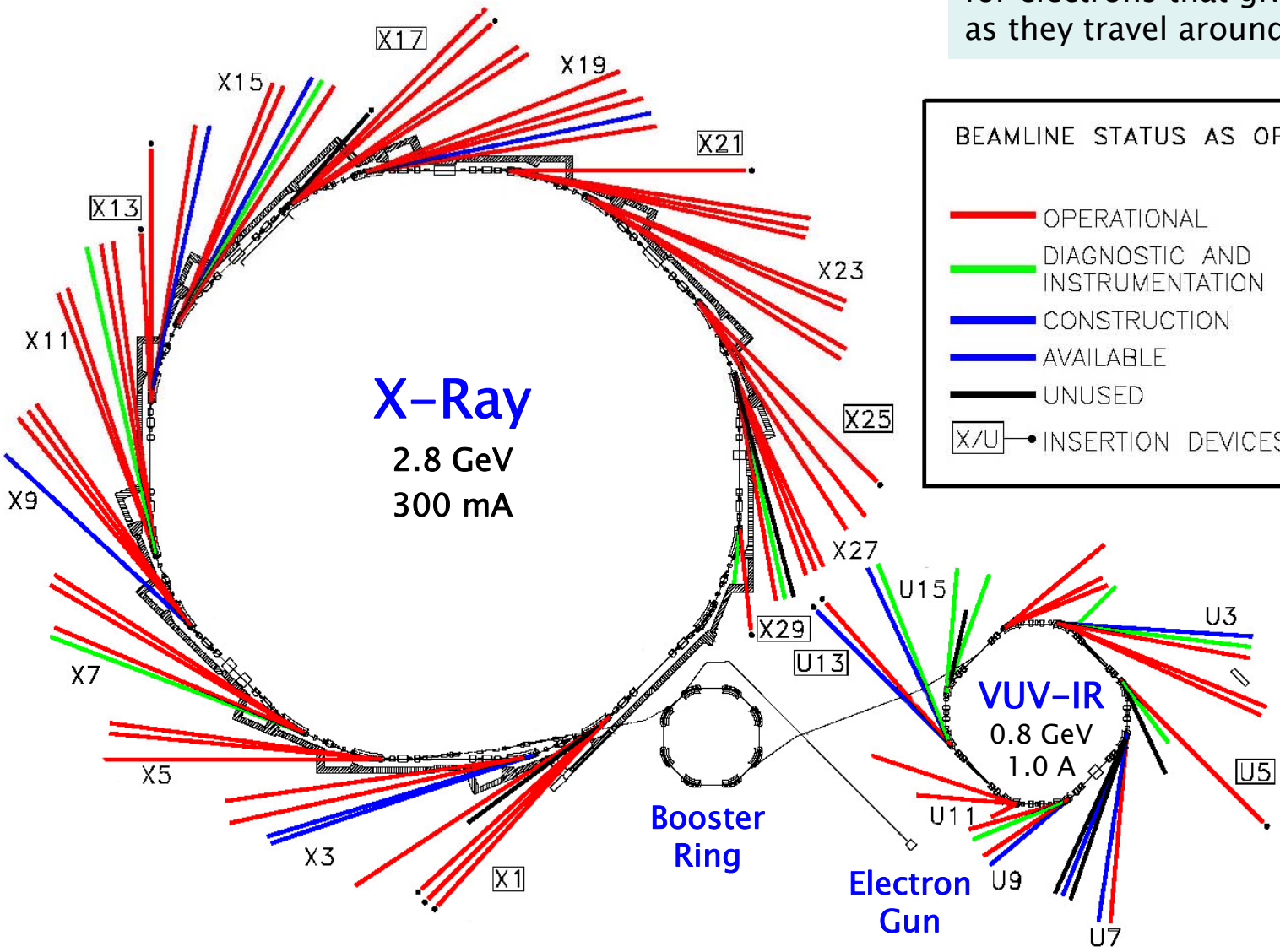
Introduction to the National Synchrotron Light Source

The Facility

A synchrotron is a storage ring for electrons that give off light as they travel around the ring.



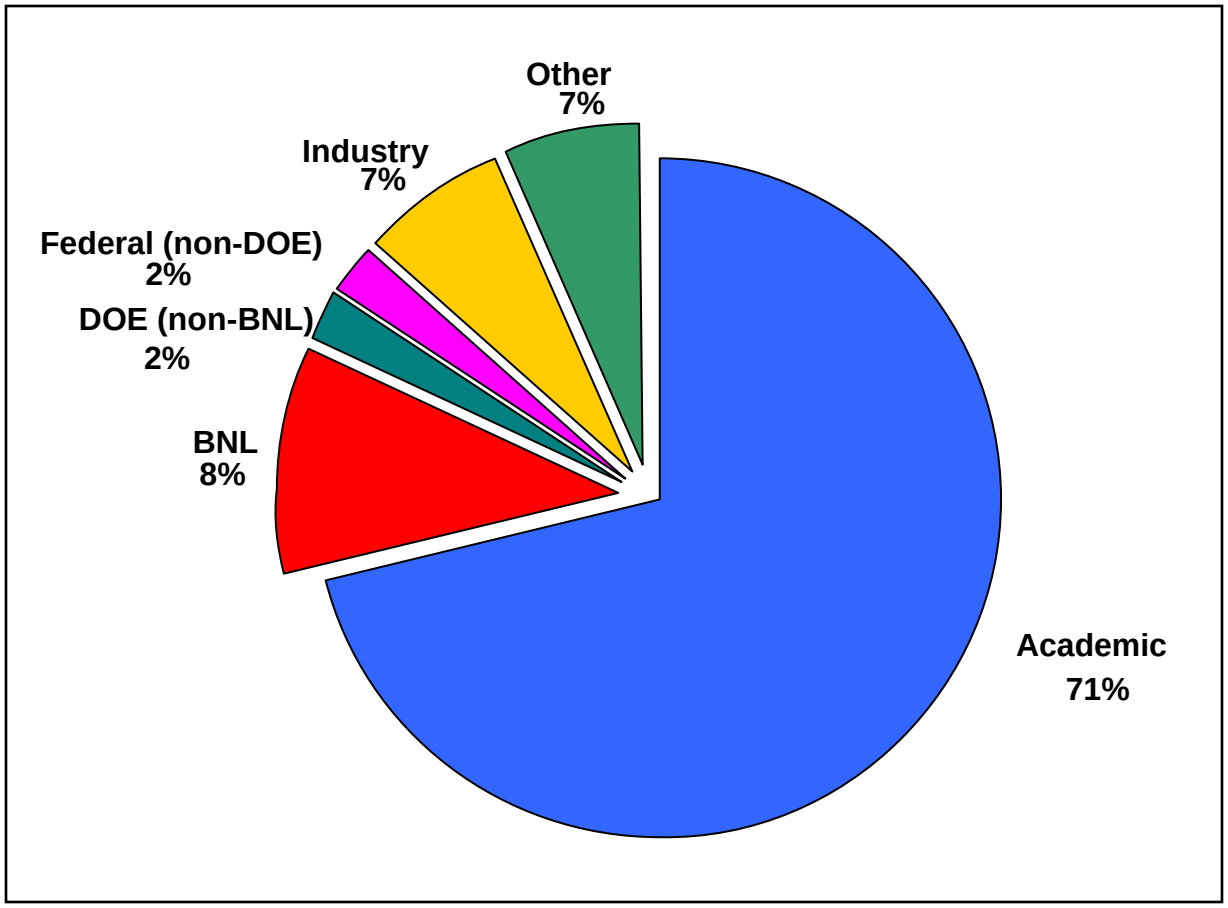
BEAMLINE STATUS AS OF JULY, 2006

	VUV	X-RAY
OPERATIONAL	14	51
DIAGNOSTIC AND INSTRUMENTATION	7	5
CONSTRUCTION	0	4
AVAILABLE	6	2
UNUSED	4	3
X/U — INSERTION DEVICES		

The Users

- Facility operates 24 hours/day, 7 days/week, ~10 months/year
- >2100 users per year (~1/3 are new users)
- Typical stay is 2-4 days (onsite housing)

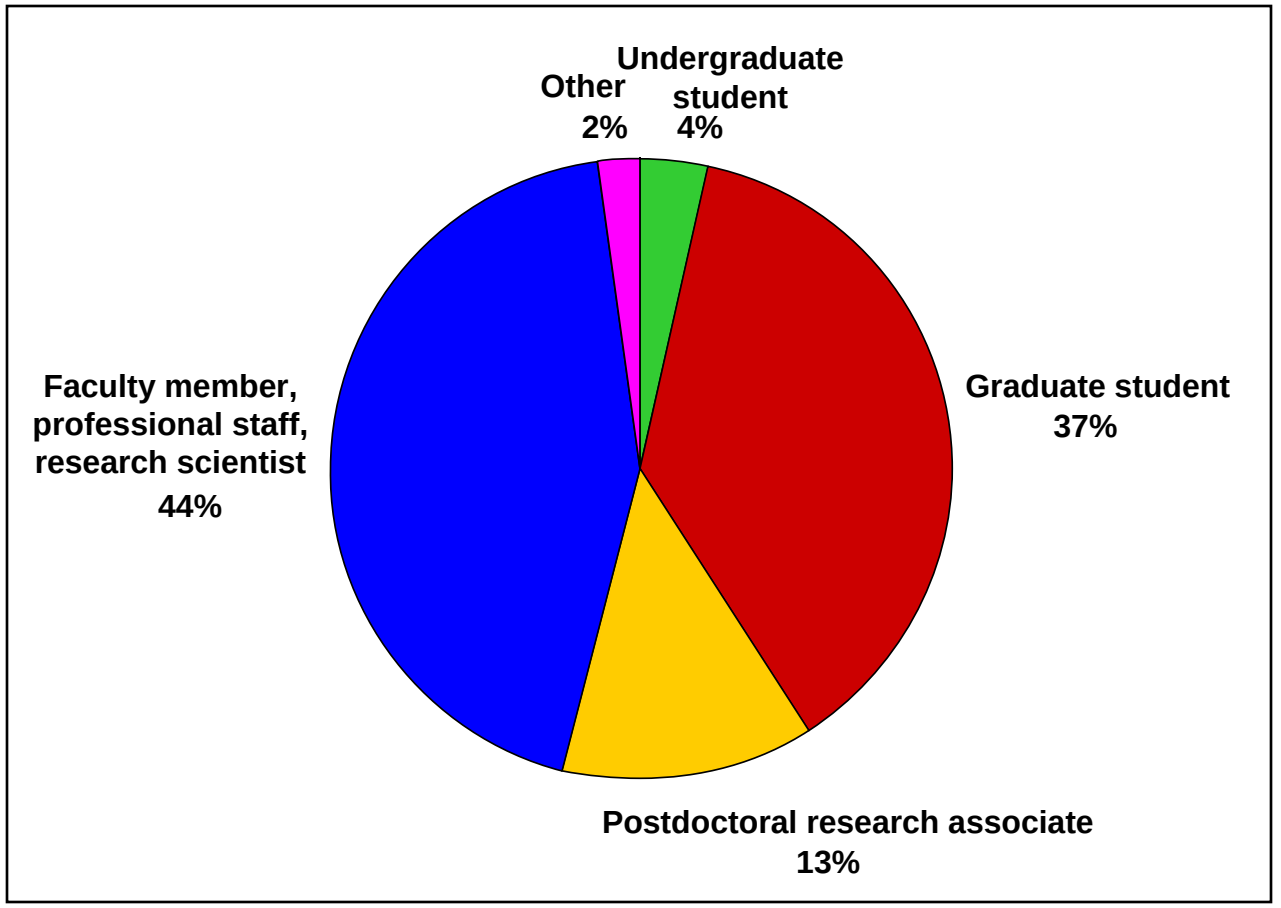
NSLS Users by Research Institution



- Large majority of users are from academia
- Industrial participation is small and diverse

FY 2006

NSLS Users by Employment Level

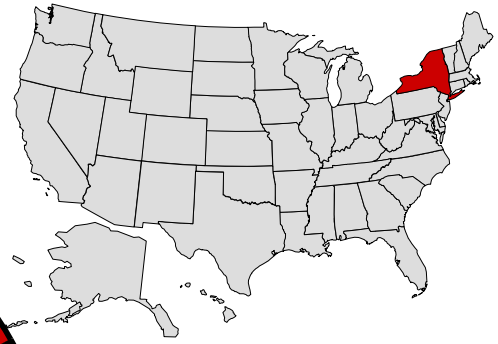


- A large number of students and postdocs work at NSLS

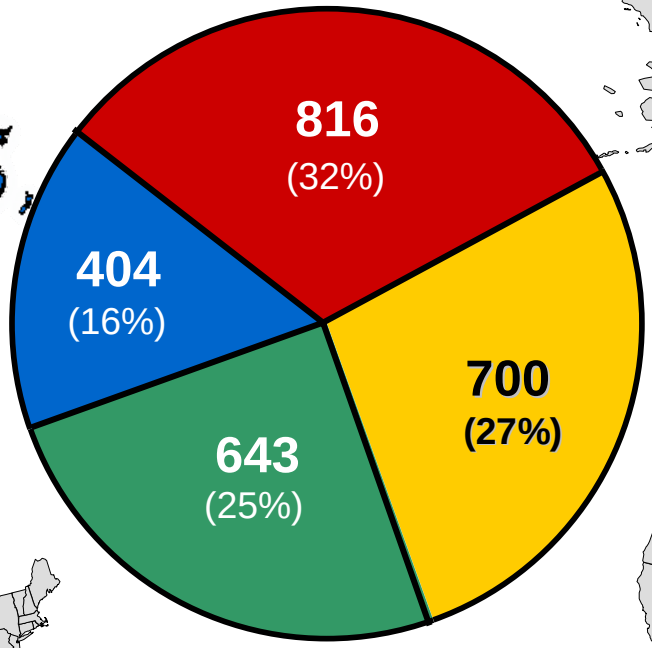
FY 2006

NSLS User Distribution

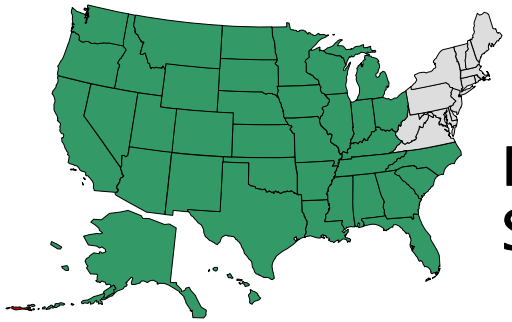
Foreign



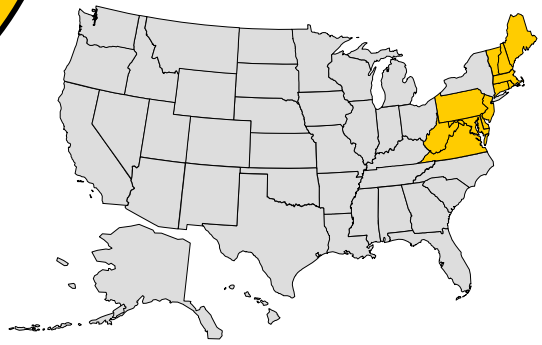
New York



Other Northeast States



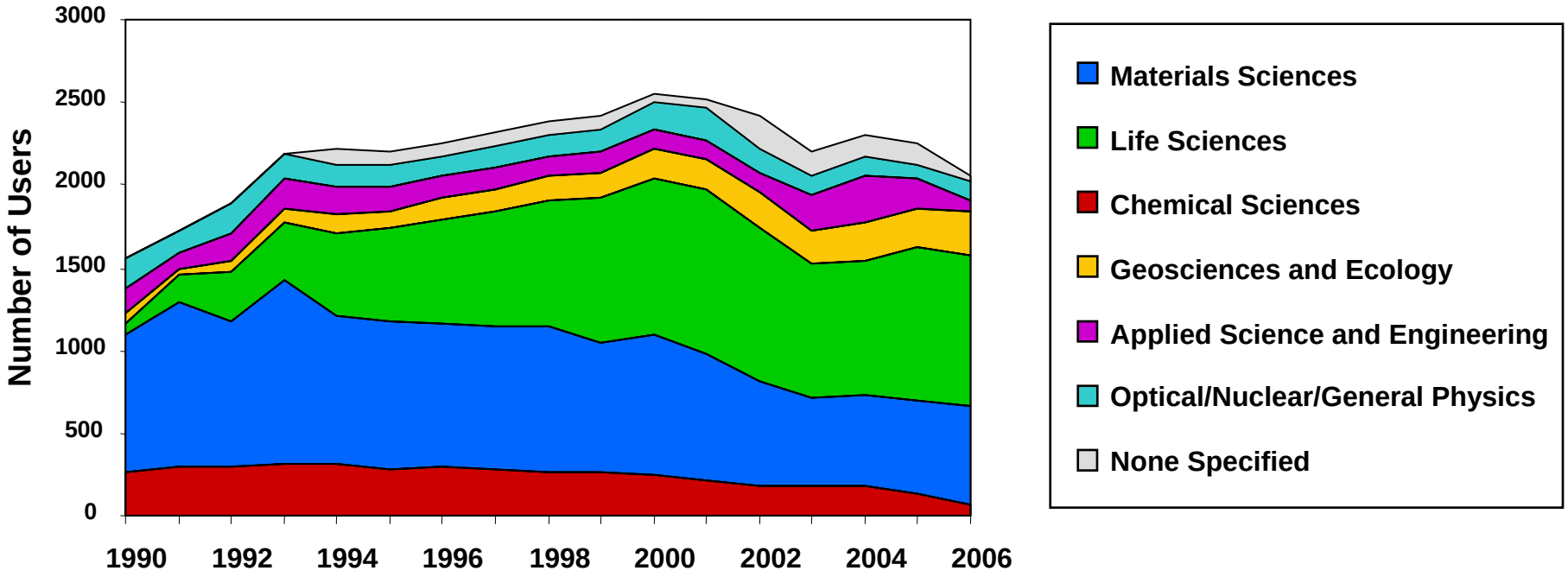
Non-Northeast States



- NSLS is primarily a regional facility

FY 2006

NSLS Users by Field of Research

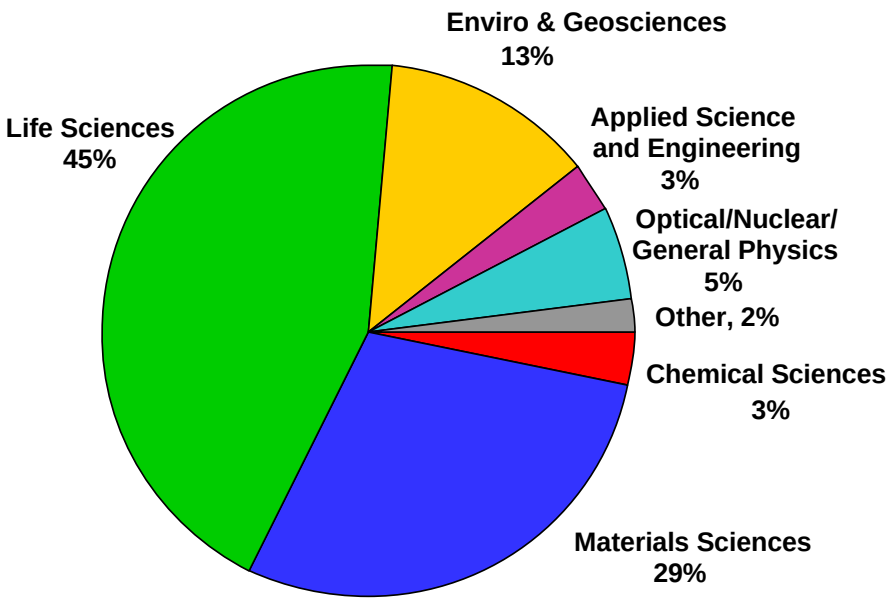


- 50% growth in last 12 years
- Strongest growth in life sciences
- Largest groups are materials and life sciences

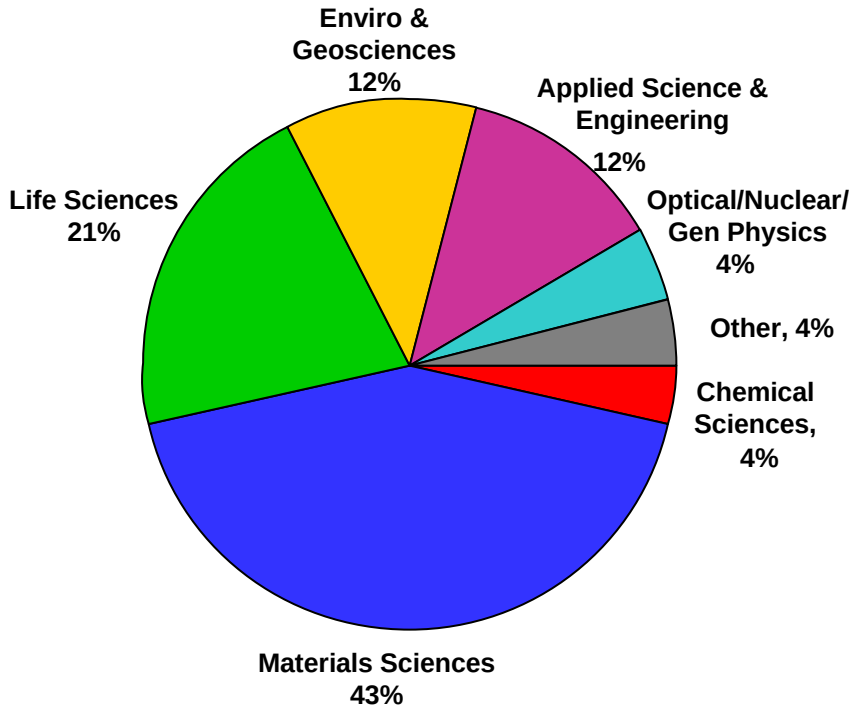
FY 2006

Beamtime Used by Field of Research

Number of Users



Beamtime Used*



*Based on running times from Safety Approval Forms

- More life science users, shorter beamtime, high-throughput
- Materials science experiments are more complicated, time-consuming

FY 2006

Major Synchrotron Techniques

SPECTROSCOPY

- Infrared spectroscopy
- Photoelectron spectroscopy
- X-ray absorption spectroscopy
- X-ray emission spectroscopy

DIFFRACTION/SCATTERING

- Protein crystallography
- Small molecule crystallography
- Powder diffraction
- Small-angle x-ray scattering
- X-ray microdiffraction
- High momentum resolution x-ray scattering

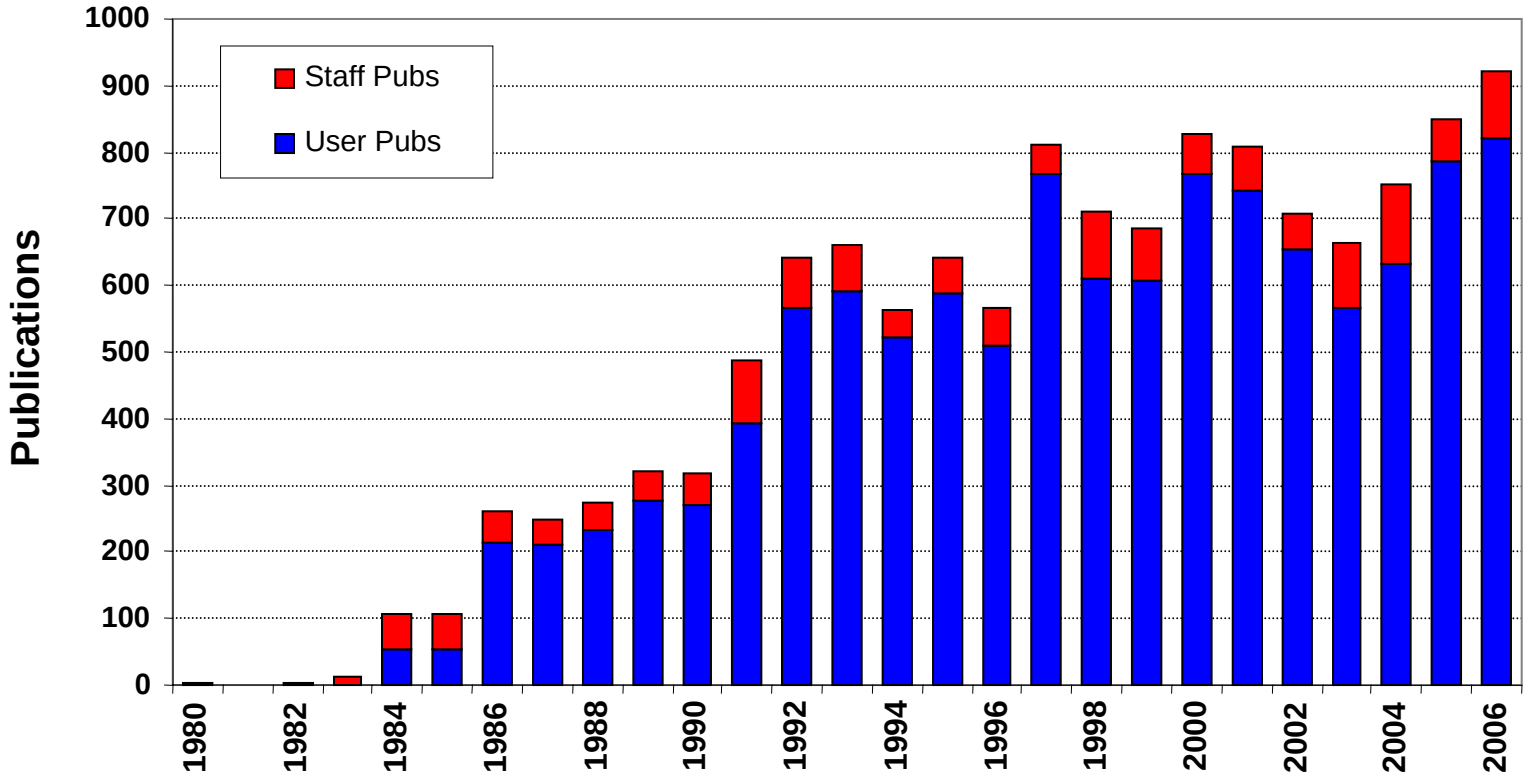
IMAGING

- Infrared microspectroscopy
- Soft X-ray scanning microscopy
- Hard X-ray microprobe
- X-ray microtomography
- Diffraction-enhance imaging

OTHER

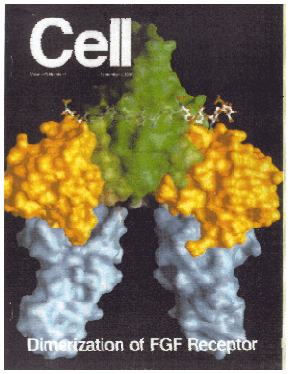
- Micro-machining
- X-ray footprinting

NSLS Publications



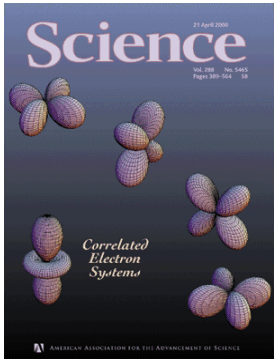
- NSLS publications have grown to >900 per year
- NSLS staff participate in ~10% of publications

NSLS Publications



- **> 800 publications per year**
- **> 200 publications in premier* journals**

	2006
Physical Review Letters	20
Science	7
Nature	12
Environ. Sci. Tech.	17
J. Amer. Chem. Soc.	21
Nature Structural Biology	14
Proc. Natl. Acad. Sci.	26
Structure	17
Applied Physics Letters	13
Total Premier Articles	228

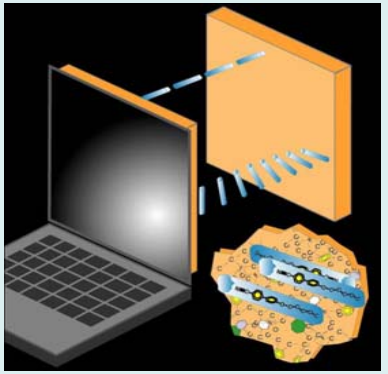


** Impact factor > 6.0, which is top 3% of all scientific journals*

Physics and Materials Science

Data storage

Improved polymers



Liquid crystal displays

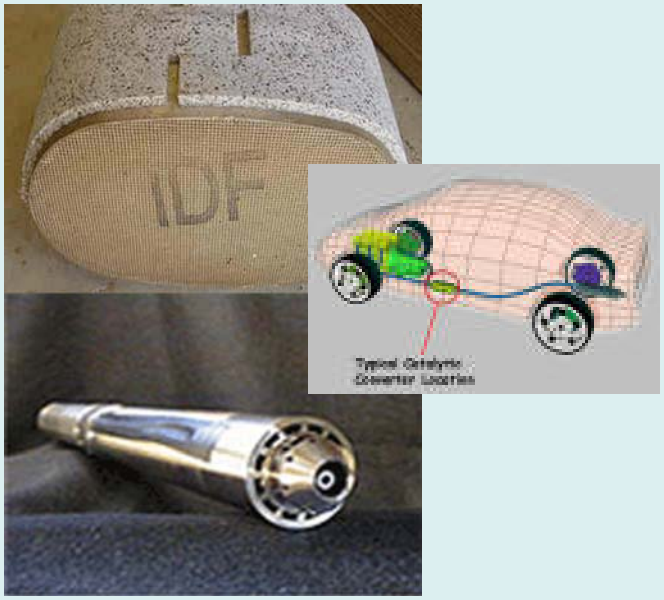
Nonstick coatings

Nanomaterials

Chemistry

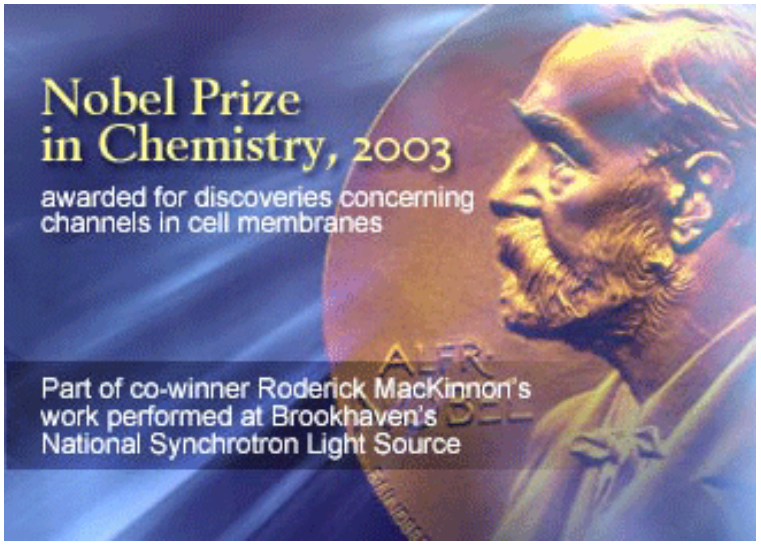
Corrosion

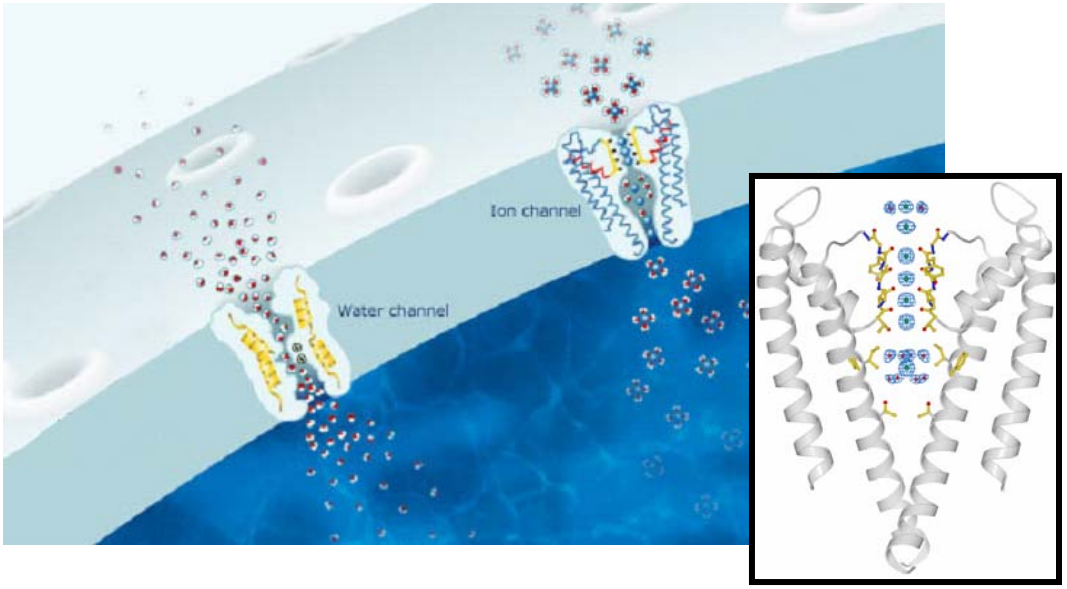
Rechargeable batteries



Catalytic converters

2003 Nobel Prize in Chemistry

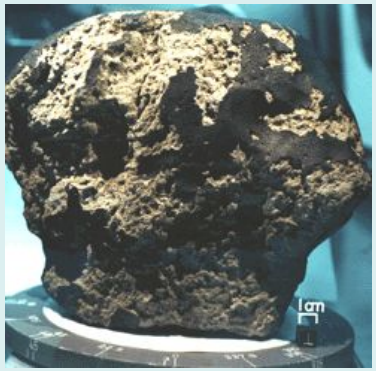




Awarded to Rod MacKinnon (Rockefeller University) for work performed in part at NSLS

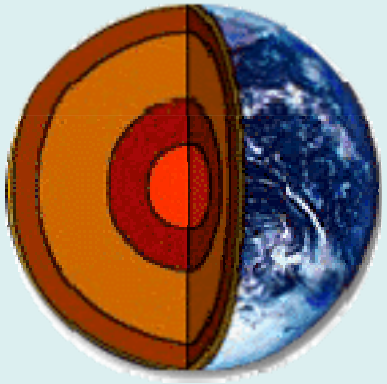
Geology and Environmental Science

Environmental cleanup



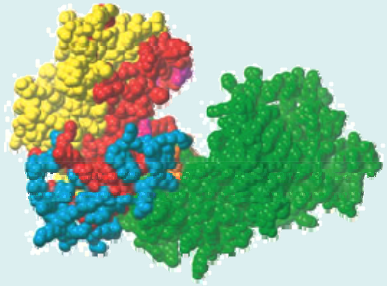
Mars meteorites

Space dust



Earth’s core

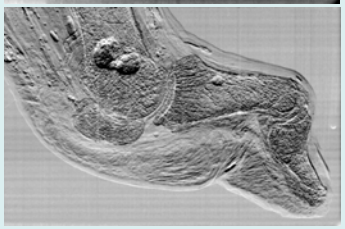
Biology and Medicine



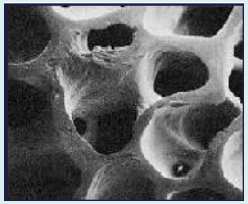
Anthrax

Malaria

Lyme's disease



Arthritis



Osteoporosis

HIV

Alzheimer's disease

Modes of User Access

1. General User
   - Peer-reviewed online proposal system

2. Proprietary user
   - Full cost recovery rate

3. Contributing User (CU) / Participating Research Team (PRT) member
   - utilize a share of beamtime in exchange for significant contribution to facility operations (instrumentation and/or staffing)

Beamline Management: Types of Beamlines

1. Facility Beamlines (18)
   - Built and operated by NSLS
   - At least 50% General User time
   - Up to 25% Contributing User time

2. Participating Research Team (PRT) Beamlines (49)
   - Built and operated by PRT
   - 25% General User time
   - 75% PRT time

NSLS Facility Beamlines and Techniques

- IR/UV/Soft X-Ray Spectroscopy: U5UA, U12IR, X13A
- X-Ray Spectroscopy: X18B, X19A
- Soft Matter/Biophysics: X6B, X9
- Hard Matter/Strongly Correlated Systems: X1B, X17B1, X21
- Powder/Single Crystal/High Pressure/Optics: U2A, X17B2, X17B3, X17C
- Imaging and Microprobes: U10B, X13B, X15A, X27A
- Macromolecular Crystallography: X6A, X25

Facility beamlines cover wavelengths from Far-IR to 100 keV and all major experimental techniques

Contributing User Program

- NSLS is responsible for operating Facility Beamlines.
- Contributing Users (CUs) are individuals or groups who carry out research at Facility Beamlines and also enhance the beamline capabilities and/or contribute to its operation.
- CUs develop and maintain a specific science program and associated endstation instrumentation, typically by contributing external financial and/or intellectual capital to the operation of the beamline.
- All CU programs are periodically reviewed and approved by the NSLS Scientific Advisory Committee.

Approved Contributing User Program

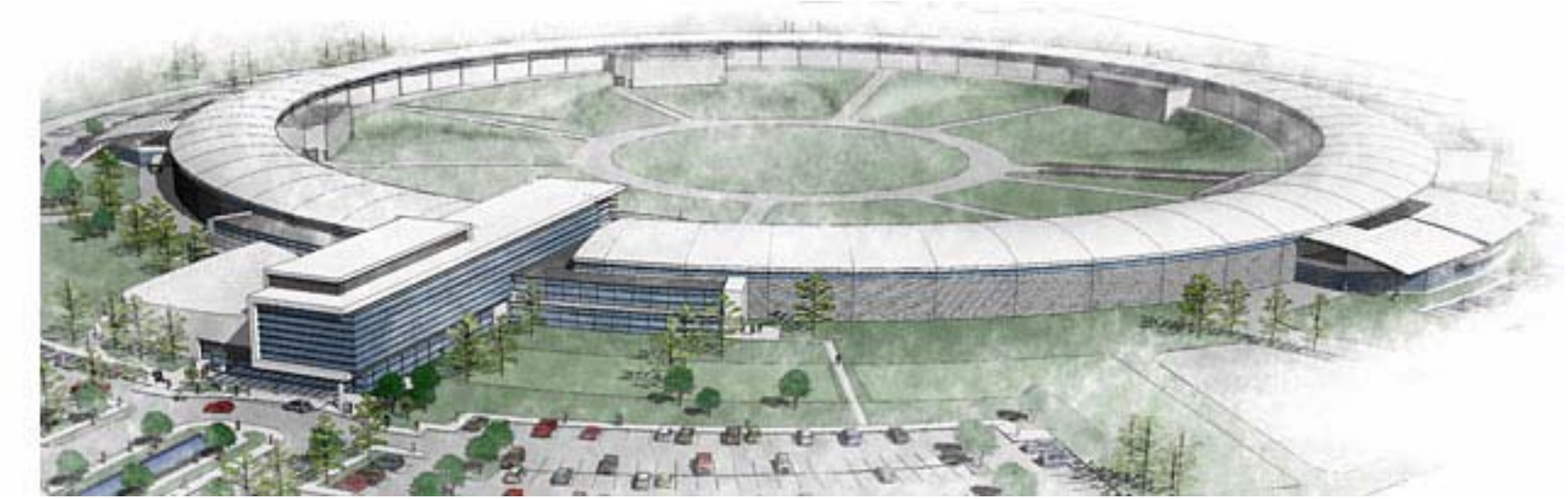
Beamline(s)	Contributing User Group	Science Program
U2UA	Carnegie Inst. Wash.& COMPRES (Consortium of 45 U.S. Universities, 3 National Labs, & 28 Foreign Affiliates)	High Pressure IR Spectroscopy Studies in Earth Sciences
U5UA	BNL Center for Functional Nanomaterials	Nano-catalysis: LEEM-XPEEM
X6B (X9)	BNL Center for Functional Nanomaterials	Soft and Bio Nanoscience: SAXS/GISAXS
X13B	Columbia Univ. & IBM	X-Ray Microbeam Diffraction Analysis
X15A	Northwestern Univ.	X-Ray Standing Wave Analysis
X17B1	Rutgers Univ.	Energy Dispersive X-Ray Diffraction: Strain Field Mapping
X17B2, B3, C	COMPRES	High Pressure X-Ray Studies in Earth Sciences
X18B, X19A	BNL Chemistry, Univ. Delaware, Yeshiva Univ., Oak Ridge Nat. Lab, UOP	Catalysis Consortium: High and Low energy EXAFS
X21	Boston Univ. and Univ. of Vermont	Center for Real-time Studies of Surface Processes
X25	BNL Biology	Protein Crystallography Research Resource (PXRR)
X27A	BNL Environmental Sciences and Stony Brook Univ..Geosciences	Environmental Science Consortium: X-Ray Microprobe Imaging

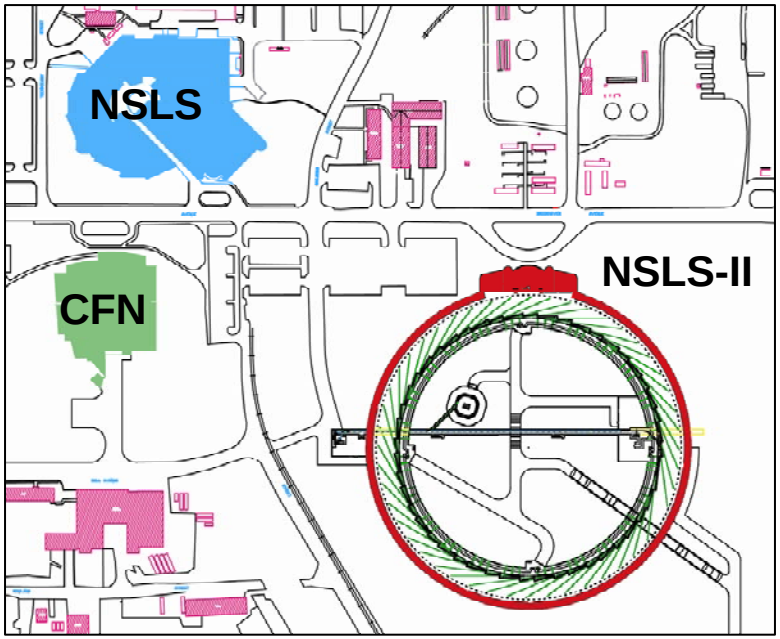
Goals of NSLS 5-Year Plan

- Maintain a strong Environmental Safety & Health (ESH) program
- Scientific Priorities
  - Enhance nanoscience and energy research
  - Continue the growth of life sciences, in particular biomedical imaging
  - Continue the growth of environmental, earth and high-pressure sciences
- Ensure machine reliability for the expected lifetime of the NSLS
- Maintain and improve machine performance including an ID/beamline/endstation upgrade plan
- Continue to develop a strong detector program
- Enhance user support and scientific productivity
- Enhance existing and develop new research resources
- Develop an organization structure and staffing plan to execute the plan
- Evolve synergistically with NSLS-II

Complete 5-Year Plan available on NSLS homepage at:
www.nsls.bnl.gov

NSLS-II: Brighter Light for the Future





- new synchrotron under design at Brookhaven Lab
- $800 M project to be completed in 2013
- x-rays and infrared light ~10,000 times brighter than current NSLS
- will be the brightest synchrotron in the world

Contact Information

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