

Beamline Engineering Meeting at BNL Overview and Plan for the Meeting

Steve Hulbert

NSLS-II Beamline Engineering Group Leader (Interim)

25 March 2019

Outline

- Purposes and Agenda
- Beamline buildout
- NSLS-II organization
 - Experiment Development Program
- Beamline Engineering Group
 - Beamlines Developed by BEG
- Value Engineering: Lessons learned from NSLS-II beamline development projects
 - Photon Delivery System Construction
 - Beamline Commissioning
- Beamline tours

Purposes

- i. Describe, show, and discuss NSLS-II beamline-related engineering accomplishments and capabilities
- ii. Learn about and discuss the beamline engineering needs of the visiting laboratories: SLAC, LBNL, and ANL

Agenda

Today

- 9:30am Tours of NSLS-II Beamlines—Building 740
- 11:00am Beamline Panel Discussions
- 1:45pm Endstation Panel Discussions
- 2:45pm Other DOE SR Facility Construction Projects & Engineering Needs
- 5:15pm Doing business between DOE laboratories
- 6:30pm Dinner – see Sue if interested in joining a group dinner (Brickhouse Brewery)

Tomorrow

- 8:50am NSLS-II Enabling technologies: Precision Engineering, Optical Metrology, Deposition Lab, Simulations, Optics Figure Error
- 11:15 am Tour of Metrology, Nano-positioning, and Deposition labs—Building 703
- 1:30 pm Summary & next steps
- 2:00 pm Engineering Seminar: Matthaues Leitner (LBNL) —Building 463
- 3:15 pm Inside-shield-wall systems: Insertion Devices, Front Ends

Engineering Seminar, Tuesday, March 26, 2-3pm
Bldg. 463 (Biology building), Large Conference Room

**Development and Production of the
Soft-X-Ray and Hard-X-Ray Undulator Segments
for the
Linac Coherent Light Source Upgrade (LCLS-II)
Project**

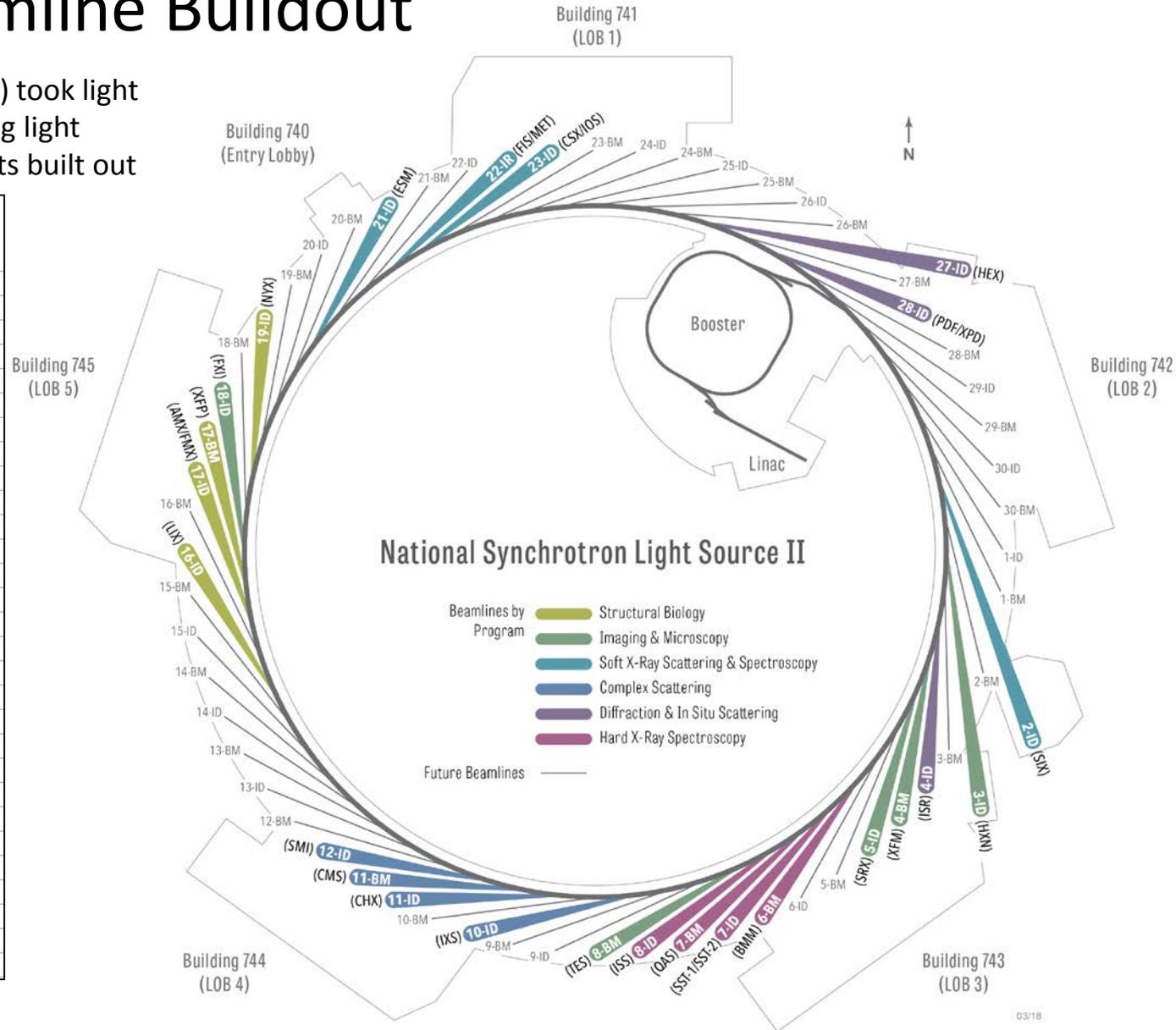
Matthaeus Leitner, *Lawrence Berkeley National Laboratory*
(for the LBNL undulator team)

NSLS-II Beamline Buildout

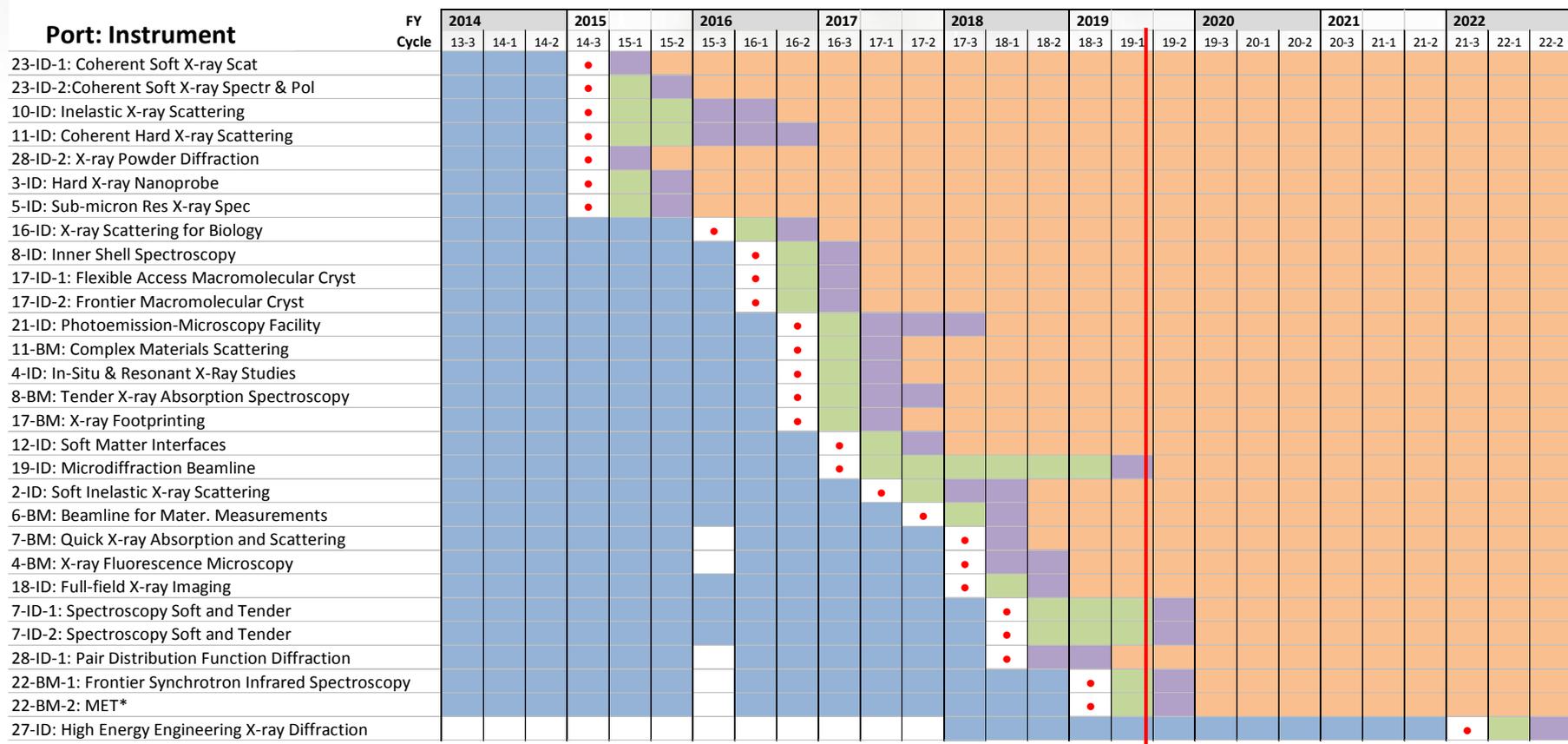
- Fall 2014: First beamline (CSX) took light
- End 2018: 28 beamlines taking light
 - Nearly ½ of NSLS-II ports built out

Port: Instrument

23-ID-1: Coherent Soft X-ray Scat
23-ID-2: Coherent Soft X-ray Spectr & Pol
10-ID: Inelastic X-ray Scattering
11-ID: Coherent Hard X-ray Scattering
28-ID-2: X-ray Powder Diffraction
3-ID: Hard X-ray Nanoprobe
5-ID: Sub-micron Res X-ray Spec
16-ID: X-ray Scattering for Biology
8-ID: Inner Shell Spectroscopy
17-ID-1: Frontier Macromolecular Cryst
17-ID-2: Flexible Access Macromolecular Cryst
21-ID: Photoemission-Microscopy Facility
11-BM: Complex Materials Scattering
4-ID: In-Situ & Resonant X-Ray Studies
8-BM: Tender X-ray Absorption Spectroscopy
17-BM: X-ray Footprinting
12-ID: Soft Matter Interfaces
19-ID: Microdiffraction Beamline
2-ID: Soft Inelastic X-ray Scattering
6-BM: Beamline for Mater. Measurements
7-BM: Quick X-ray Absorption and Scattering
4-BM: X-ray Fluorescence Microscopy
18-ID: Full-field X-ray Imaging
7-ID-1: Spectroscopy Soft and Tender
7-ID-2: Spectroscopy Soft and Tender
28-ID-1: Pair Distribution Function Diffraction
22-BM-1: Frontier Synchrotron Infrared Spectroscopy
22-BM-2: MET
27-ID: High Energy Engineering X-ray Diffraction

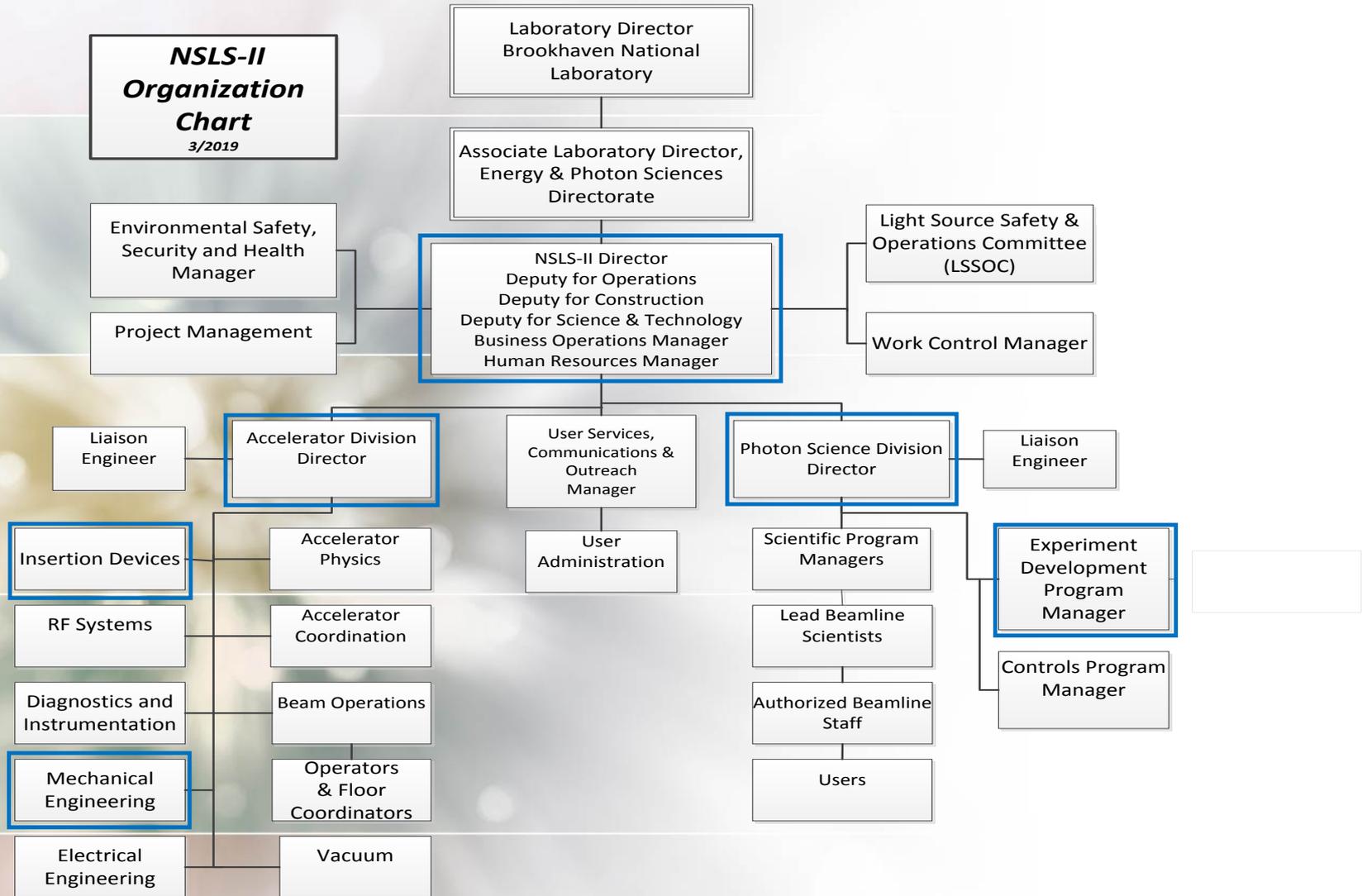


NSLS-II Beamline Buildout



28 beamlines operating/commissioning
 – 23 beamlines in GU ops
 1 beamline under development

National Synchrotron Light Source II



NSLS-II Experiment Development Program

- One of 8 programs in the NSLS-II Photon Science Division:
 - 6 Beamline Science programs
 - Experiment Development program
 - Controls program
- Groups in Experiment Development Program
 - **Beamline Engineering**
 - Research Operations Support
 - Detectors
 - **Optics & Metrology**
 - Optical Metrology
 - Deposition
 - Precision Engineering and Nanopositioning

EXPERIMENT DEVELOPMENT W.-K. Lee PROGRAM MANAGER
J. Keister
O. Chubar A. He
BEAMLINE ENGINEERING S. Hulbert (I) GROUP LEADER S. Antonelli D. Bacescu S. Coburn C. Eng E. Haas L. Lienhard M. Lucas S. O'Hara Y. Zhu
RESEARCH OPERATIONS SUPPORT M. Buckley GROUP LEADER C. Ali M. Bromfield S. LaMarra S. Sherwood
DETECTORS D.P. Siddons GROUP LEADER A. Kuczewski R. Michta A. Rumaiz
OPTICS & METROLOGY M. Idir GROUP LEADER L. Huang K. Tayabaly T. Wang
N. Bouet A. Ledbetter M. Vescovi J. Zhou
E. Nazaretski D. Kuhne Wei Xu Weihe Xu

NSLS-II Beamline Engineering Group



Steve Hulbert

- Group Leader (interim)



Steve Antonelli

- EPoC for Structural Biology Program
- BL/ES developed: ARI R&D (in progress)



Daniel Bacescu

- EPoC for Soft X-ray Scattering & Spectroscopy Program
- BL/ES developed: CSX, IOS, SMI, J-PLS (in progress)



Scott Coburn

- EPoC for Complex Scattering Program
- BL/ES developed: IXS, FXI
- WFO: APS 27-ID RIXS endstation, LCLS Soft RIXS endstation



Christopher Eng

- BL/ES developed: FIS/MET, IOS (in progress)



Ed Haas

- EPoC for Diffraction & In-Situ Scattering program
- BL/ES developed: TES, XFM, PDF



Lukas Lienhard

- EPoC for Expt. Development Program
- BL/ES developed: CMS, QAS, FIS/MET



Mike Lucas

- EPoC for Hard X-ray Scattering Program
- BL/ES developed: ISR, HEX (in progress)



Steve O'Hara

- Structural and thermal analysis, esp. finite element
- Front end engineering and analysis (NSLS-II and APS)



Yi Zhu

- EPoC for Imaging & Microscopy Program
- BL/ES developed: ESM, SIX, XFM, B-CDI (in progress)

EPoC = Engineering Point of Contact
BL = beamline
ES = endstation

Beamlines Developed by NSLS-II Beamline Engineering Group

Hard X-Ray Spectroscopy

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

8-ID (ISS): Inner Shell Spectroscopy

Imaging & Microscopy

3-ID (HXN): Hard X-ray Nanoprobe

4-BM (XFM): X-ray Fluorescence Microscopy

5-ID (SRX): Sub-micron Resolution X-ray Spectroscopy

8-BM (TES): Tender X-ray Absorption Spectroscopy

18-ID (FXI): Full-Field X-ray Imaging

Structural Biology

16-ID (LIX): X-ray Scattering for Biology

17-ID-1 (AMX): Highly Automated Macromolecular Crystallography

17-ID-2 (FMX): Frontier Microfocusing Macromolecular Crystallography

Complex Scattering

10-ID (IXS): Inelastic X-ray Scattering

11-ID (CHX): Coherent Hard X-ray Scattering

11-BM (CMS): Complex Materials Scattering

12-ID (SMI): Soft Matter Interfaces

Diffraction & In Situ Scattering

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

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

28-ID-1 (PDF): Pair Distribution Function

28-ID-2 (XPD): X-Ray Powder Diffraction

Soft X-Ray Scattering & Spectroscopy

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

21-ID-1 (ESM-ARPES): Angle-Resolved Photoemission Spectroscopy

21-ID-2 (ESM-XPEEM): X-ray Photoemission Electron Microscopy

22-IR (FIS/MET): Magneto, Ellips, High-P Infrared (2018)

23-ID-1 (CSX): Coherent Soft X-ray Scattering

23-ID-2 (IOS): In Situ & Operando Soft X-Ray Spectroscopy

Value Engineering: Photon Delivery System Construction

Improvements identified:

- Strengthen design review process
 - Implement travelers for design reviews
 - Maintain in-house design library
- Standardization on best-performing components
 - Improves performance overall
 - Increases efficiency of commissioning and operations
- Better use of in-house expertise to inform procurements
 - Early simulations to better define scope and thereby reduce cost
 - Involve in-house experts in all phases of development
- Greater use of in-house development where appropriate
 - Especially where commercial state-of-the-art is lagging
 - Increase use of BNL resources such as Instrumentation Div.
- More efficient installation coordination
 - Use lessons learned from installation of the first 25 NSLS-II beamlines

Value Engineering: Beamline Commissioning

Improvements identified:

- Improve coordination with suppliers
 - Develop testing/commissioning plan immediately after award
- Improve transition to operations
 - Develop beamline commissioning & transition-to-operations plans early
 - Engage NSLS-II management in this process, for each beamline
- Increase communication among NSLS-II beamlines
 - Wealth of useful commissioning experience has been developed to date
 - Commissioning findings should be published, at least internally
- Improve coordination among NSLS-II beamlines
 - Benefits for commissioning and transition to operations
 - Principally, coordination among beamlines within Photon Science Division programs

Beamline Tour Groups

- **Antonelli**: Biology beamlines (16-ID, 17-ID-1, 17-ID-2, 17-BM, 19-ID)
- **Bacescu, Lienhard, Eng**: IR, some soft x-ray beamlines, and TES (22-IR, 23-ID-1, 23-ID-2, 8-BM)
- **Coburn**: SRX and Complex Scattering beamlines, FXI (5-ID, 10-ID, 11-ID, 11-BM, 12-ID, 18-ID)
- **Haas**: XFM, Diffraction & In-situ beamlines (4-BM, 4-ID, 28-ID-1, 28-ID-2, HEX (poster))
- **Lucas, O'Hara**: Spectroscopy beamlines (6-BM, 7-ID-1, 7-ID-2, 7-BM, 8-ID)
- **Zhu**: Soft X-ray beamlines, HXN (2-ID, 3-ID, 21-ID)