

APS Users Organization/Partner User Council Joint Meeting

Stephen Streiffer

January 28, 2015

Agenda

- Budget status
- Status of 5-year Facility Plan and APS beamline SWOT analysis
- Beamline improvements and planning – seeking input
- Status of new beamlines for 2015
- SCUs
- APS Users' Meeting – seeking input
- 2015 & 2016 Open House planning – seeking input



FY 2015 House Energy and Water Development Guidance for BES

The program's budget consists of funding for research, the operation of existing user facilities, and the design, procurement, and construction of new facilities and equipment. The long-term success of the program hinges on striking a careful balance among these three areas. However, the increasing level of research commitments and completion of new facilities make it difficult to adequately fund all three components of the Basic Energy Sciences program within existing budgetary constraints. The Committee strongly cautions the Department against assuming an ever-increasing budget when planning the balance among facility runtime, construction, and research funding.

Pat Dehmer – BESAC Meeting, July 29-30, 2014



Budget Status

- Budgets from DOE-SUF are flat
- We understand the increase in space charges to CATs is very problematic

FY15

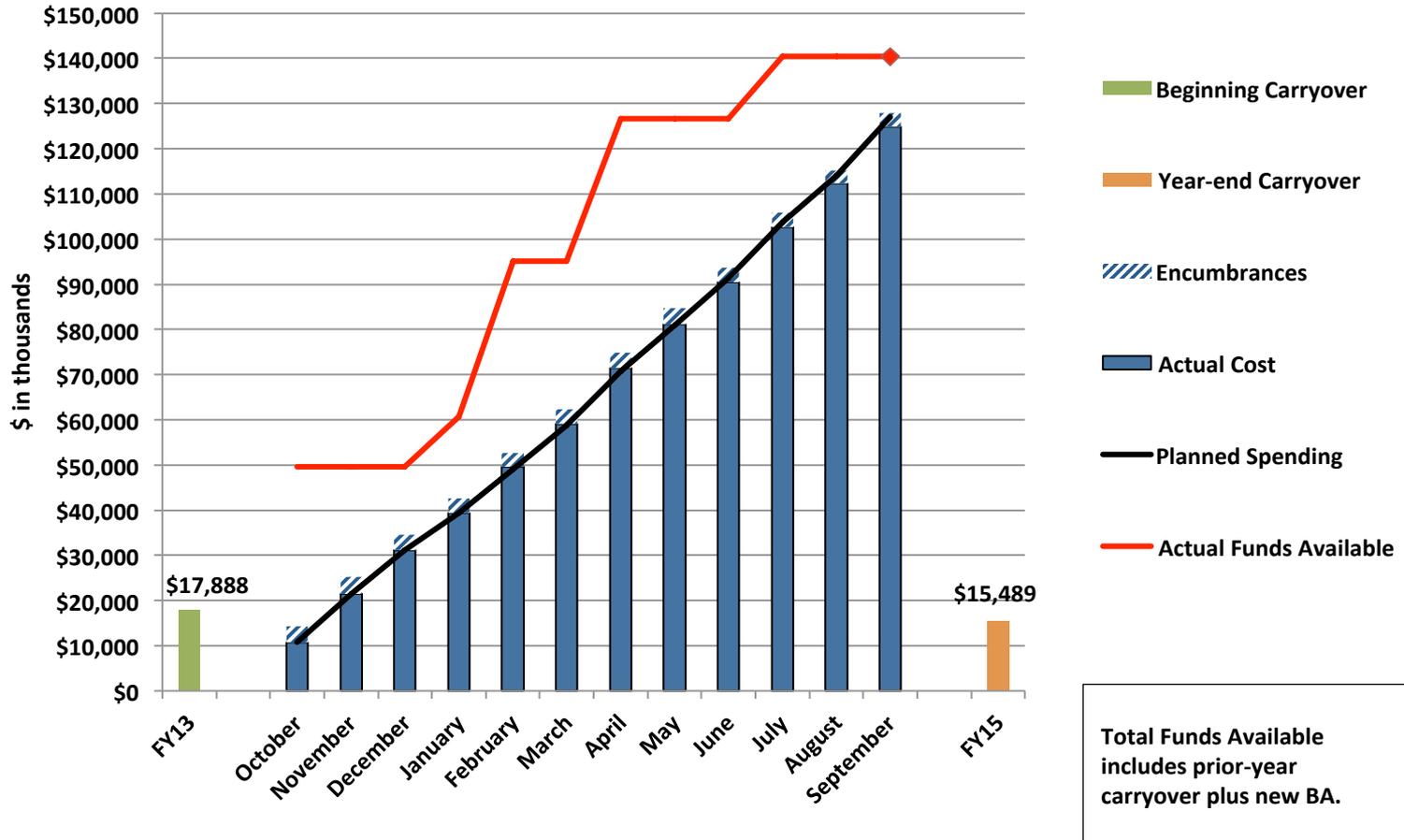
- Notified of FY15 budget number just prior to the holiday break
- Developing budget plan:
 - \$122.5M new BA (flat budget)
 - \$125.5M spend plan (use \$3M of carryover)
 - Focus on priorities; can't simply absorb the inflationary pressure

Your Input Needed

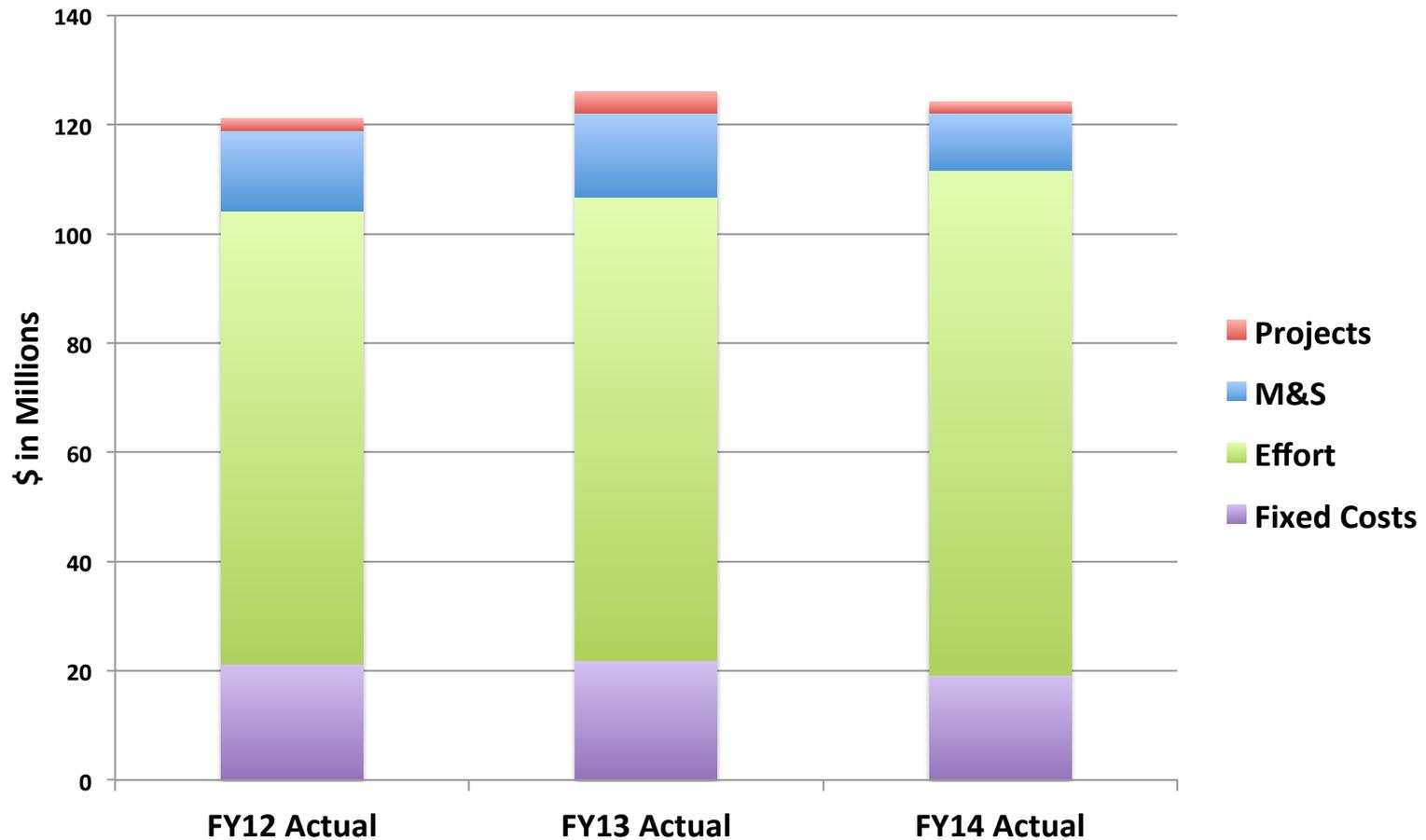
- Are there better ways to increase efficiencies?
- How can we increase partnerships to drive funding and reduce costs?



FY14 Budget



Major Components of Cost



Near-Term Activities and Planning

In order to provide world-leading science – today *and* tomorrow – the APS must plan, increase efficiencies and stimulate innovation



Steps Include:

- ANL Task Force to Review APS Operations and Alignment with ANL Services
- WBS and AIMS
- Formed a Machine Advisory Committee
- Beamline-by-Beamline SWOT Analysis
- Four year accelerator plan
- The Five-Year Facility Plan
- Upgrade Project and Upgrade Planning: Beyond 5 Years

On the path to develop a full Strategic Plan



WBS Implementation Status for Operations

- Progress to date:
 - WBS fully implemented effective October 1st
 - Training conducted for management, group leaders and control account managers (CAMs)
 - Management-level and enhanced detail reports provided
 - Focus on capturing all cost by Operations, Accelerator, Beamline and Future Concepts R&D with detailed breakdown by machine, system, project, etc.
 - Charter established for the Executive Management Board (senior management) for strategic, decision-making
 - AIMS (APS Integrated Management System) Committee is making progress towards full integration of all systems such as Shutdown Planning, Project Proposals, etc
 - Reports/Finance and Drawings/Documents Working Groups established to expand reporting capability and implement documents tracking consistency

- Future goals:
 - Pilot AIMS web interface in March
 - Submit annual FWPs that focus on area of work - Operations, Accelerator and Beamline instead of divisions



Advanced Photon Source Operations - Summary Charges to WBS

Period Ending: December 2014

			Annualized FTEs	Costs and Encumbrances		
				Month	Year-to-Date	Encumbrances
APS.01	APS Operations Support					
APS.01.01	APS Ops Management		5.7	\$116,810.95	\$402,043.06	\$0.00
APS.01.02	Business Operations		51.3	\$2,994,168.19	\$8,184,615.47	\$309,803.57
APS.01.03	Facility Projects		1.6	\$59,772.40	\$96,944.70	\$27,687.96
	TOTAL APS.01	APS Operations Support	58.7	\$3,170,751.54	\$8,683,603.23	\$337,491.53
APS.02	Accelerator Operations					
APS.02.01	Accelerator Support		5.4	\$202,520.35	\$528,663.48	\$47,819.88
APS.02.02	Accelerator Projects		22.5	\$477,665.08	\$1,450,708.44	\$49,533.35
APS.02.03	Main Control Room/Physics		24.0	\$435,694.13	\$1,307,289.74	\$0.00
APS.02.04	Machine System Management, Admin &		26.2	\$587,533.67	\$1,760,891.21	\$43,377.75
APS.02.05	Storage Ring		42.3	\$909,882.85	\$2,466,148.89	\$86,601.51
APS.02.06	Booster		3.4	\$74,489.31	\$183,986.71	\$2,155.50
APS.02.07	Particle Accumulator Ring (PAR)		1.9	\$34,893.46	\$106,388.01	\$307.51
APS.02.08	Linac		10.2	\$195,460.66	\$859,401.94	\$35,848.76
APS.02.09	LEUTL		0.9	\$11,555.17	\$47,983.57	\$0.00
APS.02.10	ITS		0.6	\$2,379.95	\$33,686.47	\$0.00
	TOTAL APS.02	Accelerator Operations	137.6	\$2,932,074.63	\$8,745,148.46	\$265,644.26
APS.03	Beamline Operations					
APS.03.01	Beamline Support		43.2	\$957,555.26	\$2,607,788.31	\$179,429.01
APS.03.02	Beamline Projects		7.8	\$189,057.56	\$540,362.21	\$389,406.59
APS.03.03	X-Ray Optics		11.7	\$211,611.56	\$710,573.14	\$69,436.02
APS.03.04	X-Ray Detectors		5.1	\$127,408.61	\$339,869.82	\$24,022.08
APS.03.05	Specialized Support Labs		1.2	\$61,727.25	\$121,046.88	\$48,729.40
APS.03.07	Beamlines		133.0	\$2,779,646.73	\$8,506,925.61	\$527,497.90
	TOTAL APS.03	Beamline Operations	201.9	\$4,327,006.97	\$12,826,565.97	\$1,238,521.00
APS.04	Research and Future Concepts					
APS.04.01	Future Accelerator Concepts		0.3	\$14,267.95	\$17,726.19	\$0.00
APS.04.02	Future Beamline Concepts		1.0	\$30,282.22	\$99,367.12	\$473,275.00
	TOTAL APS.04	Research and Future Concepts	1.3	\$44,550.17	\$117,093.31	\$473,275.00
Grand Total APS			399.5	<u>\$10,474,383.31</u>	<u>\$30,372,410.97</u>	<u>\$2,314,931.79</u>

Multiple actions to address the budget envelope

- APS-U funding ~63 FTEs in FY14 and FY15
- Work for LCLS-II brought in \$2M in FY14
- In prior years, APS cut back on postdoc positions
- Sought additional revenue sources. Last year, proprietary work generated \$2 million, XSD brought in ~\$1.5M in funding (non-LDRD, non-BES-SUF)
- Responsive heating and cooling systems for the APS and 401 are reducing utility costs
- All three divisions have been finding ways to work smarter to reduce inefficiencies and extend the lifetime of parts.
- Cost-benefit analysis shifted some building and utility costs to ANL-users of the APS facilities, such as APCF and CNM
- We are consolidating costs with core ANL services for basic work in order to free our staff up to take on more specialized tasks
- Service costs traditionally born by APS Operations have been spread among projects to take into account actual use



APS 5-Year Plan

- June 21: Draft plan sent to APS Science Advisory Committee (SAC) for initial review
- June 24: Draft plan presented at the DOE-BES Triennial Operations review
- July 9: Discussion of draft plan with APS Users Organization and Partner User Council
- Comments from all meetings and further discussions being integrated into plan
- SWOT analysis of APS-operated beamlines completed, being updated
- November 5-6: APS SAC meeting for final advice. Comments incorporated into plan.
- Incorporating final comments by key stakeholders



SWOT analysis: what, why, when & how ?

- SWOT = Strength, Weaknesses, Opportunities, Threats

- Strategic planning
 - Define future roadmap for beamlines in preparation for the APS Upgrade
 - Define opportunities for investment

- July – August 2014 – data are reasonably “up-to-date”
 - Beamline-by-beamline SWOTs carried out by Group Leaders & their teams
 - Being updated this week
 - SWOT analyses discussed with all GLs in meetings held during August
 - Additional Division-wide data collected by XSD Division Management
 - Beamline staffing
 - Beamline publications
 - Beamline citations



Mid-term results of SWOT & beamline analysis

- Identified “short-term” shared problems in optics – formed working groups to find common long-term solutions
- Prioritized list of improvements/upgrades from each group
- Identified R&D necessary for techniques that are markedly enhanced in APS-U (see 5-yr plan for details) & cobbled together funding
 - Scanning Nanoprobes (APS-U & LDRD)
 - Coherent diffractive imaging & ptychography (LDRD)
 - X-ray photon correlation spectroscopy (DOE-Detector Grant & LDRD)
 - Phase Contrast Imaging – projection microscope (LDRD)
- Plan systematic analysis of beamline layouts for Upgrade-readiness
Start with beamlines benefiting most from increased brightness & coherence

Establish working groups on common optical problems

Goal: Find common solution to shared problems.

March 2015 – report with actionable recommendations

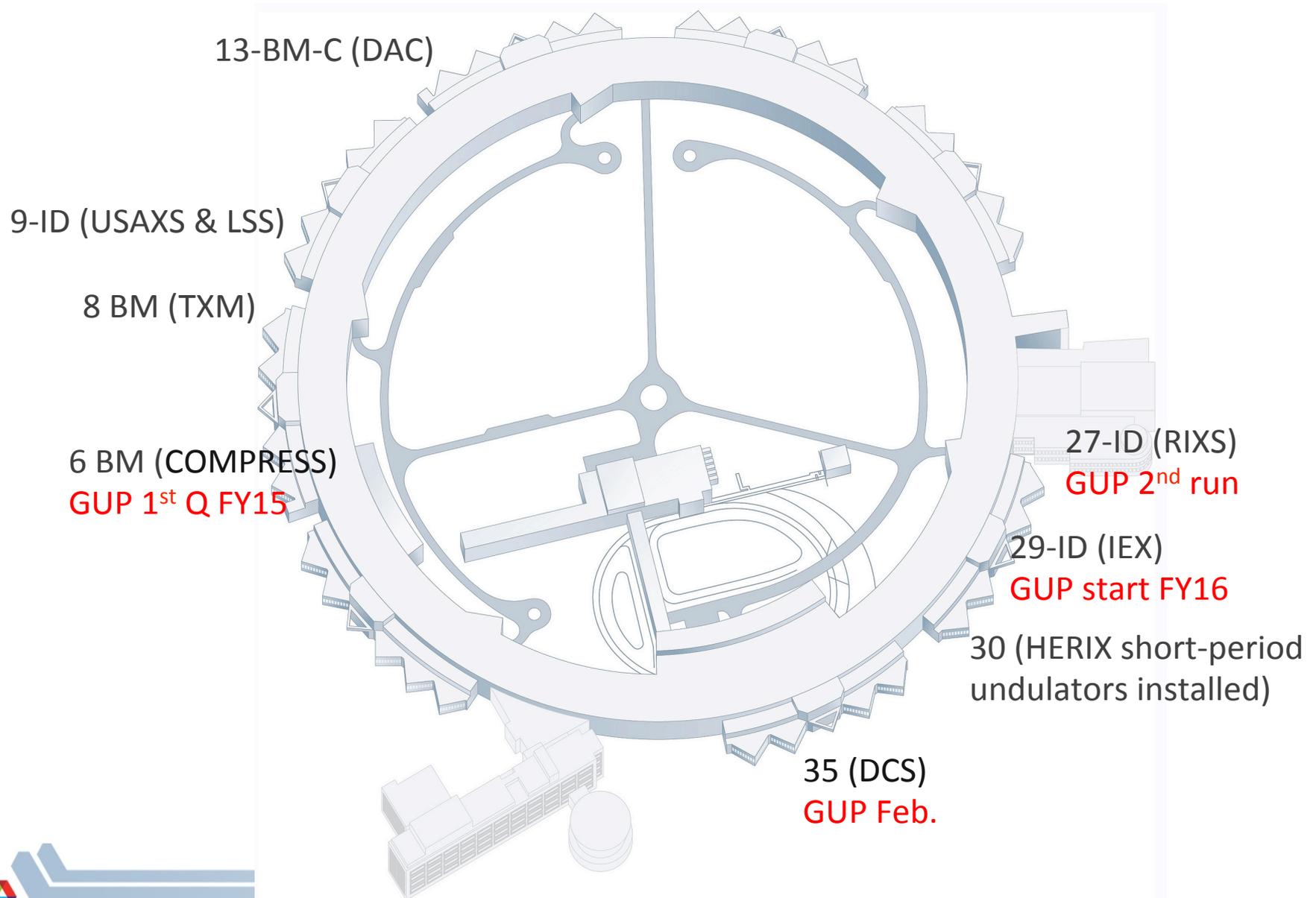
- **Double Xtal Monochromators:** Diamond to Silicon conversion (gain flux & stability)
Mark Beno (Chair)
Steve Heald, Gary Navrotski, Stan Stoupin, Ruben Reininger, Jon Tischler, Don Walko
- **Double Multilayer Monochromator:** (Increase thruput v DCM)
Ray Conley (Chair)
Ruben Reininger, Alan Kastengren, Sonke Seifert, Barry Lai, Lahsen Assoufid
- **High Energy Focussing** (>50 keV, <1 μm)
Xianbo Shi (Chair)
Ruben Reininger, Lahsen Assoufid, Sarvjit Shastri, Chris Benmore, Karena Chapman, Xianghui Xiao

The Future: Mid-Term Beamline Improvements and Long-Range Planning

Your Input Needed!

- XSD has generated a list of potential improvements to APS beamlines, in Facility Plan as appendix
 - These need to be beat up, prioritized and vetted by our user community
 - Thoughts, suggestions, offers of help welcome!
- Stuart will briefly touch on APS-U beamline planning
 - We are working with the APS SAC to define the beamline selection process
 - We want all users to be heard. Thoughts, suggestions, offers of help welcome!

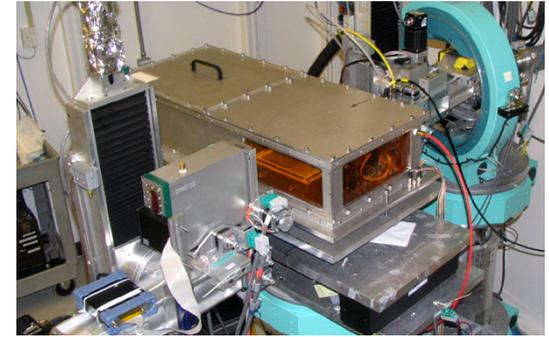
Right Now - New/Enhanced Beamlines



Ultra SAXS and Liquid Surface Scattering at 9-ID

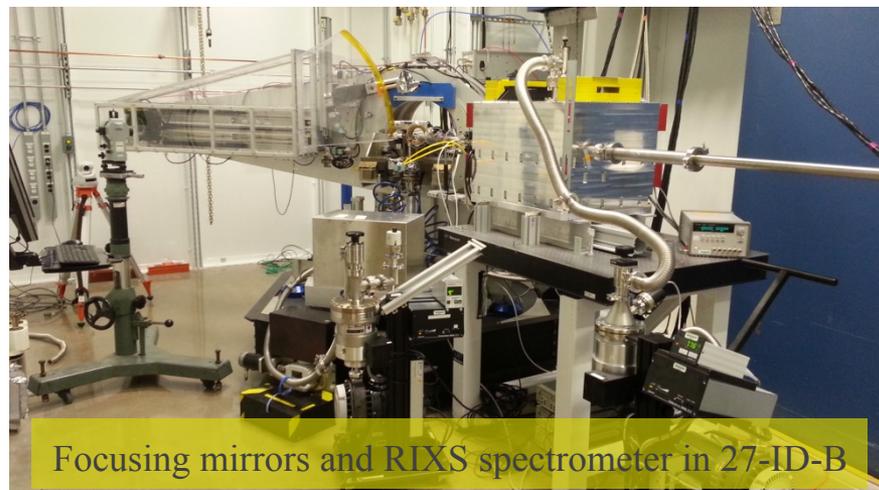
Starting in 2015-1 cycle 9-ID will be the new home for USAXS and an updated LSS

- *LSS has moved to 9-ID-B from C hutch*
New MYTHEN detector is being purchased by its PUP
Closer to the source, more stable
Isolation table for off-line setup is being installed in the lab
- *USAXS has moved from 15-ID-D to 9-ID-C*
Double amount of available beamtime, grow user community
USAXS will benefit with the extra flux from the tandem undulators at 9-ID
Existing SAXS rail in hutch will be used to extend capabilities
- Beam pipe is being reconfigured to allow both direct and reflected beams into the hutches
- Hutches have new lighting, additional internet connections and a resurfaced floor
- Operation of 9-ID has moved to the CMS group

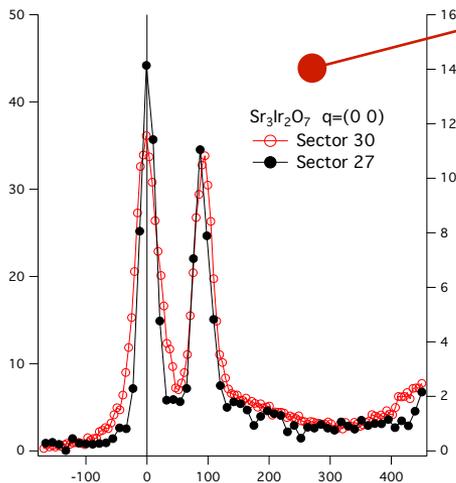


APS-U Construction Status of 27-ID RIXS

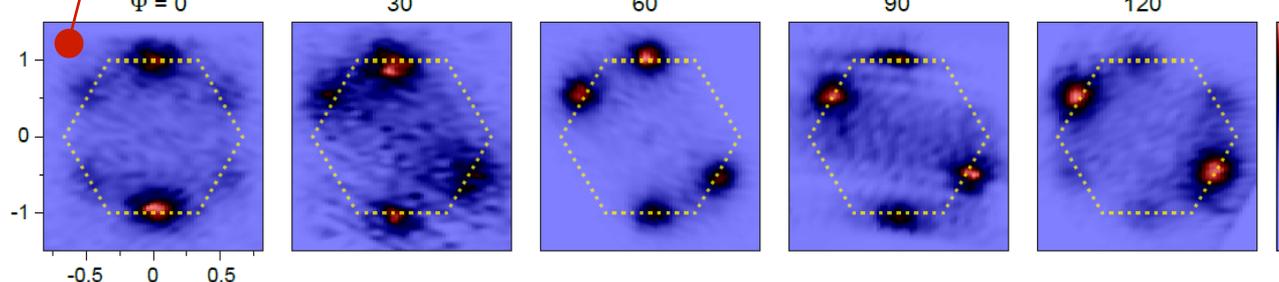
- Basic beamline construction was finished, on time and on budget by Dec 2014.
- All RIXS instrumentation and infrastructure operational by Dec 2014.
- Further commissioning during 2015-1 (high-P/low-T sample environment, new 25 μm strip detector, new spherical analyzers, ...)
- Start of GU program in May 2015



- First RIXS measurements on Iridium compounds demonstrate beamline performance
 - Energy resolution measurements show improvement due to improved focusing
 - Previously initiated diffuse magnetic scattering study on honeycomb structured Na_2IrO_3 completed at 27-ID, (submitted to Nature Physics), showing novel bond-directional magnetic interaction



$\psi = 0^\circ$



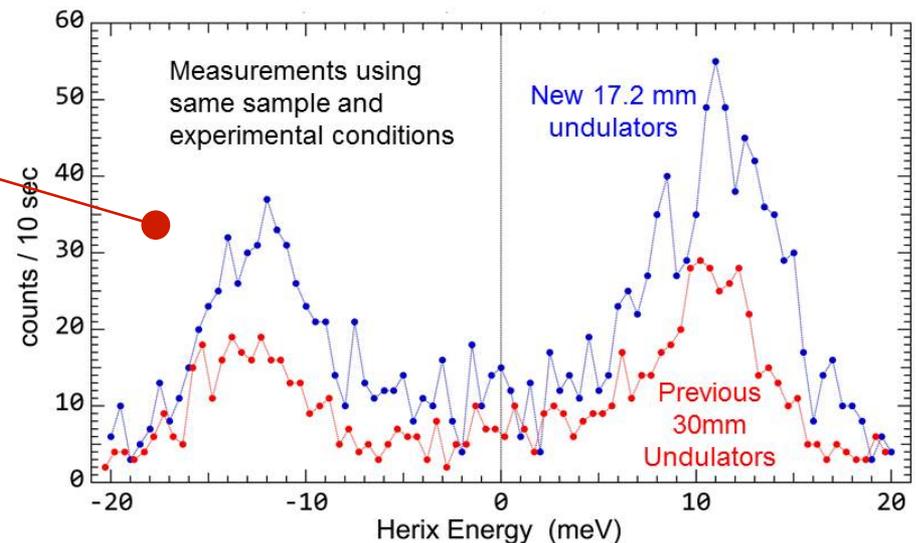
New Short-Period Undulators at 30-ID

- Oct 2014 replaced 30mm undulators by new, short-period 17.2mm devices **doubles the incident flux, substantially improves flux density, beam divergence and stability** for the HERIX instrument @ 23.7 keV
- **Immediate, significant impact on user operation** at 30-ID
- High-resolution inelastic spectroscopy is extremely photon-hungry. Doubling the incident flux enables users to obtain publishable data sets within as little as one visit to the APS, instead of multiple visits.

HERIX spectra featured in a recent publication (Budai et al., Nature 515, 535 (2014)) on the nature of the Metal-Insulator transition in Vanadium Dioxide (VO_2) (red curve) before, (blue curve) after implementation of the new undulators.

John Budai: "Measurements needed for the Nature paper required two visits of 6 days each, that were separated by one year due to high demand for beamtime. These measurements can now be obtained in a single 6 day run."

HERIX – Inelastic x-ray scattering measurement of anharmonic phonons in VO_2

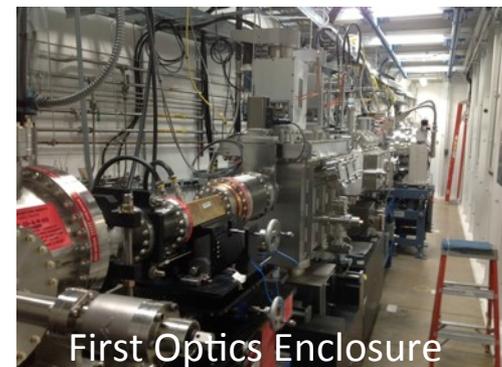


DCS Status

- White, Pink, and monochromatic focused beams have been delivered to all enclosures B, D, and E
- Experiments with X-rays have now been performed in B, D, and E
 - Small angle scattering experiments on detonation products in B enclosure, publication being prepared
 - Kolsky Bar experiments in B enclosure
 - Shots with single-stage gun and two-stage gun performed in D and E enclosures
 - Publishable, novel results with two-stage gun
 - Year ended with numerous successful experiments demonstrating DCS capability
- Revolver undulator with 3.3 and 2.7 cm periods installed during December/January shutdown
 - Passed Installation Readiness Review on November 25
- Focusing mirrors for D and E enclosures to be completed in March



Two-stage gun motion system in 35-ID-E

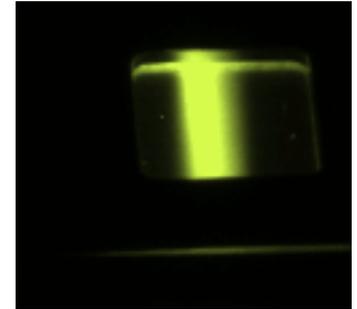


First Optics Enclosure

29-ID update on IEX installation and commissioning

Beamline: Tests of main beamline optics feeding both end stations (Dec 2014)

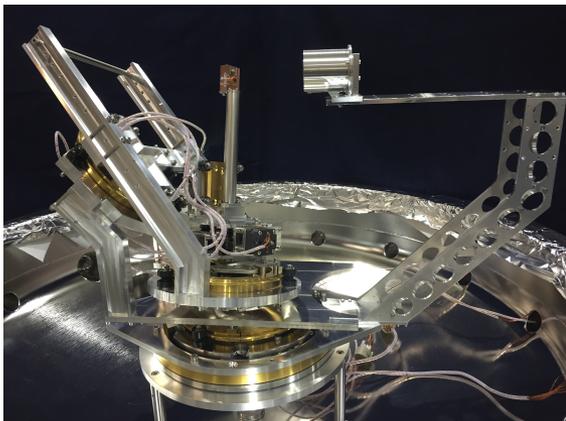
- Beam centered along entire 50 m optical path shared by both branches (beam steering)
- Mono aligned vis-a-vis ARPES-Branch exit slit independent of photon energy (exit slit size and position calibrated)
- Flux measurements: 10^{11} photons/s at 800 eV with 300 μm slit with carbon stripes on optics
- Began testing EM-VPU quasiperiodicity mode



Beam at exit slit

RSXS chamber: Continue with commissioning

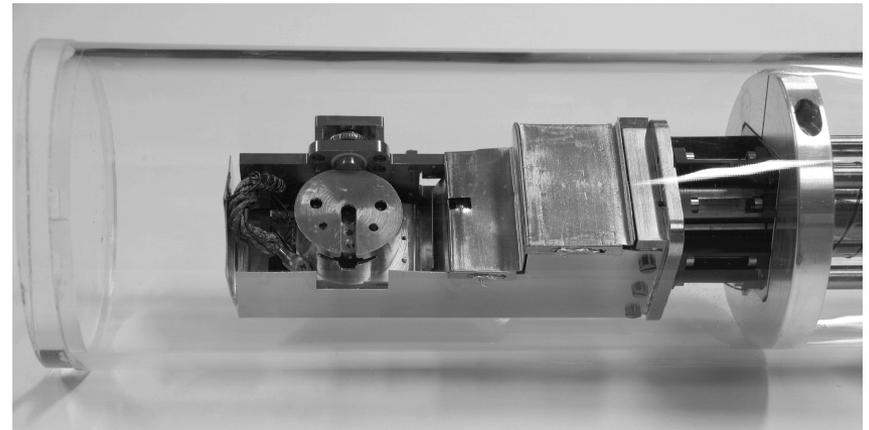
- Tested closed-cycle cryostat (Dec 2014)
- UHV Diffractometer: fixing two-theta stage decoupling; added limit switches (Jan 2015)
- First GUP proposal expected October 2015



UHV Kappa diffractometer

ARPES chamber: Installation Feb/Mar 2015

- Delivery of six-axis cryomanipulator expected Jan/Feb 2015
- Delivery of upgraded support structure expected Feb 2015
- Installation of both expected Feb 2015

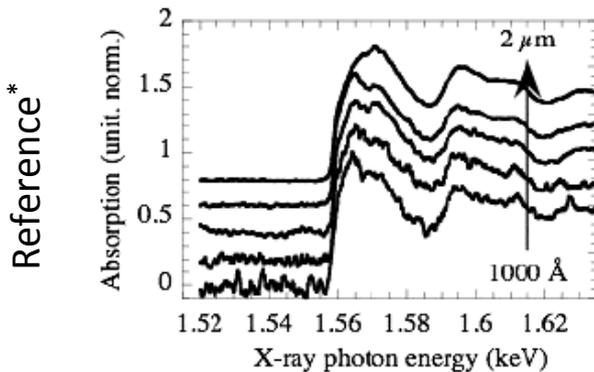
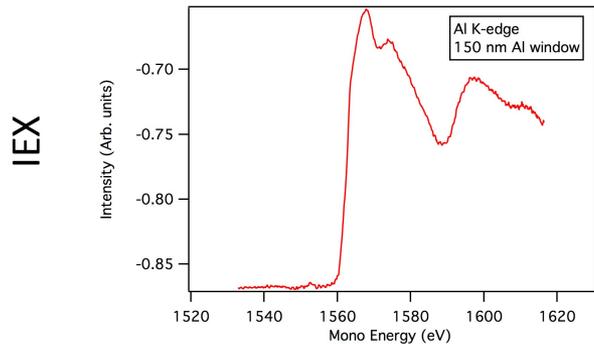


6-axis cryomanipulator

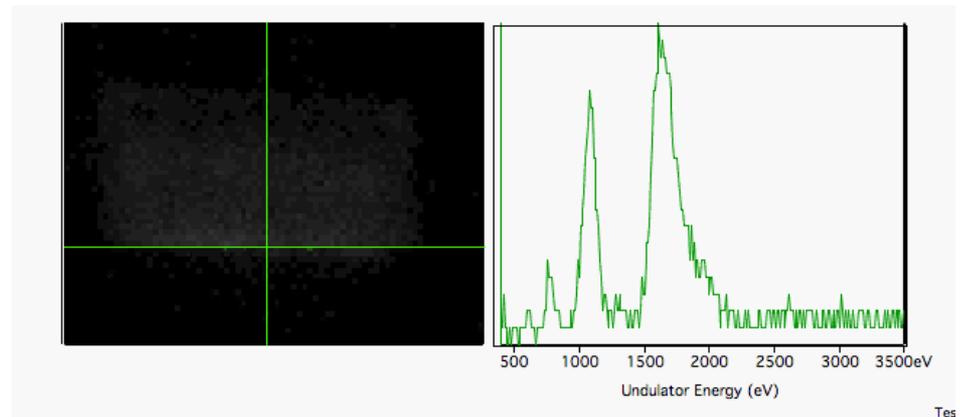
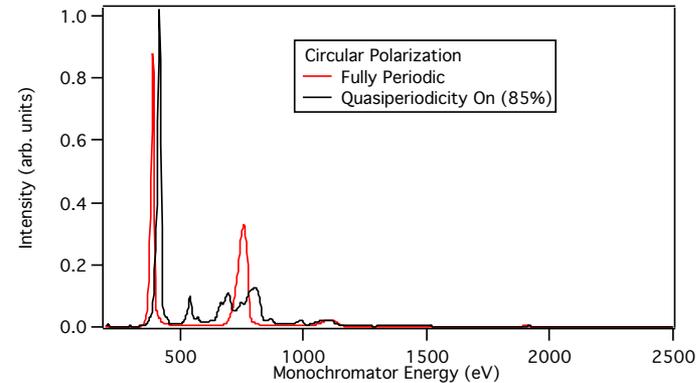
Characterization of IEX beamline

Monochromator: Continue energy/resolution calibration/testing over the entire photon energy range

Insertion Device (EM-VPU): Began characterization of higher harmonics and testing of quasiperiodicity



Transmission through Al (150 nm) window



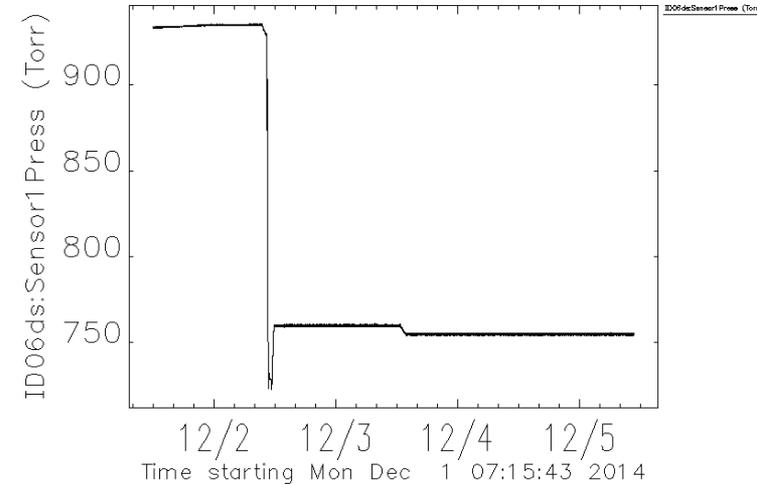
Movie, showing higher harmonics in the circularly polarized ID beam by imaging ~ 1.8 keV portion of the beam on a fluorescence screen by reflecting from Si(111) crystal at 45°

*<http://www.celia.u-bordeaux1.fr>

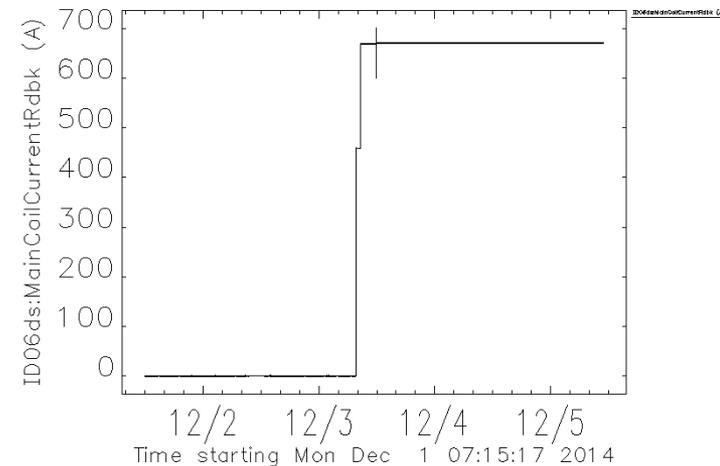


SCU0 Status

- Nov 26: SCU0 powered off due to high pressure in LHe circuit.
- The pressure rise was due to deterioration of the performance of the 4-K cryocoolers.
- On December, 2 the level of LHe in the internal reservoir was intentionally decreased. As a result, the pressure dropped and was stable.
- After Dec 3 the SCU0 was returned to operation in 324-bunch mode.
- Plan of action:
 - Warm up SCU0 on December 17-21.
 - Sumitomo performed maintenance of two 4-K cryocoolers during the shutdown.
 - SCU0 cooled back down over the holiday period and returned to service.
 - The user scheduled for Nov 28 – Dec 2 deferred his experiment. Beamline staff will use a week of Rapid Access next run-time cycle (February – April 2015) to compensate him.



LHe pressure in SCU0.

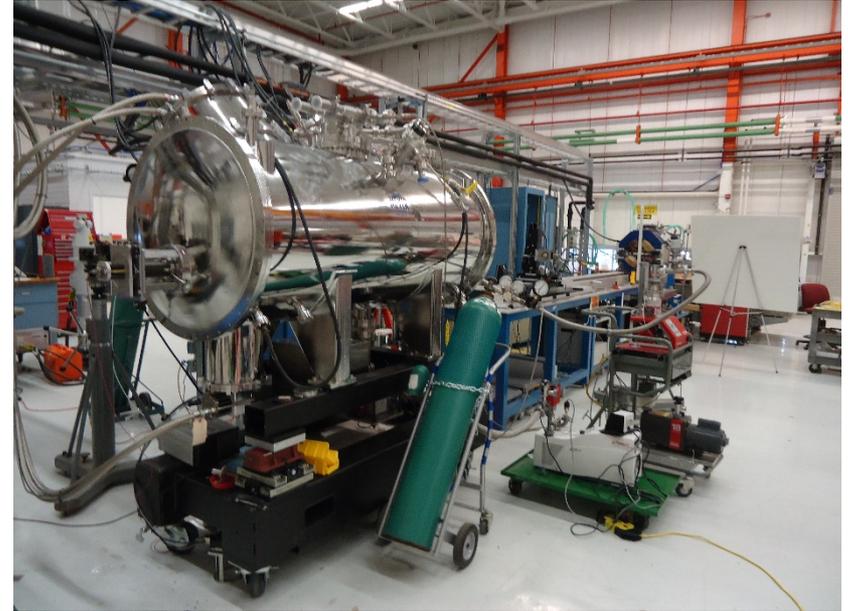


SCU0 main coil current.
(The design current is 500 A.)



SCU1 Status

- SCU1 was installed into Sector 1 starting December 18.
- On initial cool-down, an ice plug developed and the system had to be warmed back up.
- On the second cool-down, a major vacuum leak was detected in the insulating vacuum.
- SCU1 was removed and the old undulator configuration was restored.
- A Fact-Finding Team co-chaired by Sasha Zholents and John Maclean has been created to determine the origin of the problem and to develop solutions and lessons learned.



SCU1 at the magnetic measurement stand in Bldg. 314



APS/CNM Users Meeting

- Invites issued to the BES. BES replied that either Harriet Kung or Jim Murphy will plan to speak and give the DOE perspective.
- Program being organized and workshops being planned!
- Considerations
 - International Year of Light (<http://www.light2015.org>)
 - APS-U
 - Mid-term planning for the floor and machine



Tentative: 2015 & 2016 Open Houses

- 2015: We are considering hosting an internal-ANL Open House to increase mission awareness and cross-collaboration. Expected ~200 people from other directorates might tour APS.
- 2016: Lab-wide public open house for between ~24,000 to 50,000 people. Could be 1-2 days.

Your Input Needed

- What involvement would the CATs like to have in the planning process and/or the events?

