



U.S. DEPARTMENT OF  
**ENERGY**

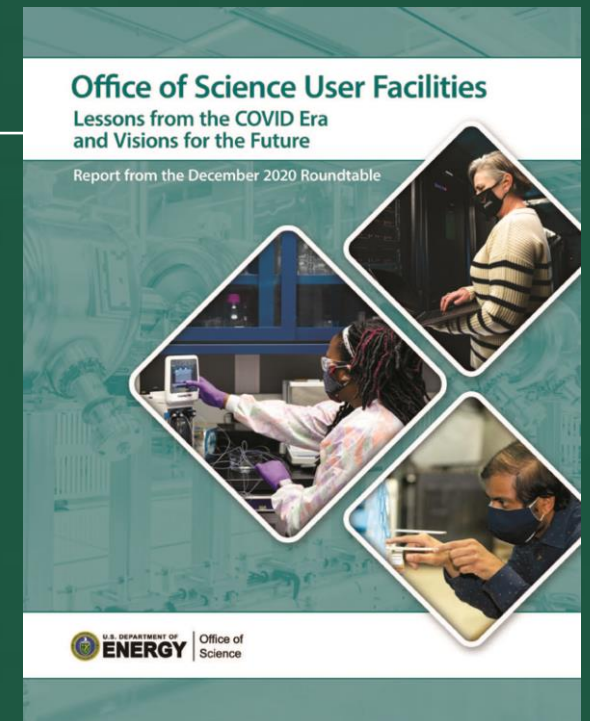
Office of  
Science

# Office of Science User Facilities: Lessons from the COVID Era and Visions for the Future

Held December 2-15, 2020

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Stephen Streiffer, Argonne National Laboratory  
BESAC Meeting August 24, 2021



# Charter

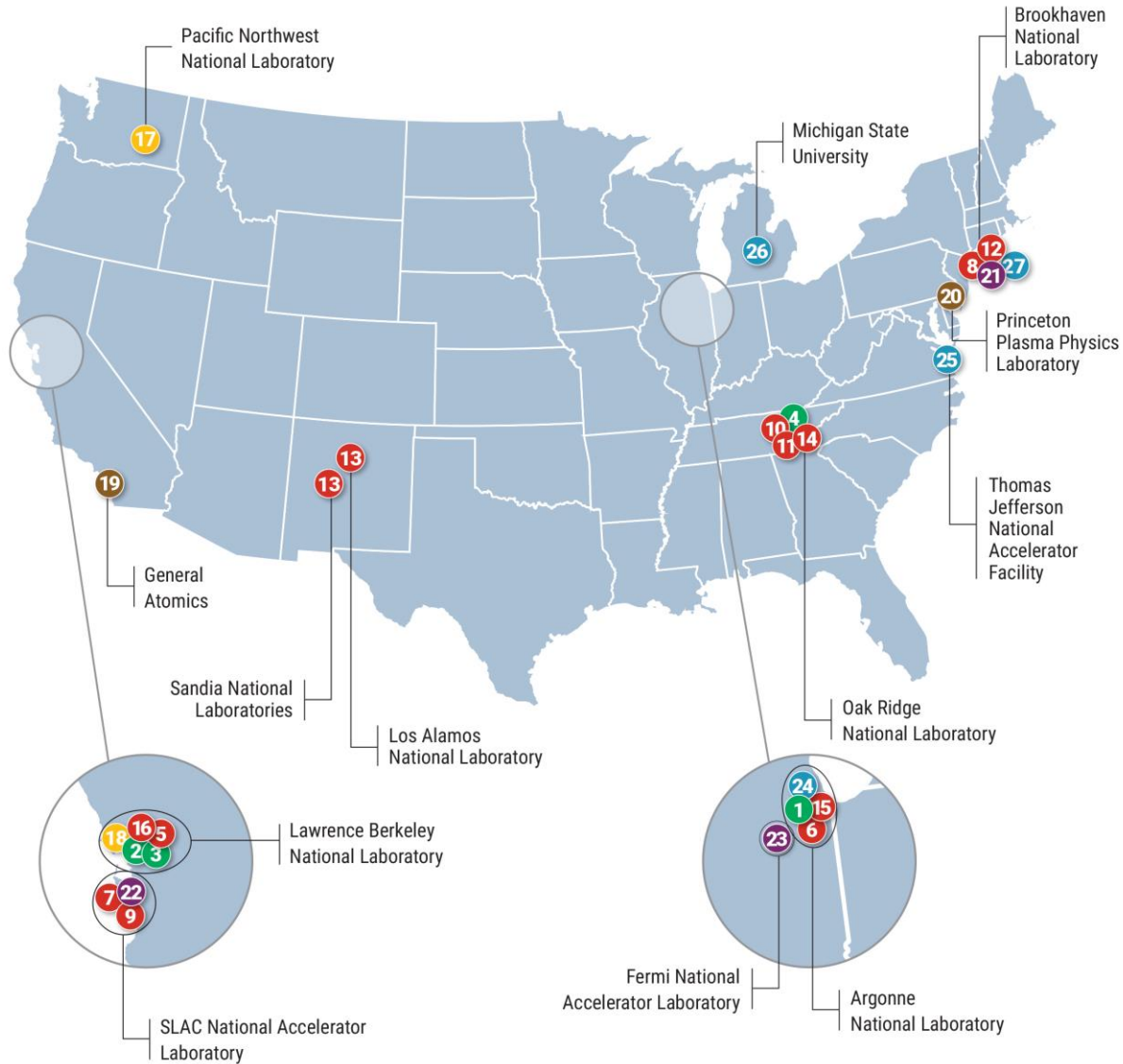
- ▶ The roundtable was chartered by the Office of the Deputy Director for Science Programs, in collaboration with the Science Programs Associate Directors and Office Directors (ASCR, BES, BER, FES, HEP, NP, Accelerators, Isotopes).

## **Motivation:**

- ▶ The COVID-19 pandemic directly impacted many SC User Facilities. In-person user experiences were canceled, postponed, abridged, or altered to a virtual mode with a broad spectrum of outcomes. User program administrators, scientific staff, and operations staff seized opportunities and encountered barriers to virtual work adaptation. New or expanded reliance on data and information networks and software was elevated, surfacing limitations.
- ▶ While we expect life to return to some semblance of normalcy at an unpredictable future point, it is imperative for the SC Programs to capture insight from user, administrator, and operator experiences to fuel both near term tactical improvements and the genesis of a long-term vision for an even stronger, more resilient, and more enabling user facilities enterprise available to an even broader spectrum of users. The COVID-19 pandemic has presented an opportunity to consider permanent changes to user facility operations.

# U.S. Department of Energy Office of Science User Facilities, FY 2021

## 33,500+ Users



### Advanced Scientific Computing Research (ASCR)

- 1 Argonne Leadership Computing Facility (ALCF)  
Argonne National Laboratory
- 2 Energy Sciences Network (ESnet)  
Lawrence Berkeley National Laboratory
- 3 National Energy Research Scientific Computing Center (NERSC)  
Lawrence Berkeley National Laboratory
- 4 Oak Ridge Leadership Computing Facility (OLCF)  
Oak Ridge National Laboratory

### Biological and Environmental Research (BER)

- Atmospheric Radiation Measurement (ARM) User Facility  
Multi-Site Global Network
- 17 Environmental Molecular Sciences Laboratory (EMSL)  
Pacific Northwest National Laboratory
- 18 Joint Genome Institute (JGI)  
Lawrence Berkeley National Laboratory

### Basic Energy Sciences (BES)

#### LIGHT SOURCES

- 5 Advanced Light Source (ALS)  
Lawrence Berkeley National Laboratory
- 6 Advanced Photon Source (APS)  
Argonne National Laboratory
- 7 Linac Coherent Light Source (LCLS)  
SLAC National Accelerator Laboratory
- 8 National Synchrotron Light Source II (NSLS-II)  
Brookhaven National Laboratory
- 9 Stanford Synchrotron Radiation Lightsource (SSRL)  
SLAC National Accelerator Laboratory

#### NEUTRON SOURCES

- 10 High Flux Isotope Reactor (HFIR)  
Oak Ridge National Laboratory
- 11 Spallation Neutron Source (SNS)  
Oak Ridge National Laboratory

#### NANOSCALE SCIENCE RESEARCH CENTERS

- 12 Center for Functional Nanomaterials (CFN)  
Brookhaven National Laboratory
- 13 Center for Integrated Nanotechnologies (CINT)  
Sandia National Laboratories and Los Alamos National Laboratory
- 14 Center for Nanophase Materials Sciences (CNMS)  
Oak Ridge National Laboratory
- 15 Center for Nanoscale Materials (CNM)  
Argonne National Laboratory
- 16 The Molecular Foundry (TMF)  
Lawrence Berkeley National Laboratory

### Fusion Energy Sciences (FES)

- 19 DIII-D National Fusion Facility  
General Atomics
- 20 National Spherical Torus Experiment Upgrade (NSTX-U)  
Princeton Plasma Physics Laboratory

### High Energy Physics (HEP)

- 21 Accelerator Test Facility (ATF)  
Brookhaven National Laboratory
- 22 Facility for Advanced Accelerator Experimental Tests (FACET)  
SLAC National Accelerator Laboratory
- 23 Fermilab Accelerator Complex  
Fermi National Accelerator Laboratory

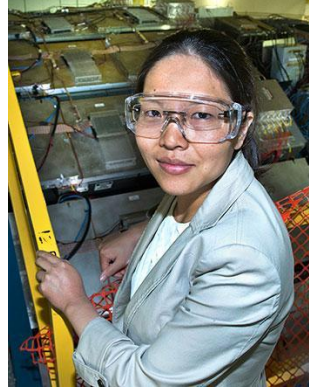
### Nuclear Physics (NP)

- 24 Argonne Tandem Linac Accelerator System (ATLAS)  
Argonne National Laboratory
- 25 Continuous Electron Beam Accelerator Facility (CEBAF)  
Thomas Jefferson National Accelerator Facility
- 26 Facility for Rare Isotope Beams (FRIB)  
Michigan State University
- 27 Relativistic Heavy Ion Collider (RHIC)  
Brookhaven National Laboratory

# Co-Chairs



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# Participants

## Co-chairs

- Nigel Mouncey, LBNL (JGI, BER)
- Lijuan Ruan, BNL (RHIC, NP)
- Stephen Streiffer, ANL (APS, BES)

## User research in virtual contexts

- Debbie Bard, LBNL (NERSC, ASCR), co-lead
- Richard Buttery, GA (DIII-D, FES), co-lead
- Ahmed Diallo, PPPL (NSTX-U, INFUSE, FES)
- Cynthia Keppel, JLab (CEBAF, NP)<sup>1</sup>
- Jonathan Lang, ANL (APS, BES)
- Emma McBride, SLAC (LCLS User, BES)
- Adam Slagell, LBNL (ESnet, ASCR)
- Indara Suarez, Boston University (CMS, HEP)
- Jerry Tuskan, ORNL (JGI User, BER)

## User research in physically distanced contexts

- Hans Christen, ORNL (SNS/HFIR/NSRC, BES), co-lead
- Christine Clarke, SLAC (FACET, HEP), co-lead
- Mike Carpenter, ANL (ATLAS, NP)
- Mary Convery, FNAL (Fermilab Accelerator Complex, HEP)
- Rajesh Maingi, PPPL (NSTX-U, FES)
- Douglas Mans, PNNL (EMSL, BER)<sup>1</sup>
- Bronson Messer, ORNL (OLCF, ASCR)
- Tom Rabedeau, SLAC (SSRL, BES)
- Adam Rondinone, LANL (CINT, BES)<sup>1</sup>
- Matthew Whitaker, Stonybrook University (NSLS-II User, BES)

## Facility operations in physically distanced or virtual contexts

- Mike Lindgren, FNAL (Fermilab Accelerator Complex, HEP), co-lead
- Gert Patello, PNNL (EMSL, BER), co-lead
- Siegfried Glenzer, SLAC (MEC, FES)
- Nicki Hickmon, ANL (ARM, BER)
- Mike Martin, LBNL (ALS, BES)
- Ben Maxwell, LBNL (NERSC, ASCR)
- Michiko Minty, BNL (RHIC, NP)
- Mark Palmer, BNL (ATF, HEP)<sup>1</sup>
- Brad Sherril, MSU (FRIB, NP)

## User training/engagement

- Rolanda Jundt, PNNL (ARM, BER), co-lead
- Lisa Miller, BNL (NSLS-II, BES), co-lead
- Ashley Barker, ORNL (OLCF, ASCR)
- Gavin Davies, University of Mississippi (Fermi UEC, HEP)
- Chuck Greenfield, GA (DIII-D, FES)<sup>1</sup>
- Terry Law, PNNL (EMSL, BER)
- Janell Thomson, ORNL (SNS/HFIR, BES)
- Xiaochao Zheng, University of Virginia (JLab User, NP)

## Computation, data, and network resources

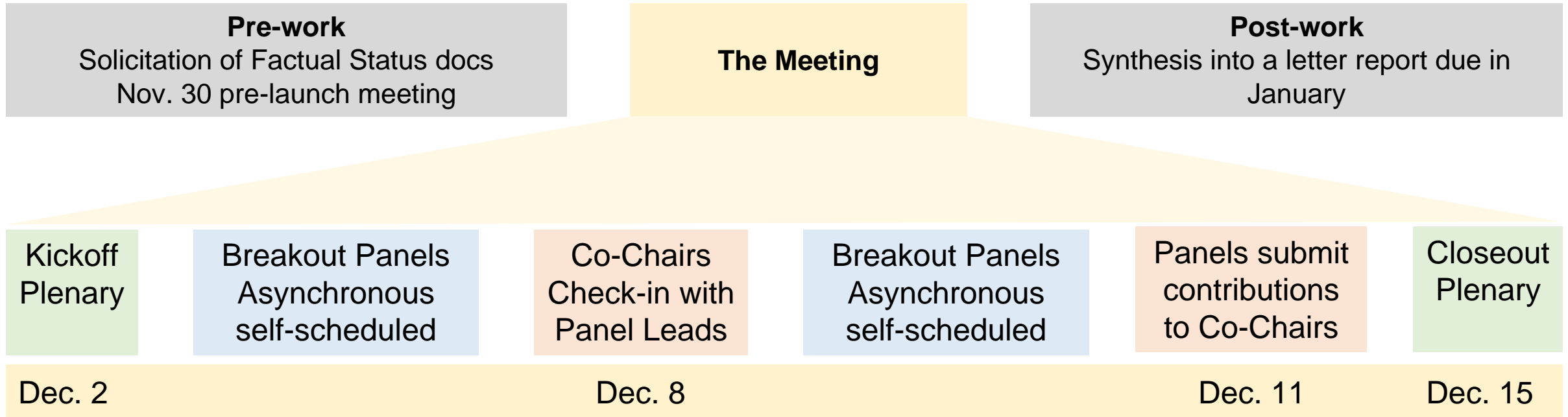
- Kjersten Fagnan, LBNL (JGI, BER), co-lead
- Jini Ramprakash, ANL (ALCF, ASCR), co-lead
- Chin Guok, LBNL (ESnet, ASCR)<sup>1</sup>
- Paul Mantica, MSU (FRIB, NP)
- Dave Schissel, GA (DIII-D, FES)
- Liz Sexton-Kennedy, FNAL (CIO, HEP)
- Jana Thayer, SLAC (LCLS, BES)

## Crosscutting issues

- Cynthia Keppel, JLab (CEBAF, NP), co-lead
- Adam Rondinone, LANL (CINT, BES), co-lead
- Chuck Greenfield, GA (DIII-D, FES)
- Chin Guok, LBNL (ESnet, ASCR)
- Douglas Mans, PNNL (EMSL, BER)
- Mark Palmer, BNL (ATF, HEP)



# Calendar



# Factual Status of User Facilities

- ▶ At the outset of this roundtable, we wanted to capture key information on status of the User Facilities → User Facility Factual Status Document
- ▶ Key questions:
  - ▶ How has the COVID-19 pandemic affected your facility?
  - ▶ What approaches are you taking to provide productive user research experiences and services in a virtual context?
  - ▶ What, if any, changes to physical access have you implemented or considered for users, vendors, or maintenance personnel?
  - ▶ Have you identified any lessons learned as a result of the COVID-19 pandemic?
  - ▶ What has the COVID-19 pandemic revealed about the needs for virtual access to computational, data management/analysis, software, and network resources or other types of instrumentation?
  - ▶ Have project award periods been extended and if so, does this impact future proposal calls and facility operating costs (including budget carryover across the fiscal year)?
  - ▶ What have been the impacts on annual user facility meetings, strategic planning workshops, and short courses and schools (to train students, early career researchers, or future users)?
  - ▶ Any other comments

# Factual Status Document - Key Themes

- ▶ Most User Facilities switched to full or predominately remote operations with limited onsite users and operated under new controls
- ▶ Virtual collaboration tools substituted for on-site presence, but significant gaps remain
- ▶ Lack of on-site presence impacts the concept of what a “user” means, in certain cases
- ▶ Concern that higher-complexity, higher-payoff experiments are being deferred at facilities with diverse experimental portfolios
- ▶ Additional burdens placed on staff to support remote Users
- ▶ Early career researchers and staff are significantly impacted
- ▶ New modalities to train Users have had to be implemented
- ▶ User outreach has become limited
- ▶ In general, scientific productivity from facilities is reduced
- ▶ Creative interactions and the progress of science severely hampered
- ▶ Cyber security and cyber productivity issues
- ▶ Remote operations have removed physical location and equity constraints and could broaden collaborations and user base



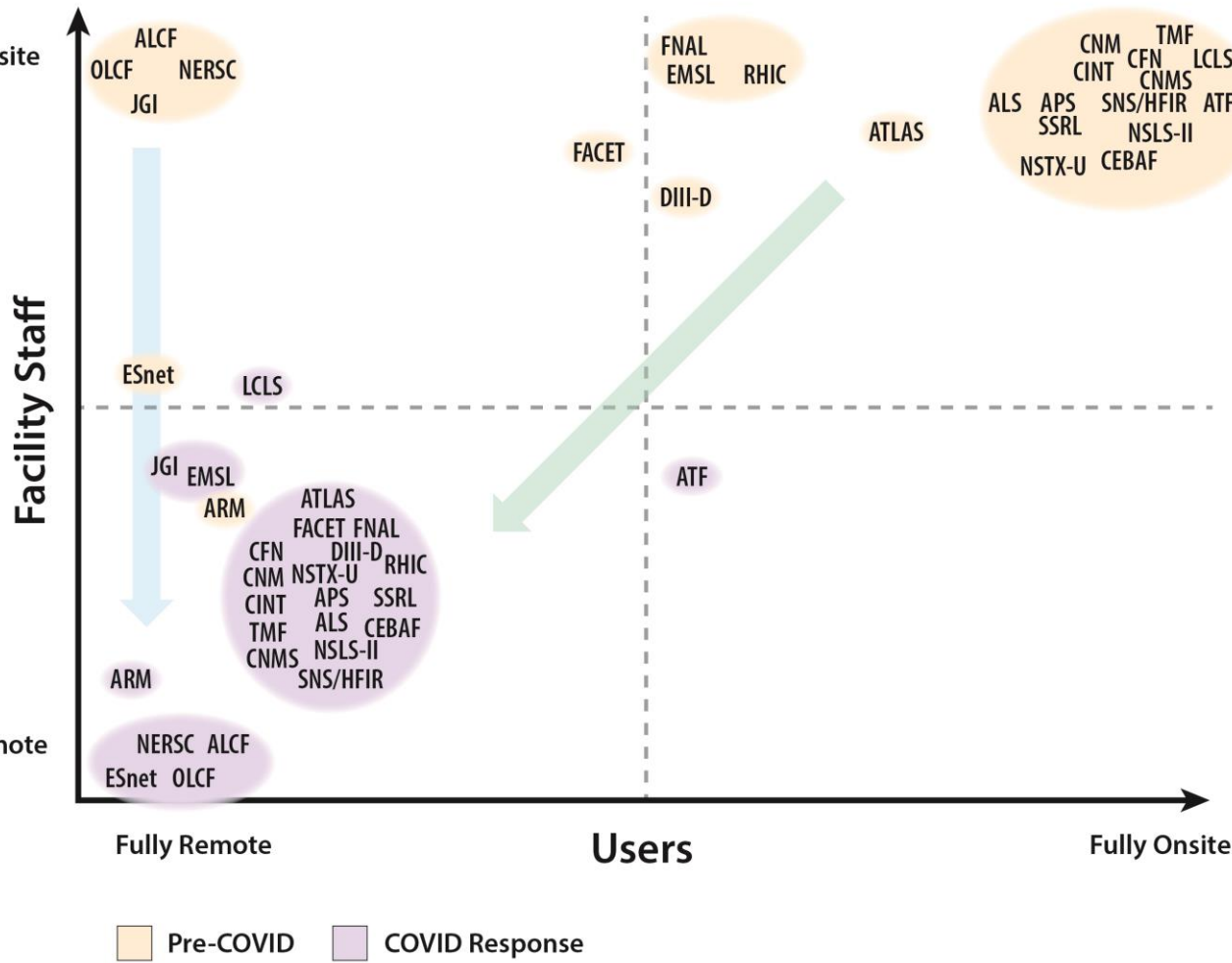


# Roundtable Panels

Panel	Panel Leads
<b>Panel 1:</b> User research in virtual contexts	Debbie Bard, NERSC Richard Buttery, DIII-D
<b>Panel 2:</b> User research in physically distanced contexts	Christine Clarke, FACET Hans Christen, SNS/HFIR
<b>Panel 3:</b> Facility operations in physically distanced or virtual contexts	Mike Lindgren, Fermilab Gert Patello, EMSL
<b>Panel 4:</b> User training/engagement	Rolanda Jundt, ARM Lisa Miller, NSLS-II
<b>Panel 5:</b> Computation, data, and network resources	Kjiersten Fagnan, NERSC Jini Ramprakash, ALCF
<b>Panel 6:</b> Crosscutting issues	Cynthia Keppel, CEBAF Adam Rondinone, CINT



# User Facilities Adapted Operations to COVID-19



- ▶ SC user facilities have diverse operation models and experienced significant disruptions because of the pandemic.
- ▶ Despite these challenges, they found ways to continue to conduct research and support users.
- ▶ There are two broad trends in how operations shifted from before the pandemic (orange circles) to fall 2020 (purple circles).
- ▶ In one case, facilities that had many remote users before the pandemic continued to support these users, but facility staff shifted to working remotely (blue arrow).
- ▶ In the other case, facilities that had mostly onsite users shifted both facility staff and users to working remotely (green arrow).



# IF virtual was as good, or better, than physical presence..

- ▶ We could better embrace the fact that increasingly it's not possible for the data to physically go to users after it's generated
- ▶ Resources devoted to travel could be used for other priorities
- ▶ The environmental impact of travel could be reduced
- ▶ There might be better configurations for facilities and operations that are more efficient
- ▶ We might be able to rely less on one-deep, expert-based approaches, and have more enduring, broader-based artifacts of the user facility universe (digital training materials, capture of experimental and facility configuration, data and design repositories,....)
- ▶ We could build more diverse, more inclusive user communities
- ▶ We could support a more diverse and inclusive staffing paradigm

# Key Opportunities Identified

- Transfer lessons learned and best practices between the different SC facilities
  - Immediate need for COVID-related issues
  - Longer-term benefit of increased inter-facility engagement
- Develop new tools to engage and support broader user communities
  - Operations and execution tools and infrastructure
  - New tools that address existing weaknesses in virtual comms, collaboration, networking
- Harmonize, coordinate, federate data management tools/strategy/solutions
- Better create and capture digital products from trainings, meetings, workshops, conferences, etc.
- Scrutinize our pre-COVID operation modes and make changes for more efficient operations and better work-life balances at facilities
- Free staff to better focus on science, by capitalizing on automation and virtualization
- Rise to our responsibility towards early career staff and users, as well as new users, to ensure they can succeed

# Concluding Remarks

- ▶ The pandemic has had profound and varying impacts on the SC user facilities.
- ▶ The balance between cost/impacts and benefit of remote user access are different for each facility.
- ▶ Opportunities have included increased breadth of access in certain cases, and a shift to a more efficient mode of operations for certain experiments.
- ▶ Costs have included increased burden on staff at facilities that historically had mostly on-site users, loss of engagement, hard but impactful experiments deferred.
- ▶ There is a loss of community built upon physical presence which puts mentoring, training, workforce development, scientific output, etc. at risk of severe damage.
- ▶ Virtual/remote access is a double-edged sword.
- ▶ We have the opportunity to capitalize on the rapid shifts necessitated by COVID-19 to move quickly to a new normal that might have been coming regardless.



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