

NSLS-II Update



J. P. Hill

NSLS-II Director

UEC Town Meeting Feb 13th , 2015



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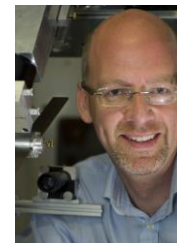
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Brookhaven National Laboratory
Doon Gibbs
Director



**Energy
Sciences Directorate**
James Misewich
Associate Laboratory
Director



NSLS-II
John Hill, Director
Deputy Associate
Laboratory Director

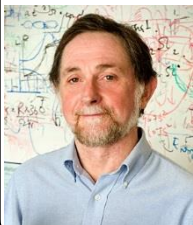
CFN
E. Mendez



Chemistry
A. Harris



**Condensed
Matter
Physics
and
Materials
Science**
P. Johnson



**Sustainable
Energy
Technologies**
J. P. Looney



**EFRC/
Energy
Storage
Center**
E. Takeuchi



**Accelerator
Division**
F. Willeke



**Photon
Division**
P. Zschack



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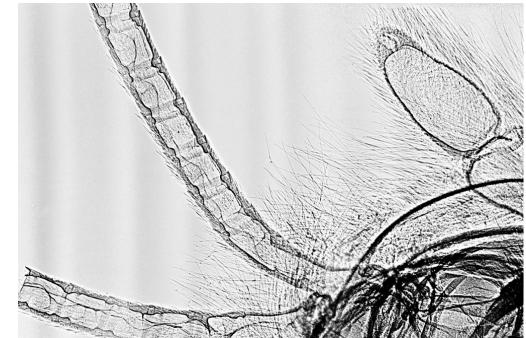
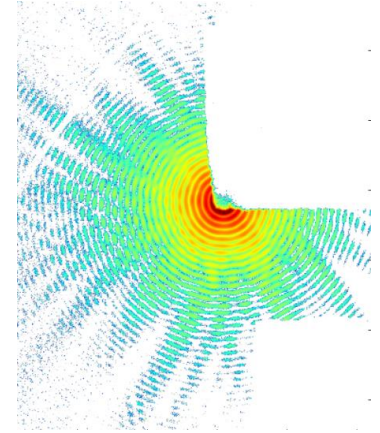
Outline

1. NSLS-II Project

1. CD-4
2. Machine ramp-up
3. Beamline commissioning

2. Transition to operations

1. Budget and consequences
2. Beamline construction projects
3. User Program



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NSLS-II Project Update

We are done!

Memorandum

Date: January 9, 2015
To: Doon Gibbs, BNL Laboratory Director
From: Steve Dierker, NSLS-II Project Director *Steve Dierker*
Subject: NSLS-II Project Completion

This memo is to formally notify you of the completion of the scope of the NSLS-II Project. The facility was approved to move into routine operations on Sep 22, 2014. All of the key performance parameters established at CD-2 were achieved or exceeded as of Oct 31, 2014.

KPP at CD-2	Attained	Current Status
Deliver 340,000 GSF conventional construction	Jun 25, 2014 (SEB-2 BORE)	Delivered 627,834 GSF, KPP Exceeded
Achieve 3.0 GeV and 25 mA	Apr 29, 2014 with Warm RF cavity, Jul 2, 2014 with SCRF Cavity	50 mA with SC Cavity KPP Exceeded
6 beamlines installed and ready for commissioning with x-ray beam	Oct 31, 2014	7 with provisions for 8 th KPP Exceeded

Independent scope review
Dec 12-14th 2014

Dedication Ceremony
Feb 6th 2015

OPA CD-4 review
Feb 10-11th 2015

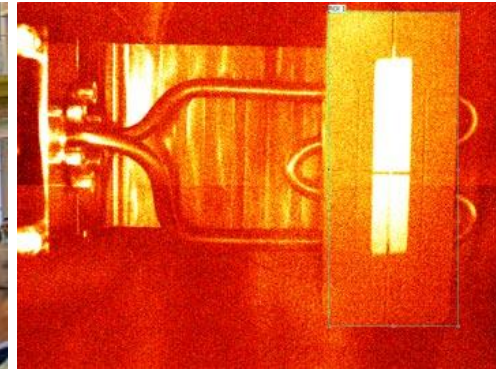
- recommendation: "Proceed to CD-4"



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NSLS-II First Light!!!!



“First light” was observed in the FOE at 23-ID on the morning of Thursday, October 23, 2014



NSLS-II Dedication February 6th 2015

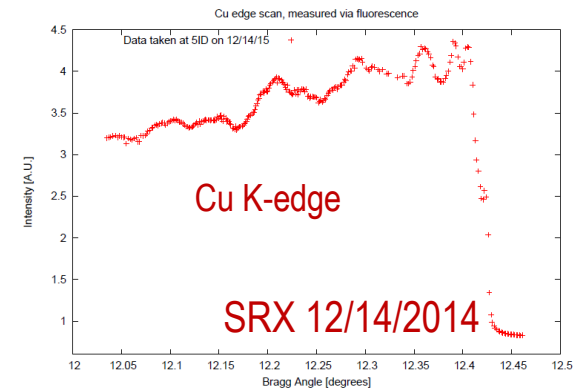


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NSLS-II Commissioning Update

- **NSLS-II Accelerator Systems** completed its first operating period on December 22, 2014, providing >700 hours of SR operations for beamline commissioning activities. All project BL IDs commissioned and front-ends are conditioned for 50 mA operations
- **NSLS-II Beamlines Commissioning:**
 - Monochromatic X-ray beams obtained at all NSLS-II project beamlines.
 - All project beamline radiation safety systems and FOE optics are commissioned for 25 mA operations
 - Technical commissioning progressing well at project beamlines, with some beamlines (CSX-1, XPD), in position to transition in the near future to science commissioning with first experiments in next two months



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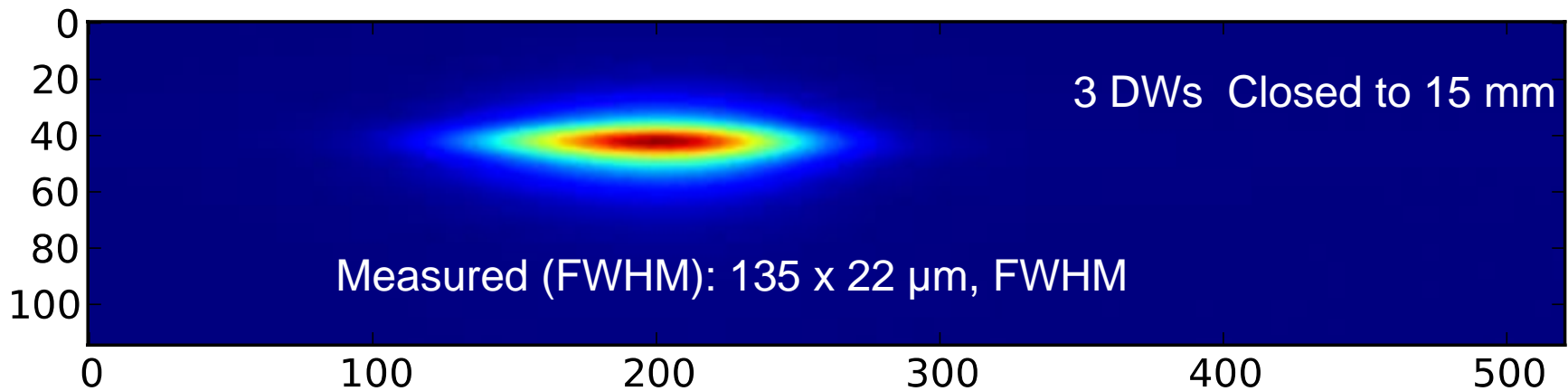
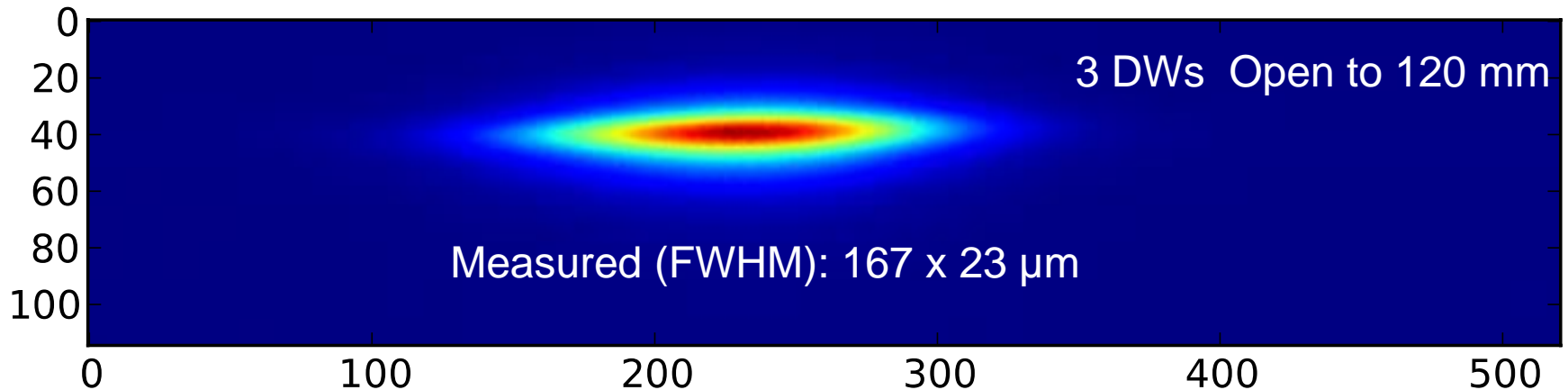
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Damping Wigglers in Action!

Measurement of Beam Size vs. DW gaps

8 keV

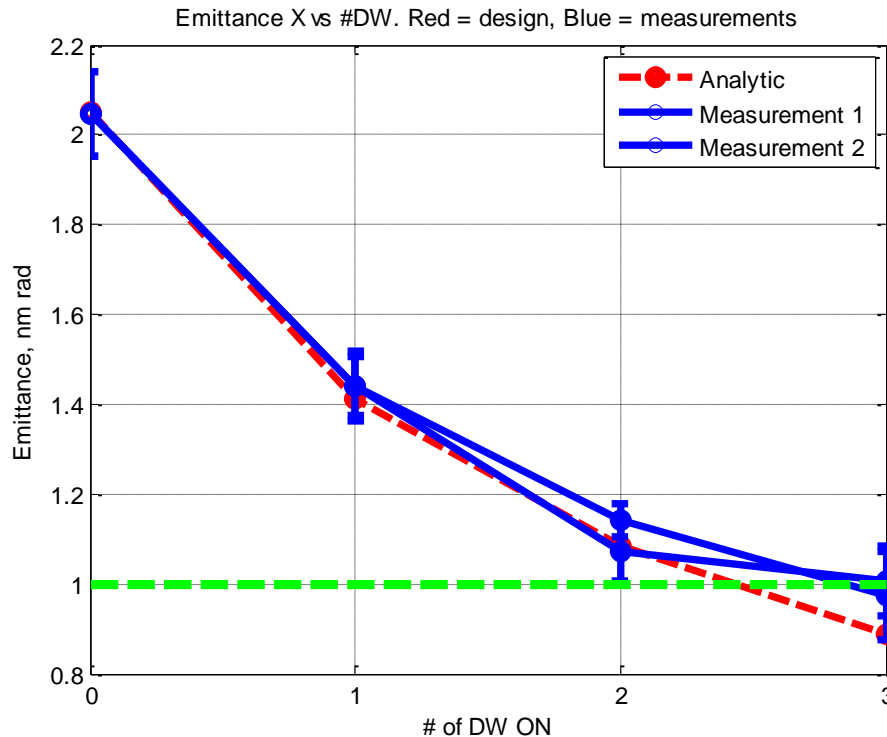


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Horizontal Beam Emittance with 3 DW



Horizontal Design Emittance Achieved

$\varepsilon_x^{\text{dw}} = 1 \text{ nm} \cdot \text{rad}$, requires good control of lattice and beam optics

$$\varepsilon_y = 16 \text{ pm} \cdot \text{rad}$$

diffraction value of 8 pmrad requires perfect control of orbit, optics and corrections

Injection Efficiency

Injection efficiency >95% has been demonstrated with all 7* ID gaps closed commissioning

(*SRX device was found to be slightly misaligned- fixed during last shut down)

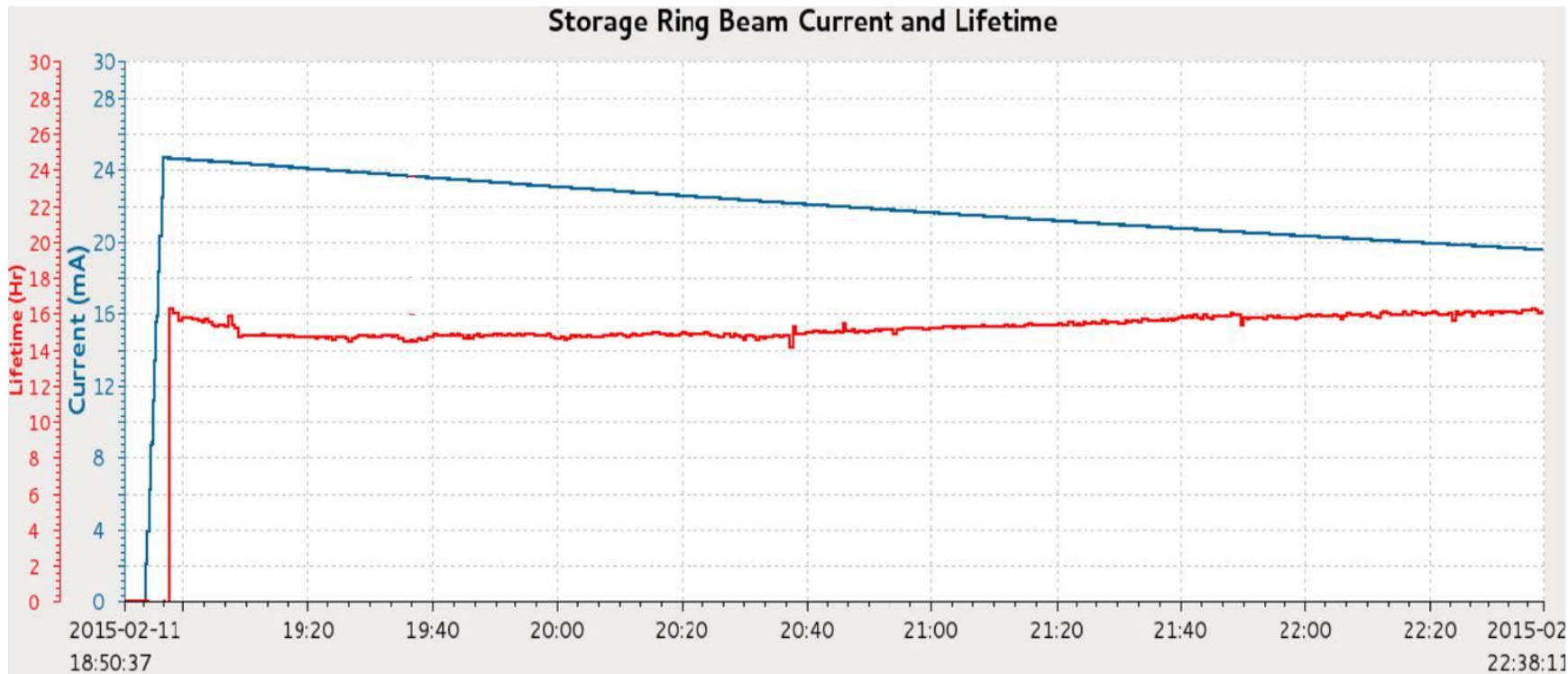


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Injection and stored beam



- With all the IDs gap closed, the injection efficiency is up to 90% (routine 80%) with charge ~ 1.4 nC/shot.
- The beam lifetime is ~ 4 hrs at 50 mA (still vacuum limited)

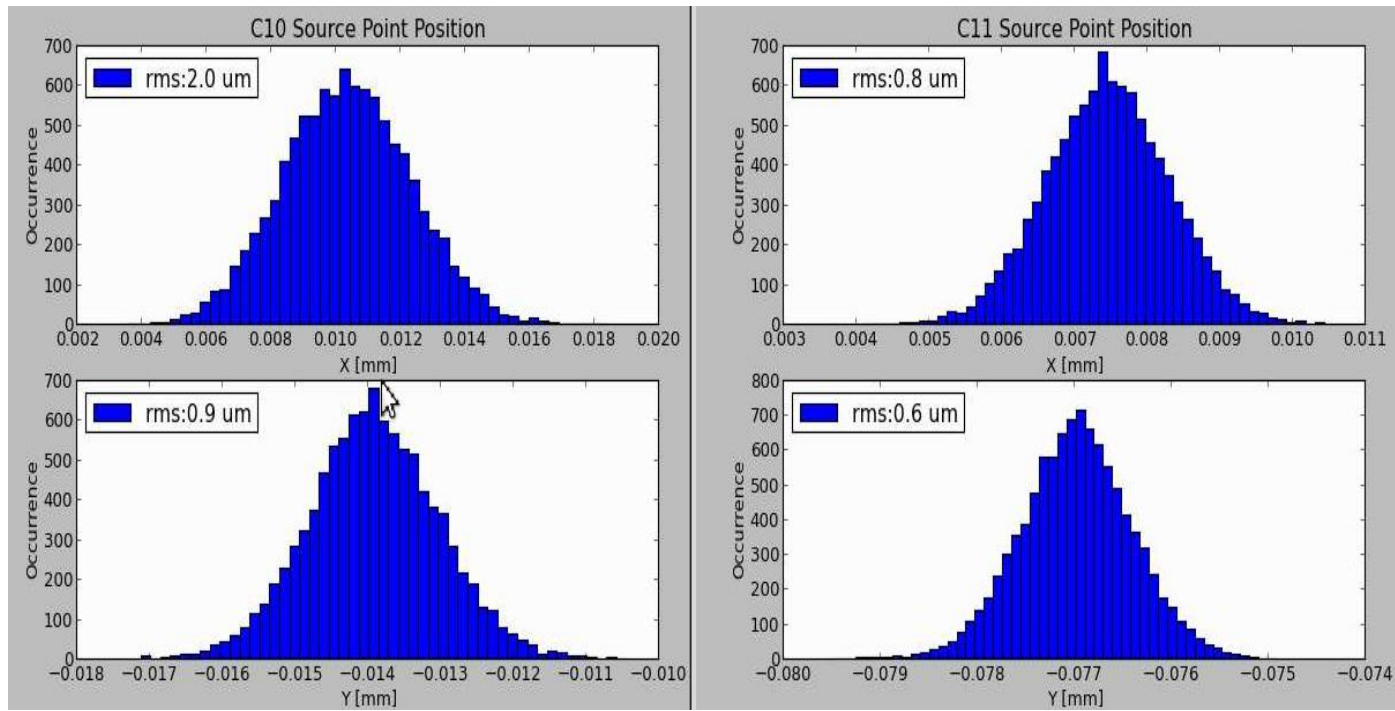


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SR Source point stability



- Data from 12 hrs continuous user beam at 5 mA.
- The beam lifetime is ~ 33 hrs.
- The photon source point jitter (rms): long straight is x (2 um, 0.2 urad), y (0.9 um, 0.3 urad)
short straight is x (0.8 um, 0.5 urad), y (0.6 um, 0.5 urad).

X: <10% σ_x , Y: ~20% σ_y



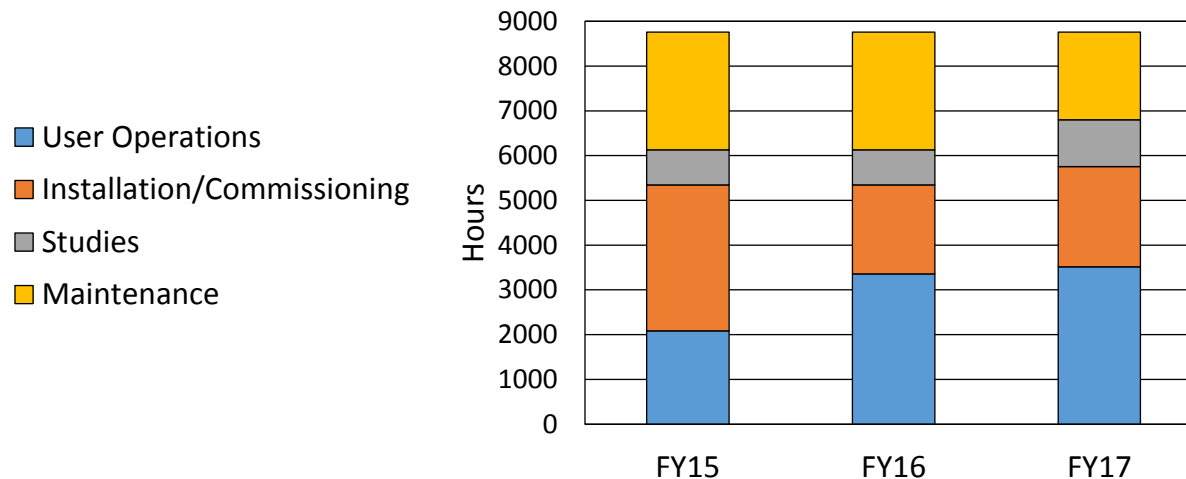
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Early Storage Ring Operations

	FY15	FY16	FY17
Current (mA)	50-300	300-400	400-500
Reliability (%)	85	90	95
Schedule (hrs)			
User Operations	2087	3357	3517
Installation/Commissioning	3260	1986	2240
Studies	783	786	1042
Maintenance	2630	2631	1961



- Top off operations is being implemented in FY15 for user operations starting FY16



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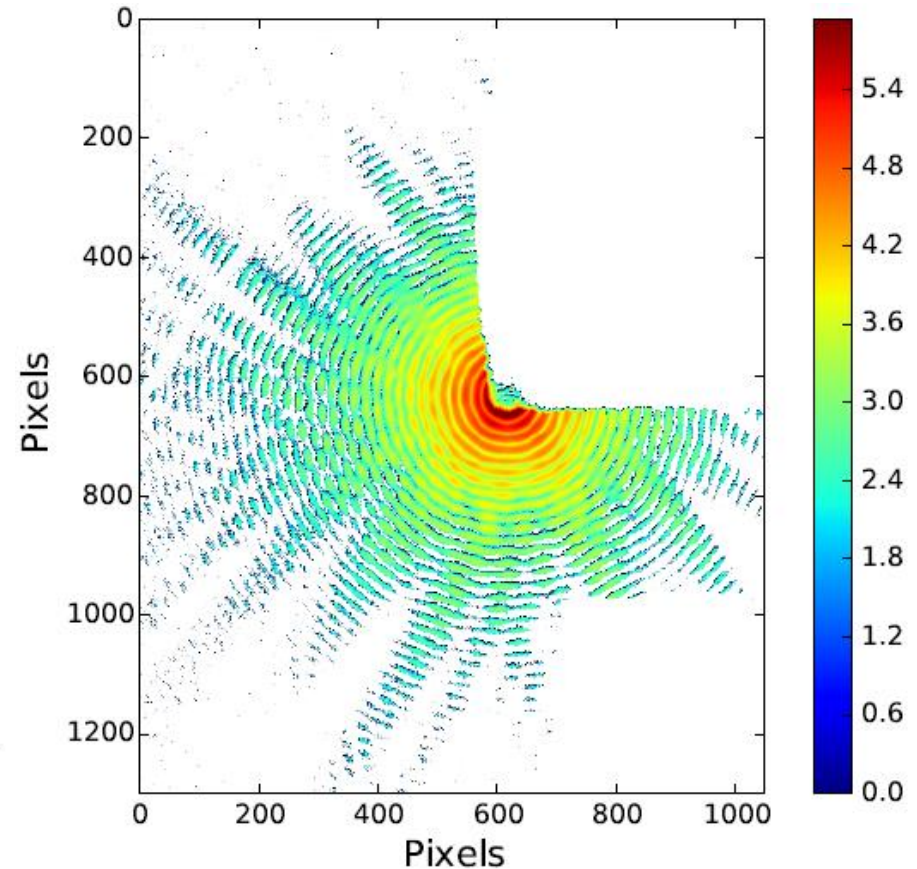
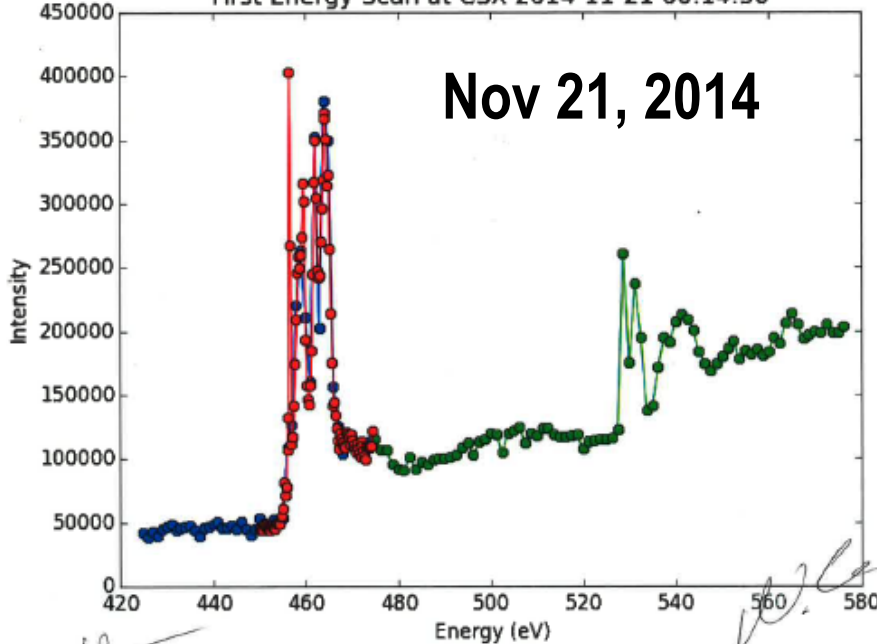
First Spectroscopy & Coherent Diffraction at CSX

Yan Hu *EDJW* *Shuang*
Wang *Cheng* *Abel*
OR² *7 PRZ*
DChid

Dec 3, 2014

First Energy Scan at CSX 2014-11-21 00:14:30

Nov 21, 2014



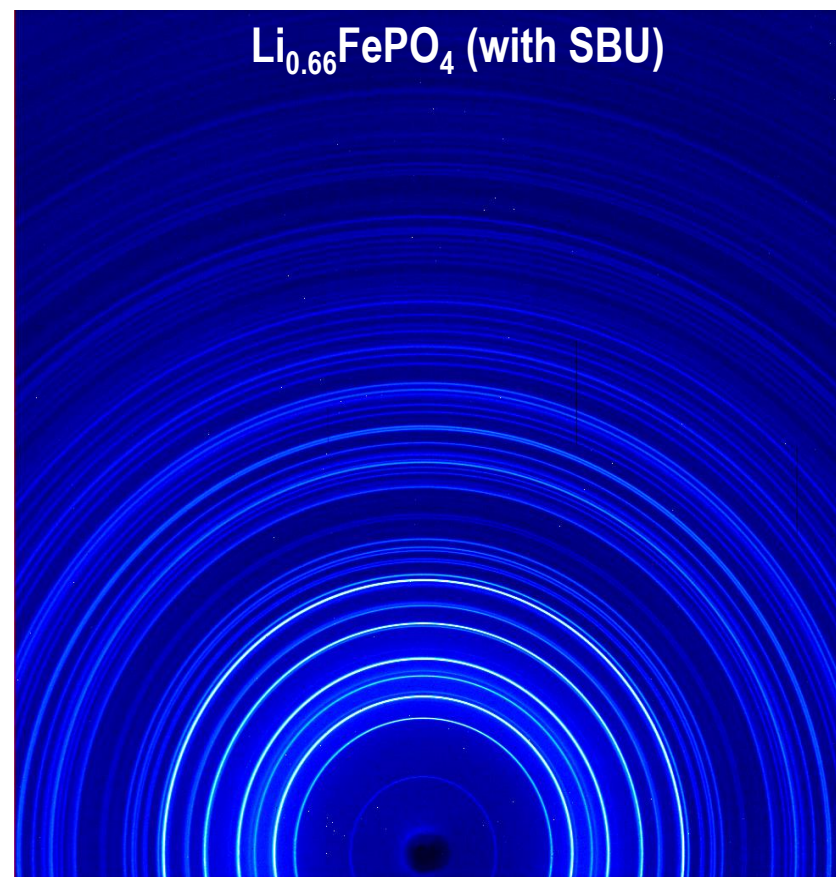
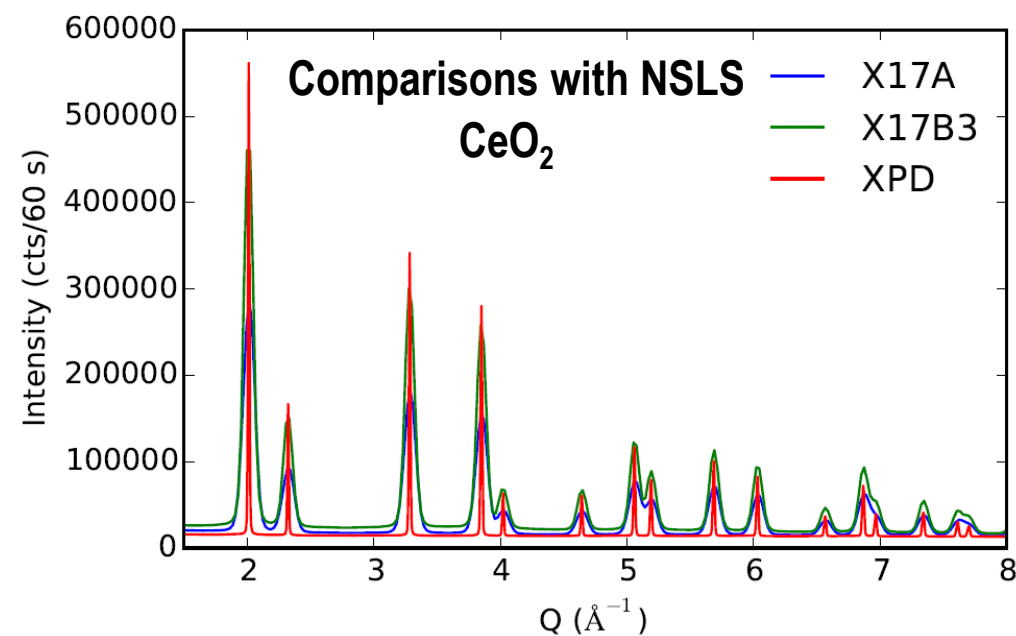
Excellent coherence and beam stability

William F. Schlotter
Cheng *Longjiao Li*

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Benchmarking Measurements at XPD

- Several benchmarking measurements have been conducted at XPD on reference samples

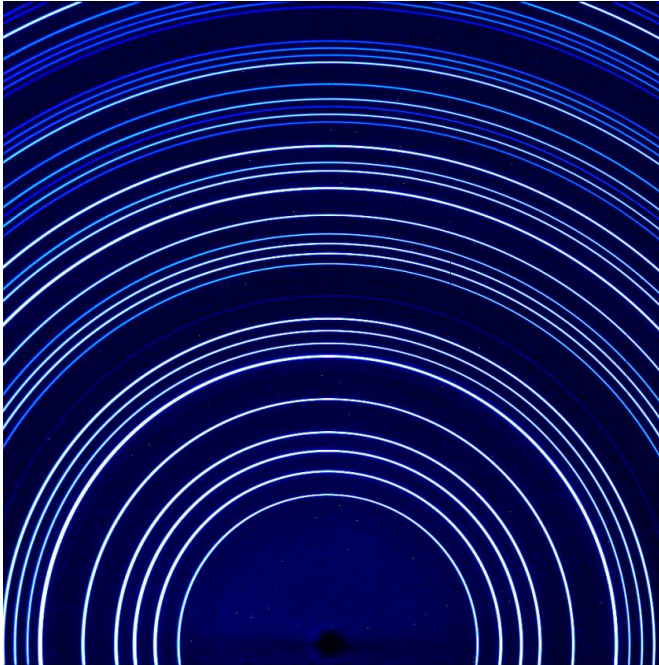


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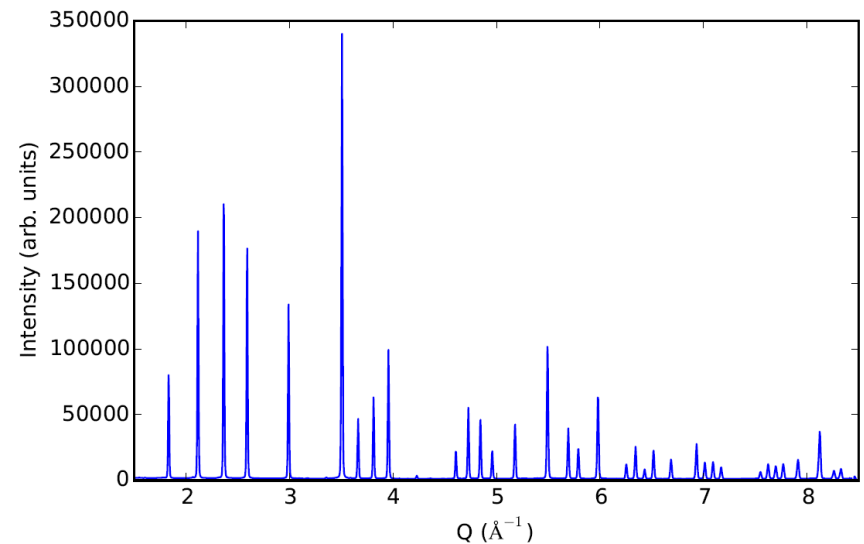
Measurements on $\text{Ru}_{0.8}\text{Ir}_{0.2}\text{Se}_2$



- 5 mA ring current; Closed gap =15mm
- 48 keV, 60 sec acquisition
- Collaboration: S. J. L. Billinge and C. Petrovic, Condensed Matter Physics and Materials Science Department, BNL.

Manuscript submitted to APL Materials
on 12/31

Title: "Enhanced Thermoelectric Power
and Electronic Correlations in RuSe_2 ".

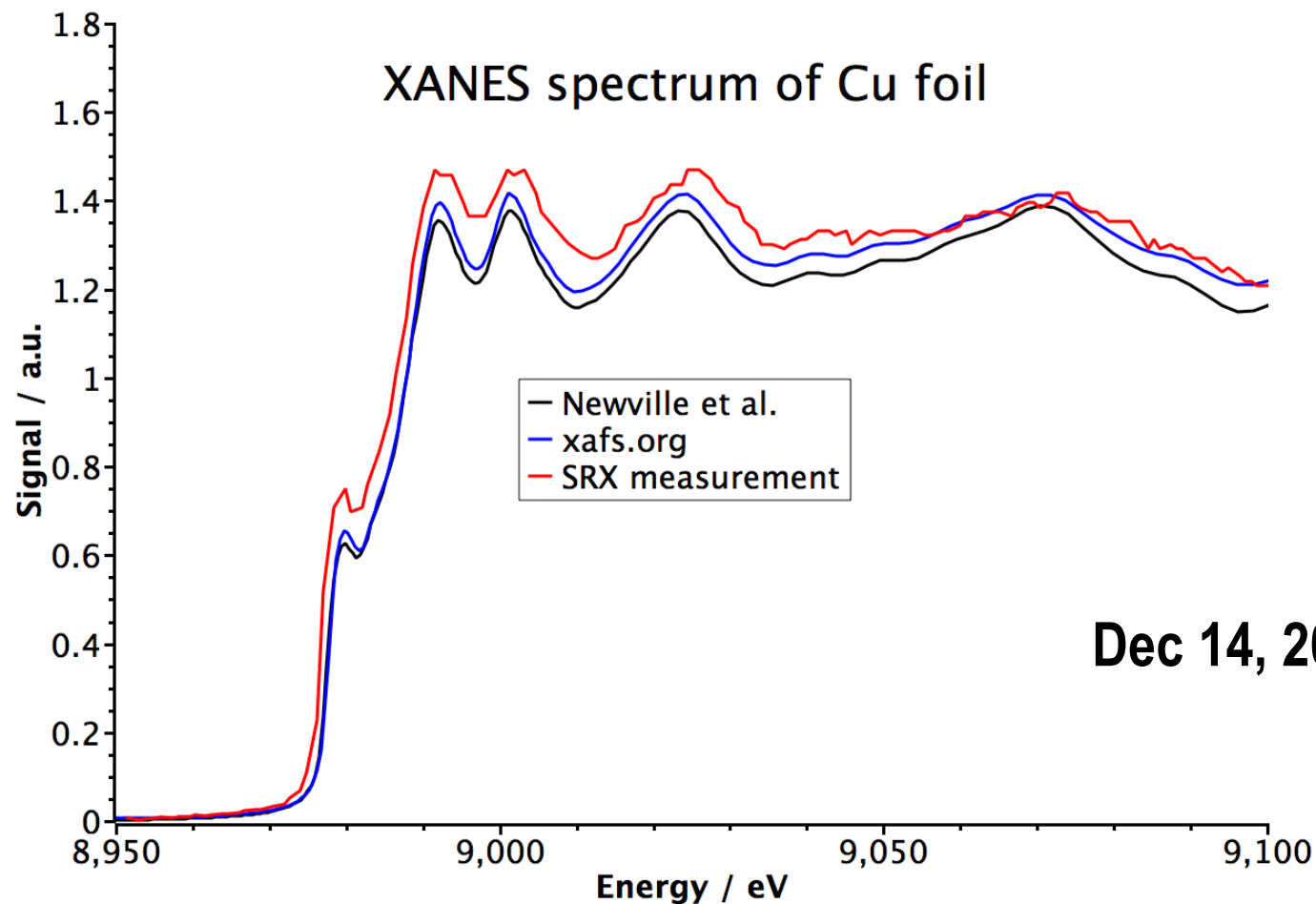


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First XANES Spectrum at SRX



Dec 14, 2014



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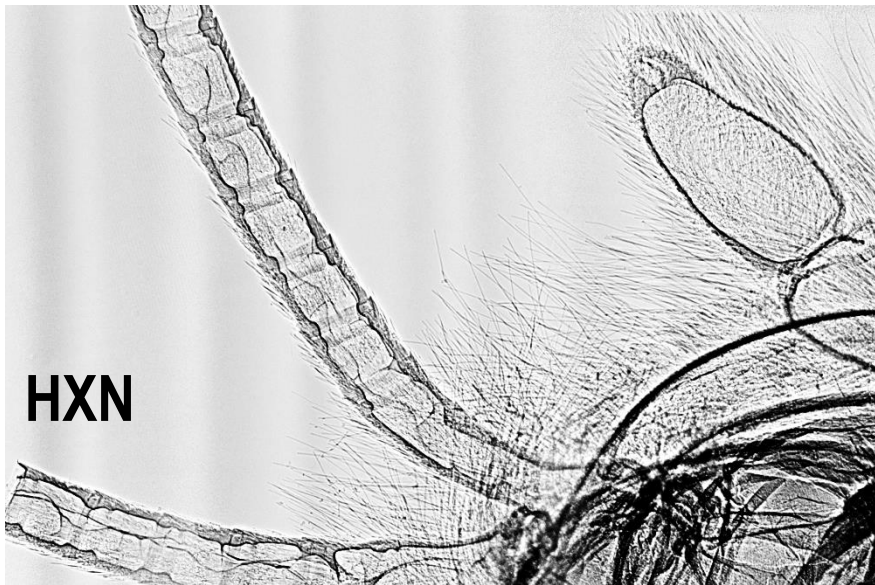
Coherence and stability

- Benchmarking measurements and tests conducted at HXN and CSX-1

First X-ray Imaging at NSLS-II

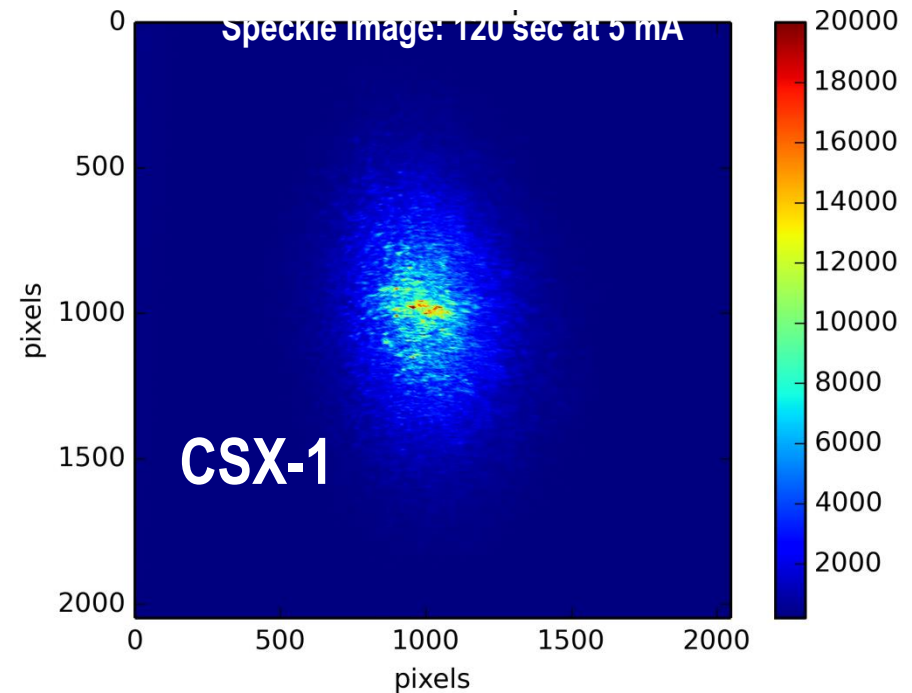
Hard X-ray Nanoprobe Beamline, 3-ID, Dec. 16th, 2014
using 10 keV x-ray beam at the secondary source location

Image: 5 sec at 0.5 mA



First Speckle Pattern

$\text{Pr}_{0.5}\text{Ca}_{0.5}\text{MnO}_3$ orbital order at $\sim 80\text{K}$



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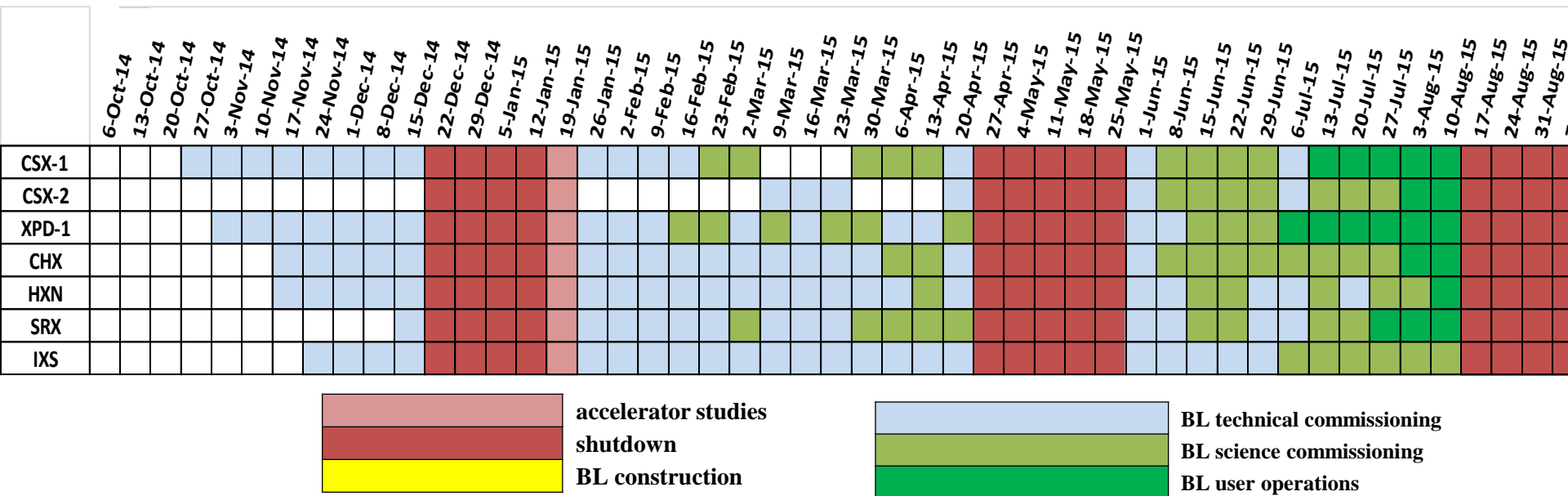
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Remaining BL Technical Commissioning Tasks

- Commissioning at high-current to allow BL vacuum conditioning with high power load at individual beamlines (started at 25 mA this week)
- DAQ and analysis still in their infancy. This will be one of the focus areas as BL commissioning proceeds to the endstations
- Status and near-term goals for individual beamlines:
 - IXS: start mono commissioning in Feb
 - HXN: bring mono beam into remote endstation 3-ID-C
 - CHX: bring mono beam into endstation in 11-ID-B
 - CSX-1: commission systems at higher power, and to look at polarization from EPU
 - CSX-2: Begin commissioning up to mono
 - SRX: Commission endstation with refined tuning of IVU-gap/mono scans
 - XPD: ramp-up current and test double-Laue mono under cryo-conditions
- Anticipate XPD, SRX and CSX-1 will be the first beamlines to transition to science commissioning during the Feb run-cycle



Project Beamline Commissioning & Ramp-up



- Scientific capabilities most likely to produce early science results will be commissioned first as determined through interactions with BATs and user community
- User science program will begin once a scientific capability or technique is commissioned, alternating with additional commissioning
- This “Phased Commissioning” approach will permit thorough technical commissioning of all planned science capabilities and will achieve early, high impact scientific productivity

User Program

Proposal system (PASS-II) is now active and used for the past two cycles.
Current cycle (Deadline Feb 9th, 2015):

General User Proposals:

Total 81 requests

HXN (3-ID) – 8 (10)
SRX (5-ID) – 13 (15)
CHX (11-ID) – 3
CSX-1 (23-ID-1) – 14 (15)
CSX-2 (23-ID-2) – 7 (8)
XPD (28-ID) – 29 (30)

First Experiment Proposals (carried into this cycle):

XPD - 3
CHX - 4
SRX - 9
HXN - 6
CSX2 – 3
Total 25

Issues: Expectation management:

- 1) Early days for beamlines user friendly-ness
- 2) Early days for machine operations
- 3) Commissioning will continue to take significant fractions of the time.
Limited time for users still.

IR beamline at ALS – 6
2-2 Beamline at SSRL - 17



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FY15 Budget

- Very challenging year:

FY15	
New funds	90
Unobligated NSLS carryover	6.6
Unobligated NSLS-II carryover	17.5
total	114.1

- Squeezed accelerator, beamlines, facilities and ESH+Q. Making painful choices.
- Worked closely with the Lab. Specifically, the lab agreed to:
 - Charge only for the operational fraction of the experimental floor ($6/60=10\%$)
 - Retain the extraordinary construction rate of 10.5% for all projects begun before CD-4



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January 15th 2015

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FY15 Operations

As a result of these measures we were able to

- Continue beamline construction on:
 - 1) FXI Full Field Imaging
 - 2) CSX-2 Ambient Pressure Photoemission and magnetic studies
 - 3) XPD-2 PDF and Powder measurements
 - 4) QAS Hard x-ray spectroscopy
 - 5) TES Tender x-ray spectroscopy
 - 6) CMS Small angle scattering: soft condensed matter
 - 7) XFM Spectroscopic imaging
 - 8) FIS/MET IR spectroscopy
- Provide support for partner beamlines (NYSBC, NIST, CWU)
- Provide support for NSLS users at APS, SSRL, ALS
- Stabilize NSLS
- Remove NSLS components for NxtGen, project, ABBIX and NEXT beamlines.

N.B. We have halted construction on IXD, MPP and MID



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Beamline Construction

NEXT: On schedule to complete (beam at sample position) 5 beamlines by early project completion, Dec 2015; SMI, SIX, ISS, ISR, ESM

NxtGen: On schedule to complete (ready to take beam) 5 beamlines (CMS, QAS, TES, XFM, FIS/MET)

ABBIX: On schedule to complete 3 beamlines by Dec 2015 (FMX, AMS, LIX)

Partner: 5 beamlines estimated completion date 2017 (SST1,2, BMM, NYX, XFP)

Other: NSLS-II ops funding 3 beamlines by end of 2016: FXI, XPD-2, CSX-2 and NYS funded HEX by 2019

By 2019 will have 28 beamlines operational

Conclusion

- The transition from construction to operations has begun.
- The machine looks beautiful and the beamlines are coming up fast.
- Its going to be a challenging, but exciting year
- Looking forward to working with the UEC to create a robust, thriving user community at the brightest synchrotron in the world!