

BES Scientific User Facilities

Office Hours
April 18, 2024



U.S. DEPARTMENT OF
ENERGY

Office of
Science

[Energy.gov/science](https://energy.gov/science)

Office of Science Statement of Commitment & Other Guidance

- ◆ **SC Statement of Commitment** – SC is fully and unconditionally committed to fostering safe, diverse, equitable, inclusive, and accessible work, research, and funding environments that value mutual respect and personal integrity.

<https://science.osti.gov/SW-DEI/SC-Statement-of-Commitment>

- ◆ **Expectations for Professional Behaviors** – SC’s expectations of all participants to positively contribute to a professional, inclusive meeting that fosters a safe and welcoming environment for conducting scientific business, as well as outlines behaviors that are unacceptable and potential ramifications for unprofessional behavior.

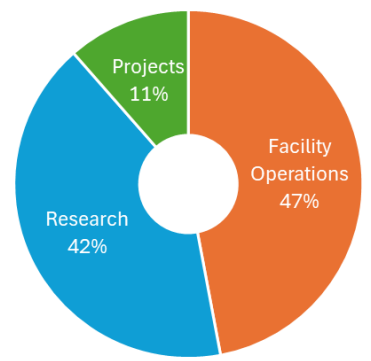
<https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/Harassment>

- ◆ **How to Address or Report Behaviors of Concern** – Process on how and who to report issues, including the distinction between reporting on unprofessional, disrespectful, or disruptive behaviors, and behaviors that constitute a violation of Federal civil rights statutes.

<https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/How-to-Report-a-Complaint>

BES Scientific User Facilities Division

FY 2024
Appropriation
\$2.625B



Office of Basic Energy Sciences
Andy Schwartz
Associate Director (A)

Materials Sciences and Engineering Division
Andy Schwartz, Director

- Materials Discovery, Design and Synthesis
- Condensed Matter and Materials Physics
- Scattering and Instrumentation Sciences

Scientific User Facilities Division
Andy Schwartz, Acting Division Director



Operations

X-ray, Neutron, Nanoscale Science User Facilities
Dava Keavney
Misha Zhernenkov
Yiping Feng (IPA, SLAC)

Accelerator and Detector Research
Eliane Lessner

Facilities Coordination; Metrics; Assessment
Van Nguyen

Construction & MIEs

LCLS-II/HE, ALS-U, CRMF, NEXT-II/III
Hannibal Joma

APS-U, PPU, HFIR-PVR, STS, NSRC-Recap
Ed Stevens

Chemical Sciences, Geosciences and Biosciences Division
Gail McLean, Director

- Fundamental Interactions
- Photochemistry and Biochemistry
- Chemical Transformations

Collaborative Research Division*
Gail McLean, Director (A)

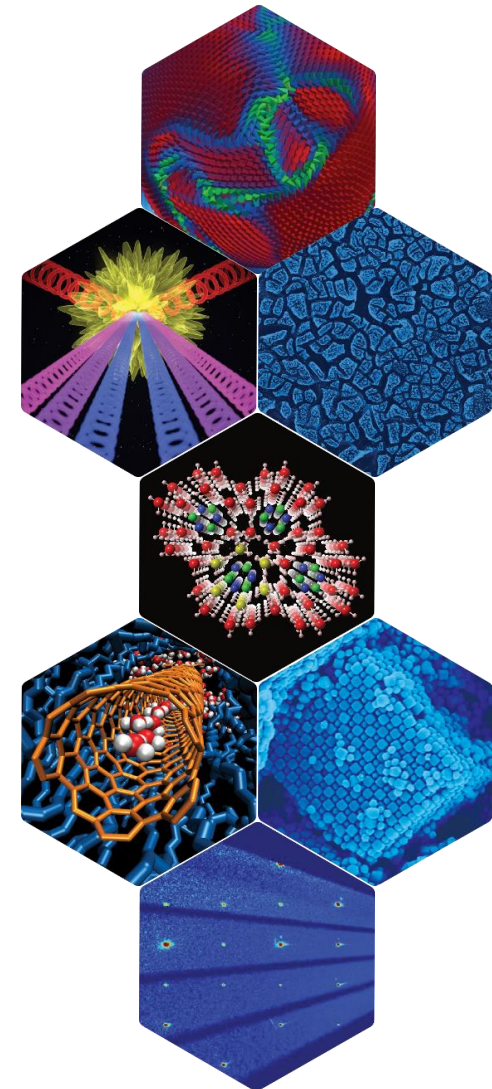
- Energy Frontier Research Centers
- Energy Earthshot Research Centers
- Energy Innovation Hubs
- Cross-SC Coordination

* Established April 2023; staffing underway

Basic Energy Sciences: Understanding Matter and Energy at Electronic, Atomic, and Molecular Levels

BES fulfills its mission through:

- Supporting **basic research**
 - “Grand Challenge” science
 - Discovery and design of materials and chemical processes that underpin a broad range of energy technologies
- Expanding research at **underrepresented institutions and regions**
- Operating **world-class scientific user facilities** in X-ray, neutron, and nanoscale science
- Managing **construction and upgrade projects** to maintain **world-leading** scientific user facilities



BES Supports 12 of DOE's Office of Science 28 User Facilities



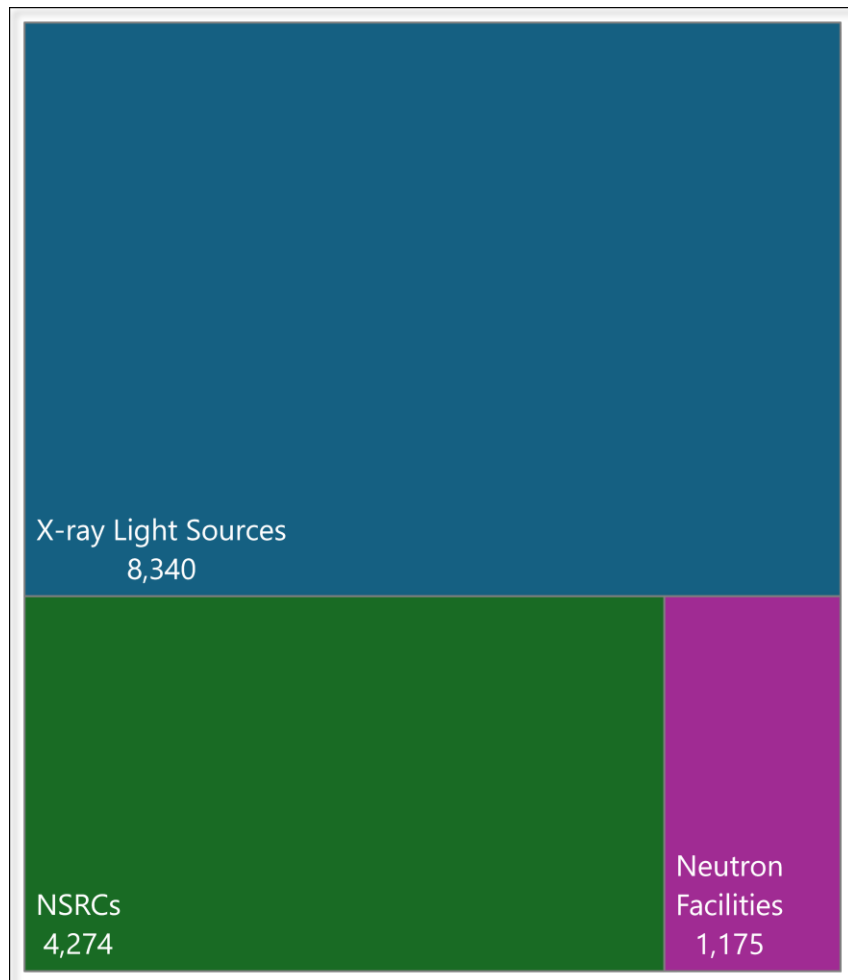
5 X-ray Light Sources (ALS, APS, LCLS, NSLS-II, SSRL)
5 Nanoscale Science Research Centers (CFN, CINT, CNM, CNMS, TMF)
2 Neutron Sources (HFIR, SNS)

User Access

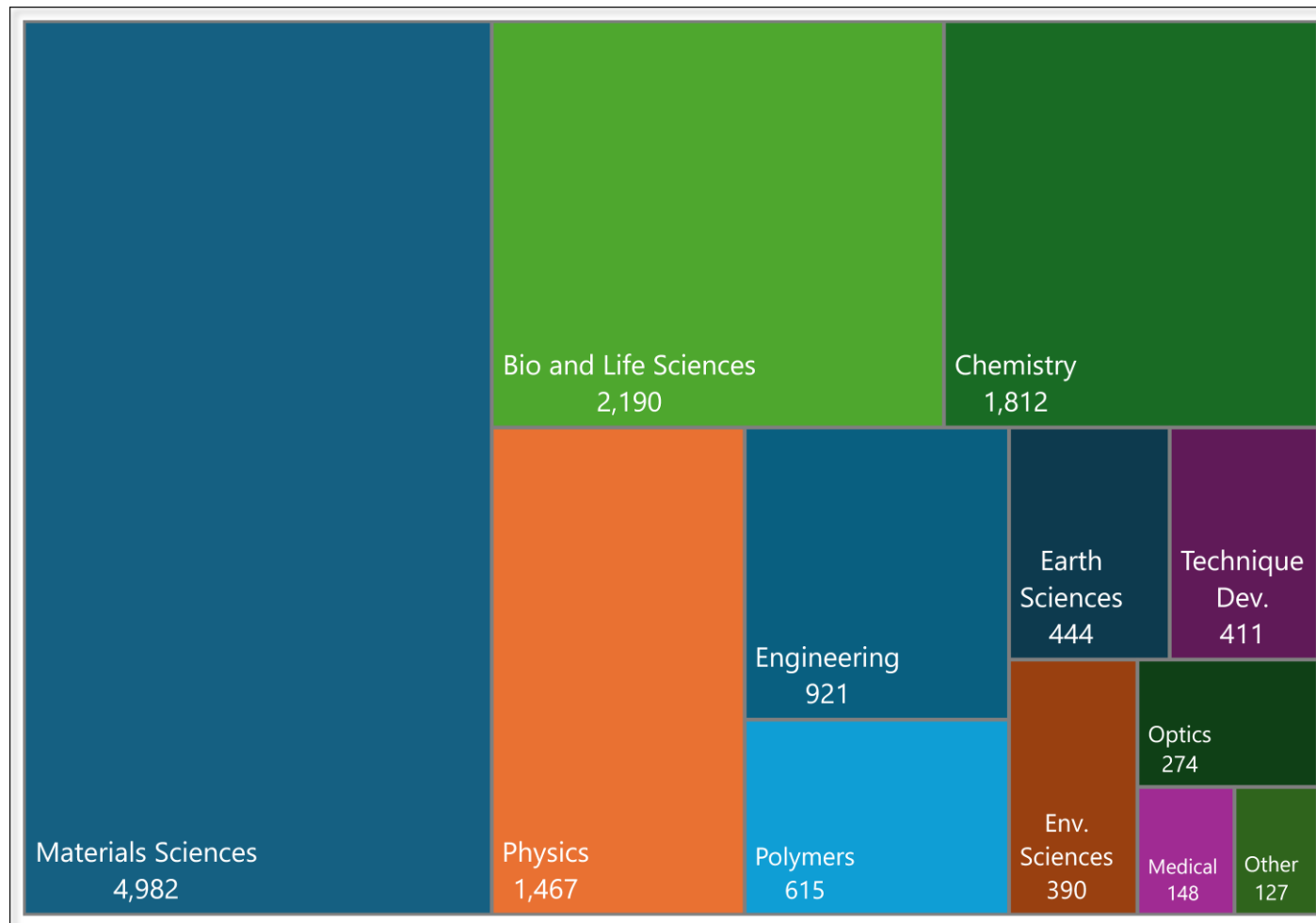
- ◆ Proposal-based access: typically, 2-3 application deadlines per year
- ◆ Available to all researchers at no cost for non-proprietary research, regardless of affiliation, nationality, or source of research support
- ◆ Access based on external peer merit review of proposals
- ◆ Proprietary research may be performed at full-cost recovery
- ◆ Remote access mode is available
- ◆ Collaboration with facility scientists an optional potential benefit
- ◆ Instrument and technique workshops offered periodically
- ◆ A variety of on-line, on-site, and hands-on training available

FY 2023 Facility Users

By facility type



By discipline



The NSRCs operate as a network of nanoscience user facilities

- Offer **unique themes and capabilities** of cutting-edge instrumentation plus highly-trained staff scientists
- **Available to inter/national users** through a competitive peer-reviewed proposal process



CFN (BNL)
Start yr 2008

- Nanomaterial synthesis by assembly, *ex* and *in situ* characterization, and computation
- Accelerated nanomaterial discovery, including use of autonomous platforms
- Nanomaterials in operando conditions



CINT (SNL/LANL)
Start yr 2006

- Electronics and photonics for QIS
- Optical nanomaterials
- Soft and hybrid materials' assembly
- *In situ* characterization in extreme environment
- AI/ML in nanoscience



CNM (ANL)
Start yr 2007

- Interfaces, interactions and assembly at nanoscale
- Nanoscale Dynamics
- QIS at nanoscale
- AI/ML for accelerating nanoscience
- Nano-enabled energy, sustainability, and preparedness



CNMS (ORNL)
Start yr 2006

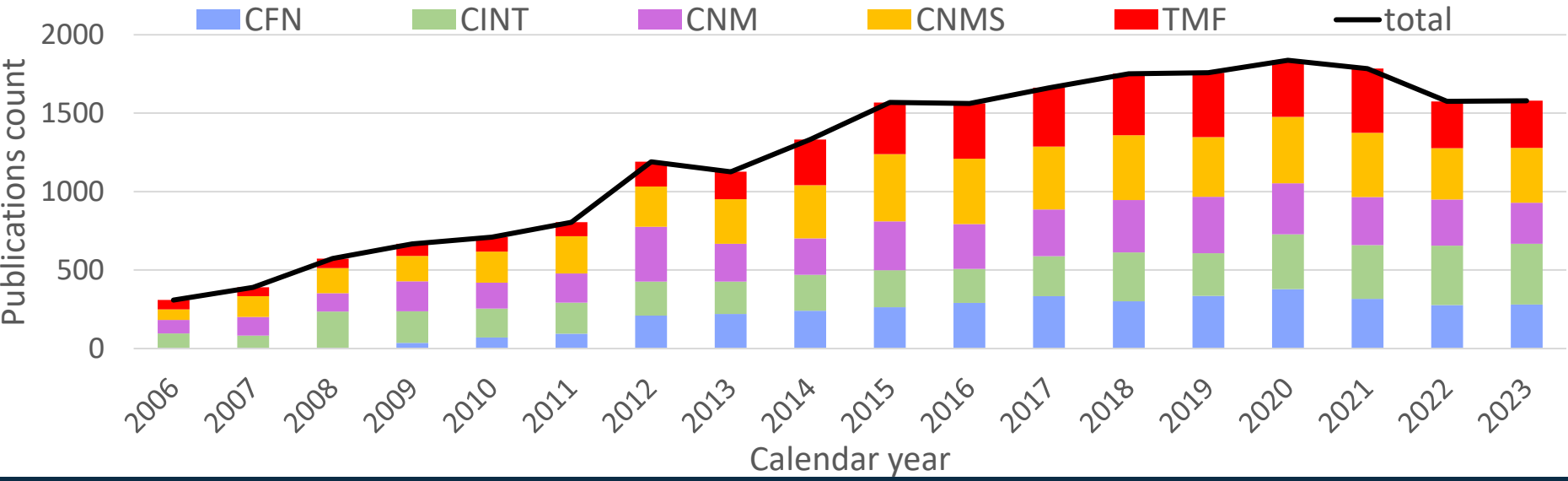
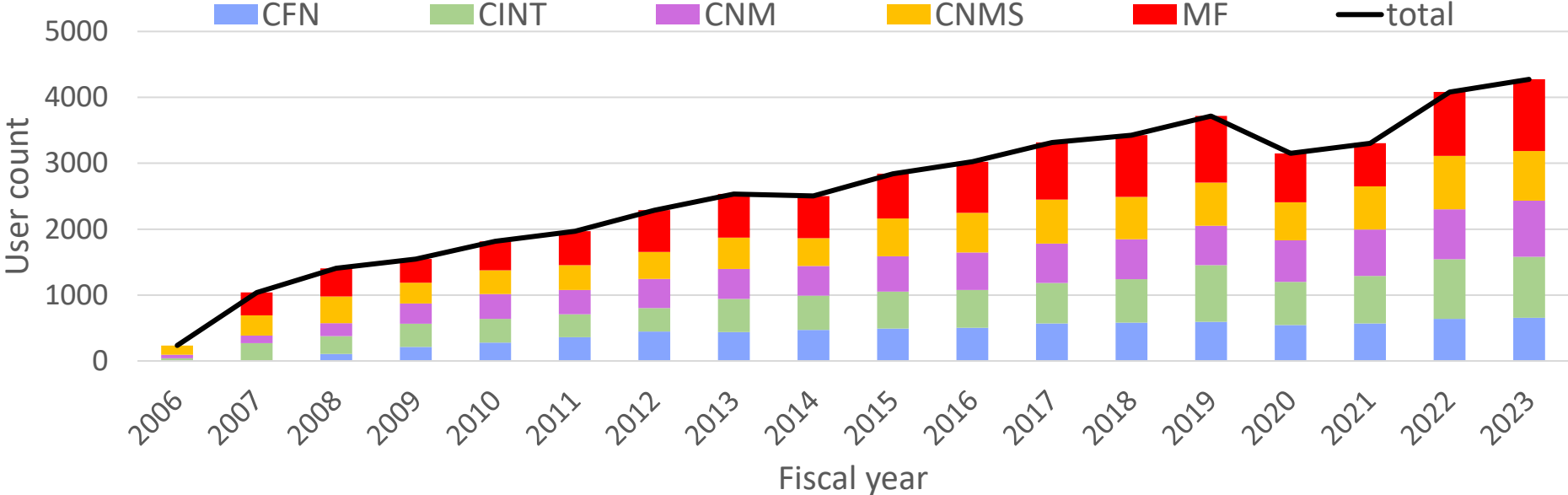
- Materials science and QIS
- Polymer and soft matter
- Neutron nanoscience
- Electron & scanning probe microscopy
- AI/ML for accelerating nanoscience
- Nanofabrication and synthesis



Foundry (LBNL)
Start yr 2006

- Soft matter synthesis and functionality
- Atomic-design of Energy and information dynamics
- Energy conversion & storage, separation
- Automated synthesis and ML characterization

Growth and Impact of User Community



Modernizing Nanoscience Infrastructure

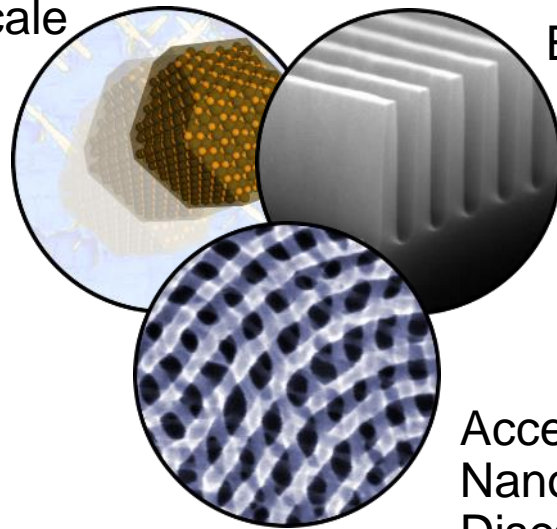
NSRC-Recapitalization will acquire & install 17 instruments across the network of NSRCs

“...a forward-looking, strategic investment in emerging areas of nanoscience, designed to ensure continued U.S. leadership in the... important materials advances of the upcoming decade.”

Total Project Cost: \$80M, Early Completion estimated for Jan 2026

NSRC-Recap adds state-of-the-art capabilities in three important areas:

Decoding Nanoscale Dynamics & Heterogeneity



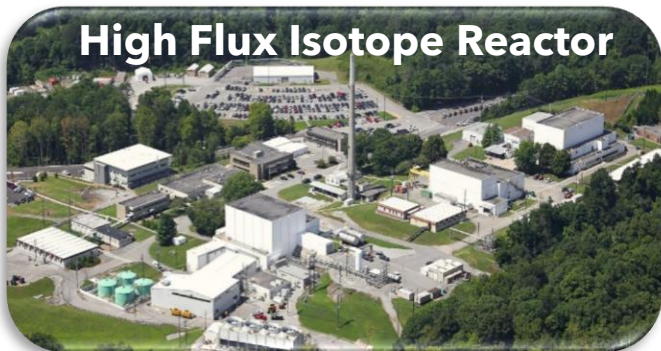
Expanding the Limits of Nanofabrication

Accelerating Nanomaterial Discovery & Design

- Advanced microscopes
- Lithography and deposition
- Robotics and multimodal tools
- Novel sample environments
- Time-resolved tools

BES Neutron Scattering Facilities

High Flux Isotope Reactor



- Current power: 85 MW
- Highest steady-state brightness of thermal and cold neutrons
- Monochromatic beams
- Polarized beams
- Parametric studies
- Kinetics
- 12 instruments

Spallation Neutron Source

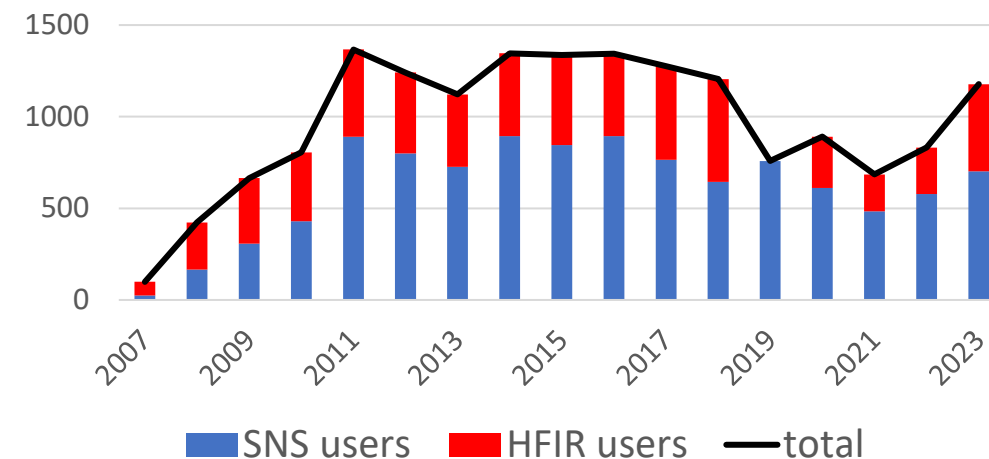


First Target Station

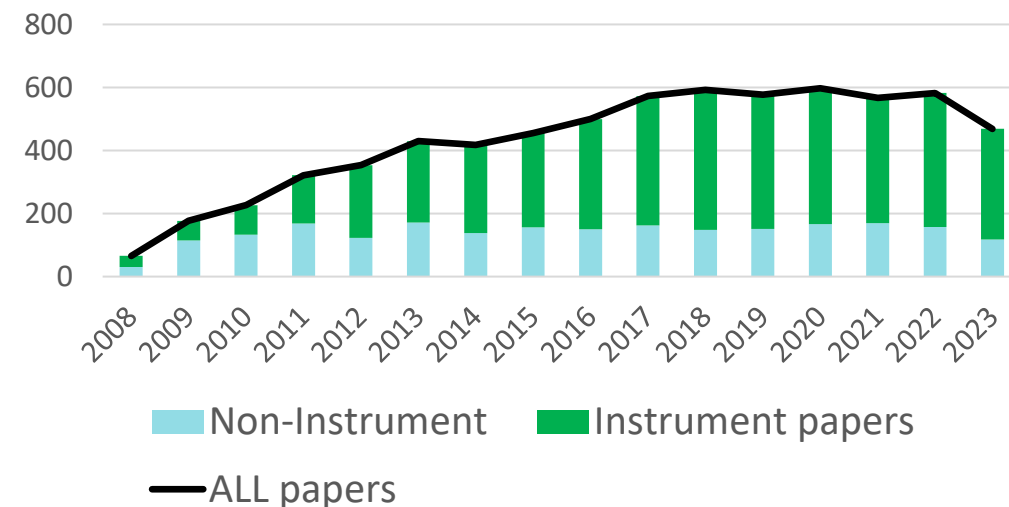
- Highest peak brightness of thermal neutrons
- High resolution
- Focused bandwidth
- High-resolution crystallography
- Fast and high-energy dynamics
- 24 instrument positions (19 built, 1 under construction, VENUS)

<https://neutrons.ornl.gov/>

Users



Publications



BES X-ray Light Sources

Five sources (four synchrotrons and one free electron laser) employing advanced spectroscopy, scattering, and imaging for research in physical, chemical, and bio sciences, geo and environmental sciences, and medical/pharmaceutical sciences.



Advanced Light Source (LBNL)

- 3rd Gen synchrotron
- Massive upgrade in 2026!
- High brightness soft X-ray source
- Material, chemical, geo and bio sciences, life sciences, pharma
- 42 beamlines



Advanced Photon Source (ANL)

- 4th Gen synchrotron
- Massive upgrade almost complete!
- High coherence, high brightness hard X-ray source
- Material, chemical, geo and bio sciences, life sciences, pharma
- 72 beamlines



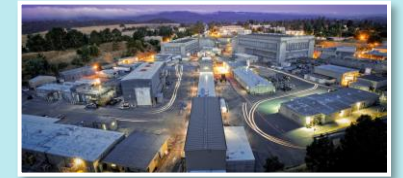
Linac Coherent Light Source (SLAC)

- X-ray laser
- LCLS-II Upgrade complete!
- Femtosecond, ultrahigh brightness pulses, high repeat rate
- Materials science, matter in extreme conditions, “molecular movies”, biosciences
- 9 instruments



National Synchrotron Light Source-II (BNL)

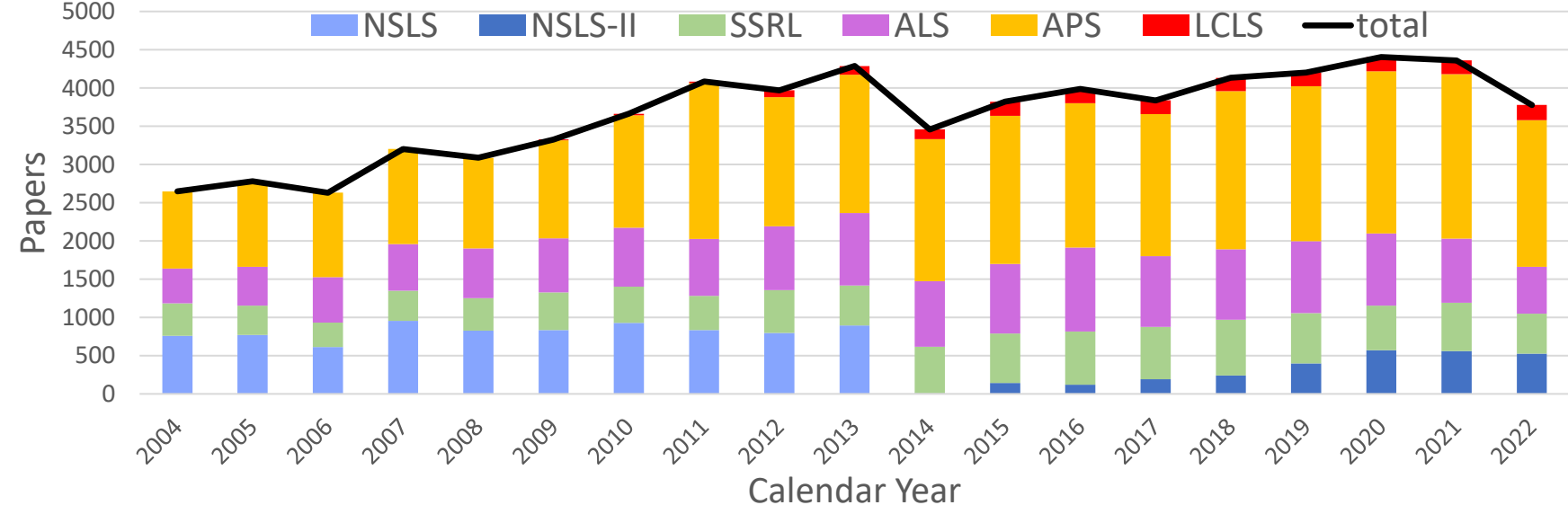
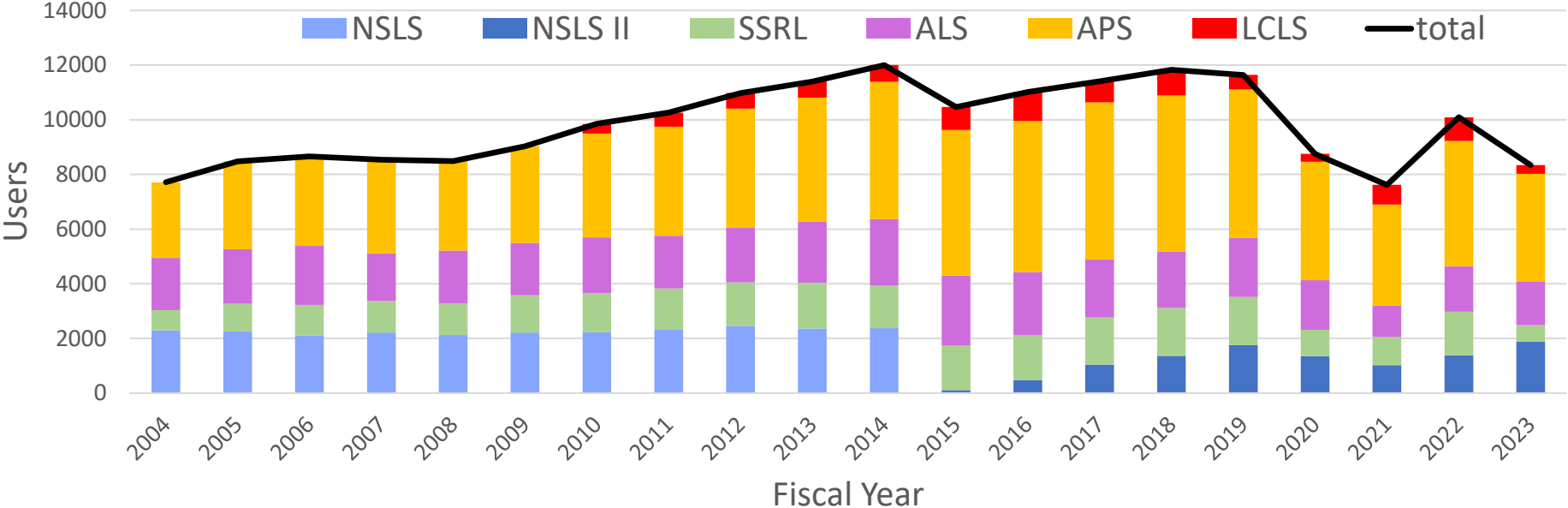
- 3.5th Gen synchrotron
- Beamline developments and expansions underway
- High brightness hard and soft X-ray source
- Material, chemical, geo and bio sciences, life sciences, pharma
- 29 beamlines



Stanford Synchrotron Radiation Lightsource (SLAC)

- 3rd Gen synchrotron
- Beamline developments and expansions underway
- High brightness hard X-ray source
- Material, chemical, geo and bio sciences, life sciences, pharma
- 27 beamlines

Growth and Impact of User Community



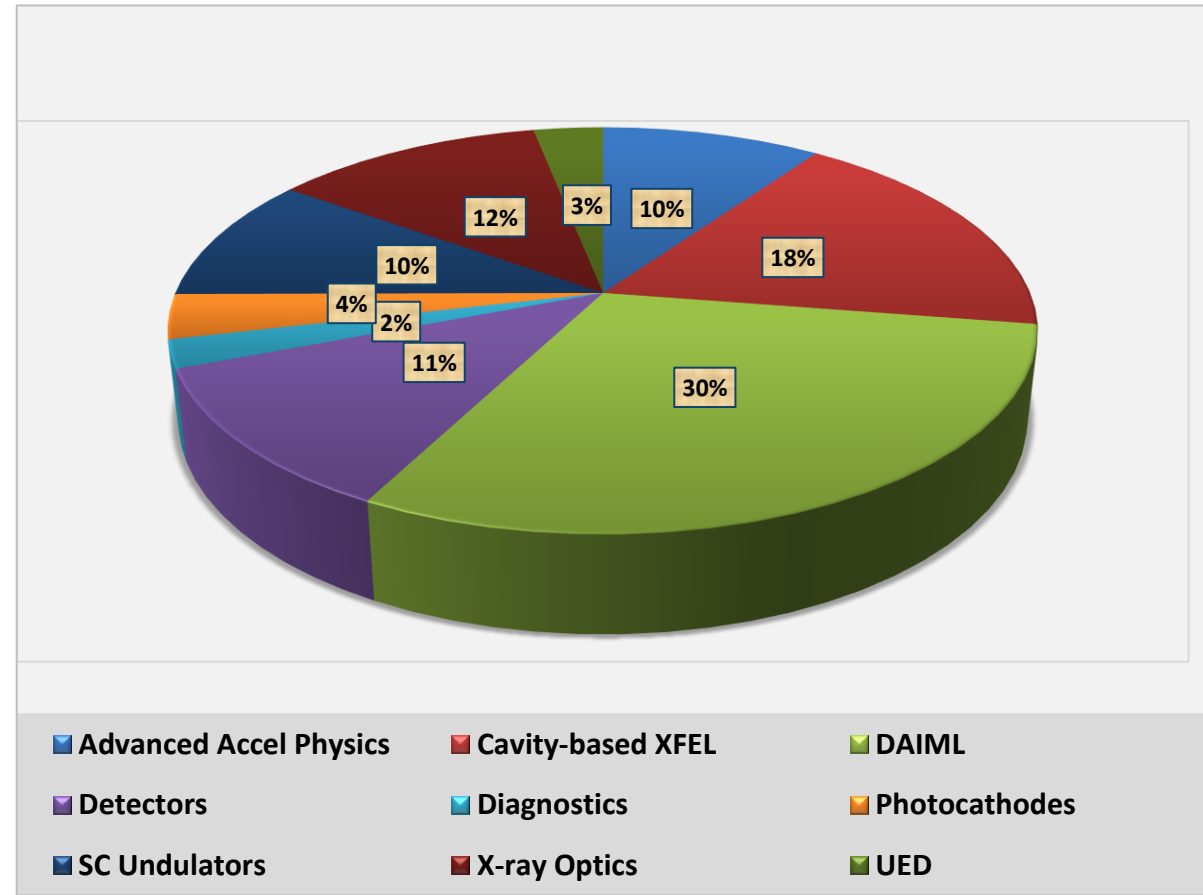
BES Accelerator and Detector Research (ADR) Program

Mission: sustain R&D in accelerators, optics, and detectors with emphasis on providing support for existing & future BES facilities

Balanced support of :

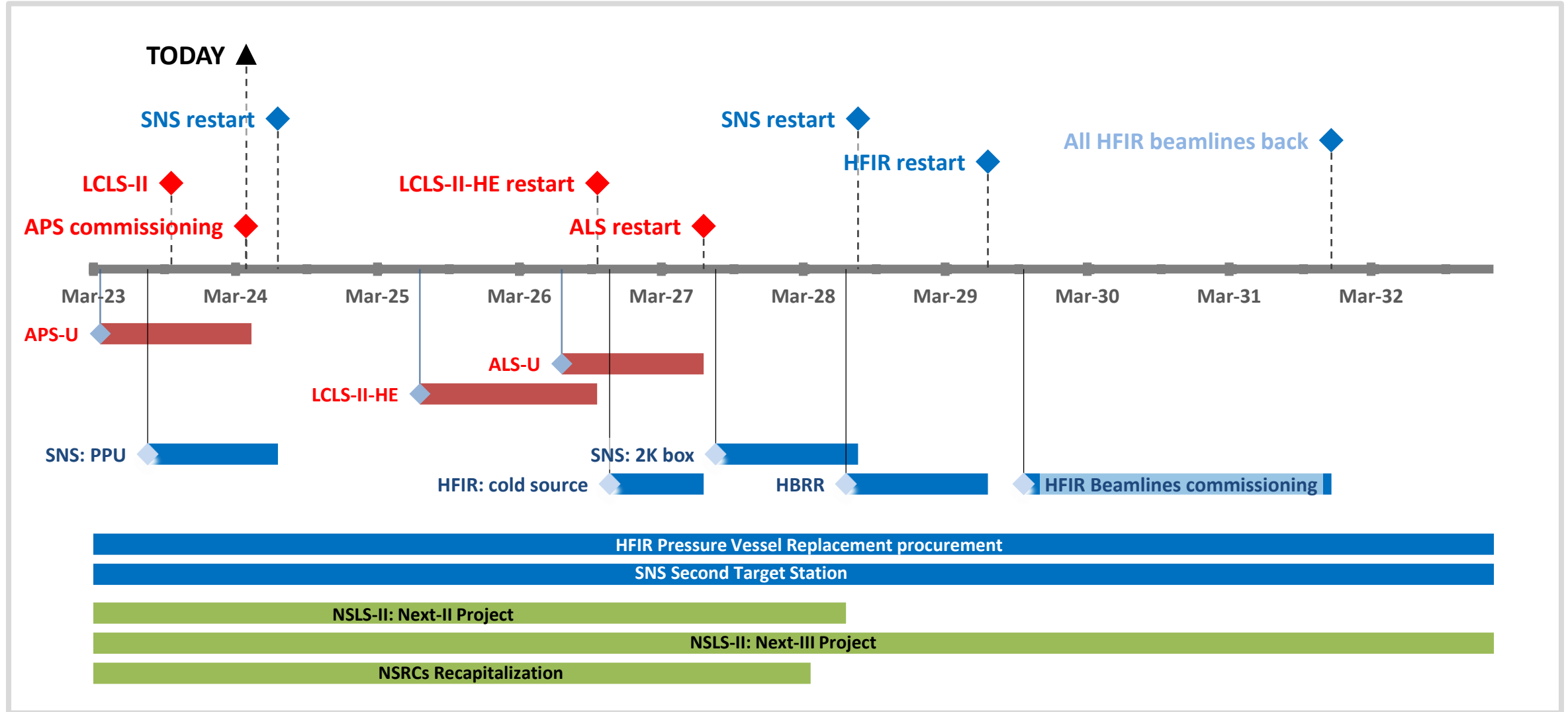
- *existing facilities to guarantee continued performance*
- *future electron, light, and neutron sources R&D through innovative concepts, modeling, design, and testing*
- *detectors for electrons, x-rays, and neutrons*
- *next generation of x-ray/neutron optics instruments*
- *AI/ML tools that address efficient extraction of critical and strategic information from large data*

according to strategic needs and fund availability



Funding Distribution:
20% University 80 % Facilities

BES User Facilities 10-years Outlook: Upgrades and Outages



Future BES Office Hours

- ◆ Upcoming dates/topics:
 - Thursday, May 16, 2024 at 2pm ET -
*Introduction to **BES Chemical Sciences, Geosciences, and Biosciences Division** - Organization, priorities, and funding opportunities*
- ◆ Additional information and registration links here:
<https://science.osti.gov/bes/officehours> (inc. this slide deck)
- ◆ Zoom Poll
 - How did you hear about these BES office hours?
 - What additional office hours topics would interest you?

Questions?