

# PSC ALL-HANDS MEETING JANUARY 23, 2019

## **STEPHEN STREIFFER**

Associate Laboratory Director,  
Photon Sciences Directorate  
and Director,  
Advanced Photon Source



# AGENDA

- APS Update
  - Safety (Rossi to provide)
  - Budget
  - Awards
  - HR and D&I
  - Highlights
  - Upcoming Events
- Annual APS Users Survey – Denny Mills
- APS Upgrade Update – Jim Kerby



*R. Fischetti, 01/21/19, taken from APS 5<sup>th</sup> Floor*

# SAFETY

*Respect the unexpected*

Think through your risks

Celebrate what went right



# ELECTRICAL SAFETY EFFECTIVENESS ASSESSMENT

## JANUARY 21 – FEBRUARY 1

- The objectives include:
  - Evaluation of corrective actions implementation and addressing cause(s) to prevent recurrence
  - Evaluation of the Electrical Safety Program for effectiveness in changing the safety culture
  
- The assessment team comprises:
  - Jim Tarpinian (co-lead)
  - Mike Pakan (co-lead)
  - Scot Winningham, ORNL
  - Mark Scott, LBNL
  - Tommy Martinez, LANL
  - David Mertz, FNAL

# WORK PLANNING AND CONTROL PROJECT

- The Improving How We Work project addressed several opportunities to improve our work planning and control efforts, making it simpler wherever possible, and safer for all
  - Streamlined processes and documentation
  - Updated, targeted, and effective training
  - Wider employee engagement through increased communications
  - Field assistance
  - A new user-friendly web application (AWARE)
- Upcoming Training Opportunities:
  - **WPC 203 - HUMAN FACTORS (courses on Jan 23, Feb 6, Feb 7)**
    - Human errors in the workplace can ruin research projects, jeopardize grant funding, and even threaten life and limb. Learn management strategies used by pilots, surgeons, elite military units, and other high-reliability teams.

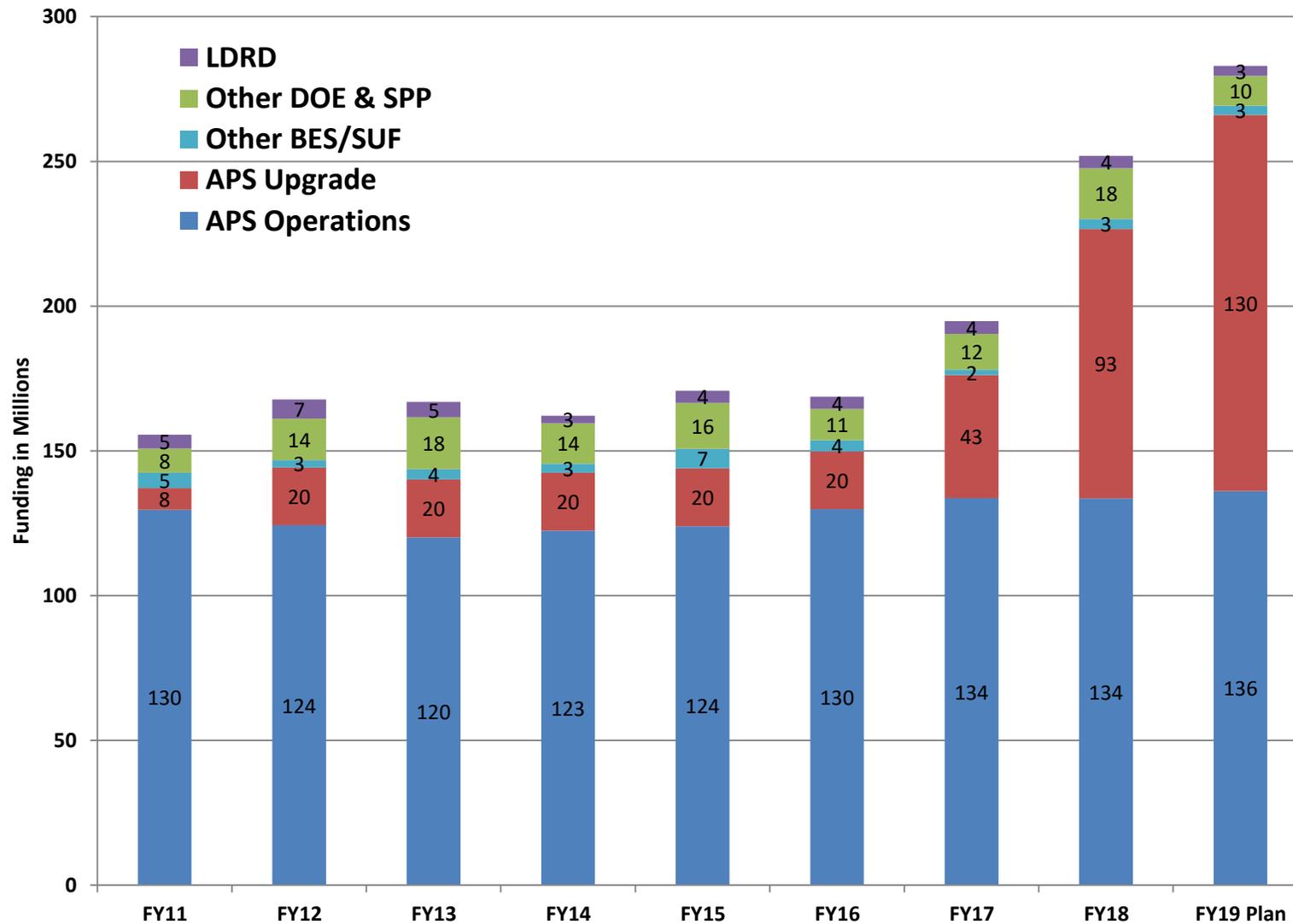
# WORK PLANNING AND CONTROL PROJECT

- Upcoming Training Opportunities:
  - **WPC 303/403, WORK PLANNING & EXECUTION / AWARE APPLICATION WORKSHOP (courses Feb 12, Feb 13, Apr 4, May 2, May 14)**
  - APS scenario-based workshop to learn how to effectively and collaboratively plan and execute work with an optional hands-on workshop utilizing the AWARE application

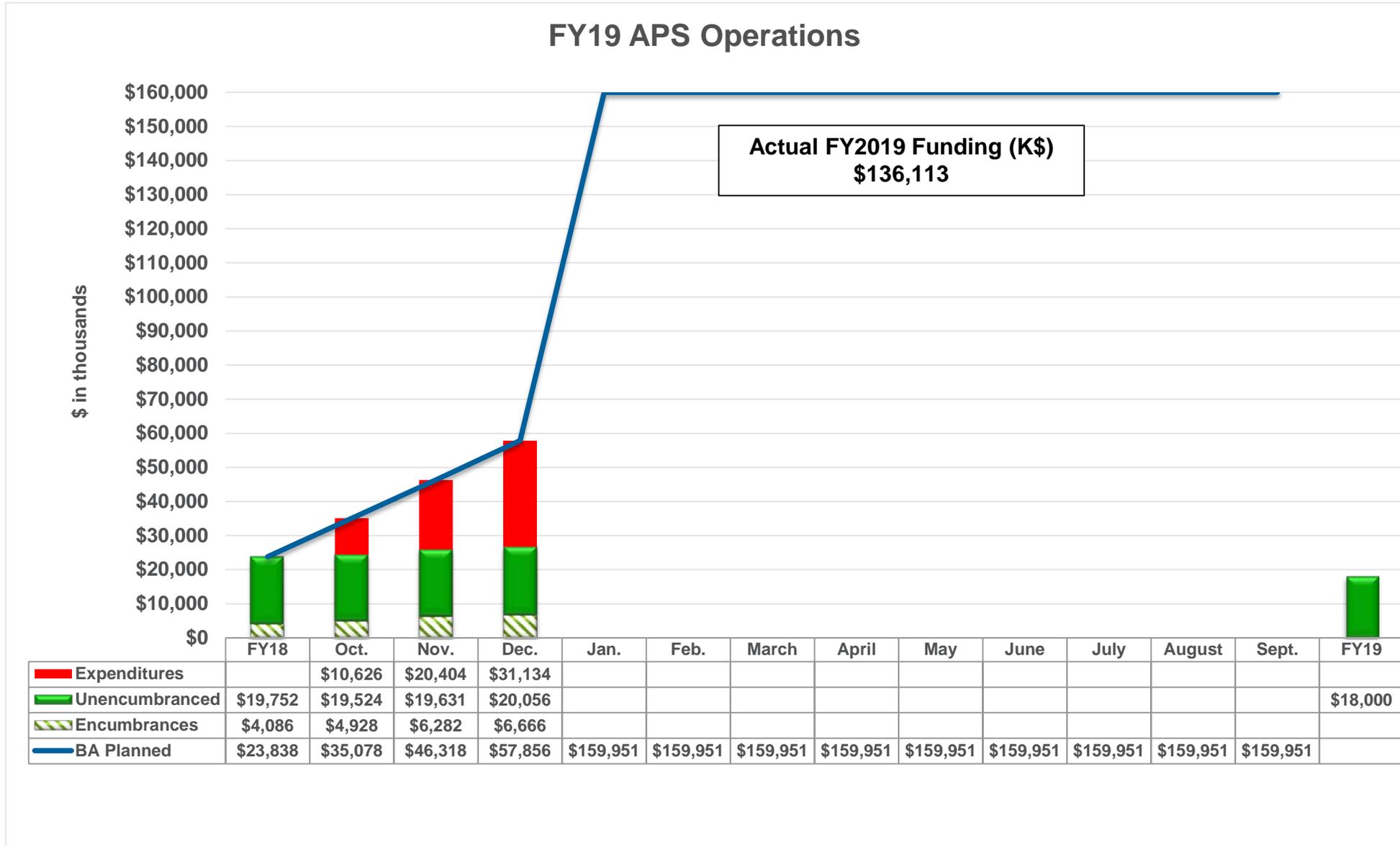




# PSC FUNDING



# APS OPERATIONS – FY19 FUNDING & EXPENSES





# AWARDS & HONORS

- **Joseph Sullivan** and **Tom Walsh** (XSD/BC)
  - **Pacesetter Award** for their extraordinary effort in getting beamline 8-ID-I back in operation after the entire VME control system for the beamline crashed just a day before the start of 2018-3 run. They replaced the VME crate and restored all the control cards and cables in less than 8 hours.
- **Curtis Forth** and **Christopher Sawatski** (AES/SI)
  - **Pacesetter Award** for their extraordinary effort in showing dedication, quality workmanship, and attention to detail, enabling AES/SI to complete six FE EPS system upgrades on schedule during the August/September 2018 shutdown.
- **Soenke Seifert** (XSD/CMS) **Kevin Beyer**, and **Olaf Borkiewicz** (XSD/SRS)
  - **Pacesetter Award** for extraordinary effort in finalizing the refurbishment and commissioning of 11-ID-B in time, even though a major component got lost. 11-ID-B has gained a factor of 2.5 in angular resolution, a factor of 6 in intensity for working with high spatial resolution, and significantly more space for sample environments.

# AWARDS & HONORS

- **Joshua Downey** (APS-U/PSC) and **William Turner** (APS-U/AES-MED)
  - **Pacesetter Award** for excellence in achievement and performance in their efforts to investigate and implement a top-down, skeleton-based modeling approach to the APS-U three-dimensional models and systems. Their improvements have spread to all aspects of the design and have been recognized by the Design Review members of other organizations.
- **John Conway, Kristi Wood,** and **Steven Landers** (APS-U/NWM)
  - **Pacesetter Award** for their extraordinary efforts in successfully and safely performing complex task on projects linked to the design of components for the APS-U storage ring vacuum system.

## 25 YEARS SERVICE AWARDS

Congratulations to the following individuals for **25 years of dedicated service to Argonne National Laboratory** (fourth quarter 2018):

**Scott Wesling**

**Bingxin Yang**

**Lahsen Assoufid**



# FROM THE HUMAN RESOURCES DESK

The PSC Directorate is strongly committed to talent management approaches to effectively attract, engage, and retain the best people to achieve our goals and objectives

- PSC Human Resources Office focus:
  - Continued consultation on all **staffing and onboarding activity**
  - Working with Divisions on **workforce requirements for APS-U**
  - Leading collaborative Division planning to shape strategy for a **diverse and inclusive** work environment
    - Transitioning the Directorate Diversity & Inclusion (D&I) Advisory Group to include balanced representation from each Division (two individuals per Division)
    - Consultation with Divisions in reference to the last climate survey – developing action plans to use Division feedback for path-forward strategy for D&I engagement
  - Helping to develop **supervisory and management training strategy**
  - Assisting with individual employee/manager outcomes from the most recent performance **appraisal and merit process**

# PSC D&I update

- Identified representatives for each “division”
  - Form the PSC D&I committee, supplemented with volunteers as they come to meetings
  - Meet with division directors on regular basis, to address and be cognizant of division specific developments
  - Use climate survey to identify most immediate topics



- AES

- Arista Thurman
- Maria Pilar O’Neill



- APS-U

- Katie Martin
- Animesh Jain



- XSD

- Fanny Rodolakis Simoes
- Stefan Vogt



- ASD

- Iftikhar Abid
- Kathy Harkay



- PSC directorate office

- Tracy Thomas
- Nena Moonier



# HIGHLIGHTS



# FIRST OBSERVATION OF NEAR-ROOM-TEMPERATURE SUPERCONDUCTOR?

## Scientific Achievement

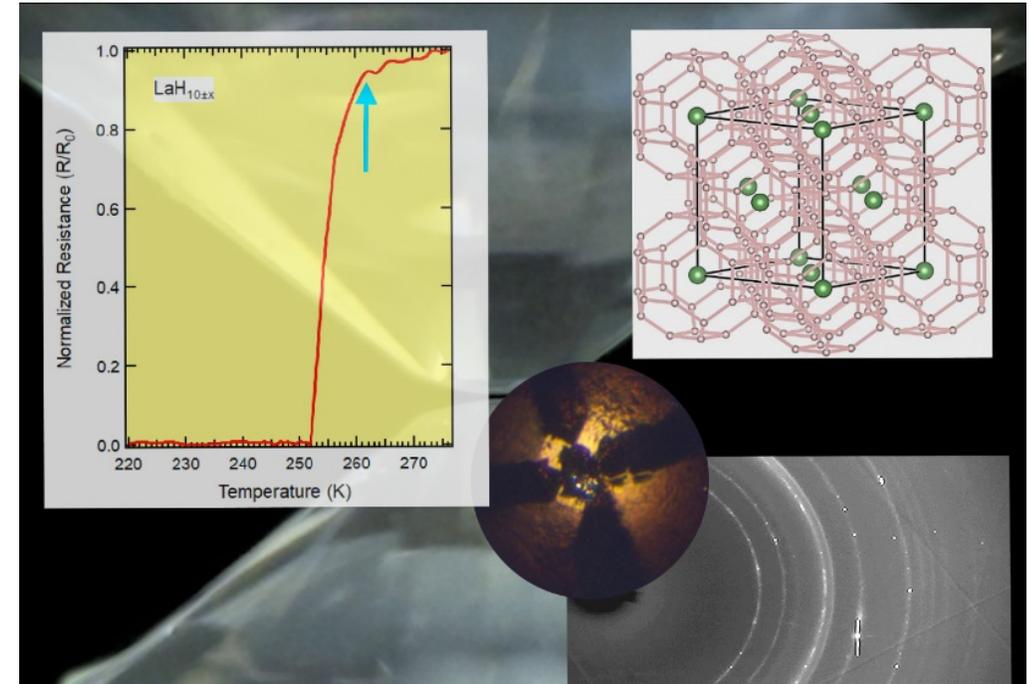
Scientists from The George Washington University and the Carnegie Institution for Science synthesized, and using a HP-CAT beamline, characterized several lanthanum super-hydride materials that demonstrated the first experimental evidence of superconductivity at near room temperature.

## Significance and Impact

In addition to important observations of superconductivity at temperatures  $>260$  K, the work highlights importance of synchrotron x-ray diffraction as a critical tool for these experiments and for extreme conditions materials science in general.

## Research Detail

- Along with the x-ray diffraction studies, electrical conductivity measurements were performed *in situ* at pressures up to 200 GPa, with resistance measured as a function of temperature.



The structure of LaH<sub>10</sub> with the sample and the four platinum leads at 180 GPa. The confirmation with in situ x-ray diffraction after laser heating shows the drop in resistivity starting at around 265 K in one of the samples synthesized. The confirmation of the structure was determined from the powder diffraction pattern shown in the lower panel.

M. Somayazulu, M. Ahart, A.K. Mishra, Z.M. Geballe, M. Baldini, Y. Meng, V.V. Struzhkin, R.J. Hemley, "Evidence for superconductivity above 260 K in lanthanum superhydride at megabar pressures," *Phys. Rev. Lett.* **122**, 027001 (14 January 2019). DOI: <https://doi.org/10.1103/PhysRevLett.122.027001>

# SIGNIFICANT FINDINGS RELATED TO TRAUMATIC BRAIN INJURY

## Scientific Achievement

X-ray diffraction data obtained at Bio-CAT by Illinois Institute of Technology, RDECOM Research Laboratory (ARL, the Army's corporate research laboratory), and Argonne researchers was used to examine changes to myelin, the fatty material that wraps around nerve cell projections in the brain and other parts of the body.

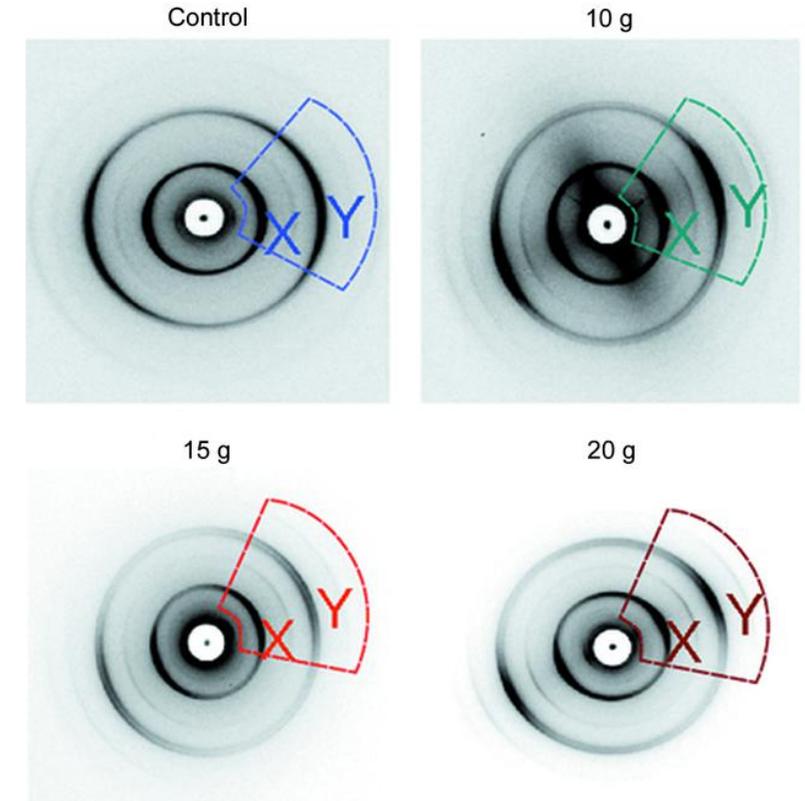
## Significance and Impact

This research takes a first step in identifying the changes that occur in otherwise normal-looking brain neurons due to the specific impact forces experienced during head trauma.

## Research Detail

- Study looked at optic nerves of rats that experienced a range of forces starting with no force and working upwards.
- Researchers detected the exact force at which a change in the myelin structure occurred.
- The changes were tiny, less than a nanometer, but they consistently occurred at the same small load of force.
- Researchers measured how much the myelin sheath changed, reflecting the kind of change that occurs in head trauma.

Contact: [orgel@iit.edu](mailto:orgel@iit.edu), [rmadhura@iit.edu](mailto:rmadhura@iit.edu)



**X-ray diffraction patterns** (a) and integrated data (intensity versus d-spacings) (b) of control and impact-loaded rat optic nerve samples. From J. Orgel et al., *J. Synchrotron Rad.* **26** (2019). © International Union of Crystallography.

J. Orgel, R.S. Madhurapantula, A. Eidsmore, M. Wang, P. Dutov, C.D. Modrich, O. Antipova, J. McDonald, S. Satapathy, "X-ray diffraction reveals blunt-force loading threshold for nanoscopic structural change in *ex vivo* neuronal tissues," *J. Synchrotron Rad.* **26** (2019). DOI: 10.1107/S1600577518015035



# DOE CYBER SECURITY AUDIT 2018

## Good results this time. We can't stand still.

- A team of 18 from DOE on-site from October 15 to 18, with weeks of preparatory work
- We were warned the APS accelerator network was a large area of focus
- Management Assessment (MA) by ANL Security and Cyber Security performed in preparation
- DOE Audit – No findings for APS!
- MA and our own preparation raised some improvement opportunities
  - Tightened firewall rules *<done>*
  - Removing internet access from the accelerator subnets *<in process>*
  - Restrict write access through PV gateways to those essential for operations *<in process>*
  - A documented approval process for changes to PV gateway rules *<in process>*
  - A documented approval process for access to the accelerator networks, with periodic renewal *<in process>*

# APS OPERATIONS STORAGE SPACE REDUCTION UPDATE

- Effective January 31, space returned to ANL: 15088 sq. ft. (Bldgs. 335, 364, 365, 375)
  - Provided 3400 sq. ft. of temporary space in Bldg. 335 for APS-U
- New storage space acquired: 5553 sq. ft. (Bldg. 363B)
- 26% net reduction so far: 9535 sq. ft. - goal was 20%
  - Estimated annual savings: \$228,463
- Recycled over 65,000 lb of copper and aluminum
  - Proceeds: ~\$125,000 used to fund building improvements below
- Building improvements:
  - Bldg. 378: new & improved Controlled Area for storing activated components, epoxy floors, new LED lighting
  - New pallet rack shelving in Bldgs. 378 and 363B, new doors and Cardkey entry in process, installation of light switches (were breaker operated)
- Associated activities:
  - Identification of special process spares, CSI/property & their owners
  - Surveying & disposal of Richardson material, electronics disposal, documentation associated with disposal of any/all of the above



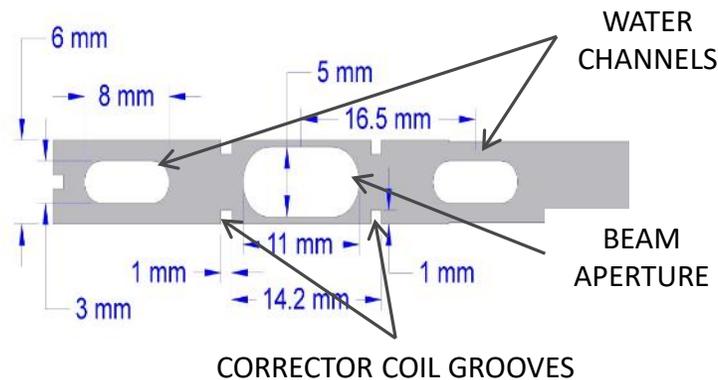
Bldg. 363B



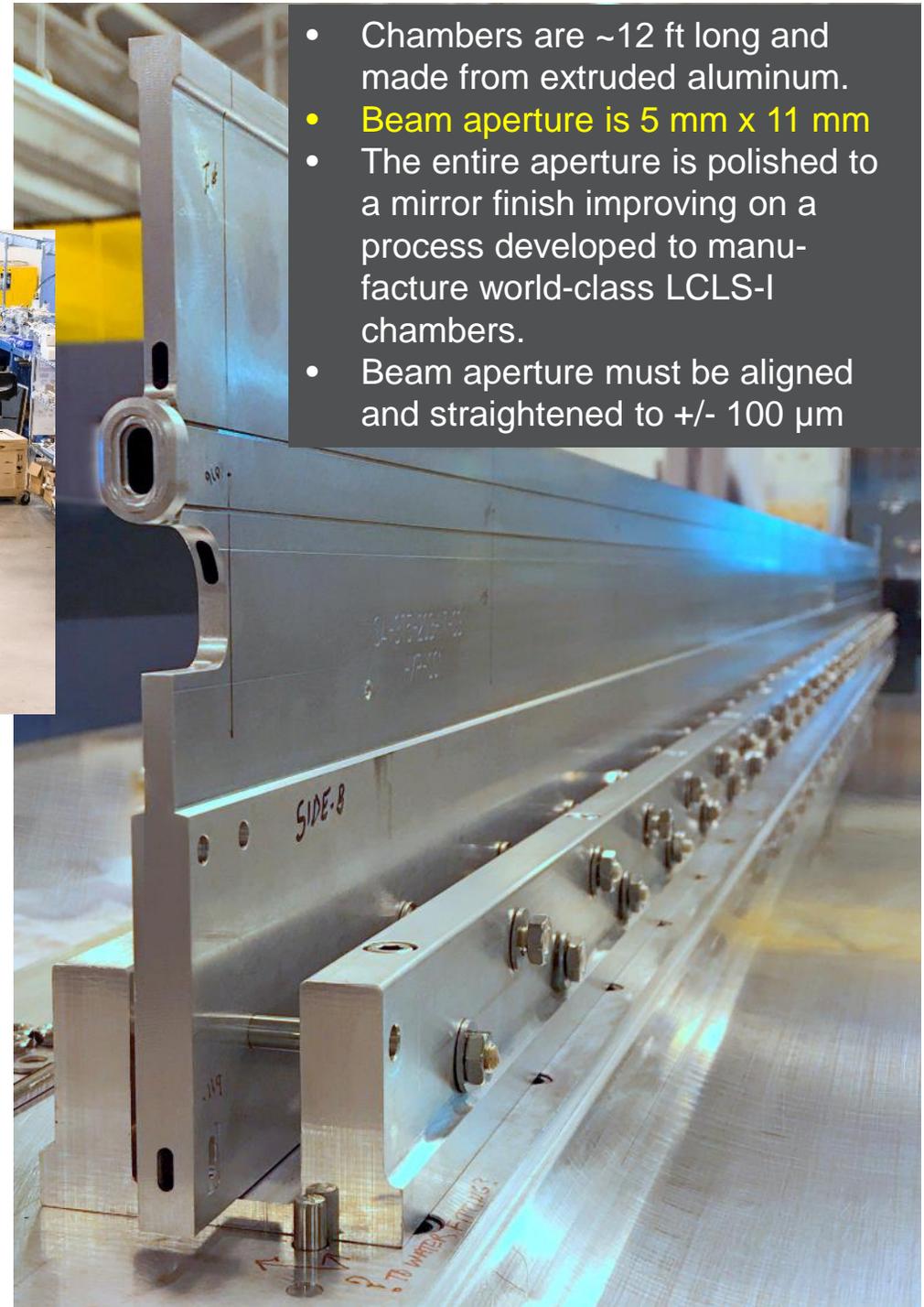
Bldg. 378

# COMPLETED DESIGN, CONSTRUCTION OF LCLS-II ID VACUUM CHAMBERS

- Delivered 26 soft x-ray and 39 hard x-ray undulator vacuum chambers to SLAC
- Completed in August 2018
- The ~\$4M project involved ~40 matrixed people over a 4-year period.
- Production of the 65 chambers took advantage of in-house expertise and best-in-class facilities
- **Major contributors to the success of this effort : MED, MOM, DD, Safety, TSS, Central Shops**



- Chambers are ~12 ft long and made from extruded aluminum.
- **Beam aperture is 5 mm x 11 mm**
- The entire aperture is polished to a mirror finish improving on a process developed to manufacture world-class LCLS-I chambers.
- Beam aperture must be aligned and straightened to +/- 100  $\mu\text{m}$



# MAGNETIC DEVICES GROUP SUPPORTS ADVANCES AT LCLS

## LCLS-II HXU Tuning

Horizontal-gap concept pioneered at APS, adopted by LCLS-II

Received 3 undulators. Completed HXU-019 tuning.

HXU-020 tuning is in progress

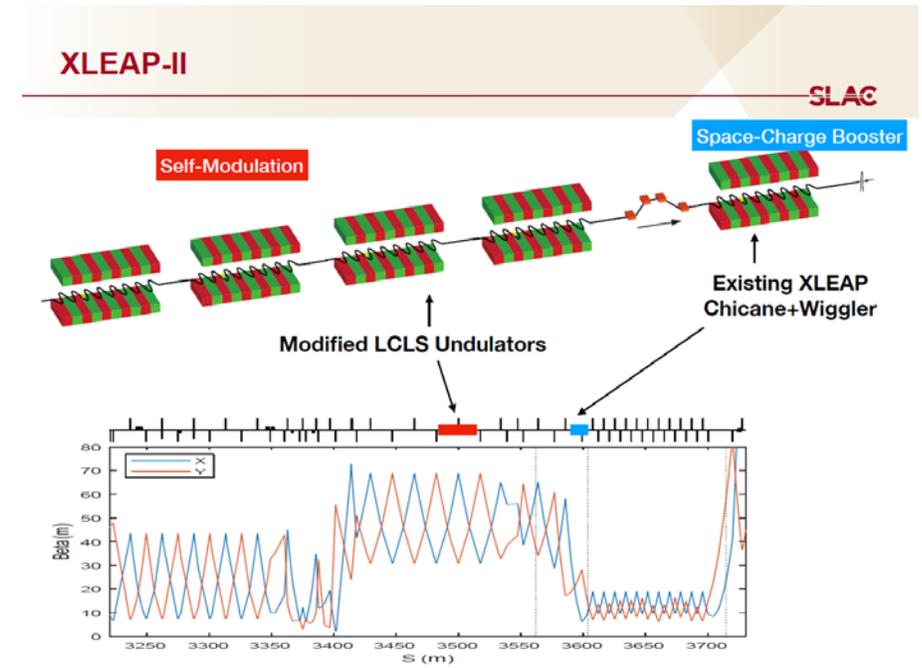


Kyle McCombs from LBNL is training APS staff how to use the tuning fixtures developed by LBNL.

## xLEAP-II

Second-generation system to produce attosecond pulses in ESASE mode (Zholents, APS)

Received initial \$400k of 1.5M\$ for production of four wigglers; wiggler design is in progress



LCLS-II xLEAP-II Plans

# RF GROUP WORKS TOWARD THE POST-UPGRADE ERA

- Successful repair of Thales 352-MHz klystron used for SR/Booster
  - Cost to purchase new: ~1M\$, with uncertain delivery date
  - Burned-out center conductor re-machined
  - Reached 700 kW in rf test stand



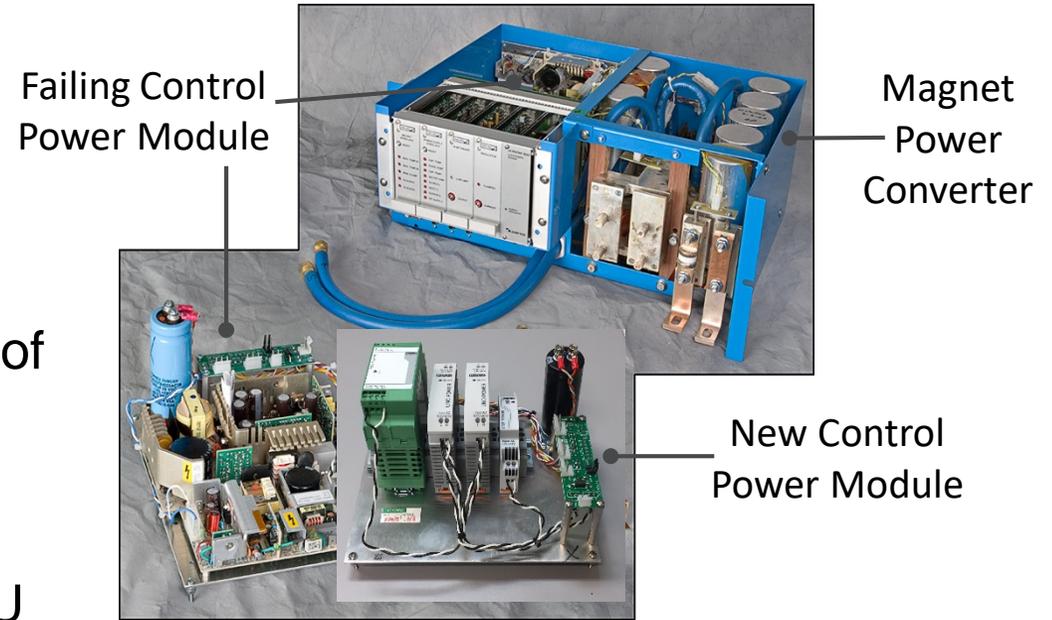
## RF (continued)

- Retuned LANL EEV 352-MHz klystrons now operating in 3 of 5 slots
  - Avoids need to procure several ~1M\$ klystrons
  - These are historically long-lived, reliable units
- Contract awarded for prototype 32-kW, solid-state 352-MHz rf source
  - This is our intended path away from reliance on hard-to-obtain klystrons
  - Promises better reliability and stability



# POWER SYSTEMS GROUP ADDRESSES A SERIOUS THREAT TO RELIABILITY

- Replaced control power modules in 400 SR quadrupole magnet power converters
  - Old modules in operation for 25 years
  - Failure rate increased recently – approaching end of lifetime
  - Failures potentially cause damage to other key components
  - Replacement needed to extend lifetime until APS-U shutdown
- Installed a new power supply for Booster focusing sextupole magnets
  - Provides more current to the magnets when needed
  - Provides much better current tracking performance
  - Supports high-charge studies for APS-U 48-bunch mode



New BSF-U PS,  $\pm 250V$ ,  $\pm 260A$

Old BSF PS,  $\pm 150V$ , 155A



# MAGNETIC DEVICES GROUP CONTINUES TO PUSH SUPERCONDUCTING UNDULATOR DEVELOPMENT

## APS SCUs:

- Two Planar SCUs and Helical SCU demonstrate reliable operation on the APS storage ring

## APS-U SCUs:

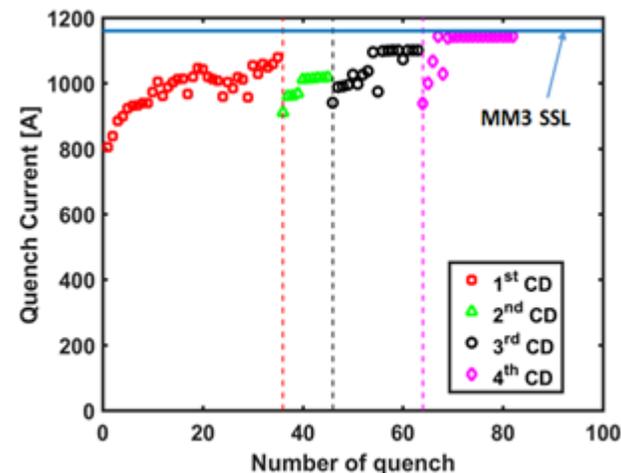
- Design of the first long undulator (two undulators in a 4.8-m-long cryostat) is being completed
- Cryostat main package (vacuum vessel, thermal shield and LHe tank) ordered
- Mechanical structures for undulator magnets being ordered
- New magnetic measurement system being tested

## APS Nb<sub>3</sub>Sn Undulator:

- Promises 30% increase in magnetic field, allowing shorter-period devices
- R&D on magnet models is in progress; the short sample limit currents have been achieved
- Conceptual design review scheduled for February



Design model of APS-U SCU cryostat.



Training curves for Nb<sub>3</sub>Sn Magnet Model 3 along with its short sample limit. The magnet has gone through four thermal cycles and reached the full transition at 1150A at the fourth cool down. This level corresponds to ~100% of the short sample limit.

# Upgraded miniXES Spectrometer at Sector 20/25 for APS-U

## Miniature emission spectrometer (miniXES) allows rapid acquisition of full spectra

### Achievement

- The use of a Pilatus 2M allows a significant improvement in the performance of miniXES (Fig. 1)
- Using 4 types of crystals, obtained simultaneous non-resonant X-ray emission (XES) of Cr K<sub>β</sub>, Fe K<sub>β</sub>, Co K<sub>β</sub>, and W L<sub>α</sub>
- Demonstrates simultaneous 2D microprobe mapping of XES spectra from four different elements

### Significance

- Demonstrates the measurement of simultaneous non-resonant XES at multiple edges/elements, and the potential of measuring sequential resonant XES at multiple edges/elements at exactly the same experimental conditions
- Demonstrates the potential of simultaneous 2D mapping of XES spectra from multiple elements
- The new design has a larger sample space needed for laser pump-probe experiments on liquid jets, high-pressure cells, and other complex sample cells
- Loading all 72 crystals for the same element gives ~7x the signal and we expect another 20x improvement at Sector 25 using a planned multilayer monochromator

### Future Plan

- Build next version miniXES with better matching of the crystals to the module layout of the Pilatus 2M

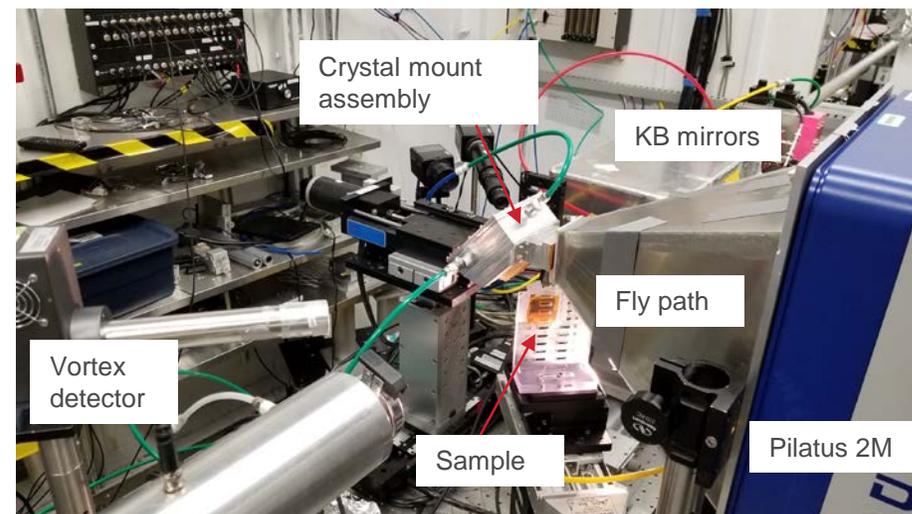


Fig. 1: Experimental setup at the APS 20-ID-C beamline

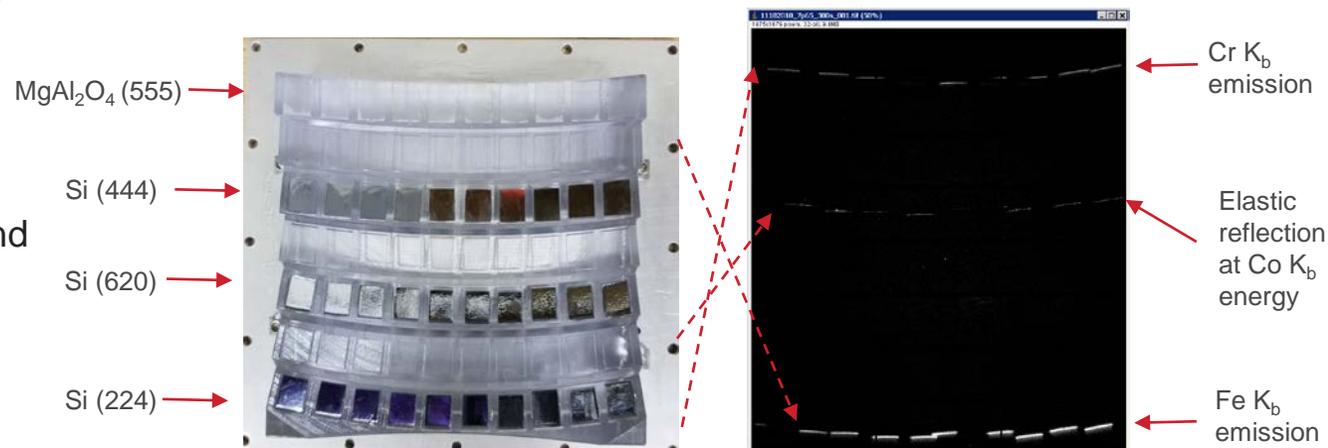


Fig. 2: Crystal mount and the Pilatus 2M Image. 72 crystals are possible. They can be identical for maximum signal or different for multiple elements. Sample: stainless steel with Fe/Cr18/Ni10; Incident energy: 7650 eV; exposure time: 300 s

# UPCOMING EVENTS

- Ongoing through April – Annual Lab Plan Preparation
- Feb 20: Argonne Board of Governors Meeting, Plenary talk on APS-U science
- Apr. 8 - 9, 2019: APS Scientific Advisory Committee Beamline Reviews, ANL
- Apr. 10 - 11, 2019: APS Scientific Advisory Committee, ANL
- May 6 - 9, 2019: APS/CNM User Meeting
- May 19 – 24, 2019: International Particle Accelerator Conference, Melbourne, Australia
- June 16 – 29, 2019: NX School, ORNL and ANL
- October 19, 2019: ICALEPCS, New York, NY