Basic Energy Sciences
Scientific User Facilities

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Office of Science
U.S. Department of Energy

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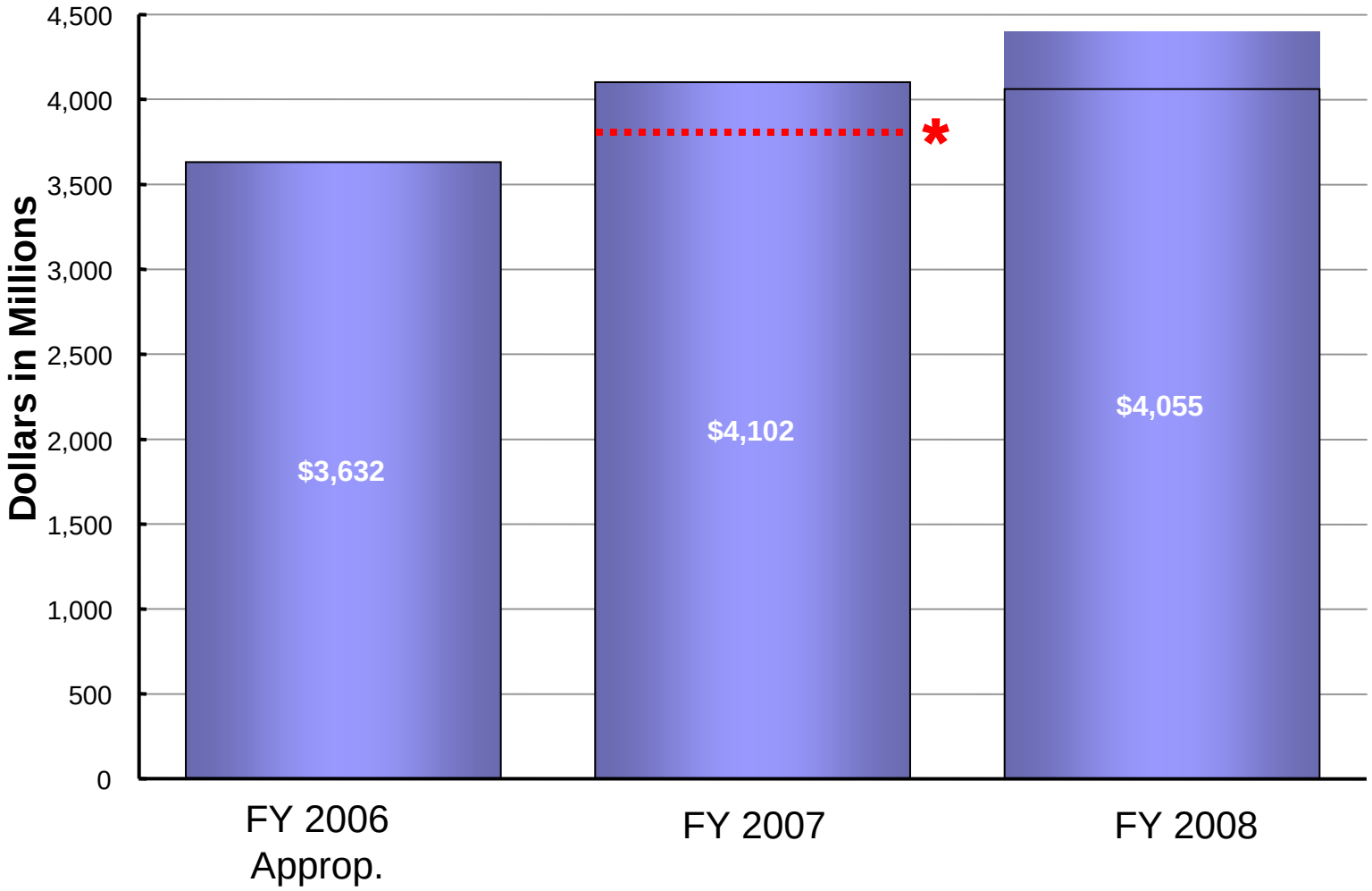
The Office of Science FY 2006-2008



"Basic Research Needs" Workshops

- **Basic Research Needs to Assure a Secure Energy Future**
  BESAC Workshop, October 21-25, 2002
  The foundation workshop that set the model for the focused workshops that follow.
- **Basic Research Needs for the Hydrogen Economy**
  BES Workshop, May 13-15, 2003
- **Nanoscience Research for Energy Needs**
  BES and the National Nanotechnology Initiative, March 16-18, 2004
- **Basic Research Needs for Solar Energy Utilization**
  BES Workshop, April 18-21, 2005
- **Advanced Computational Materials Science: Application to Fusion and Generation IV Fission Reactors**
  BES, ASCR, FES, and NE Workshop, March 31-April 2, 2004
- **The Path to Sustainable Nuclear Energy: Basic and Applied Research Opportunities for Advanced Fuel Cycles**
  BES, NP, and ASCR Workshop, September 2005
- **Basic Research Needs for Superconductivity**
  BES Workshop, May 8-10, 2006
- **Basic Research Needs for Solid-state Lighting**
  BES Workshop, May 22-24, 2006
- **Basic Research Needs for Advanced Nuclear Energy Systems**
  BES Workshop, July 31-August 3, 2006
- **Basic Research Needs for the Clean and Efficient Combustion of 21st Century Transportation Fuels**
  BES Workshop, October 30-November 1, 2006
- **Basic Research Needs for Geosciences: Facilitating 21st Century Energy Systems**
  BES Workshop, February 21-23, 2007
- **Basic Research Needs for Electrical Energy Storage**
  BES Workshop, April 2-5, 2007
- **Basic Research Needs for Materials under Extreme Environments**
  BES Workshop, June 10-14, 2007
- **Basic Research Needs for Catalysis for Energy**
  BES Workshop, August 5-10, 2007

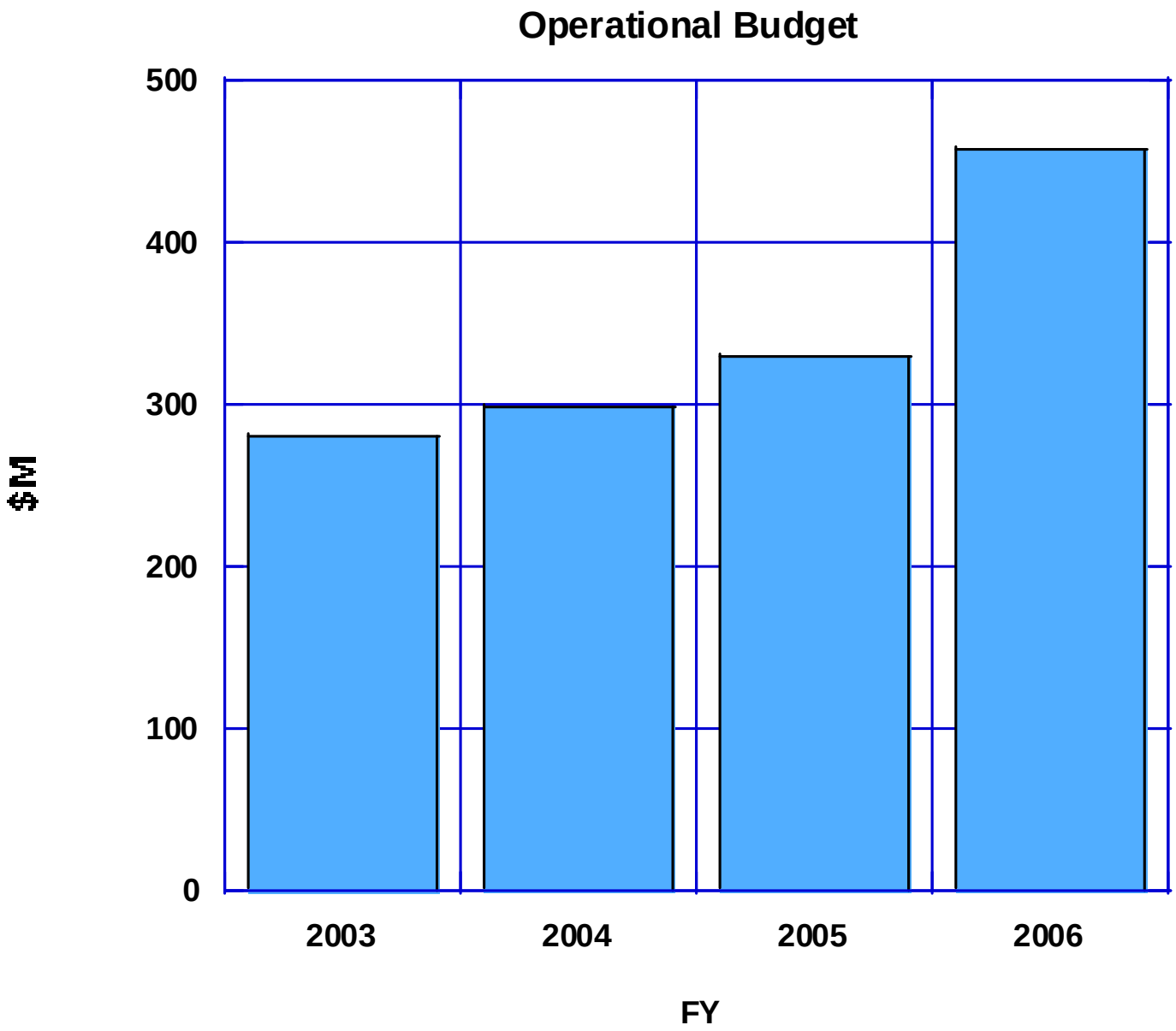
SUFD Operation Budget

Facilities Operational Budget

$ M

FY 2006	FY 2007	FY 2008
459.384	621.879	652.869

Operation Budget for all Facilities



BES Facilities for X-ray Scattering

Advanced Photon Source

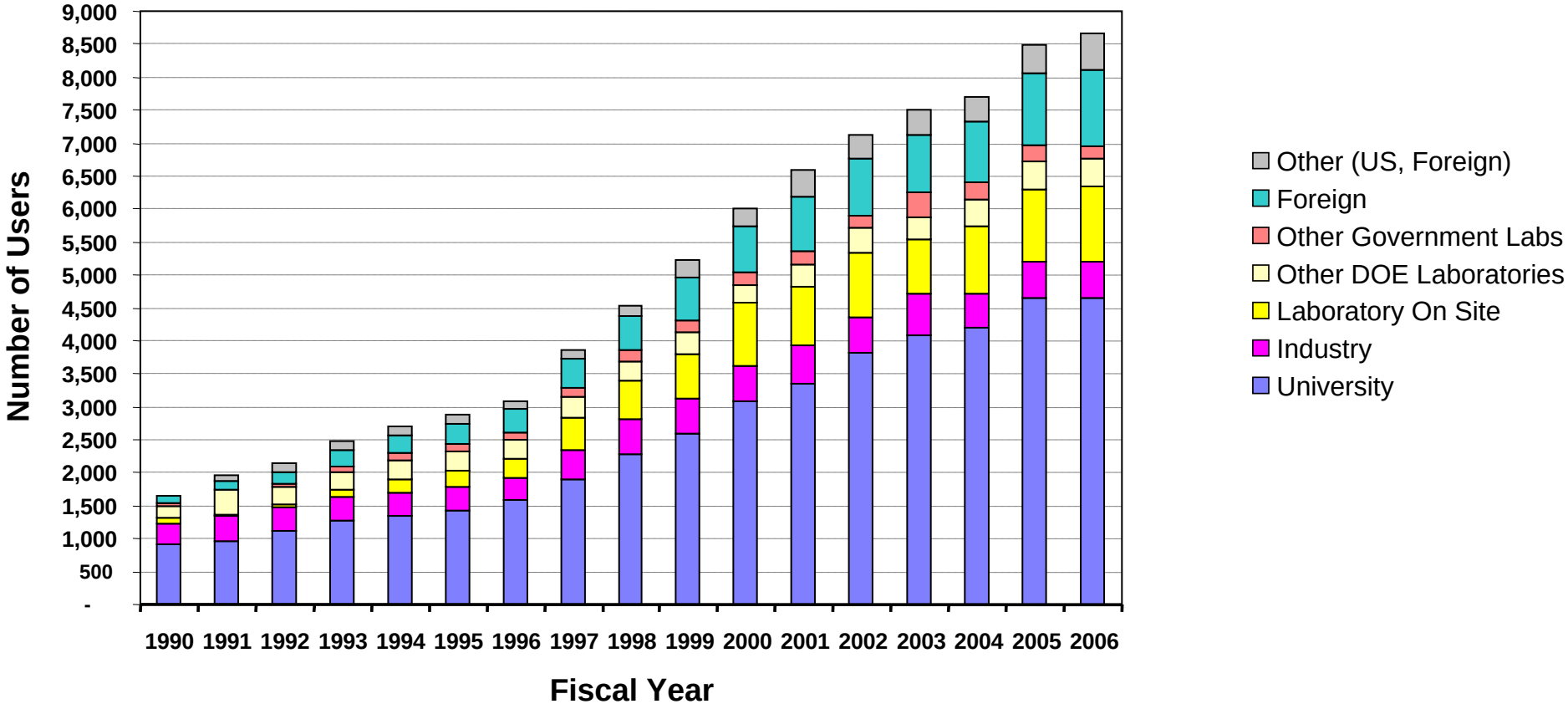
National Synchrotron Light Source

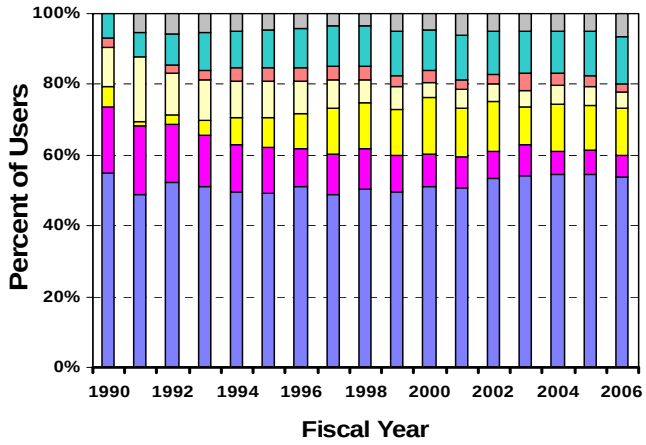
Advanced Light Source

Stanford Synchrotron Radiation Laboratory

The long-established metric for light source operation – i.e., the ratio of delivered to scheduled annual hours of operation of the accelerator complex – generally ranges from 0.95 to 1.00. However, this ratio gives little information about the overall well being of the facility. Over the past year and a half, BES has developed alternate ways of measuring how effectively the light sources are utilized.

For the 4 BES Light Sources, the Majority of Users Continue to be from Academia





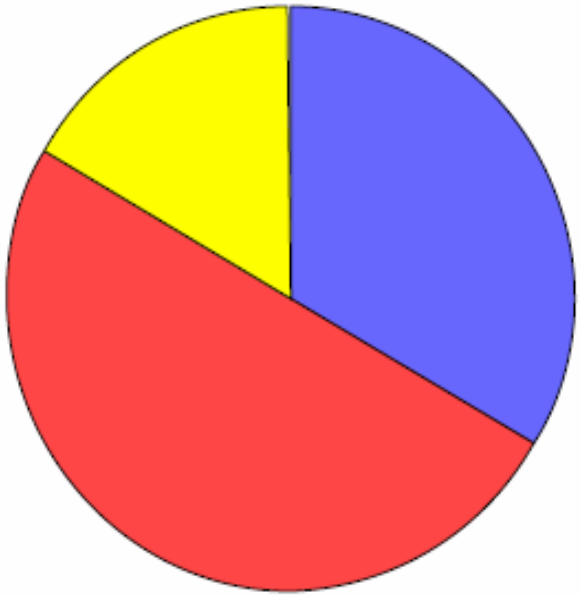
Notably, the fraction of industrial users has declined significantly over the past 15 years, reflecting the trend of industry to move away from fundamental research.

The fraction of users from the host institutions has grown, reflecting a new commitment on the part of the host institutions to these user facilities.

Distribution of Beamline Techniques

ere is a graphical display
f the summary statistics
or all 179 operating beam
nes at the four DOE light
ources.

lote that the APS (a
ard x-ray light source)
mphasizes scattering
hile ALS (a soft x-ray
ght source) emphasizes
pectroscopy and imaging.



Spectroscopy

Scattering

Imaging

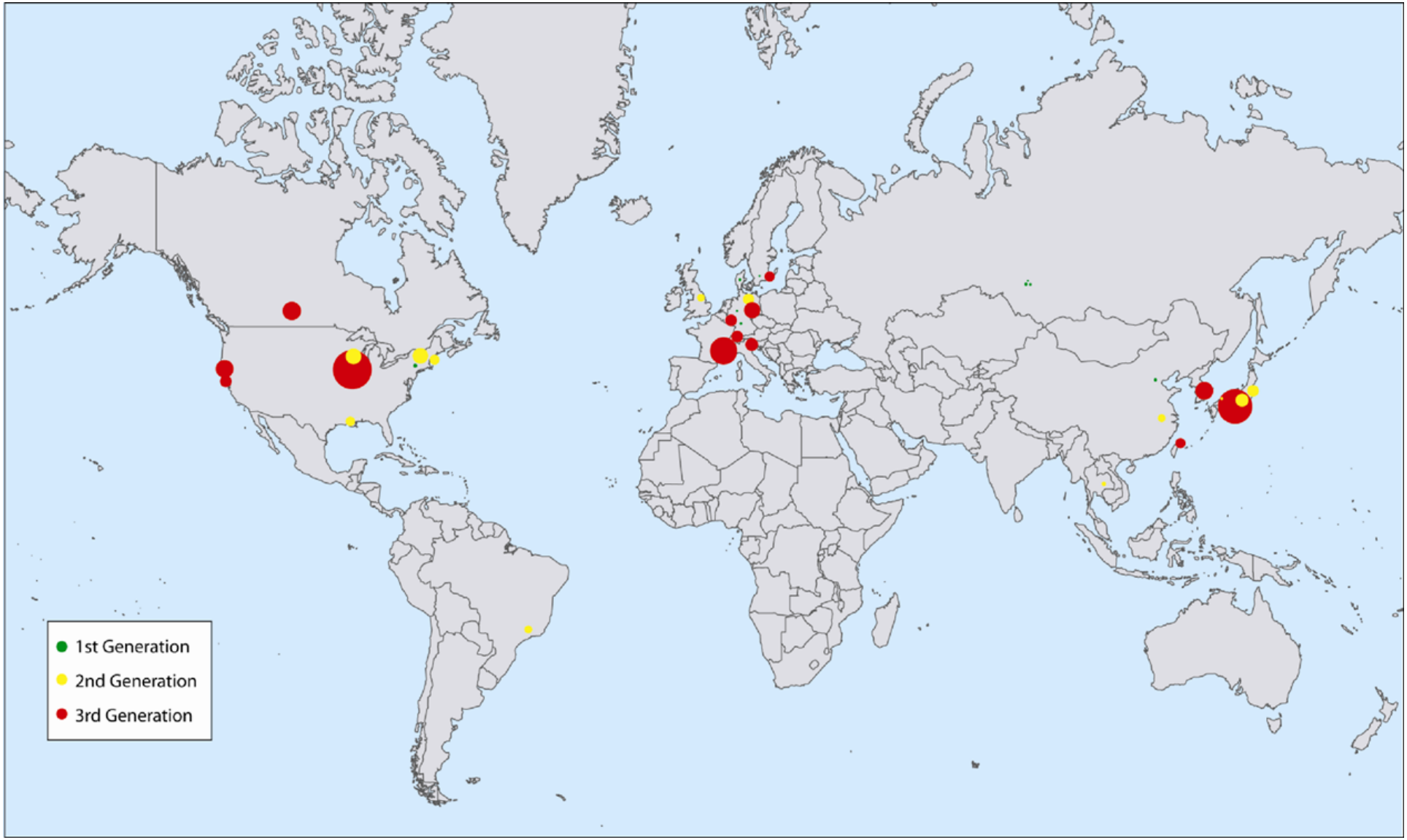
NSLS

SSRL

ALS

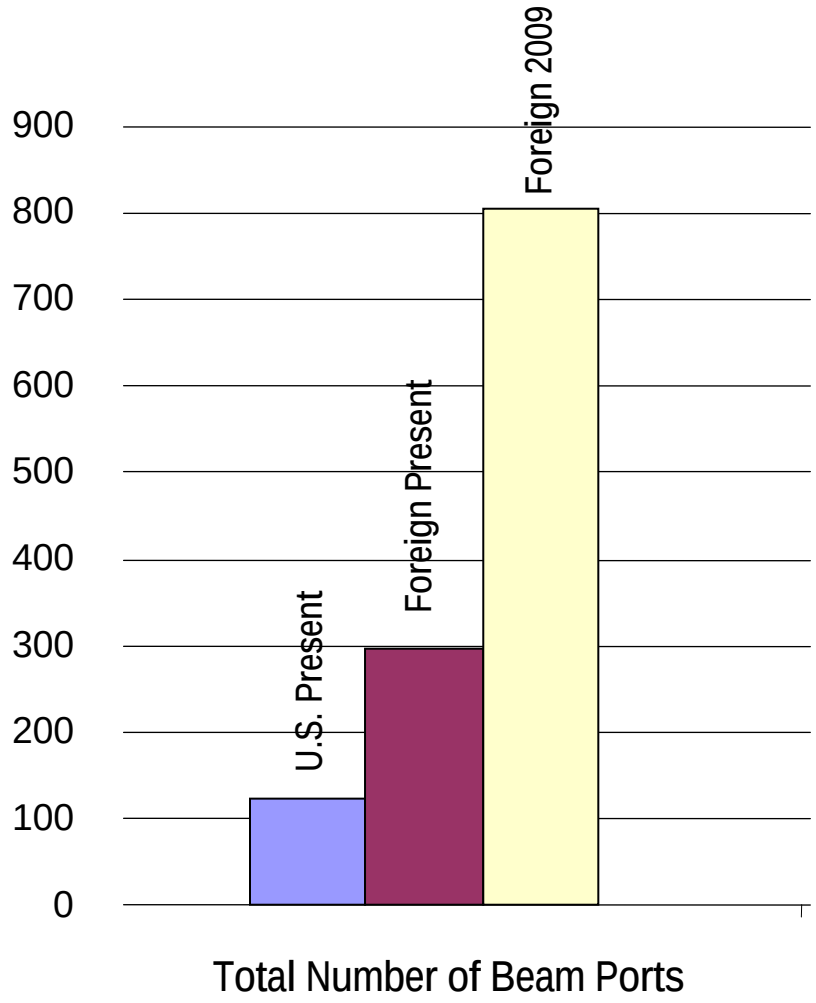
APS

World-wide Capacity of All Light Sources in Operation Today



World-wide capacity of all sources in operation today. In this figure, the size of the symbols has been scaled to the total capacity, i.e. sum of insertion device ports and bending magnet ports, for each facility. From the plot one can see that each region (U.S., Europe, Asia & Pacific Rim) has very comparable capacity at the present.

International Benchmarking: 3rd Generation Synchrotrons Worldwide



Considering only beam ports on the 3rd generation sources, this shows that by 2009 the U.S. will be outnumbered by the rest of the world by 7:1 (123 beam ports in the U.S. versus 806 beam ports in the rest of the world).

Scientific User Facilities

BESAC evaluation February 2003
Report released late 2003

- Under construction at the time of the evaluation
  - *Spallation Neutron Source*
  - *5 Nanoscale Science Research Centers*
  - *SSRL (SPEAR3) upgrade*
- Facilities underway since the evaluation
  - *Transmission Electron Aberration Corrected Microscope*
  - *Linac Coherent Light Source*
  - *National Synchrotron Light Source - II*
- Facilities rated longer-term priority at the time of the evaluation
  - *Spallation Neutron Source power upgrade (CD-0 signed)*
  - ---
  - *Spallation Neutron Source 2nd target station*
  - *Advanced Light Source upgrade*
  - *Advanced Photon Source upgrade*
- What's next in our planning?
  - *Workshop on frontiers in electron-beam microcharacerization*
  - *BESAC study on light sources*

Available at
http://www.science.doe.gov/Sub/Facilities_for_future/facilities_future.htm

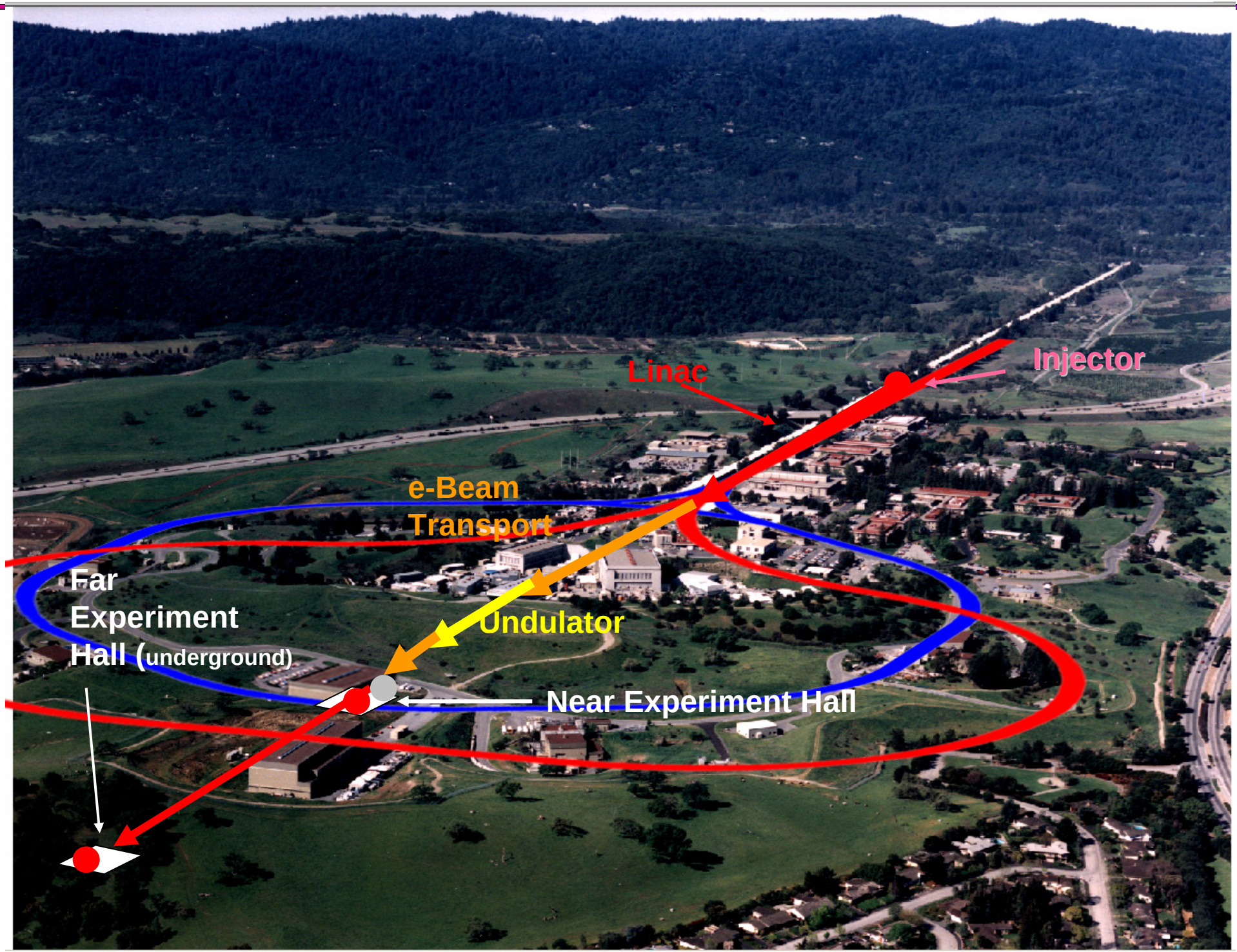
BES Goals Align with Those of the ACI

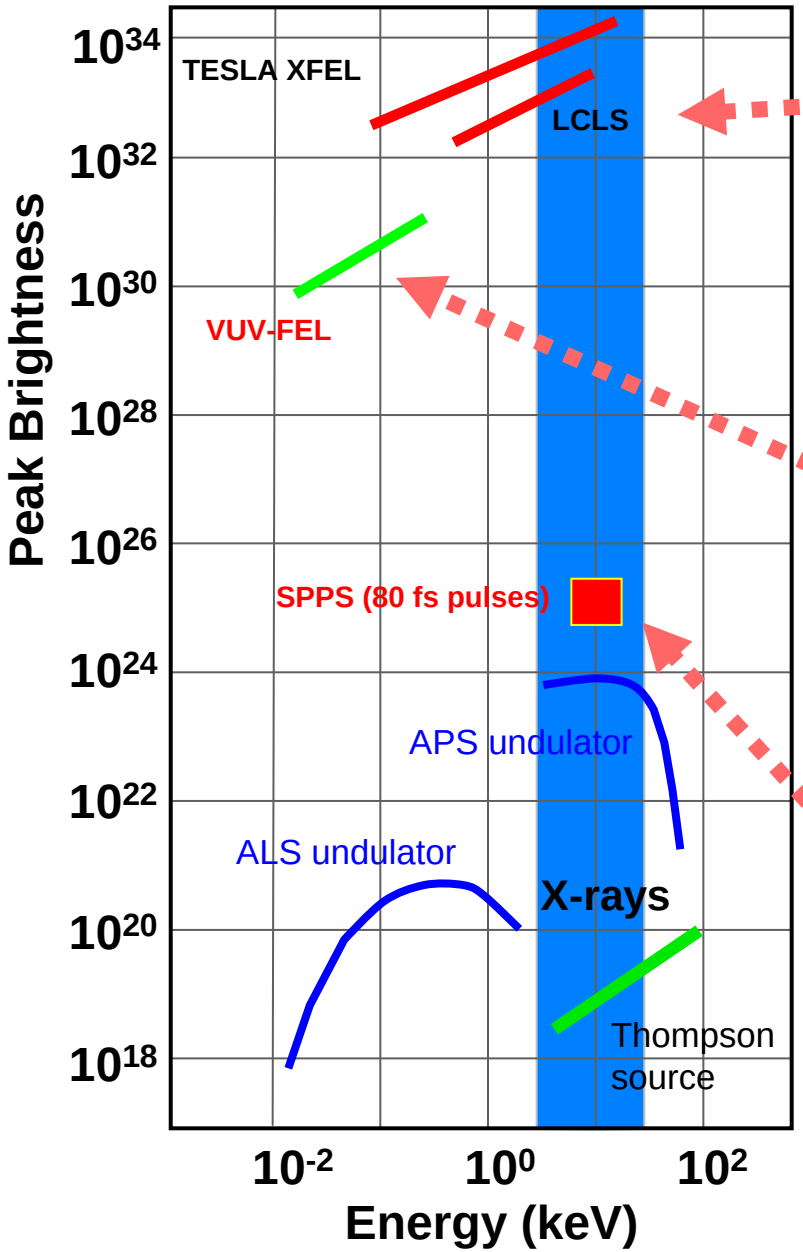
Balance key portfolio components that together create a uniquely DOE program:

- Fundamental research
  - in support of a *decades-to-century energy security plan* and
  - in support of *discovery science* that enables the mission; this also includes the support of a critical mass of principal investigators – "the great discovery machine"
- Forefront scientific user facilities for the Nation

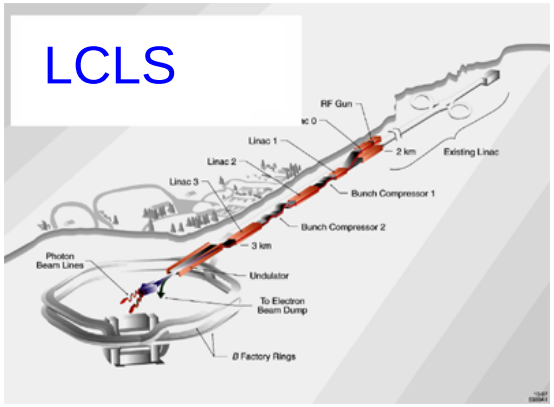
Aim for world leadership in all activities that are supported

LCLS at SLAC – The World's First X-ray FEL





APS - Advanced Photon Source (ANL)
ALS - Advanced Light Source (LBNL)



operational 2010

8 keV, ~100 fs, 10^{12} photons/pulse

Linac Coherent Light Source, SLAC, Stanford

operational now

40 eV, ~30 fs, 10^{13} photons
(500 eV in 2007)

DESY, Hamburg

2004-2006 operation

8 keV, 80 fs, 10^{7} photons

Sub-picosecond Photon Source, SLAC, Stanford

Rendering of NSLS - II

NSLS-II is a highly optimized x-ray synchrotron project delivering:
extremely high brightness and flux; exceptional beam stability; and
a suite of advanced instruments, optics, and detectors that capitalize on these special capabilities.
About one fourth of the highest brightness beamlines will be instrumented as part of the project.