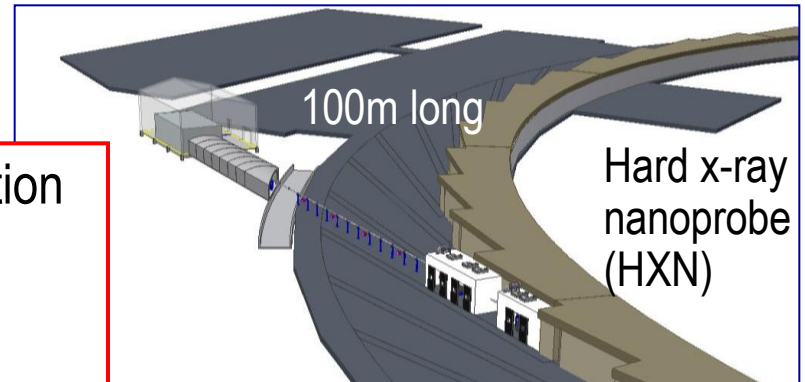
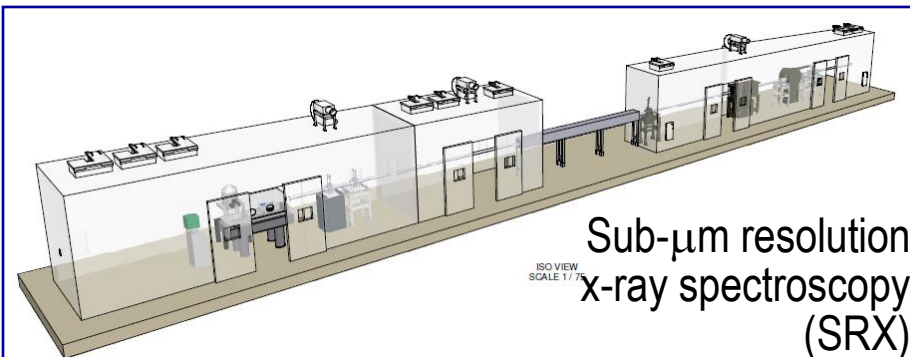
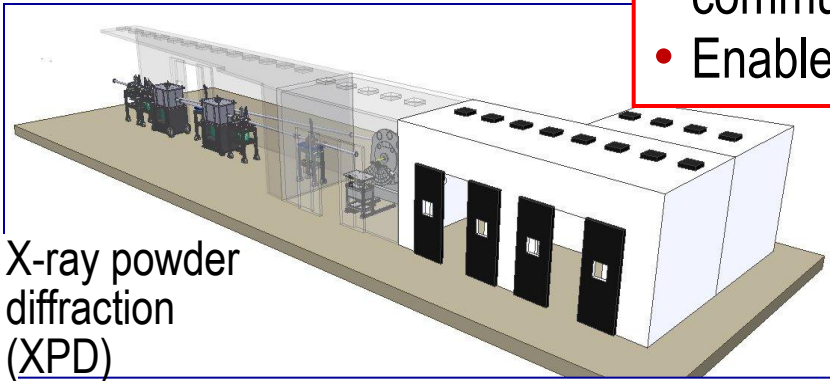
# First Fully Integrated NSLS-II Magnet Girders



# Six Project Beamlines

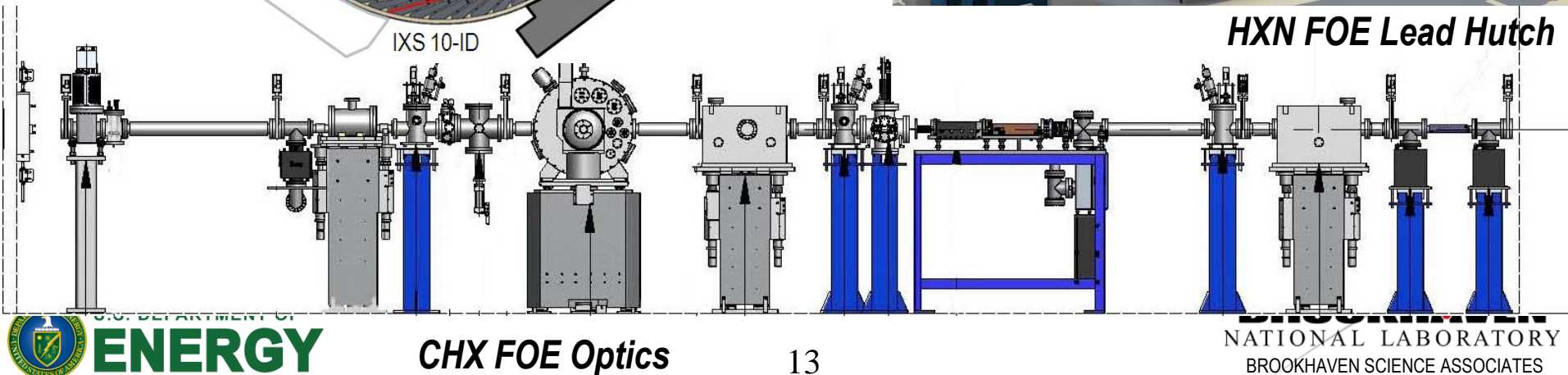
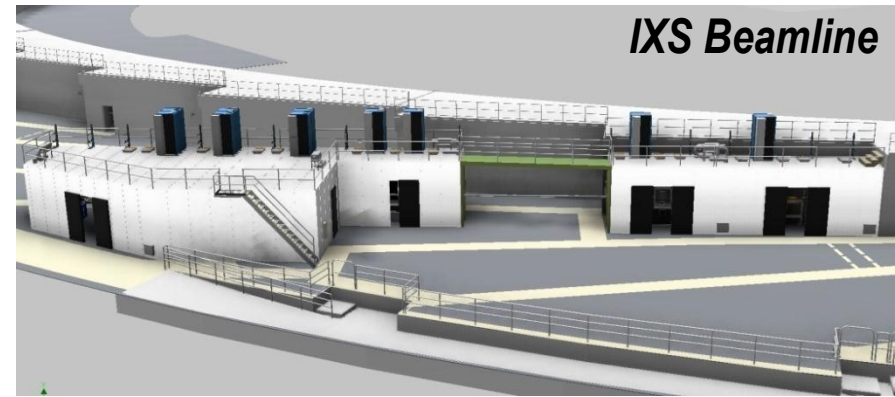
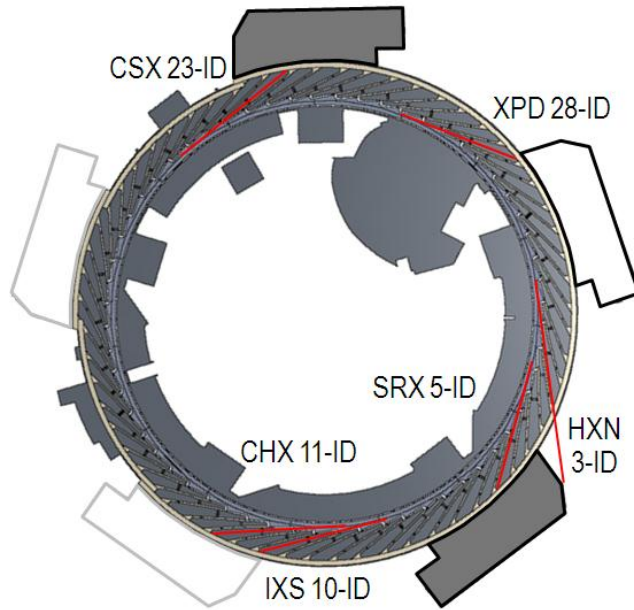


- Initial suite of insertion device beamlines
- World-leading characteristics
- Meet the needs of user community
- Enable new science



# Experimental Facilities Progress

- Procurement underway for long lead time beamline components (lead and steel hutches and optics components)



# Key Project Milestones

Aug 2005	<b>CD-0</b> , Approve Mission Need_____	<b>(Complete)</b>
Jul 2007	<b>CD-1</b> , Approve Alternative Selection and Cost Range_____	<b>(Complete)</b>
Jan 2008	<b>CD-2</b> , Approve Performance Baseline_____	<b>(Complete)</b>
Jan 2009	<b>CD-3</b> , Approve Start of Construction_____	<b>(Complete)</b>
Feb 2009	Contract Award for Ring Building_____	<b>(Complete)</b>
Aug 2009	Contract Award for Storage Ring Magnets_____	<b>(Complete)</b>
May 2010	Contract Award for Booster System_____	<b>(Complete)</b>
Feb 2011	1 <sup>st</sup> Pentant Ring Building Beneficial Occupancy_____	<b>(Complete)</b>
Mar 2011	Start Accelerator Installation_____	<b>(Complete)</b>
Feb 2012	Beneficial Occupancy of Entire Experimental Floor	
Apr 2012	Start LINAC Commissioning	
Jun 2012	Beneficial Occupancy of 1 <sup>st</sup> LOB	
Oct 2012	Start Booster Commissioning	
May 2013	Start Storage Ring Commissioning	
Mar 2014	Projected Early Project Completion	
Jun 2015	<b>CD-4</b> , Approve Start of Operations	

# NSLS-II Project Transition to Operations

---

- NSLS-II Project Transition to Operations well defined and advancing on schedule
  - Integrated Transition Management Team established
  - Authorization processes well defined and on schedule
  - Coordinators and working groups identified and in place
  - BORE process underway
  - Installation and Commissioning Plans well developed
  - Accelerator Readiness Review (ARR) team established
  - Starting to prepare for project closeout

# Beamline Development Proposals

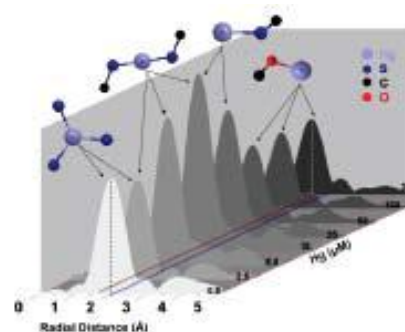
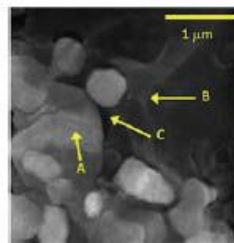
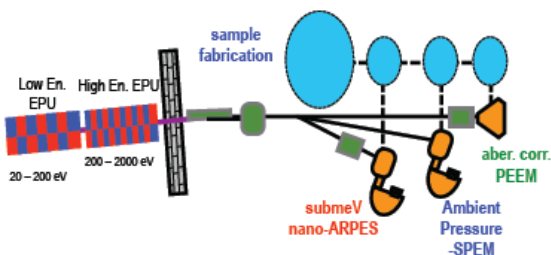
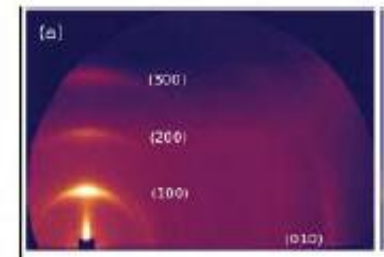
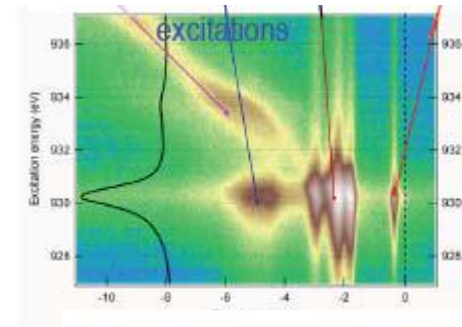
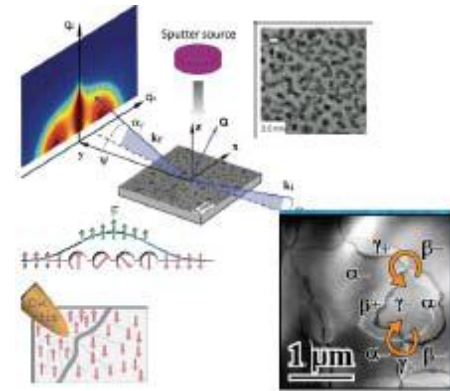
---

- 54 Beamline Development Proposals submitted in 2010
  - User community organized 13 workshops with hundreds of participants
  - Science case and technical requirements
  - Any area of science and any beamline type – ID, BM, 3PW, IR
  - Independent of funding source or implementation approach (i.e., new, reused, who builds – Type I: Photon Sciences, Type II: external group)
- Review Process
  - SAC Study Panel evaluations and overall assessment by full SAC
- Outcome:
  - 31 Type I BDPs approved, 3 Type II BDPs approved
    - “Approved” in “Mission Need / CD-0” sense – funding is not assured
- 2011 BDP Call issued in Feb
  - 14 Beamline Development Proposals received
  - 50% new + 50% resubmissions
  - SAC reviews to take place in the Fall

# NSLS-II Experimental Tools (NEXT) Project

- Scope:
  - ESM: Electron Spectro-Microscopy
  - FXI: Full-field X-ray Imaging from  $\mu\text{m}$  to nm
  - ISS: Inner Shell Spectroscopy
  - ISR: Integrated In-Situ & Resonant X-Ray Studies
  - SIX: Soft Inelastic X-ray Scattering
  - SMI: Soft Matter Interfaces
- Cost:
  - CD-0 cost range: \$50M-\$90M
  - CD-1 TPC ~ \$90M
  - Received \$3M for conceptual design in FY11
- Schedule:
 

• CD-0	Approved May, 2010
• CD-1	Review scheduled for Aug 30 - Sep 1
• CD-2/CD-3A	Jun 2012
• CD-3	Jan 2013
• Early Finish	Sep 2015
• CD-4	Sep 2016



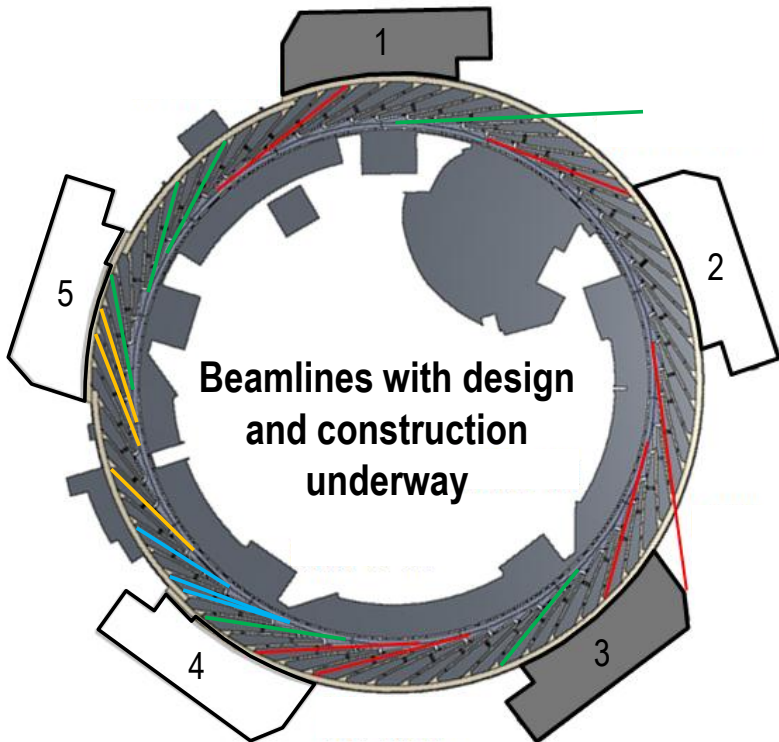
# NIH & Type II Beamlines

---

- NIH committed \$45M in FY10 to fund construction of 4 ID beamlines
  - \$12M awarded to NSLS-II in FY10 (ARRA) to design & construct undulators
- Recommended FMX, AMX, LIX, and CDI but pointed out \$45M is not sufficient
- In February NIH convened its NSLS-II advisory committee and decided to descope to 3 ID beamlines: FMX, AMX, LIX
  - FMX: Frontier Macromolecular Crystallography at an Undulator Beamline
  - AMX: Flexible Access Macromolecular Crystallography at an Undulator Beamline
  - LIX: A High-brightness X-ray Scattering Instrument for Biological Applications
- Expect to receive \$10M in FY11
- Work has begun on beamline design
- Type II beamlines are under development by external groups
  - NYSBC: Microdiffraction Beamline (New York Structural Biology Center)
  - SST: Spectroscopy Soft and Tender (NIST)
  - BMM: Beamline for Materials Measurements (NIST)

# NSLS-II Beamlines Underway

18 Beamline Construction Projects Underway  
21 Simultaneous Endstations (SE)  
28 Total Endstations (TE)



22 additional beamlines (25 SE) have been proposed by the user community and approved by the SAC and NSLS-II but are not yet funded

Beamline Construction Projects	SE	TE
<b>NSLS-II Project Beamlines</b>		
• Inelastic X-ray Scattering (IXS)	1	1
• Hard X-ray Nanoprobe (HXN)	1	1
• Coherent Hard X-ray Scattering (CHX)	1	1
• Coherent Soft X-ray Scat & Pol (CSX)	2	2
• Sub-micron Res X-ray Spec (SRX)	1	1
• X-ray Powder Diffraction (XPD)	1	1
<b>NEXT MIE Beamlines</b>		
• Photoemission-Microscopy Facility (ESM)	2	3
• Full-field X-ray Imaging (FXI)	1	1
• In-Situ & Resonant X-Ray Studies (ISR)	1	2
• Inner Shell Spectroscopy (ISS)	1	1
• Soft Inelastic X-ray Scattering (SIX)	1	1
• Soft Matter Interfaces (SMI)	1	2
<b>NIH Beamlines</b>		
• Frontier Macromolecular Cryst (FMX)	1	1
• Flexible Access Macromolecular Cryst (AMX)	1	1
• X-ray Scattering for Biology (LIX)	1	1
<b>Type II Beamlines</b>		
• Spectroscopy Soft and Tender (NIST)	2	6
• Beamline for Materials Measurements (NIST)	1	1
• Microdiffraction Beamline (NYSBC)	1	1
<b>TOTAL</b>	<b>21</b>	<b>28</b>

# NSLS to NSLS-II Capability Overlap - I

NSLS		NSLS - II under construction											Approved NSLS-II Beamlines																	By project group						
Beamline		CSX	XPD	ESM	FXI	ISR	ISS	SIX	SMI	FMX	AMX	SST	BMM	NYX	AIM	CMS	IRI	IXD	MPP	QAS	TES	XFM	FIS	MET	MID	SSS	4DE	MXD	SM3	XFP	LT	NEXT	NIH	T2	✓	
U2A	38																																			
U2B	35																																			
U4B	47																																			
U5UA	19																																			
U7A	51																																			
U10B	20																																			
U12A	14																																			
U12IR	9																																			
U13UB	9																																			
X1B	25																																			
X2B	10																																			
X3A	20																																			
X3B	40																																			
X4A	53																																			
X4C	70																																			
X6A	99																																			
X6B	42																																			
X7B	32																																			
X9	146																																			
X10A	35																																			
X10B	11																																			
X10C	16																																			
X11A	53																																			
X11B	8																																			
X12B	36																																			
X12C	98																																			
X13A	15																																			
X13B	13																																			
X14A	34																																			
X15B	17																																			
X16C	14																																			
X17B1	22																																			
X17B2	54																																			
X17B3	17																							</												

# NSLS to NSLS-II Capability Overlap - II

NSLS		NSLS - II under construction												Approved NSLS-II Beamlines																	By project group				
Beamline		CSX	XPD	ESM	FXI	ISR	ISS	SIX	SMI	FMX	AMX	SST	BMX	NYX	AIM	CMS	IRI	IXD	MPP	QAS	TES	XFM	FIS	MET	MID	SSS	4DE	MXD	SM3	XFP	LT	NEXT	NIH	T2	✓
X18A	50																																		
X18B	99																																		
X19A	101																																		
X20A	21																																		
X20C	13																																		
X21	23																																		
X22B	9																																		
X22C	28																																		
X23A2	58																																		
X24A	21																																		
X24C	2																																		
X25	251																																		
X26A	61																																		
X26C	13																																		
X27A	36																																		
X27B	6																																		
X27C	51																																		
X28C	18																																		
X29A	265																																		
2487 Total Users served by NSLS in FY2010																																			
1477 Users who would find comparable capability at NSLS-II for beamlines currently in construction (left of blue line)														Integrated total number of beamlines										2	12	18	23	54							
2402 Users who would find comparable capability at NSLS-II for all of the beamlines shown														Overlap with existing NSLS Users										37	455	1224	1477	2402							

Together the 59 NSLS beamlines hosted a total of 2487 users in Fiscal 2010

- 13 of the NSLS-II beamlines in construction have capabilities that correspond to 18 NSLS beamlines that hosted 1477 users in FY 2010
- 29 of the NSLS-II beamlines that are in construction or have been approved have capabilities that correspond to 54 NSLS beamlines that hosted 2402 users in FY 2010

# NSLS & NSLS-II Beamline Portfolio

Experimental Technique	NSLS*			NSLS-II					
				Construction			Approved		
	BL	SE	TE	BL	SE	TE	BL	SE	TE
<b>SPECTROSCOPY</b>	<b>22</b>	<b>22</b>	<b>31</b>	<b>5</b>	<b>7</b>	<b>12</b>	<b>10</b>	<b>11</b>	<b>21</b>
Low-Energy Spectroscopy	6	6	12	1	2	3	2	3	5
Soft X-ray Spectroscopy	3	3	4	1	2	6	1	1	4
Hard X-ray Spectroscopy	9	9	10	3	3	3	5	5	7
Optics/Metrology	4	4	5	0	0	0	2	2	5
<b>SCATTERING</b>	<b>31</b>	<b>28</b>	<b>35</b>	<b>11</b>	<b>12</b>	<b>14</b>	<b>11</b>	<b>13</b>	<b>17</b>
Hard X-ray Diffraction	11	8.5	11	1	1	1	5	7	10
Macro Crystallography	10	10	10	3	3	3	2	2	2
Hard X-ray Scattering	7	7	8	5	5	7	4	4	5
Soft X-ray Scattering	3	2.5	6	2	3	3	0	0	0
<b>Imaging</b>	<b>9</b>	<b>8</b>	<b>9</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>
Hard X-ray Imaging	5	5	5	2	2	2	1	1	1
Soft X-ray Imaging	2	1	2	0	0	0	0	0	0
Infrared Imaging	2	2	2	0	0	0	2	2	2
<b>TOTAL</b>	<b>62</b>	<b>58</b>	<b>75</b>	<b>18</b>	<b>21</b>	<b>28</b>	<b>24</b>	<b>27</b>	<b>41</b>

If all of these are eventually built out:

- provides a world-class and well balanced portfolio
- provides a smooth transition path for existing NSLS beamlines

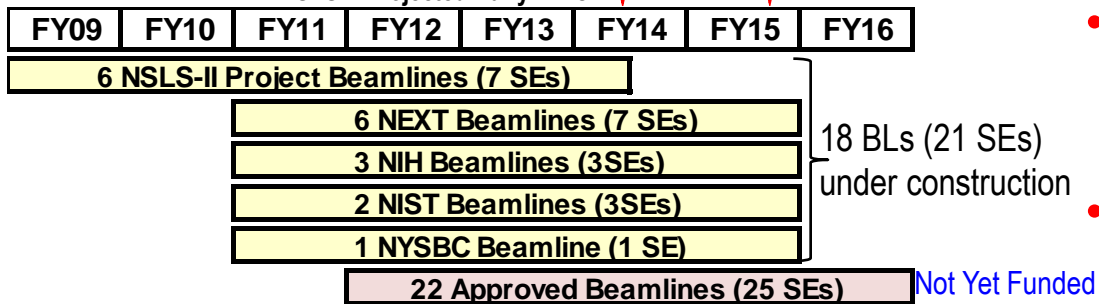
Would still leave 24 ports available:

- 6 Insertion Device straights
- 18 BM/3PW ports

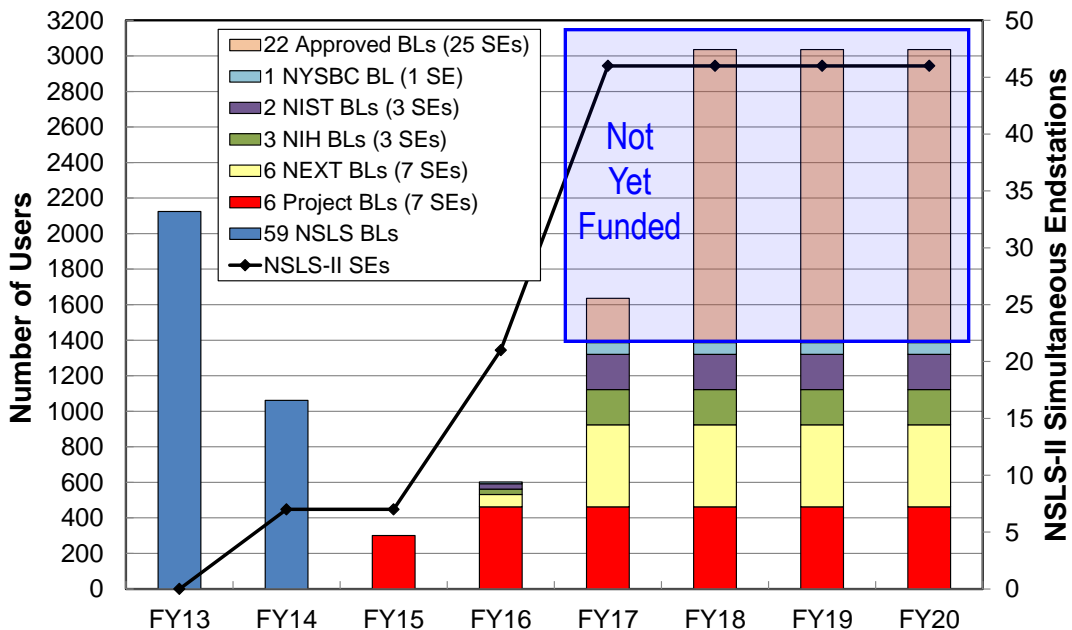


# NSLS-II Beamlines and Users

NSLS Stops Operations  
NSLS-II Projected Early Finish  CD-4 



SEs = Simultaneous Endstations



- NSLS stops & NSLS-II starts mid-FY14
- Rapid ramp up of NSLS-II beamlines for delivering new capabilities and accommodating user community
- Identified transition paths for NSLS beamlines & programs to NSLS-II beamlines under construction or approved but not yet funded
- NSLS-II will host
  - ~ 300 users with 7 SEs in FY 15
  - ~ 600 users with 21 SEs in FY16
  - At least 1400 users with 21 SEs in FY17 (more if additional beamlines are funded)
- NSLS-II provides net capacity increase before end of decade (with additional beamline funding)
- But substantial capacity reduction for several years starting FY14

# NSLS to NSLS-II Dim Period

---

- DOE Storage Rings host ~9000 users per year
- NSLS hosts ~ 2250 users per year (~25% of all users)
- Capacity of NSLS/NSLS-II will be substantially reduced for several years starting FY14
- Impacts on users, facilities, and science
  - Substantial loss of capabilities and capacity until NSLS-II is fully built out
  - Displacement of substantial fraction of user community
- Mitigation Options
  - Build out NSLS-II
  - Identify and communicate to users similar capabilities at ALS, APS, SSRL
  - Adjust capacities at ALS, APS, SSRL
    - Increase Operating Hours and/or refurbish/resource beamlines
- BES and facilities are coordinating to minimize the disruption
  - Identifying comparable capabilities elsewhere
  - Informing user community of alternatives for carryout out their programs
  - Developing options for interim increases in capacity
  - BES and Facility Directors met on Aug 1 and will meet again in November
    - Launched working group to further develop alternatives analysis and formulate communications plan

# Closing Thoughts

---

- NSLS highly productive facility and will be a strong contributor to synchrotron science until its planned closing in FY 14
- NSLS to NSLS-II transition is a significant change for the entire synchrotron radiation research community
- Significant capabilities and capacity will be lost from the DOE light source portfolio until NSLS-II is fully built out
- A significant fraction of the user community will be disrupted
- Collaboration between facilities can help to minimize the disruption
- Work with our users to help identify options for maintaining scientific productivity through the user transition
- Work to assure that the best science is being supported by the DOE light sources