Beamline Buildout

Erik Johnson, Deputy Director for Construction, NSLS-II

Triennial Operations Peer Review

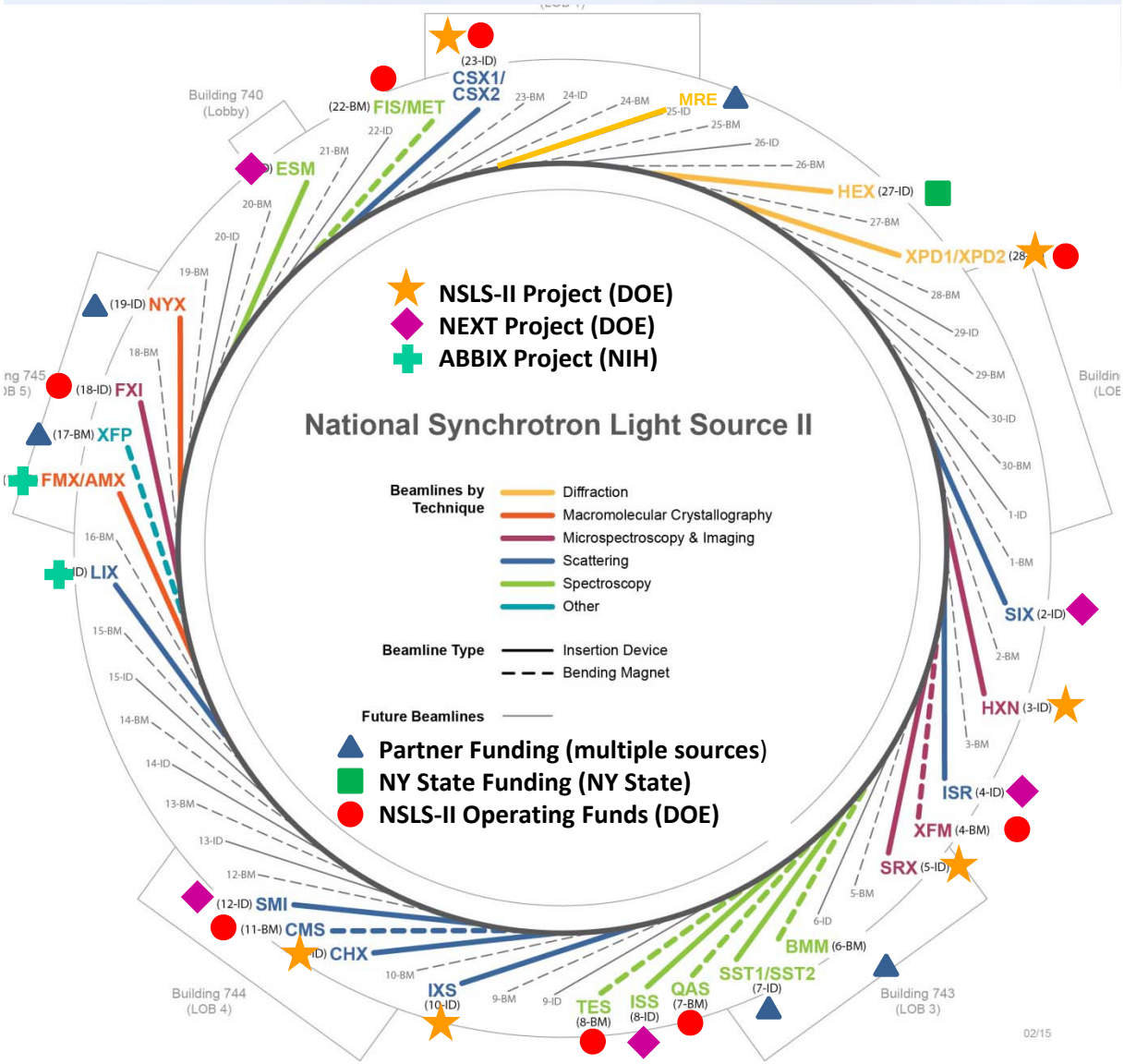
Experimental Operations Breakout Session June 20th 2017

Introduction and Overview

Questions to discuss -

- What are we building out
- How are we going about it
- What is it costing to deliver beamlines
- Improving our delivery of engagements
- Engagements that are planned
  - Those starting up now
  - Prospective engagements
- Back-up information is available to go into more depth on topics of specific interest

NSLS-II Beamlines



Soft X-Ray Scattering & Spectroscopy

23-ID-1: Coherent Soft X-ray Scat (2015)
23-ID-2:Coherent Soft X-ray Spectr & Pol (2015/2016)
21-ID: Photoemission-Microscopy Facility (2017)
2-ID: Soft Inelastic X-ray Scattering (2017)
22-BM: Magneto, Ellipso, High Pressure IR (2018)

Complex Scattering

10-ID: Inelastic X-ray Scattering (2015)
11-ID: Coherent Hard X-ray Scattering (2015)
11-BM: Complex Materials Scattering (2016)
12-ID: Soft Matter Interfaces (2017)

Diffraction & In Situ Scattering

28-ID-1: X-ray Powder Diffraction (2015)
28-ID-2: Pair Distribution Function (2018)
4-ID: In-Situ & Resonant X-Ray Studies (2017)
27-ID: High Energy X-ray Diffraction (2022)
25-ID: Materials in Radiation Environments (2023?)

Hard X-Ray Spectroscopy

8-ID: Inner Shell Spectroscopy (2017)
7-BM: Quick X-ray Absorption and Scattering (2017)
8-BM: Tender X-ray Absorption Spectroscopy (2016)
7-ID-1: Spectroscopy Soft and Tender (2018)
7-ID-2: Spectroscopy Soft and Tender (2018)
6-BM: Beamline for Mater. Measurements (2017)

Imaging & Microscopy

3-ID: Hard X-ray Nanoprobe (2015)
5-ID: Sub-micron Res X-ray Spec (2015)
4-BM: X-ray Fluorescence Microscopy (2017)
18-ID: Full-field X-ray Imaging (2018)

Structural Biology

17-ID-1: Frontier Macromolecular Cryst (2016)
17-ID-2: Flexible Access Macromolecular Cryst (2016)
16-ID: X-ray Scattering for Biology (2016)
17-BM: X-ray Footprinting (2016)
19-ID: Microdiffraction Beamline (2017)

Producing High Impact Science

General User Operations
CSX-1, CSX-2, XPD, HXN, SRX, IXS, CHX, LiX, AMX, FMX, ISS, XFP, CMS

Science Commissioning
TES, SMI, ISR

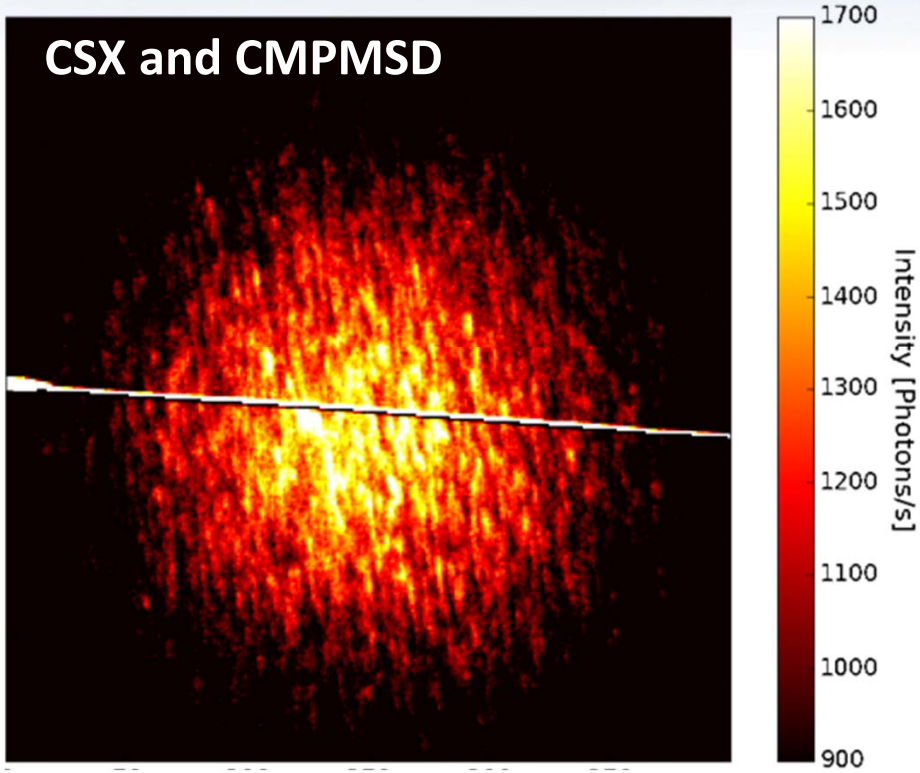
Technical Commissioning
ESM, NYX, SIX

IRR Planned in FY17
BMM, QAS, XFM

IRR Planned in FY18
SST-1, SST-2, PDF, FXI, FIS, MET

19 beamlines in operations or commissioning

NSLS-II
ABBIX
NEXT
BDN
NPB



High coherent flux facilitated the **first ever** speckle and XPCS measurement of charge stripes in a cuprate *X.M. Chen, et al. PRL (2016)*

Only 2 years beyond NSLS-II Project CD-4!

Beamline Construction

- ABBIX Project *(3 beamlines)*
  - NIH Sponsored Activity for Life Sciences Research - $45M budget
  - All instruments delivered at nearly the same time, all in user ops
  - Recently completed
- NEXT Project *(5 beamlines)*
  - DOE sponsored Major Item of Equipment - $90M budget
  - All instruments delivered at nearly the same time (one is already in user ops)
  - CD-4 review successfully completed on June 1
- Beamlines Developed by NSLS-II Portfolio (8 beamlines)
  - *NSLS-II Operations budget funds these instruments*
  - Organized roughly in pairs for delivery to operations, at ~1 year intervals
  - High priority for NSLS-II (but not the highest)
  - Focus on cost performance and optimize schedule within other constraints
- NSLS-II Partner Beamlines Portfolio *(5 beamlines)*
  - Most of the activity is funded by external sponsors (NSF, DOD, NIST)
  - *Some work performed by NSLS-II at partner expense, some funded by NSLS-II*
  - Delivered asynchronously
- New Engagement Development *(~7+ beamlines under consideration)*
  - *Initial prospecting and evaluation work is generally funded by NSLS-II operations*

Engagement principals

- Advanced Beamlines for Biological Investigations with X-rays Project
  - Lonny Berman Project Manager
    - **High Energy Instrument Development**

- NSLS-II EXperimental Tools Project
  - Steve Hulbert Project Manager
    - **Low Energy Instrument Development**

  - Jeff Keister Deputy Project Manager
    - **Practice Development**

- Beamlines Developed by NSLS-II Portfolio
  - Julian Adams Portfolio Manager
    - **Ray Tracing Standards Development**

- NSLS-II Partner Beamlines Portfolio
  - Andrew Broadbent Portfolio Manager
    - **HEX and MRE Development**

Elements of charting future instrument delivery

Beamline Development - looking to the Future

'Committed' Beamlines	FY	2015			2016			2017			2018			2019		
	Cycle	14-3	15-1	15-2	15-3	16-1	16-2	16-3	17-1	17-2	17-3	18-1	18-2	18-3	19-1	19-2
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JUN-17

Operations Support
- Fully NSLS-II budget
- Common support (user operations supported by others)

● First light - In Service	9	4	8	0
Technical Commissioning				
Science Commissioning				
General User Operation	6	16	20	28

Starting

Prospective

INF

QIX

J-PLS PLS

HEX MRE

CDI ARI/SMF

FED

~38

Overview of BES Funding and Costs FY15-17

	Operations Funds and Costs ($M)			
		Actual	Actual	Expected
Funds		FY15	FY16	FY17
	new BA (Budget Authority)	90.1	109.6	111.8
	committed carryforward from previous FY	4.1	9	11.5
*	dedicated funds carried forward from previous FY	0	3.9	1.9
	Uncommitted carryforward from previous FY	16.7	8	19.1
	Total Funds	**110.9**	**130.5**	**144.3**
Costs	Operations Costs	85.6	80.1	98.1
	BL Build up costs	4.4	17.9	22.5
	commitments carried forward into next FY	9	11.5	4.2
*	dedicated funds carried forward into next FY	3.9	1.9	3.5
	uncommitted carryforward into next FY	8	19.1	16
	Total Cost, Commitments & Carryforward	**110.9**	**130.5**	**144.3**

- Dedicated funds are funds for which there are definite plans in the following year, but not yet commitments. For example, BDN and NPB plans
- FY17 actuals to March 2017 and (then current) ETC plans to the end of FY17
- Excludes ABBIX and NEXT, includes only NSLS-II operations funds

Beamline Build-up Costs Overall

	FY2015						FY2016						FY2017					
	BES-SUF Operation Funding			Other Funding Source			BES-SUF Operation Funding			Other Funding Source			BES-SUF Operation Funding			Other Funding Source		
Category	FTEs	Direct	Burdened	FTEs	Direct	Burdened	FTEs	Direct	Burdened	FTEs	Direct	Burdened	FTEs	Direct	Burdened	FTEs	Direct	Burdened
Non-labor		1,713.9	1,877.8		1,822.0	1,910.9		8,375.6	8,843.8		3,595.4	3,852.4		8,433.9	9,045.5		1,394.0	1,611.3
Labor	12.1	2,059.5	2,489.4	4.4	594.7	695.7	54.2	8,068.5	9,019.9	14.3	1,915.8	2,224.9	68.8	10,734.2	13,508.4	18.8	2,727.6	3,292.4
By source	NSLS-II Operations			Other funding sources			NSLS-II Operations			Other funding sources			NSLS-II Operations			Other funding sources		
FTE	12.1			4.4			54.2			14.3			68.8			18.8		
Labor			57%			27%			50%			37%			60%			67%
Direct		3,773.3			2,416.7			16,444.2			5,511.2			19,168.1			4,121.6	
Burdened			4,367.2			2,606.6			17,863.6			6,077.3			22,554.0			4,903.6
Net Overhead rate			15.7%			7.9%			8.6%			10.3%			17.7%			19.0%
Overall	FY 2015 Cost All fund sources						FY 2016 Cost All fund sources						FY 2017 Cost All fund sources					
FTE	16.4						68.5						87.6					
Labor			46%						47%						61%			
Direct		6,190.0						21,955.4						23,289.7				
Burdened			6,973.8						23,941.0						27,457.6			
Net Overhead rate			12.7%						9.0%						17.9%			
SPP Fraction			37%						25%						18%			

Analysis of data from Operations Budget Details (Posted on Website)

- Beamline Operations: Beamline buildup equipment (Non-labor) and labor
- This includes BDN, NPB, and the Construction Practice activities (included in WBS 4.1.6)
- Overall ($58.4M - all funding sources) about 54% labor with a net overhead of about 13.5%
  Early build-up has benefited greatly from special overhead arrangements

Overview of Activities by Portfolio

	BDN			NPB			WBS 4.1
Year	Other	NSLS-II	Work	Other	NSLS-II	Work	NSLS-II
FY15	5,000	2,727	Establish BDN, (CMS, TES, QAS, XFM, FIS/MET, IXD, MID, MPP); Repurpose NSLS (725) equipment and make stable for storage; Project execution documentation; Preliminary design on CMS, QAS, XFM, TES & FIS/MET; Transferred FXI, & PDF into BDN; Halt efforts on IXD, MPP & MID	2,893	1,236	Establish Partner project, (XFP, NYX, SST1, SST2, BMM). Commence work on XFP, NYX, SST1, SST2 & BMM	273
FY16	-	14,725	Completed TES & CMS (BNL PEMP Notables); Continued development of FXI, XFM, QAS, FIS/MET & PDF;	6,156	3,370	XFP complete work Continue work on NYX, SST1, SST2, & BMM	135.7
FY17	-	16,800	Completed FE & ID for others ; Complete QAS & XFM beamlines; Continued development of FXI, FIS/MET & PDF	4,765	1,859	NYX & BMM complete work Continue work on NYX, SST1,&SST2 HEX commence work	1,740.7

All burdened [$K]

- Current projection moves some work into FY18 that (as of March) was planned for FY17
- BDN had $5M of residual NSLS operations funds available in FY15 (not NSLS-II)
- WBS 4.1 includes
  - planning activity in FY16 and FY17 for new beamlines
  - Initial work for implementation of CDI beamline and J-PLS instrument

The NSLS-II Construction Practice

- Focused on delivery of project work for NSLS-II
- Includes management, coordination, development and execution components
  - Management – includes oversight, coordination, and development of information tools and processes facilitate execution of multiple engagements across their life cycle
  - Coordination – utilization of tools for resource coordination and oversight to facilitate prioritization when resource conflicts arise
  - Development – evaluating and planning approved engagements to bring them to a baseline status
  - Support and Execution of engagements either in portfolios, or as stand-alone activities
- Supported by NSLS-II operations funding
- Manage engagements funded both by NSLS-II operations and by external sponsors
- Nearly all of the resources are matrixed from the NSLS-II organization - emphasizes importance of communication!

FY18 Goals for the Construction Practice

- Complete construction of BDN beamlines
  - QAS and XFM
  - FXI, PDF and FIS/MET
- Complete construction of NPB (Partner) beamlines
  - SST-1 & SST-2
- Proceed with construction of HEX beamline (In Partner Portfolio)
- Practice Activities
  - CDI activities (to become an engagement in the BDN Portfolio)
  - J-PLS construction (Station on 12-ID SMI)
  - ARI R&D activity and planning
  - SMF, INF, QIX plan development (at a modest level)
  - Capture and codification of Lessons Learned
  - Development of reproducible processes for beamline construction
  - Support of department 'project' engagements
  - Proceed with beamline value engineering exercise

- *Long term goal –*
  - *facilitate efficient and reliable delivery of engagements across their life cycle*

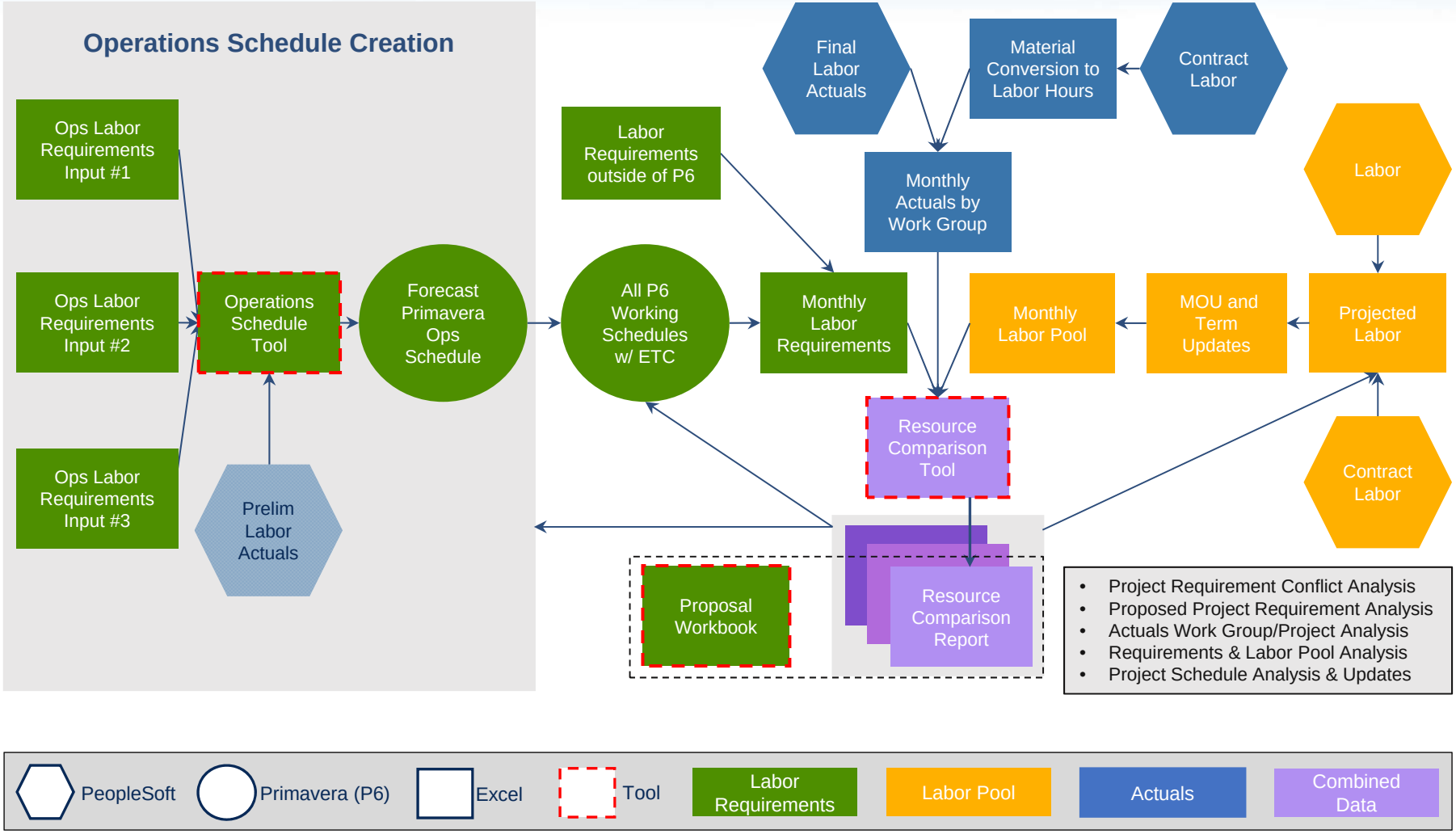
Planning Development

- Completed Projects provide a good deal of the basis of estimate and guide development of new work
  - Improving capture and availability of information from prior beamline construction projects
  - Extending utilization of the Construction SharePoint sites
- Adopted standardized WBS for beamline engagements
  - Proposal tool optimized to this WBS
  - Construction Divisions organized in line with the WBS
- Have utilized these tools in estimating new proposed work
- Approach continues to evolve….
  - Started from initiative coming out of NSLS-II project in 2015 to Improve Instrument Development and Delivery into the future….
  - *More information on the development process evolution provided as back-up slides*

Planning Tools

- Proposal Workbook
  - Excel based tool to standardize and simplify proposal creation process and enable smooth compatibility when switching to project controls systems upon proposal approval.
- Operations Schedule Tool
  - Translates excel based operations requirements and actuals into format that enables operations team to update work group requirements similar to how "status" is taken on project schedules. These updated requirements are imported into Primavera to create an operations working schedule.
- Resource Comparison Tool
  - Compiles actuals, labor pool, and labor requirements into format that enables easy comparison between data sets from both a Project Manger and Work Group Manager perspective. Enables management to analyze resources at the organizational level or view the detail at the division, project or work group level.

Resource Planning Process



Operations Schedule Tool

Operations Schedule Tool - May 2017 [Read-Only] - Microsoft Excel

File | Home | Insert | Page Layout | Formulas | Data | Review | View | Acrobat

Check Out Required To modify this server workbook, you must check it out. Check Out

A7 | 4.01.01.01.01 General

ACTUAL CHARGES WITHOUT PLANNED REQUIREMENTS

PLANNED REQUIREMENTS WITHOUT ACTUAL CHARGES

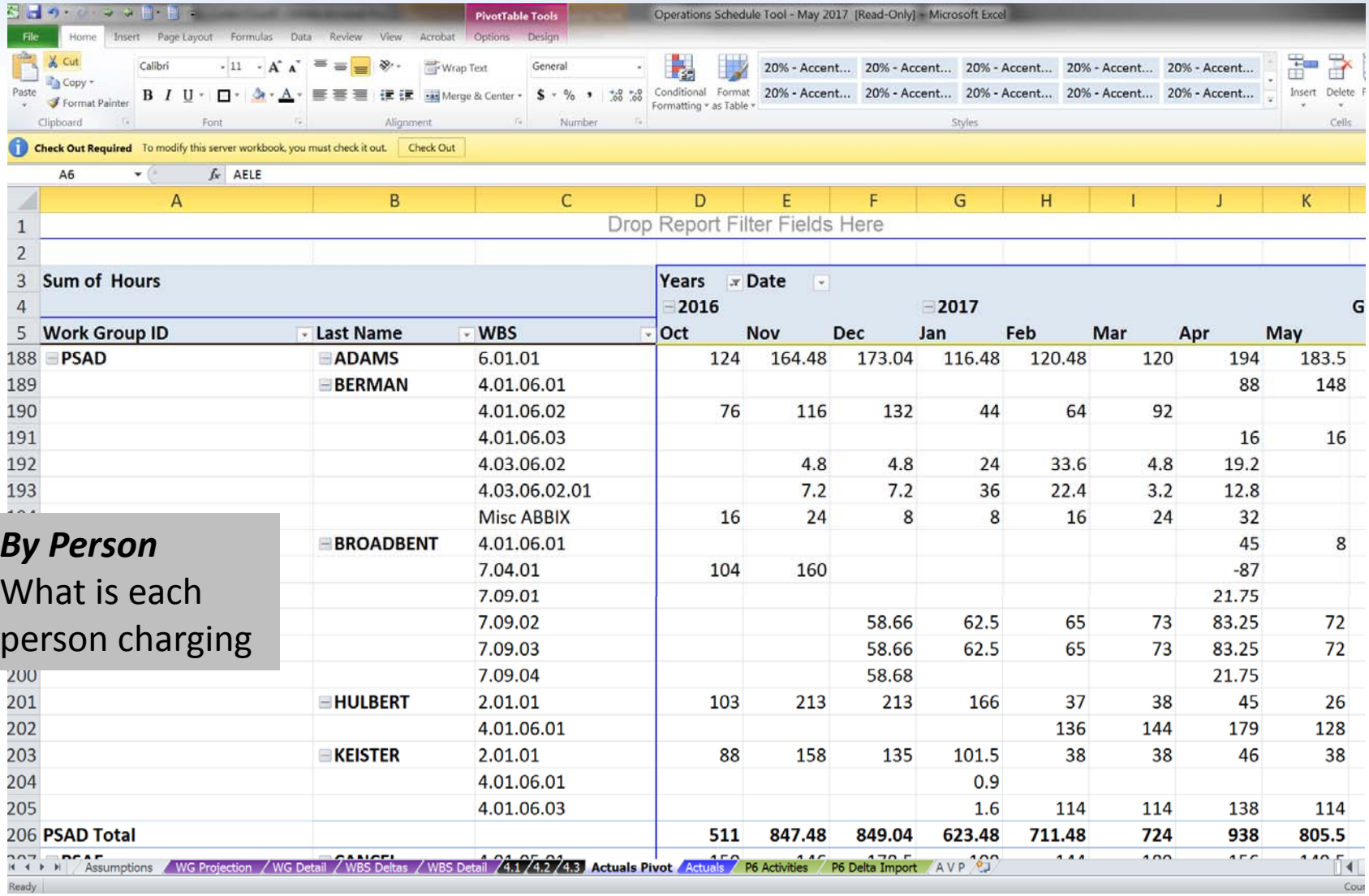
MONTHLY LABOR EQUIVALENT (MLE)

DATA SET	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	AVE
AVE MONTHLY REQ + DELTA									
4.01.06.01 Information Tools									
PLANNED REQUIREMENTS	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
PSAD	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	
ACTUALS	2.21	3.58	3.41	2.27	3.51	4.62	6.47	6.00	
PSAD				0.01	0.92	1.07	2.01	1.92	
PSBE					0.04	0.06			
PSBP			0.11			0.23	0.04	0.05	
PSEG						0.69	1.08	0.86	
PSEP	1.52	0.90	1.03	0.80	0.53	1.16	1.16	1.03	
PSER		1.88	1.30	0.73	1.03	0.97	1.21	1.15	
PSET	0.69	0.80	0.96	0.73	0.87	0.41	0.96	0.98	
PSEV					0.11	0.02			
DELTA	-1.71	-3.08	-2.91	-1.77	-3.01	-4.12	-5.97	-5.50	
AVE MONTHLY EST. ACTUALS									
AVE MONTHLY REQ + DELTA									-
4.01.06.02 Construction Engagement Coordination									
PLANNED REQUIREMENTS	2.80	2.80	2.80	2.80	2.80	2.80	2.80	2.80	
PSAA	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	
PSET	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
PSHD									
PSHH	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	
ACTUALS	1.30	5.53	5.16	4.02	4.93	4.42	3.97	3.74	
PSAD	0.81	0.75	0.99	0.29	0.43	0.69			

Assumptions | WG Projection | WG Detail | WBS Deltas | WBS Detail | 4.1 | 4.2 | 4.3 | Actuals Pivot | Actuals

By WBS
Which workgroups are planned and charging

Operations Schedule Tool



By Person
What is each person charging

Instrument Execution Plan Development (IEPD)

- Preliminary investigation of 6 BDPs completed by Taskforce led by Lonny Berman
- Refined and prototyped our now Standard WBS
- Created a library of recent estimates informed by current (best) practices in building NSLS-II beamlines
- Construction practice supported the effort with development of the Proposal Workbook
  - Allows capture of estimates and high level schedule that can be ported to our P6 scheduling system
  - From here can be modeled in our Resource Comparison Tool (Merges Plans from Operations and Projects, Compares with Resources and Actuals to allow forecasting and plan development)

Proposal Workbook J-PLS Example

RESOURCE SUMMARY								
RESOURCE	FY17		FY18		FY19		TOTAL	
	UNITS	COST	UNITS	COST	UNITS	COST	UNITS	COST
Labor_Scientist_NS1	432.00	$ 91,714.58	1,030.59	$ 218,796.23	121.41	$ 25,775.99	1,584.00	$ 336,286.80
Labor_Project Engineer_MO7	180.00	$ 24,754.57	429.41	$ 59,055.02	50.59	$ 6,957.17	660.00	$ 90,766.76
Labor_Mechanical Engineer_NO1	264.43	$ 35,744.80	221.57	$ 30,589.50	-	$ -	486.00	$ 66,334.30
Labor_Mechanical Designer_NO2	192.00	$ 23,046.32	-	$ -	-	$ -	192.00	$ 23,046.32
Labor_Mechanical Technician_NO3	-	$ -	280.00	$ 32,365.31	-	$ -	280.00	$ 32,365.31
Labor_EL - Survey Technician_SE2	3.40	$ 401.31	76.60	$ 9,037.62	-	$ -	80.00	$ 9,438.93
Labor_EL - Survey Engineer_SE1	1.36	$ 217.92	30.64	$ 4,907.71	-	$ -	32.00	$ 5,125.63
Labor_Plant Engineering-Building Trades Carpenter_BTC	0.34	$ 43.66	31.66	$ 4,066.69	-	$ -	32.00	$ 4,110.35
Labor_Plant Engineering-Building Trades Riggers_BTS	2.04	$ 261.97	45.96	$ 5,899.58	-	$ -	48.00	$ 6,161.55
Labor_Plant Engineering-Building Trades Electrician_BTE	-	$ -	88.00	$ 11,305.90	-	$ -	88.00	$ 11,305.90
Labor_Controls Engineer_NE4	16.55	$ 2,631.20	455.45	$ 72,983.22	-	$ -	472.00	$ 75,614.42
Labor_Electrical Technician_NE3	-	$ -	276.00	$ 32,592.39	-	$ -	276.00	$ 32,592.39
Labor_IT Professional (Software)_NA7	6.62	$ 956.67	599.38	$ 87,330.01	-	$ -	606.00	$ 88,286.67
LABOR TOTAL	1,098.75	$ 179,773.00	3,565.25	$ 568,929.18	172.00	$ 32,733.16	4,836.00	$ 781,435.35
Material_Travel Cost_NTR	4,090.91	$ 6,397.78	9,759.36	$ 15,262.68	1,149.73	$ 1,798.07	15,000.00	$ 23,458.54
Material_Material (Purchase <$25k)_NMA	-	$ -	238,500.00	$ 369,291.02	-	$ -	238,500.00	$ 369,291.02
Material_Material (Purchase >$25k)_NSM	15,715.74	$ 19,308.96	242,284.26	$ 297,679.75	-	$ -	258,000.00	$ 316,988.71
MATERIAL TOTAL	19,806.65	$ 25,706.74	490,543.62	$ 682,233.45	1,149.73	$ 1,798.07	511,500.00	$ 709,738.26
GRAND TOTAL	20,905.39	$ 205,479.74	494,108.88	$ 1,251,162.63	1,321.73	$ 34,531.23	516,336.00	$ 1,491,173.60

Utilization of Proposal Workbook:

- Decreases time to input and create Proposals
- Standardizes rate and resource assumptions across proposals
- Proposals created in the workbook can more easily be compared
- Dramatically reduce time to create Primavera schedule due to import capability

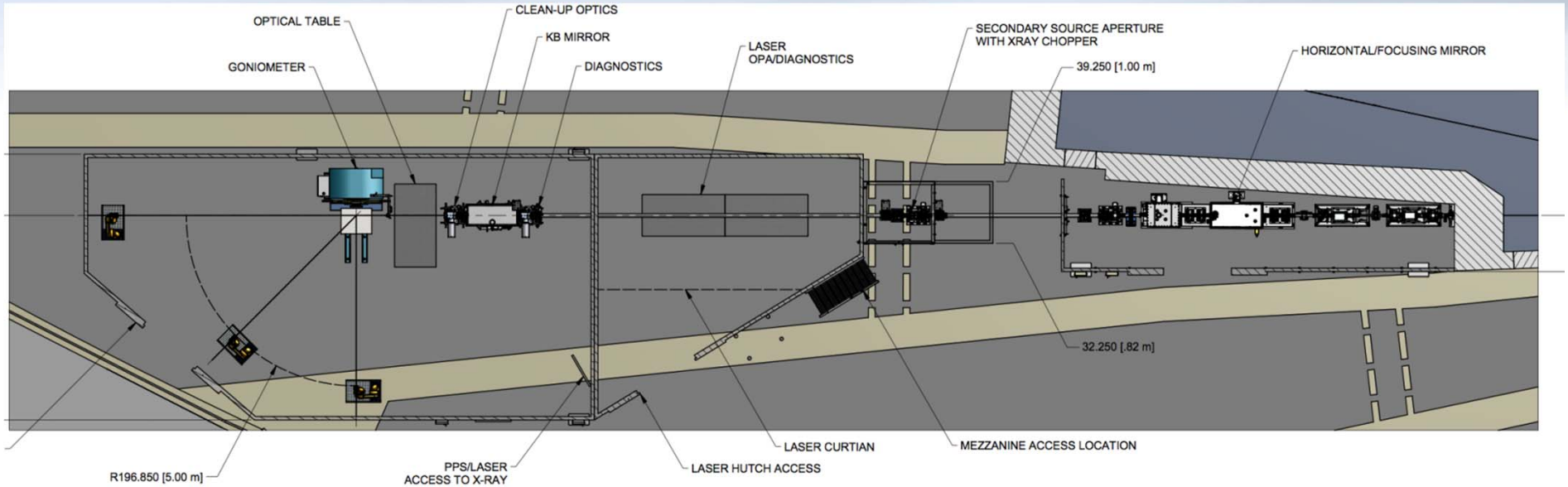
Execution Plans for IEPD beamlines

- Recognize state of development as well as funding realities
- Can only move one ahead 'full-speed' on NSLS-II Operations Budget

FY17 into FY18

- Pursue
  - B-CDI – Ramp up for full design and execution
  - PLS – Execute an alternate proposal to jumpstart the program using equipment that was recently transferred from APS (J-PLS)
- Investigate
  - ARI – Execute an R&D program to investigate zoneplate design proposed for the spectrometer (is RP=10,000 achievable)
- Develop further..
  - SMF – Design study (end stations), estimates
  - QIX – Further design study – (alternative spectrometer optics), estimates
  - INF – Refine design and estimates

CDI Layout (IEPD Estimate Version)



'Short' layout inside of NSLS-II ring building was evaluated

- IVU20 – 3m source
- 6-15 keV spot size at sample 1 to 7 μm FWHM
- $22.4M estimate (w/Extraordinary Project Rates) – 4.3 year TL schedule
- Affordance for future optical laser (shielded hutch upstream of endstation)
- End-station hutch allows measurements 1.5 m above nominal beam height
- *Careful design required to evaluate long design with separate SEB*

Bragg Coherent Diffraction Imaging

Questions

- Based on the science case outlined in the BDP, what is the technical case for having a remote endstation?
- What are the cost implications of having a remote endstation?
- Are there other programmatic reasons for having a remote endstation?
- What is the science case for the time-resolved program?
- What is the preferred sector for BCDI? (IEPD assumed 09-ID)

Tasks

- Perform optical and engineering design
- Develop specs and be ready to launch procurements for long lead beamline items
- Continue endstation design
- Develop full resource loaded schedule

Next Steps

- Hire beamline scientist
- Form Beamline Advisory Team
- Conduct review of technical scope focusing on the internal vs external configuration
- Make configuration selection
- Baseline cost, scope and technically limited schedule (Review FY18)

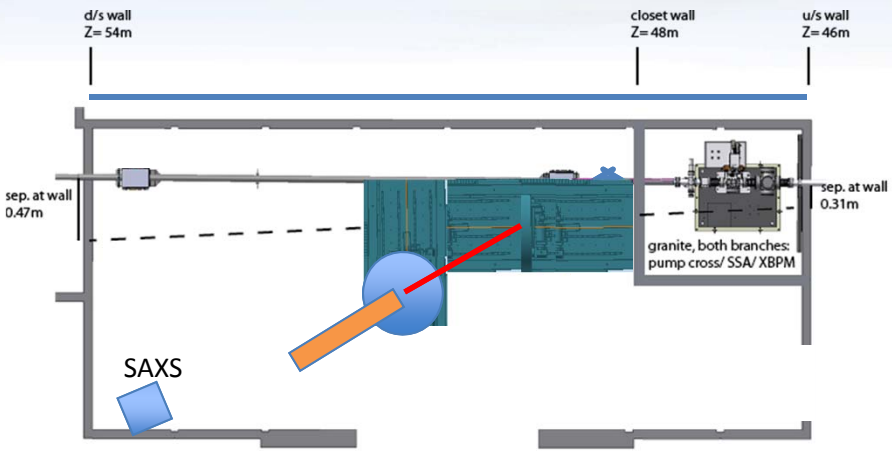
CDI Development

- NSLS-II will pursue CDI to completion when ready
- FY 17 & 18 prepare a baseline design
- This planning phase to be executed as part of the construction practice (Operating funds, full Overhead)
- When ready to baseline (late FY18 or early FY19) will move into BDN Portfolio for Execution

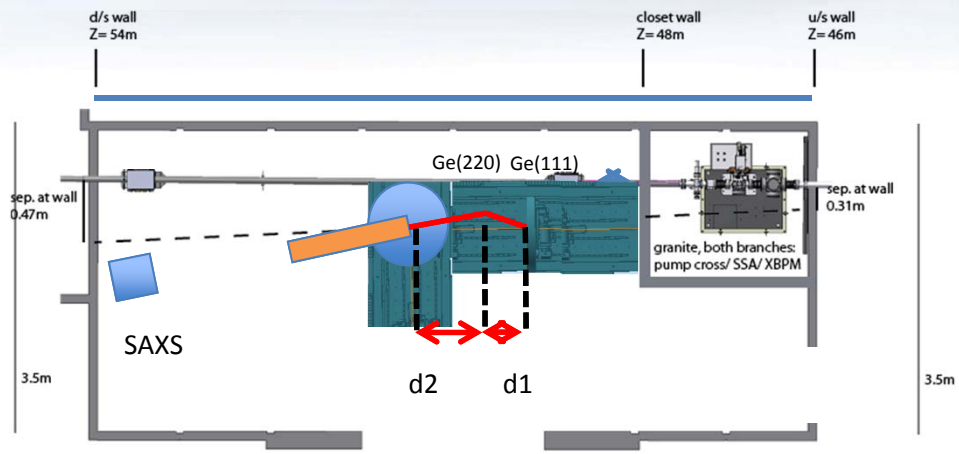
WBS	Activity Name	$
P-CDI 18 Month - Beamline		$ 1,473,780.83
P-CDI 18 Month.01 - Management		$ 331,524.30
	project manager scientist for project management	$ 139,711.73
	admin assistant	$ 14,670.74
	ESH	$ 43,081.75
	QA	$ 26,345.30
	business ops	$ 30,421.01
	training	$ 8,066.18
	human resources	$ 10,140.34
	travel	$ 59,087.25
P-CDI 18 Month.02 - Design		$ 1,066,419.91
P-CDI 18 Month.02.01 - Conceptual Design		$ 579,104.05
	lead scientist for conceptual design	$ 187,615.07
	simulations scientist for conceptual design	$ 92,797.86
	project manager scientist for conceptual design	$ 92,797.86
	mechanical engineer for conceptual design	$ 121,533.48
	mechanical designer for conceptual design	$ 53,976.41
	liaison engineer(s) for conceptual design	$ 30,383.37
P-CDI 18 Month.02.02 - Preliminary Design		$ 487,315.86
	lead scientist for preliminary design	$ 187,615.07
	simulations scientist for preliminary design	$ 46,903.77
	project manager scientist for preliminary design	$ 46,903.77
	mechanical engineer for preliminary design	$ 121,533.48
	mechanical designer for preliminary design	$ 53,976.41
	liaison engineer(s) for preliminary design	$ 30,383.37
P-CDI 18 Month.05 - Accelerator Infrastructure		$ 75,836.61
P-CDI 18 Month.05.02 - Source		$ 75,836.61
	insertion device preliminary design/specs development effort	$ 75,836.61

PLS – Liquid Scattering and Polymer Processing

Liquid Surfaces: Single Crystal Deflector Mode



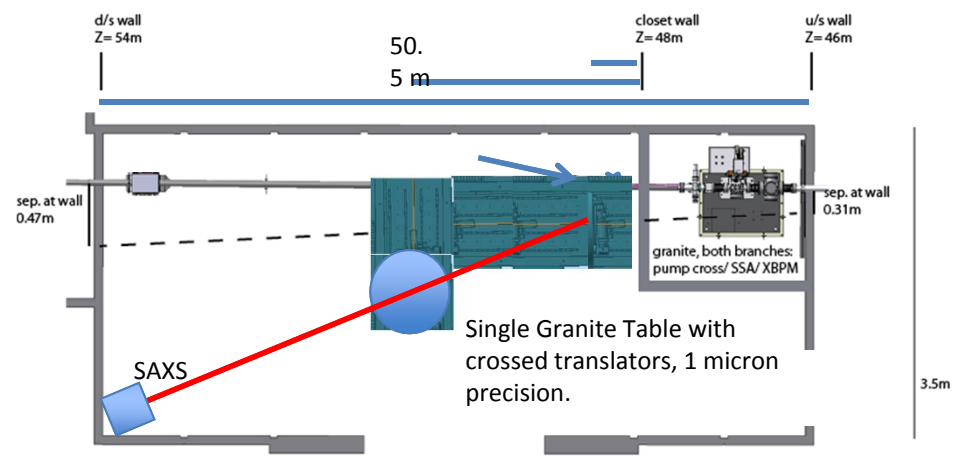
Liquid Surfaces: Double Crystal Deflector Mode



Planned as independent branch at SMI

- IVU21 – 1.5m source
- 8-24 keV 2 to 10 μm vertical focus
- $10.5M estimate – 3.5 year TL
- 2 m long processing chambers
- Two deflector modes
  - Double Crystal – fixed height
  - Single crystal – higher flux, more flexible
- Jump-start planned with APS-LSS
  - *Not PLS capabilities*

Polymer Mode: sample in the center of the hutch



Working with community to better define instrument requirements

Processing and Liquid Surfaces (PLS)

Questions

- Can the LSS recently transferred from APS have a useful program at SMI? What are the costs for a minimal solution? What would be the impact on the SMI program?
- What would a thin film polymer processing endstation look like, consistent with the space constraints of the ID-12-B hutch?
- What are the partnering opportunities with the advanced manufacturing initiatives?

Tasks

- Develop plan for intermediate step with LSS (Jumpstart PLS; J-PLS)
- Finalize end-station design
- Finalize optical design including performance assessment

Next Steps

- Review Plan for J-PLS
- Start execution of J-PLS

J-PLS
Use SMI beam/optics and existing hutch
(Share beam with SMI – not independent)
Based on APS/LSS components with enhancements
Requires minimal reworking, new supports and motors

Jumpstart – PLS

- J-PLS is moving from planning to execution
- FY 17 to beginning of FY19 to complete
- Scope Includes
  - Management
  - Upgrades to existing LSS hardware
  - New Detector (Pilatus 1M or equivalent)
  - EPS additions
  - Update of controls
  - DAMA effort
- J-PLS will be executed as part of the construction practice (Operating funds, full Overhead)

WBS	Activity Name	$	
JPLS - Beamline		$	1,491,173.60
JPLS.01 - Management		$	450,512.10
	JPLS Project Support- Management	$	427,053.56
	JPLS Project Support- Travel	$	23,458.54
JPLS.03 - Beamline Construction		$	770,619.50
JPLS.03.03 - End Station Procurement and Fabrication		$	698,267.71
	JPLS Mechanical- Design and Development- Initial	$	58,180.98
	JPLS Mechanical- Fabrication	$	270,779.37
	JPLS Mechanical- Procurement of Pilatus 1M detector	$	316,988.71
	JPLS Mechanical- Design and Development- Final	$	18,036.30
	JPLS- Control Station- Design and Development	$	3,314.55
	JPLS- Control Station- Procurement	$	30,967.80
JPLS.03.04 - End Station Installation and Test		$	72,351.79
	JPLS Mechanical- Assembly and Installation	$	55,715.77
	JPLS Mechanical- Testing	$	7,385.74
	JPLS- Control Station- Installation	$	9,250.28
JPLS.04 - Beamline Infrastructure		$	30,014.15
JPLS.04.04 - EPS		$	30,014.15
	JPLS- EPS- Design and Development	$	6,412.56
	JPLS- EPS- Procurement	$	7,741.95
	JPLS- EPS- Installation and Testing	$	15,859.63
JPLS.06 - Controls		$	240,027.86
JPLS.06.01 - Basic System Controls		$	240,027.86
	JPLS Controls- Design and Development	$	8,670.67
	JPLS Controls- Motion and Diagnostics Integration	$	47,672.83
	JPLS Controls- Installation	$	17,386.33
	JPLS Controls- Testing	$	15,390.15
	JPLS Controls- Detector Integration	$	6,412.56
	JPLS Controls- Procurement and Materials	$	65,806.58
	JPLS- DAMA- Design and Development	$	26,229.58
	JPLS- DAMA- Installation and Integration	$	26,229.58
	JPLS- DAMA- Testing	$	26,229.58

Cost Planning for Beamline Construction

	FY17	FY18	
Construction Practice			
Construction Mgmt	279,252	289,272	
Engagement Coordination	477,022	222,978	FY17 constrols surge will ramp down from the Construction Practice in FY18
Engagement Development	3,517,287	1,496,820	Mostly IEPD work inf FY17 as planned, continue planning at low level in FY18
	232,710	1,226,766	CDI - Pre-baseline planning - will move to BDN at baseline
	205,480	1,251,163	J-PLS Current plan - to be reviewed and validated
Total	4,711,751	4,486,999	
BDN Portfolio			Cost includes completeing prior year commitments
BDN Mgmt	1,558,554	524,938	
FIS-MET	2,178,930	1,077,742	
CMS	1,021,941	-	
QAS	2,320,069	109,902	
TES	(6,116)	-	
XFM	3,126,661	116,675	
PDF	2,933,278	741,963	
FXI	4,300,101	298,589	
ID & FE	102,200	-	
Total	17,535,617	2,869,809	
NPB Portfolio			
NPB Mgmt	537,450	108,246	
XFP	18,075		
NYX	150,825		
SST	574,364	28,523	
BMM	333,060		
HEX	355,981	841,347	Current plan for HEX - to be reviewed and validated
Total	1,969,755	978,116	

Preliminary Cost Planning
Evaluate committed work as well as work we wish to undertake to continue with delivery of beamlines and instruments

Used approved baselines or technically limited schedules

Includes only NSLS-II operations funded costs (whole $)

FY18 Proposed Cost for Construction

Cost Element ($)	FY17	FY18
Construction Practice	4,711,751	4,486,999
BDN Portfolio	17,535,617	2,869,809
NPB Portfolio	1,969,755	978,116
	24,217,123	**8,334,923**

NSLS-II Operations Funded Beamline Construction

- Funding required for FY18 would $6.9M
- Achieving the Cost Plan requires $1.4M carry forward from FY17
- Funds planned for beamlines in FY17 but not utilized are adequate for this cost
- If funds are not available due to other priorities will need to adjust plan

Resource Allocation

- Significant risk for small operations supported engagements is the nearly exclusive use of matrixed resources
  - If some engagements run late or consume resources beyond plan this can cascade to subsequent engagements

- Developed and utilized a set of resource planning tools to monitor the nexus of operations and project activities
  - Proactively plan over all of the department activities
  - Adjust schedules or resources to avoid big surprises
  - Manage within the resource constraints and department objectives
  - Assists in evaluating consequences of priority decisions when conflicts in plans occur.

Adapting to funding – general concepts

- Construction of new engagements is at some level 'optional' as compared to ongoing user operations
- If budgets require reductions in activities they need to be strategic, and except in dire circumstances respect contracts and agreements with agencies
  - Generally Partner Activities need to proceed to agreed schedules, or adjust to partner schedule changes (they can have issues too….)
  - Ongoing active construction engagements funded entirely by operations should be preserved, but schedules may be significantly adjusted to provide relief if funding is reduced below plan.
    - This might result in higher overall cost
    - Potentially reduced scope (if possible for the engagement)
  - Planning or development activities do not generally consume large amounts of resource, but can be curtailed or eliminated
    - Can have a significant impact on positioning the development for the facility, so would avoid this reduction if possible

Adjustment to Flat funding guidance for FY18

Under Flat scenario operating expenditures on beamline development shift from $6.9M to $4.5M

- NPB (Hold to $1M plan)
  - SST 1&2 Complete as planned
  - HEX (NYSERDA) proceeds as planned
- BDN ($2M in flat, compared to $2.5M plan)
  - If carryover and savings in FY17 are available proceed to plan (total spend in FY18 2.9M$)
    - would almost make it (assuming no over-runs)
  - If Funding for the year is only $2M would need to curtail spending, or complete to plan but reduce spending on the new beamline (CDI), or reduce spending on J-PLS
- Beamline prospecting and practice development would be curtailed or eliminated
  - Limits planning for evolution of beamline capabilities
  - Forces greater reliance on 'institutional memory' for execution of future work – likely reducing efficiency and increasing cost

Summary

- Operations funds will be increasingly utilized for construction of entire instruments, or to leverage funding from other sources
- Roll-off of large projects in FY17 leaves some space to reorient and retool for delivery in evolving portfolios
  - Working to refine the construction practice tools for planning and managing engagements
  - Taking advantage of the large body of recently completed work to improve estimating and planning for new work
  - Continue to refine plans for engagements arising from FY17 IEPD process (ARI/SMF, INF, QIX) through FY18
  - Detail planning of CDI and execution of J-PLS
- Stay with Internal (BDN) and Partner (NPB) portfolios for execution of baselined engagements
- Provide support for other project engagements within NSLS-II
- Partner with other DOE Light Sources to improve our delivery of beamline engagements

Back-up : Construction Practice Development

- Instrument Development Improvement effort
  - Started as NSLS-II Project was completing
  - Forms basis for our Delivery Improvement plans
- Extending Information Sharing in the Practice
  - SharePoint Applications
  - Standard WBS
  - Value Engineering
  - Construction Divisions
- Engagement development pathway

Instrument Development Improvement

- Objectives
- WBS and Instrument Divisions
- Round Table Discussions
- Process Map and topics highlighted in construction group meetings
- Recommendations
  - Refine ideas on process improvement opportunities
  - Develop internal plan for pursuing opportunities
  - Discuss the ideas w/DOE facilities (5-way meeting Oct 2016)
  - Hold 'kick-off' meeting at BNL as part of a round robin series (like the hackathons)?

Summary from April 2016

Objectives and Plans

- Cultivate the Capability to develop ~3 beamlines per year
  - Need a reproducible process
  - Predictable cost and schedule
  - As cost effective as can be reasonably accomplished
  - Consider entire life cycle of an instrument
- NSLS-II evaluation of current state
  - Started with Project/Portfolio managers considering issues in current work
  - Turned out to be heavily weighted to process and practice, with some technical VE opportunities identified
  - Expand discussion to beamline leaders and technical staff
  - *Value Engineering Round Tables*
- Coordination with DOE peers
  - Develop a common understanding of beamline development process and costs
  - Capture and adapt best practices where possible
  - Share development information and data where practical
  - Provide some level of uniformity (standardization)

Instrument Development Improvement

- By end of CY 2016 will have developed 17 ports (19 Simultaneous Endstations)
  - 6 NSLS-II Project (CSX1/CSX2, XPD, HXN, SRX, IXS, CHX) - 2 ABBIX (LIX, AMX/FMX)
  - 5 NEXT (ISS, ESM, ISR, SMI, SIX) - 2 BDN (CMS, TES)
  - 2 Partners (XFP, NYX)
- Working to capture lessons looking to the future
  - Informal discussions on cost of NSLS-II beamlines as compared with others
  - In Construction group discussions started with 'traditional' VE questions
    - Some opportunities have been identified and certainly others exist yet to be explored
    - Found much of the discussion actually centered on process improvements
- Activities undertaken or planned – judged to be high impact areas in need of attention
  - Self Assessment on Controls (Spring 2015)
  - Requirements Capture and Analysis Tool (Spring 2016)
  - Ray Tracing Practice Task Force (May 2016)
  - Value Engineering Round Tables
    - Organize 'Divisions' around our now standard WBS to collect information
    - Charrette broad crosscut of staff to capture current state practice and possible improvements
- Evaluating next round of instrument development
  - Instrument Execution Plan Development Task force (Charged May 2016)
  - Will guide the selection of the next instruments to be built on NSLS-II Operating

Information Sharing

- Practice has a large and diverse stakeholder community
- Continues to be challenging to make sure everyone has access to what they need
- Make use of standard coordination meetings for many things and for many situations this is still the best way to go
  - Project Management Oversight Group
  - Beamlines Installation Meeting
  - Procurement Meeting
  - Accelerator Operations Meeting
  - ……
- Have continued to evolve our use of SharePoint as a simple and flexible information exchange
  - Works well for structuring interactions
  - Good dynamic update and revision history
  - Can 'push' changes to users

Construction SharePoint landing page

NSLS-II Construction ▸ Home

Sub-pages

Home | Construction Lessons Learned | HEX Construction Planning | IEPD Taskforce | Metrology | MRE Construction Planning | Ray Trac

Key Lists

Pictures

Lists

- Announcements
- Construction Calendar
- Procurement Tracker
- Procurement Meetings
- Members
- IRR Dates
- Beamline Status

Libraries

- Site Pages
- Shared Documents
- Reference Pictures

Discussions

Recycle Bin

Announcements

Title	Body
Beamline Status List	The Beamline Status list has been established for capturing the major milestones in the construction and transition to operations of NSLS-II beamlines.
IRR Dates	Added a SharePoint list for the IRR dates for beamlines. If you are sensitive to changes in the list consider setting an alert.
Metrology Page Established	Set up Metrology SharePoint site to provide a listing of the optics needed for beamlines and the measurements schedule to qualify them for use. There is an annotated guide as a word file that explains the site and how to use the lists.
Procurement Tracker in Production	Moved on to the SharePoint tracker in October 2015. Intermediate steps in the procurement process are now recorded on this list. See the Shared Document Library for 'SharePoint implementation of the Procurement Tracker August 2015 R1' and 'Changing Entries in the Sharepoint Procurement Tracker September 2015' for more informatoin.

Add new announcement

References to tools and features

Procurements – Basic Information Record

NSLS-II Construction ▸ Procurement Tracker ▸ Active

NSLS-II Major procurements tracking list

Home | Construction Lessons Learned | HEX Construction Planning | IEPD Taskforce | Metrology | MRE Construction Planning | Ray Tracing Practice | Value Eng

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Announcements
Construction Calendar
Procurement Tracker
Procurement Meetings
Members
IRR Dates
Beamline Status

Libraries
Site Pages
Shared Documents
Reference Pictures

Discussions

Recycle Bin
All Site Content

Key	Description	CAM	Tech Rep	PPM	Status	RFx	Direct Value	Amended Value	Next Milestone
007NX	ESM/SIX M4 Mirror and Tank (Combined with APP043NX)	Jarrige	Jarrige	Bernath	O	RFP	$410,000		T6 - Completed
013NX	FXI Photon Delivery System	Lee	Lee	Bernath	O	RFP	$3,400,000		T6 - Completed
020NX	ISR Dual Phase Plate Assembly	Nelson	Lucas	Alexander	O	RFP	$517,000		T6 - Completed
026NX	ISS Collimating Mirror and Tank	Attenkofer	Attenkofer	Bernath	O	RFP	$725,000	$926,500.00	DONE
027NX	ISS High Heat Load Monochromator	Attenkofer	Attenkofer	Bernath	O	RFP	$876,000	$1,347,900.00	DONE
028NX	ISS Focusing Mirror	Attenkofer	Attenkofer	Alexander	O	RFP	$587,000		DONE
031AX	FMX/AMX Photon Delivery System	Schneider	Schneider	Schlock	O	RFP	$4,248,338		T6 - Completed
037AX	LIX BL Optics Pkg	Yang	Yang	Bernath	O	RFP	$997,595	$1,042,550.00	T6 - Completed

Can examine whole list and sort or filter (view) to get details for a specific procurement or vendor. Can also examine version history to follow evolution.

Procurements – keeping track

View can make specific selection

NSLS-II Construction ▸ Procurement Meetings ▸ By Procurement

I Like It | Tags Note

Home | Construction Lessons Learned | HEX Construction Planning | IEPD Taskforce | Metrology | MRE Construction Planning | Ray Tracing Practice | Value Engineering | Resource Planning | Search this site...

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All Site Content

Procurement	Description	Notes	Topic	Meeting	Tech Rep
Procurement : (95)					
Procurement : 001PS (2)					
Procurement : 007NX (2)					
Procurement : 013NX (15)					
Procurement : 020NX (11)					
020NX	ISR Dual Phase Plate Assembly	• Being delivered by Huber • Phase Plates are here, but outstanding report is due	Other	18 JAN 17 O7	Lucas
020NX	ISR Dual Phase Plate Assembly	Looking into Huber/Aleph contracts regarding delivery for ISR (these are Sheri's contracts), status of invoices and expected FAT & delivery dates on these: (PO 273069), $427,770 due to vendor (accrued but not paid), partial delivery so far, delivery was contracted for Jan 2016. 11/2- item has been delivered. Huber expected to arrive 11/2 for installation 11/9 – Installation Completed	Other	16 NOV 16 O1	Lucas
020NX	ISR Dual Phase Plate Assembly	• Installation finished on Saturday 11/5 • Waiting on final milestone, which is getting the documentation	Other	09 NOV 16 O1	Lucas
020NX	ISR Dual Phase Plate Assembly	• Looking into Huber/Aleph contracts regarding delivery for ISR (these are Sheri's contracts), status of invoices and expected FAT & delivery dates on these: • (PO 273069), $427,770 due to vendor (accrued but not paid), partial delivery so far, delivery was contracted for Jan 2016. 11/2- item has been delivered. Huber expected to arrive 11/2 for installation	Other	02 NOV 16 01	Lucas
020NX	ISR Dual Phase Plate Assembly	ISR Dual Phase Plate Assembly •Looking into Huber/Aleph contracts regarding delivery for ISR (these are Sheri's contracts), status of invoices and expected FAT & delivery dates on these:	Other	26 OCT 16 O1	Lucas

Can follow history of procurements in meeting discussions

- Captures information that may not be part of the normal tracking list fields

Construction Lessons Learned Capture

Look across engagements

Site Actions | Browse | List Tools: Items, List

Construction Lessons Learned ▸ Lessons List ▸

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Engagement

- Heading : Accelerator Readiness Process
- Heading : Accelerator Systems (38)
- Heading : Closeout (17)
- Heading : Conventional Facilities (39)
- Heading : Engineering and Design (19)
- Heading : ES&H (37)
- Heading : Experimental Facilities (20)
- Heading : Human Resources (29)
- Heading : Overall (40)
- Heading : Procurement (59)
- Heading : Project Management (100)
- Heading : QA (17)

Add new item

Heading : Experimental Facilities (20)

Category : Potential Improvement (10)

ABBIX	Experimental Facilities	Potential Improvement	Staffing Profile and Timeline	Beamlines would have benefited fro mechanical designers and controls inappropriate.
ABBIX	Experimental Facilities	Potential Improvement	BATs and Reviews	Beamlines benefited from importan a review capacity, as BAT meetings the program (LSBR) were often red
ABBIX	Experimental Facilities	Potential Improvement	Beamline Controls Planning	The planning and scheduling of bea especially needed during the later i
ABBIX	Experimental Facilities	Potential Improvement	Attention Given to Procured Components Having Significant Technical Risk	Increased attention should be giver example, to procure mirrors for the burdens onto the contractor (a goo beyond any risks associated with th the attention they deserve, their pr could be let out for such elements.
ABBIX	Experimental Facilities	Potential Improvement	Scope Expansion Potential in Common Beamline Systems	Scope expansion in the various eler in the project. Mitigation of the pot beamline systems through, for exa trays, and spare channels in protec
NSLS-II	Experimental Facilities	Potential Improvement	Clear definition of project completion	Verify by equipment acceptance tes
NSLS-II	Experimental Facilities	Potential Improvement	Clear definition of project completion	Includes passing Instrument Readir
NSLS-II	Experimental Facilities	Potential Improvement	Clear definition of project completion	Formal process requiring sign-offs s
NSLS-II	Experimental Facilities	Potential Improvement	Clear definition of project completion	Require instrument acceptance by s
NSLS-II	Experimental Facilities	Potential Improvement	Metric vs. English Units	For foreign vendors, need to ensure

Beamline Work Breakdown Structure

- Have developed a standard WBS to use for beamline construction going forward
- Captures all work to construct a beamline regardless of funding source
- In addition to using WBS for specific engagements, use it as the headings for 'Divisions' parallel to those used for Conventional Construction

XYZ Beamline
01 XYZ Management and Support
02 XYZ Design
02.01 XYZ Conceptual Integrated Design
02.02 XYZ Preliminary Integrated Design
02.03 XYZ Final Integrated Design
02.04 XYZ R&D Program
03 XYZ Beamline Construction
03.01 XYZ Photon Delivery System Final Design, Specification, Procurement and Fabrication
03.02 XYZ Photon Delivery System Assembly, Installation and Test
03.03 XYZ End-Station Final Instrument Design, Specification, Procurement and Fabrication
03.04 XYZ End-Station System Assembly, Installation and Test

04 XYZ Beamline Infrastructure
04.01 XYZ Hutches and Cabins
04.02 XYZ Mechanical Utilities
04.03 XYZ Electrical Utilities
04.04 XYZ Equipment Protection System
04.05 XYZ Personnel Protection System
04.06 XYZ Control Station Furniture
05 XYZ Accelerator Infrastructure
05.01 XYZ Front End
05.02 XYZ Source
05.03 XYZ Straight Section
06 XYZ Beamline Controls
06.01 XYZ Basic System Controls
06.02 XYZ Instrument Applications
07 XYZ Conventional Construction
07.01 XYZ Building Design
07.02 XYZ Building Construction Contract
07.03 XYZ Building Construction Oversight
08 XYZ Special Systems

Value Engineering Round Table - Hutches

- Hutches effort led by Andrew Broadbent
- Developing a consistent approach for soliciting and capturing information across the facility
- Ran the hutch process in Mid-February
  - captured the presentations and current SPEC/SOW examples
  - report on improving hutch designs and cost performance
  - Includes follow up activities
- Proved out the ideas for running a round table where it is appropriate
  - have plans for applying it to other technical areas (Utilities are probably next)

Beamline Construction Divisions

- Started indexing work as we are collecting it
- Added 00 Division for General Requirements, Information and Tools (avoids overloading the 01 management Division)

Division	Title
00	General Requirements, Information and Tools
01	Management
02	Design
03	Beamline Construction
04	Beamline Infrastructure
05	Accelerator Infrastructure
06	Beamline Controls
07	Conventional Facilities
08	Special Equipment

Organize information and activities around these divisions
- Cost estimates
- Value engineering documentation
- Round table discussions

Engagement Development Pathway

- Potential engagements are generally already vetted before they come to the Construction Practice
  - Beamline Development Proposals
  - Proposals from Operating Divisions
- The Practice can then develop the initial proposal into a plan that can be integrated into resource planning
- These plans are themselves reviewed by management prior to implementation
- Execution can be performed:
  - Portfolios (with Construction Practice involvement or oversight)
  - Operations Engagement (managed by the Practice)
  - Operating Divisions (with support from the Practice)
- Coordinate with the customer (program or group) throughout the engagement
- Completed engagements are transitioned to the operating unit that championed their execution

Charge questions

1. Have NSLS-II management properly addressed the recommendations of the 2015 facility operations budget review?
2. *Evaluate the appropriateness of the organization structure. Is the staffing level and skill distribution appropriate and consistent with the operational needs? Is the organization adaptable to reflect the ramp up of a new facility over the coming years?*
3. Assess the appropriateness of the facility operating budget and staffing level, and subsequent operations cost for fiscal year (FY) 2015 to FY2017. Are they appropriately reflecting the required resources to achieve the overall strategic goal(s) of the facility?
4. *Evaluate the effectiveness of budget execution for FY 2015 and FY2016?*
5. Evaluate the performance and cost effectiveness of accelerator and beamline operation.

Charge questions

6. *Evaluate the beamline build out plan and execution including the transition to operations. Is the cost and schedule consistent and appropriate to maximize the utilization of the new facility with the budget and resources provided?*
7. Evaluate the Environment, Safety and Health (ES&H) and Quality Assurance (QA) at the NSLS-II facility. Is the organization and resource allocation appropriate?
8. What is the morale level of NSLS-II scientific and technical staff and their opportunities for career development?
9. Assess the appropriateness of the Facility Strategic Plan: scientific goals, facility improvement plans, Research and Development (R&D) program, etc.
10. Evaluate appropriateness, quality and selection process of the facility staff R&D programs (including research on synchrotron radiation science and accelerator science, beamline instrumentation and optic development, detector R&D, data management, and data acquisition and data analysis software development).
11. Evaluate if there is an appropriate level of funding for efforts related to improving operations, instrumentation, sample preparation, spares, upkeep, etc.