

14 DECEMBER 2016

**PSC  
ALL-HANDS MEETING**



**STEPHEN STREIFFER**

**DIRECTOR, ADVANCED PHOTON SOURCE**

**ASSOCIATE LABORATORY DIRECTOR, PHOTON SCIENCES**

# OUTLINE

- Safety
- Budget Update
- Machine Operations
- News, Awards & Recognition
- 2016 APS User Survey Results

# S'NO JOKE



- Recent significant snowfall
  - Approximately 6 inches total, wet snow
  - AES employee shoveling neighbors' walkway adjacent to his home
  - Within minutes of finishing walkway, pictured set of branches buckled and fell about 15-20 feet to ground
- Hazards of snow are more than slip and driving hazards
  - Weight of snow + diseased tree = high hazard
  - Minimize time under large branches or avoid totally
  - Keep up with tree maintenance

# SAFETY

- First recordable injury for FY2016 occurred in October
  - Beamline staff member cut back of hand on a thermocouple mount while reaching under a vacuum chamber
  - Required stitches and restrictions, but restrictions did not impact normal duties so Medical Treatment and not a DART
- Argonne has issued standard ESH signage requirements and APS has ordered 224 special sign holders to meet the requirements
- Roles, Responsibilities, Authorities, and Accountabilities (R2A2s) are being developed for a new ESH position: Experimental Work Area Custodian
  - Latest version has been sent to DDs, ALD, & DALDs for final comments
  - XSD laboratory safety captains likely already meet the R2A2

# APS OPERATIONS – BUDGET UPDATE

APS Operations carried over \$17,333K into FY17. There was \$5,641K of unspent M&S for recurring, non-recurring, and projects of which \$3,487K was encumbered

APS leadership are working the FY17 divisional budgets

The current CR goes through 4/28/17 and we are receiving a percentage of FY17 funds based on FY16 funding.

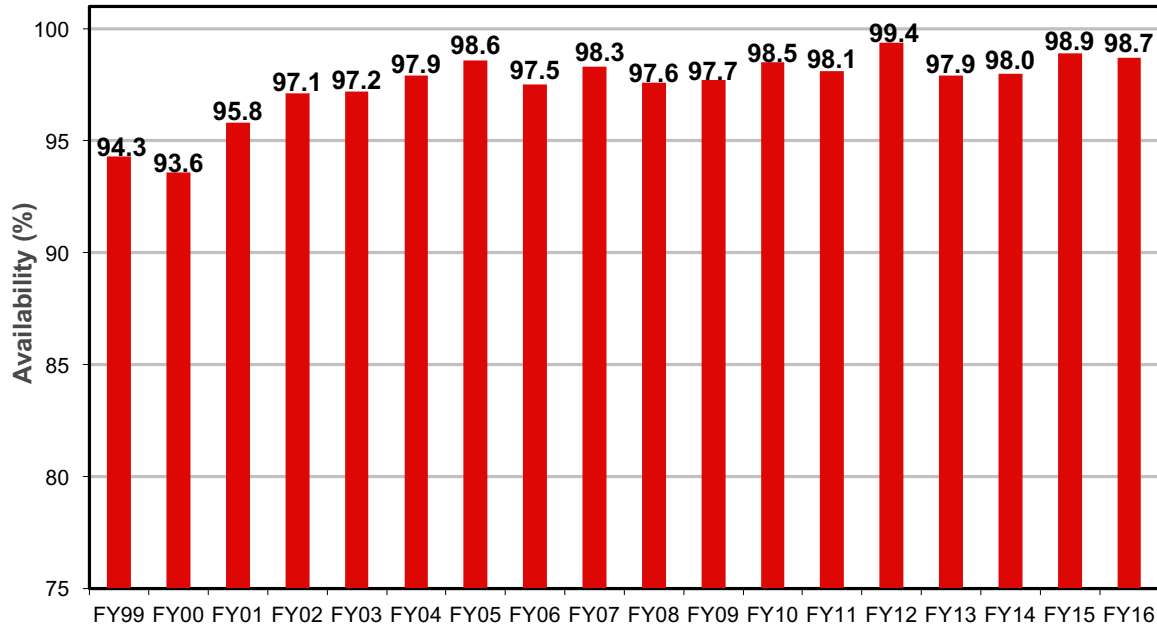
	FY16 Budgeted FTE	FY16 Budget	FY16 Actual FTE	FY16 Actual
Effort	354.7	\$86,671,486	350.4	\$88,297,393
Non-effort		\$43,419,531		\$37,396,524
Non-recurring		\$6,442,624		\$3,474,091
Projects		\$3,250,264		\$1,998,073
Recurring		\$33,726,643		\$31,924,360
<b>Total Operating</b>	<b>354.7</b>	<b>\$130,091,017</b>	<b>350.4</b>	<b>\$125,693,917</b>
<b>Total Equipment</b>		\$405,904		\$405,904
<b>Total Operating &amp; Equipment</b>		<b>\$130,496,921</b>		<b>\$126,099,821</b>

# ACCELERATOR OPERATIONS

Several issues in accelerator operation impacted “business as usual”:

- Issues with linac reliability in L2 and L5 structures; problem resolved by reducing energy early in run
- Downtimes due to vacuum-related RF trip and power supply glitches in first week of user ops
- It was not possible to deliver 16 mA in a single bunch in a hybrid fill pattern and only 12 mA was delivered.
  - This problem was likely caused by a significant aperture obstruction in a narrow gap vacuum chamber in Sector 4 (which disappeared later)
  - Normal operation with 16 mA was later achieved during machine studies
- The lifetime in 324 bunch fill pattern dropped from typically 60 hours to ~ 20 hours requiring more frequent refills (every 6 hours).
  - This problem is likely caused by poor vacuum at or near the RF cavity 4 in Sector 36.
  - This problem was mitigated by implementing top-up with 324 bunches

# APS X-RAY AVAILABILITY AND MTBF

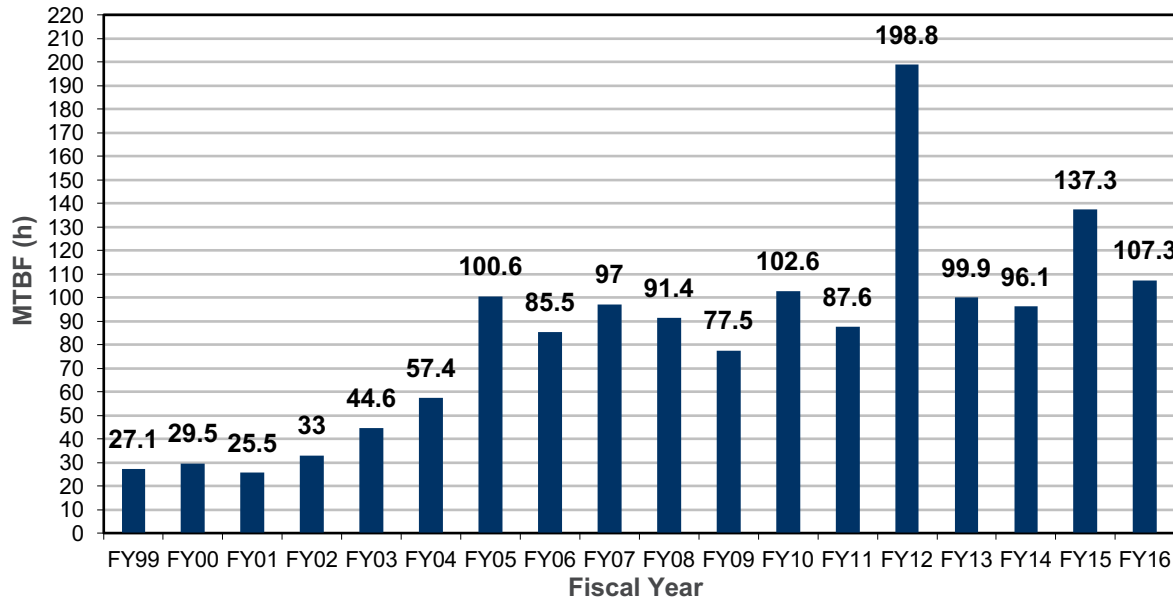


**Run 2016-3 to date**

Availability: 98.5%

Faults: 16

MTBF: 88.7 hrs



# Winter Shutdown

- LINAC/PAR tunnel opening now 0800 on Thurs Dec 22
- Notable activities:
  - 4-ID vacuum chamber will not be replaced this shutdown after demonstrating that 16 mA in a single bunch for hybrid mode. Monitoring of chamber will continue in next run.
  - Linac L2 AS2 conditioning and potential replacement
  - Removing pink beam shutters at 2-ID-B and -C for future use on 4-ID and 2-ID-D, respectively
  - PC gate valve support stand, snubber replacement Sectors 17 & 18 and XBPM at 26-ID postponed





# **NEWS, AWARDS & RECOGNITION**

# THE STRUCTURE OF A HYDROGEN-STUFFED, QUARTZ-LIKE FORM OF ICE

## Scientific Achievement

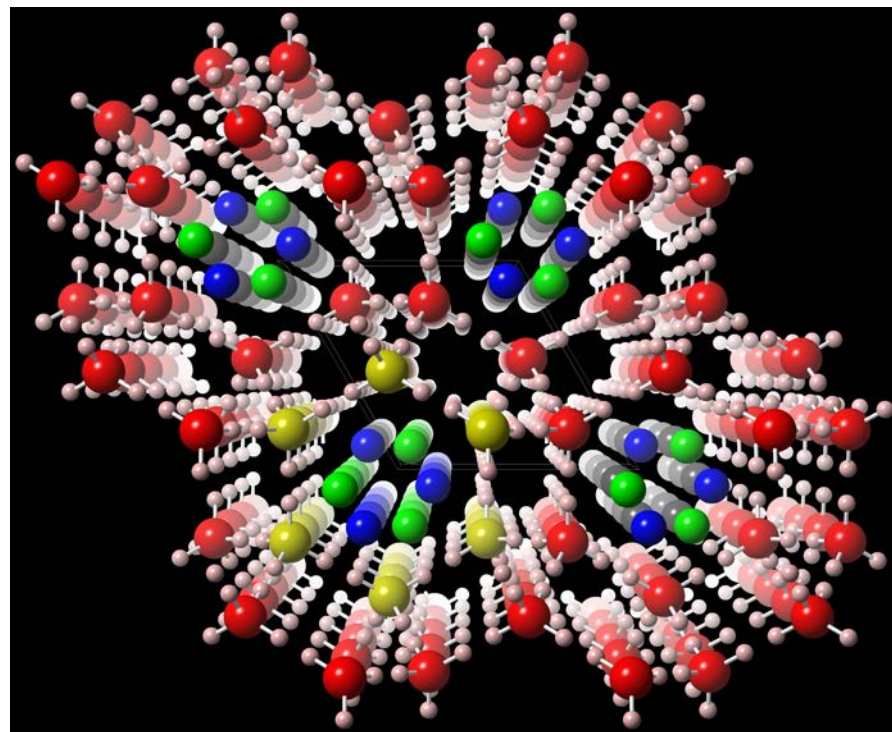
Researchers identified the structure of a new type of ice crystal that resembles the mineral quartz and is stuffed with over five-weight percent of energy-rich hydrogen molecules.

## Significance and Impact

This could have implications for the mineralogy of icy planetary bodies, and is a long-standing Department of Energy goal for hydrogen storage.

## Research Details

- The researchers created this quartz-like ice and used advanced diffraction and spectroscopic tools to determine its structure.
- The new compound appears under specific conditions: at about 4,000 times normal atmospheric pressure (400 megapascals) and 44 degrees Fahrenheit (280 kelvin).
- Its crystalline structure consists of interconnected spiral chains of water molecules that form tubes.



Structure of C0 phase structure discovered recently in the  $\text{H}_2 + \text{H}_2\text{O}$  system. Large red and small pink spheres indicate water O and H atoms, respectively, while blue and green spheres indicate disordered  $\text{H}_2$  molecules, which are 50% occupied.

T.A. Strobel, M. Somayazulu, S.V. Sinogeikin, P. Dera, R.J. Hemley, "Hydrogen-Stuffed, Quartz-like Water Ice," *J. Am. Chem. Soc.* **138**, 13786 (2016). DOI: 10.1021/jacs.6b06986

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Work performed at Argonne National Laboratory

# SOLVING THE STRUCTURE OF A CRUCIAL DNA REPLICATION PROTEIN

## Scientific Achievement

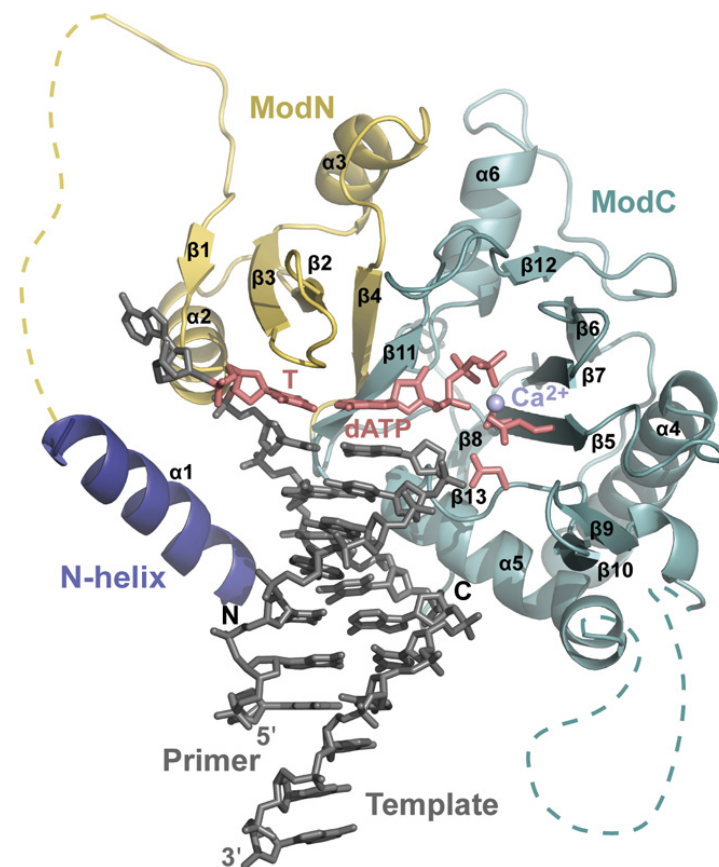
Researchers have determined the three-dimensional structure of a key protein that helps damaged cellular DNA repair itself.

## Significance and Impact

Knowing the chemical structure of the protein is invaluable for designing an inhibitor for this enzyme as a future cancer therapy.

## Research Detail

- This research deciphered the unusual configuration of the protein PrimPol, whose function was discovered in 2013.
- PrimPol is used in cells when normal repair proteins encounter damaged sections of DNA, often caused by anticancer chemotherapy drugs. The protein can skip over the damage to rescue DNA replication.



O. Rechkoblit, Y.K. Gupta, R. Malik, K.R. Rajashankar, R.E. Johnson, L. Prakash, S. Prakash, A.K. Aggarwal, "Structure and mechanism of human PrimPol, a DNA polymerase with primase activity," *Sci. Adv.* **2**, e1601317 (21 October 2016). DOI: 10.1126/sciadv.1601317

Work performed at Argonne National Laboratory

Contact: [aneel.aggarwal@mssm.edu](mailto:aneel.aggarwal@mssm.edu)

# IMAGING DRUG DISTRIBUTION FROM METERED-DOSE INHALERS

## Scientific Achievement

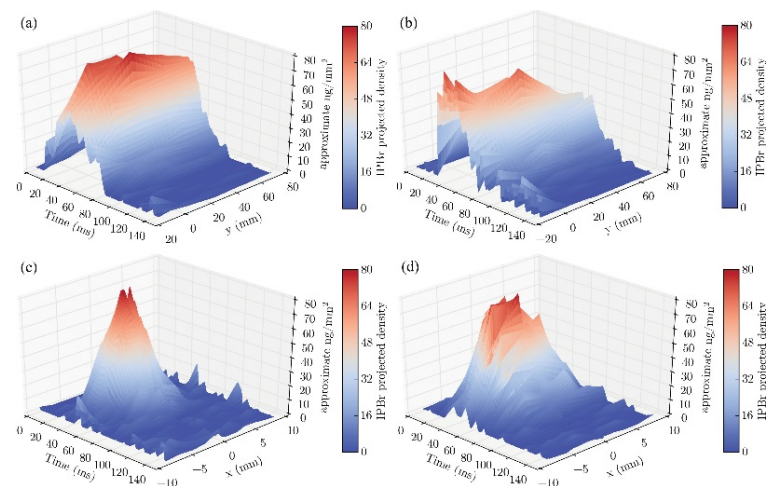
Limitations of metered-dose inhalers (MDIs) have been overcome by imaging spray distributions with x-ray fluorescence spectroscopy (XFS).

## Significance and Impact

The evolving distribution of bromine (an element found in some common inhaler drugs) within MDI sprays was determined with millisecond precision; it is expected that these findings will lead to improvements in the drug-delivery performance of MDIs.

## Research Detail

- Synchrotron-based XFS is well suited to probing the near-field spray region.
- By causing the drug to fluoresce, its distribution and concentration throughout the evolving spray plume can be mapped with very high spatial (5  $\mu\text{m}$ ) and time (1 ms) resolutions.
- Moreover, XFS can measure the drug's concentration within the multitude of droplets that suddenly appear and grow throughout the spray, providing insight into dosing.



Panels (a) and (b) show bromine concentrations measured along the centerline of the mouthpiece. Vertical axes indicate drug concentration in ng per square mm. Both panels show that within 140 ms, the drug concentration rises sharply and peaks, then quickly dissipates. Panels (c) and (d) are based on the same propellant (HFA-134a) and show how drug concentration falls away rapidly from the centerline of the mouthpiece in the transverse direction (x). The effect is very pronounced close to the mouthpiece (5 mm), but less so further away (25 mm).

D.J. Duke, A.L. Kastengren, N. Mason-Smith, Y. Chen, P.M. Young, D. Traini, D. Lewis, D. Edgington-Mitchell, D. Honnery, "Temporally and Spatially Resolved x-ray Fluorescence Measurements of in-situ Drug Concentration in Metered-Dose Inhaler Sprays," *Pharm. Res.* **33**, 816 (2016). DOI 10.1007/s11095-015-1828-6

Contact: [dduke@anl.gov](mailto:dduke@anl.gov)

Work performed at Argonne National Laboratory

# CHANGE AN ATOM, CHANGE A MATERIAL

## Scientific Achievement

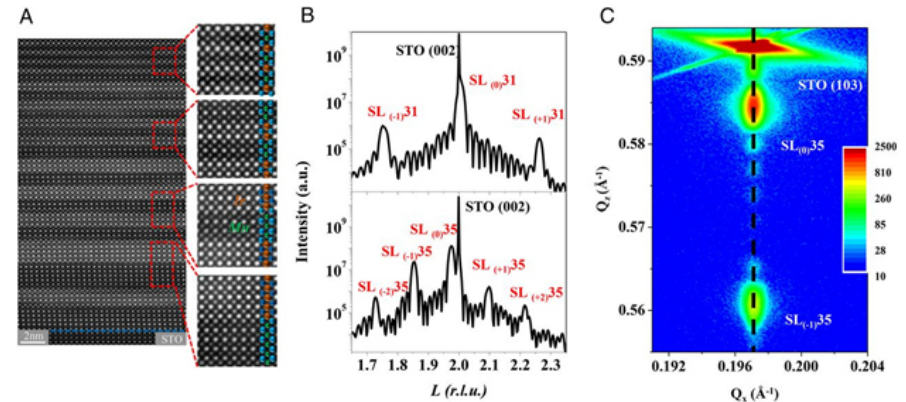
With just the change of an atom, researchers have found it is possible to change a material's properties.

## Significance and Impact

As modern information technology demands components that fit into smaller spaces, research like this plays a valuable role in making that possible. The results reveal a novel magnetic state that could pave the way for new devices.

## Research Details

- To achieve the best magnetic state, researchers combined two materials, one ferromagnetic ( $\text{La}_{2/3}\text{Sr}_{1/3}\text{MnO}_3$ ), one paramagnetic ( $\text{SrIrO}_3$ ), as layers on top of one another in a specific pattern.
- The material was characterized using XAS and XMCD of the magnesium edge, and XAS and XMCD characterization at the iridium edge.
- Building the superlattice scaled-down the SIO layer to 0.4 nm, allowing for manipulation of the magnetism, owing to a novel spin-orbit coupling state that developed in the SIO layers.



**Structural characterization of the LSMO/SIO superlattice.** (A) High-angle annular dark-field (HAADF) STEM images of LSMO/SIO superlattice with designed periodicities in one sample. The atoms are marked by different colors: Ir (brightest contrast) in orange, Mn (darkest contrast) in green, and A-site atoms in blue. (B)  $\theta$ - $2\theta$  X-ray diffractograms of an SL31 (Top) and an SL35 (Bottom) superlattice. Both the superlattice peaks and the thickness fringes reveal the high degree of interface abruptness. (C) X-ray reciprocal spacing mapping of an SL35 superlattice around (103) peak, confirming coherent growth of the superlattice.

D. Yi, J. Liu, S.-L. Hsu, L. Zhang, Y. Choi, J.-W. Kim, Z. Chen, J.D. Clarkson, C.R. Serrao, E. Arenholz, P.J. Ryan, H. Xu, R.J. Birgeneau, R. Ramesh, "Atomic-scale control of magnetic anisotropy via novel spin-orbit coupling effect in  $\text{La}_{2/3}\text{Sr}_{1/3}\text{MnO}_3/\text{SrIrO}_3$  superlattices," *PNAS Early Edition* (May 2016). DOI: 10.1073/pnas.1524689113

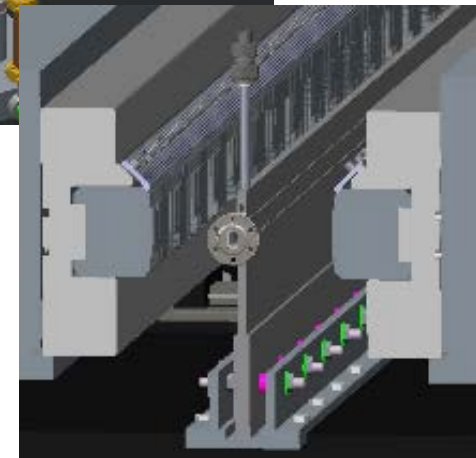
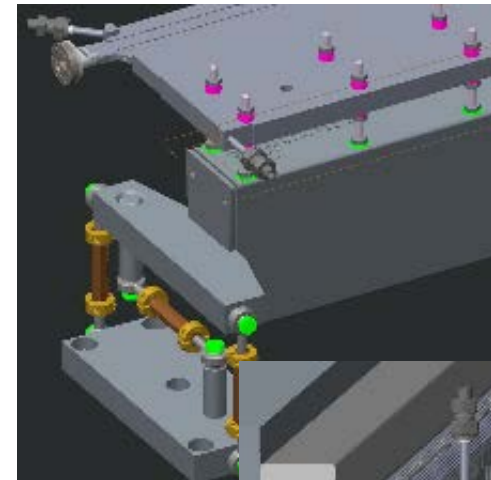
Contact: [yid@berkeley.edu](mailto:yid@berkeley.edu), [jianliu@utk.edu](mailto:jianliu@utk.edu)

Work performed at Argonne National Laboratory  
and  
Lawrence Berkeley National Laboratory

# MECHANICAL ENGINEERING & DESIGN

## ■ LCLS II Undulator Vacuum Chambers

- LCLS II project provided funding for the APS to design and fabricate prototype vacuum chamber for the LCLS II baseline undulator (Berkeley design) and for the HGVPU (APS design).
- The final design review of the HXU vacuum chambers for LCLS II was held on June 27.
  - AES team responded to all recommendations and action items during July.
- AES has received \$1,570,00 funding from SLAC as of July 27th to proceed with the fabrication of the HXU and SXU vacuum chambers for LCLS II.



## ■ XLEAP wiggler for LCLS

- A successful final design review was held on July 29 for the XLEAP wiggler for LCLS. No showstoppers were revealed.

# INFORMATION SOLUTIONS

## ▪ AIMS – Development

- Completed the integration from APS on-premises “Work Request System” to cloud based ServiceNow platform.
- Developed the new features for Demand and Project Modules on ServiceNow.

## ▪ User Office Support

- Completed “Rapid Access Proposal” project, which significantly reduced the work load of Proposal Review Panels (11 in total), streamlined the proposal/beamtime request submission and sped up rapid access proposal review process.
- Developed I-HOST form to meet the DOE requirements (DOE Order 142.3A) regarding foreign visits.
- Developed the system of sending automated user reminders of filling out “End of Experiment Form” survey after each cycle within the fiscal year.

## ▪ APS OPS Procurement Dashboard

- Integrates procurements for PSC, AES, ASD and XSD divisions
- Integrates data from PARIS, AMOS, BPA, APS Stockroom and ISAAC APS\_GROUPS
- Summarizes data by OPS WBS, Fiscal Year and Period, CAM division/group and Requester division/group

# NEW PSC MANAGEMENT

**Stefan Vogt** was appointed XSD Associate Division Director (and is also APS Principal Science Advisor to the APS-U)



# NEW SCIENTIFIC ADVISORY COMMITTEE MEMBER

**Cynthia Wolberger**

Professor, Department of Biophysics and Biophysical Chemistry, Johns Hopkins University School of Medicine

Interest in the structural and mechanistic basis for transcriptional regulation and ubiquitin signaling





## ▪ **New additions to AES**

- Ned Arnold started in Nov as Controls Group Leader
- Tressa Alcantara started in Oct as Admin Specialist, supporting AES
- Aleksandar Marcetic started in Nov in SI group as Adjunct Tech
- Jason Lerch started in Dec in MED group, from previous role in DD group

## ▪ **Union Negotiations for Design & Drafting group**

- Ongoing negotiations from August, aiming to have all in place in January 2017

# ASD DIVISION DIRECTOR SEARCH - UPDATE

- Search Committee kick-off held August 12
- Considering 7 applicants

## SEARCH COMMITTEE MEMBERS

**Stuart Henderson – Committee Chair**, Director, APS Upgrade Project

**Michael Borland**, Associate Division Director, Accelerator Systems Division

**Louis Emery**, Storage Ring Manager, Accelerator Systems Division

**Patricia Fernandez**, Associate Division Director, X-ray Science Division

**Bob Hettel**, Head of the Accelerator Research Division, SLAC National Accelerator Laboratory (Chair, Machine Advisory Committee for APS)

**Geoff Pile**, Associate Division Director, APS Engineering Support Division

**John Power**, Physicist, High Energy Physics Division, Argonne National Laboratory

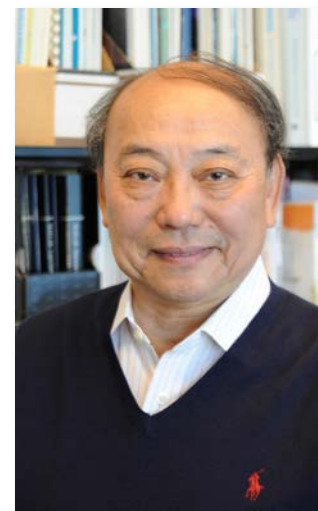
**Mark Rivers**, Executive Director of the Center for Advanced Radiation Sources (CARS), The University of Chicago

# ANNUAL PSC/ESH/XSD/AES SUPPORT GROUP SURVEY

- Sent out the week of Dec 5<sup>th</sup>
- Please complete the survey and provide meaningful feedback

# AWARDS & HONORS

**Deming Shu** (XSD-ADM) was one of the recipients of a 2016 R&D 100 Award for development of the Hard X-Ray Scanning Microscope with Multilayer Laue Lens (MLL) Nanofocusing Optics, a high-throughput scientific imaging tool that is installed at the Hard X-ray Nanoprobe beamline at the National Synchrotron Light Source II facility at Brookhaven National Laboratory



Deming Shu

Two "Breakthrough Prize" Winners in Life Sciences are APS users **Harry F. Noller** (Director of the Center of Molecular Biology of RNA at the University of California, Santa Cruz, and GM/CA-XSD user), and **Stephen J. Elledge** (Gregor Mendel Professor of Genetics and Medicine in the Department of Genetics at Harvard Medical School, and NE-CAT user)



Above: Harry F. Noller  
Right: Stephen J. Elledge

# PACESETTERS

**Roy Agner** (ASD-RF), **Timothy Jonasson** (ASD-RF), **Wayne Michalek** (AES-MOM), **Leonard Morrison** (AES-MOM), **Terry Smith** (ASD-EE), and **Geoff Waldschmidt** (ASD-RF)

For extraordinary efforts in fabricating, testing and on-time installation of an S-band transverse deflecting structure (TCAV) in the linac.

**Albert Barcikowski** (NE/APSU) and **Joshua Rohrer** (PHY/APSU)

For the rapid assembly, alignment, and preparation of the second APS-U fast stripline kicker, which enabled its installation in the APS-BTX beamline during the September 2016 shutdown

# 25-YEAR SERVICE AWARD

**Michael Douell**, **Christine McGhee**, **Phillip McNamara**, **Marion White**, **Michael Johnson**, **Wayne Michalek**, **Richard Rosenthal**, and **Eugene Swetin**

Pacesetter Award recipients (along with your respective DD and GL):  
Please hang around after the meeting for photos.