Welcome!

XAS 2024
Fundamentals of XAS Data Analysis: A Hands-on Tutorial
Hosted by Brookhaven National Laboratory
March 19–21, 2024

Erik D. Johnson
NSLS-II Interim Director and Deputy Director for Construction

XAS 2024, March 19th, 2024
Brookhaven Lab Today

- Relativistic Heavy Ion Collider, future Electron-Ion Collider
- Chemistry
- Physics
- Instrumentation
- Computational Science
- Interdisciplinary Science Bldg. for Energy
- Center for Functional Nanomaterials
- Lab for BioMolecular Structure (Cryo-EM)
- National Synchrotron Light Source II
- Northeast Solar Energy Research Center
- Long Island Solar Farm
- Biology, More
- Environment, Nonproliferation, and More

Plus Much, Much More!
Brookhaven Lab Yesterday

BNL circa 1962
AGS brand new
BGRR operating
HFBR construction

National Synchrotron Light Source II
Enduring Priorities and Science Initiatives

Brookhaven’s enduring priorities:
• Discovery science and technology
• Transformational user facilities, including accelerator science and technology
• Applications of the Lab’s core capabilities to new opportunities

Enhanced by DOE, national lab, NYS, university, industrial, and international partners
Brookhaven National Laboratory
A Multipurpose DOE Office of Science Lab

• Managed for the U.S Department of Energy (DOE) by Brookhaven Science Associates. BSA is a partnership between Stony Brook University and Battelle.
• Operating principle: Simultaneous excellence in S&T, operations, and community engagement
• People
  • 2,900 staff
  • 140 joint faculty
  • 500 students
  • 4,400 facility users and guests
  • Pre-COVID: 30,000+ students and educators (K–12) annually
• Mission: Discovery S&T that addresses national issues
  • Pulls together large teams from labs, industry, universities
  • Builds, operates large facilities
• Budget: >$750 million
• Regional economic impact:
  • Supports over 4,700 jobs in New York State
  • Strong relationship with New York State: $400M invested by NYS since 2013
  • Long Island Railroad station near Discovery Park
National Synchrotron Light Source II

- U.S. Department of Energy Facility
  - Hosts peer reviewed science and technology research
  - Serves scientific, industrial and education communities
- World brightest synchrotron light source
  - 3 GeV electron beam energy
  - 792m in circumference
  - Designed for current up to 0.5A
  - Can host ~ 60 instruments (Beamlines)
- In eighth year of user ops
  - 29 beamlines from InfraRed to Hard X-rays
  - 4 beamlines in construction
The challenges of today are complex and multiscale and require a multimodal approach enabled by an advanced data infrastructure.

To achieve its mission, NSLS-II must remain a competitive facility delivering cutting-edge science across a wide range of photon energies.
Vision

To be an extraordinary hub for the use of synchrotron light to solve the world’s most challenging scientific problems that will improve our lives for decades to come.

NSLS-II as the hub for a network of capabilities, partners and users to tackle those problems.
NSLS-II User Program

For FY 2023
Fraction Onsite users: 77%

First-time users:
• On-site: 690
• Remote: 220
• Fraction on-site: 76%

User visits (no staff):
• On-site: 3522
• Remote: 1554
• Fraction on-site: 69%

As of October 3, 2023
NSLS-II Users
First Time Users
Insight to NSLS-II experiments since 2015

Allocated NSLS-II Proposal Titles – Subjects and Techniques

The larger the word, the more frequent. The color coding is random.

National Synchrotron Light Source II
The Power of Multimodal at NSLS-II

Reaction mechanism in aqueous batteries

*operando* studies on five beamlines using scattering (XPD), imaging (FXI, SRX) and spectroscopy (ISS, BMM) to reveal the structural, chemical, and morphological changes during battery cycling.

Verified for the first time a dissolution-deposition mechanism

Work could lead to faster charging times and longer lifetimes in aqueous batteries

But, we are missing additional capabilities that prevent our users doing the science that they need.

.... A story for another time
Sense of NSLS-II

- High demand
- High productivity
- Lots of potential
- Only about ½ built out

**NSLS-II BY THE NUMBERS**

**FY 2023**

Together, we shine light on the world’s most challenging problems

- 1,885 unique users:
  - 321 institutions
  - 211 universities
  - 33 companies
  - 42 states
  - 30 countries

- >7600 user visits

- 29 beamlines
- 20 partner users
- 5 partner beamlines

- 550 papers published
- 49% in high-impact journals
- >14,900 citations of NSLS-II papers

- ~196,000 hours of beam time requested
- ~83,000 hours of beam time used
- 2.4x beam time oversubscription rate

- >2300 proposals submitted
- >1000 proposals run

- $143.2 M spent
  - $121.8 M (BES-SUF)
  - $21.4 M (other)

**SCIENCE AREAS**

- Materials science: 57%
- Biosciences: 17%
- Environmental science: 8%
- Chemistry: 9%
- Soft matter: 5%
- Other: 4%

**RESEARCH COVERING:**

National Synchrotron Light Source II
Welcome to NSLS-II

Hopefully you can gain a sense of our current capabilities and potential opportunities for you and your work!