Argonne NATIONAL LABORATORY

... for a brighter future

APSUO/PUC Meeting Introduction

J. Murray Gibson

01/20/2009

U.S. Department of Energy

THE UNIVERSITY OF CHICAGO

Office of Science
U.S. DEPARTMENT OF ENERGY

A U.S. Department of Energy laboratory managed by The University of Chicago

SAC Members (and terms)

- Ending Feb 2009
  - Jens Als-Nielsen
  - Michelle Buchanan
  - Piero Pianetta
  - Don Weidner
  - Wei Yang
- Ending 2010
  - Howard Einspahr
  - Miles Klein (Chair)
  - Soichi Wakatsuki
- Ending 2011
  - Britt Hedman
  - Janos Kirz
  - Dan Neumann
  - Bill Stirling
  - Glenn Waychunas
- Ex-officio
  - Denis Keane (PUC)
  - Larry Lurio (APSUO)

SAC plans

- In 2009 we must appoint 4-5 new members
  - Areas of expertise needed in particular
    - *Chemistry, Materials Science, X-Ray Physics, Accelerator Physics, Engineering, Geoscience, Life science and non x-ray imaging*
    - *Industrial, other National Labs, European, Universities in particular*
  - *Offline suggestions appreciated*
- SAC relationship to UC review process (Mary Frances Miley, UC plans to attend and discuss)
- Meeting more often?
  - Keeping touch during the year
    - *Especially during renewal planning*

SAC Agenda: January 20-22, 2009

Tuesday, January 20, 2009 – a.m.

Welcome and Overview - *M. Gibson*

APS Renewal Inst. Rev., Part I - *D. Keane*

Tuesday, January 20, 2009 – p.m.

Group Photo - Working Lunch with APS Mgt.

APS Renewal Inst. Rev., Part II - *D. Mills*

Science Drivers for Renewal Inst. - *P. Fuoss*

Executive Session

Dinner at the Argonne Guest House - SAC Members and APS Senior Mgt.

Wednesday, January 21, 2009 – a.m.

Letters of Intent (LOIs) and Proposals for New Beamlines - *M. Gibson & D. Mills*

New Scientific Proposal - *Y. Gupta*

Wednesday, January 21, 2009 – p.m.

Executive Session Working Lunch

XOR Update - *G. Srajer*

APS Access: General and Partner User Programs - Updates and Issues - *D. Mills*

SAC Science and Management Review Process - *G. Waychunas, M. Buchanan*

Applied Research at the APS - Industrial and Energy Implications

Executive Session

Dinner at the Argonne Guest House - SAC Members and APS Senior Mgt.

Wednesday, January 21, 2009 – a.m.

APS Renewal: Disc. of Priorities & Next Steps

SAC Advice & Recommendations on List of Issues

Lunch Discussion – Future Issues Involving the APS SAC

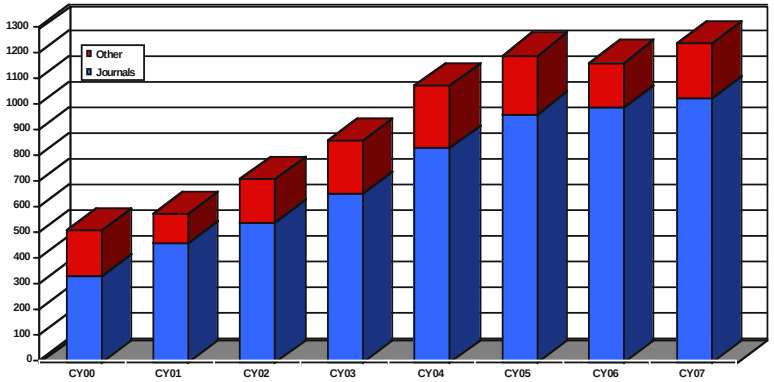
Outline of my presentation

- 2008 APS performance
- Budget and planning
- Response to DOE Review of Dec 2007
- Other issues
- APS Renewal planning (introduction to following talks)

FY 2008 Performance

54 operating beamlines

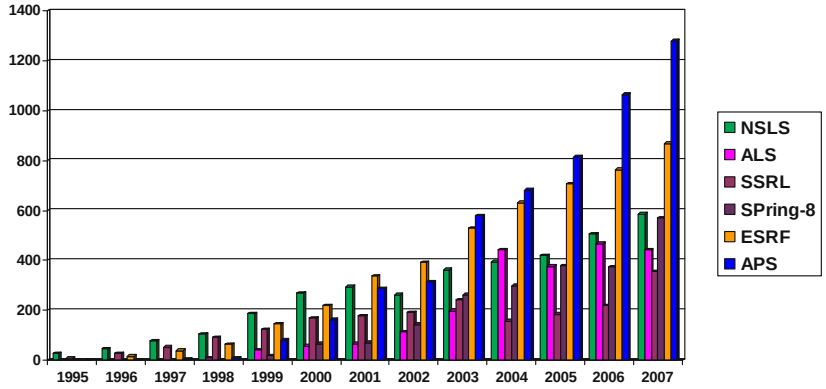
Refereed publications



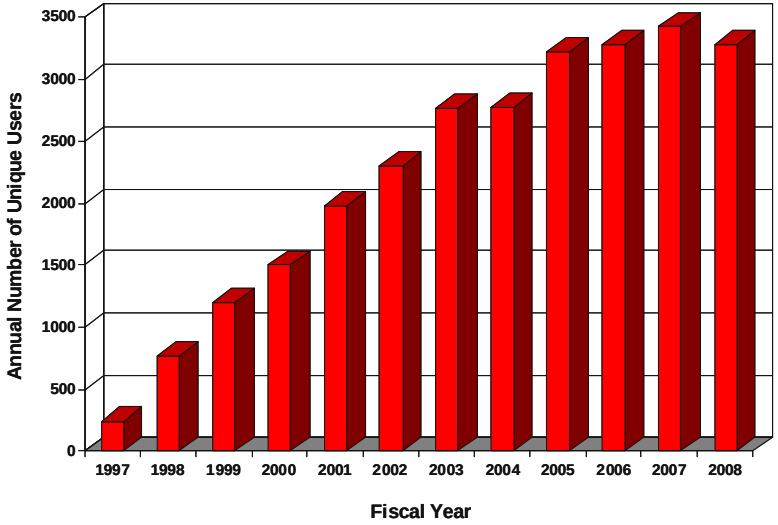
Selected high profile publications

	2003	2004	2005	2006	2007	2008*
Cell	6	7	6	14	12	3
JACS	19	25	19	15	27	23
Nature (all)	12	32	37	37	42	44
PRL	22	21	27	37	32	35
PNAS	18	33	44	42	40	55
Science	8	11	9	20	22	17

Protein databank deposits

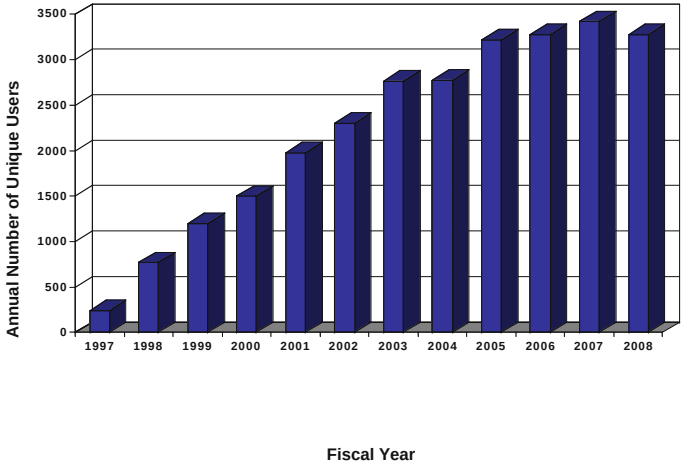


Unique users

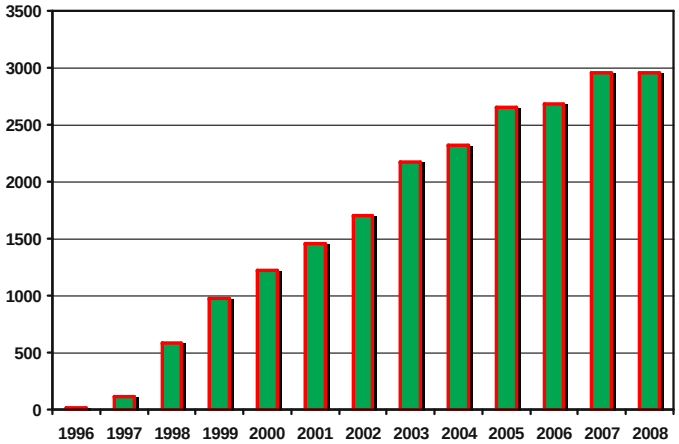


User numbers in 2008 (runtime reduced by ~10%)

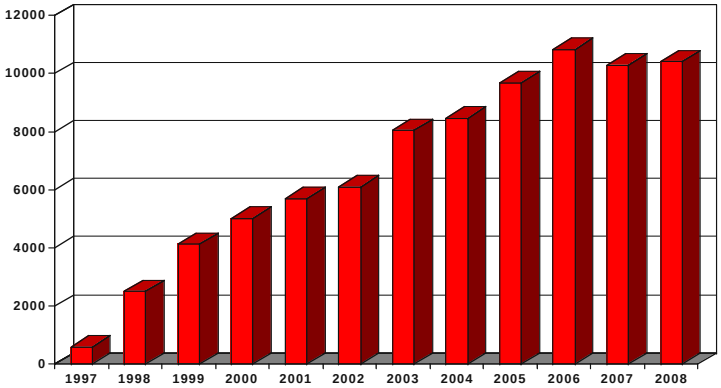
Unique users



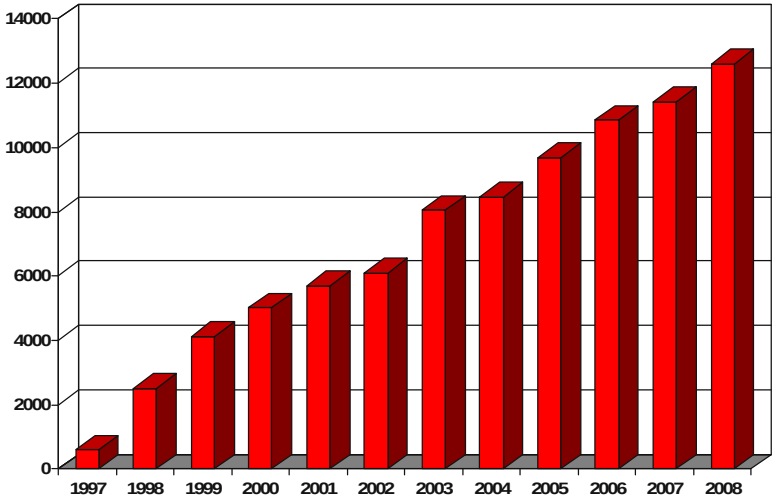
Experiments



User visits



User visits including remote and co-PIs



World-leading APS research

- APS produced 50% more protein structures in 2007 than any other synchrotron facility in the world
- APS has almost twice as many high impact papers (Science/Nature/PRL/PNAS) in high pressure science compared with any other facility worldwide
- XPCS – APS is the most productive facility showing impact in the science of soft materials – 26 high impact papers in three years
- Breakthroughs in accelerator R&D re upgrade

PRL **100**, 244802 (2008) PHYSICAL REVIEW LETTERS week ending 20 JUNE 2008

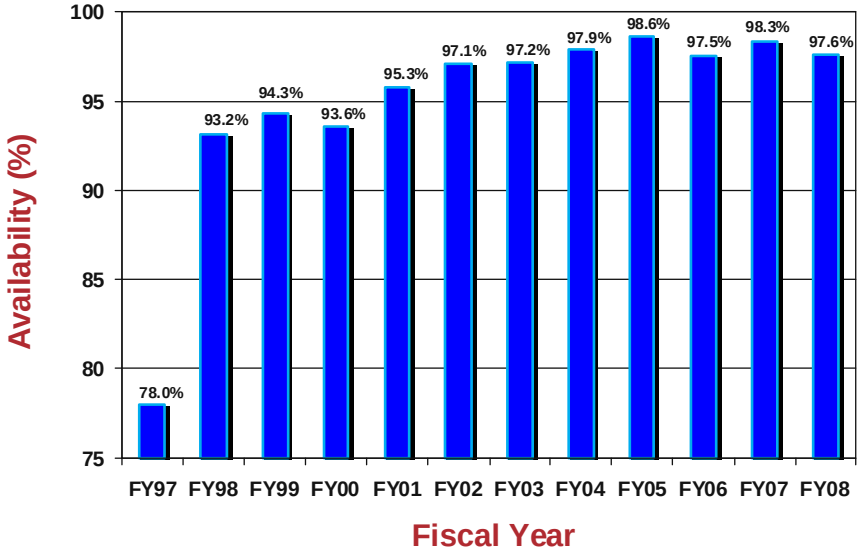
A Proposal for an X-Ray Free-Electron Laser Oscillator with an Energy-Recovery Linac

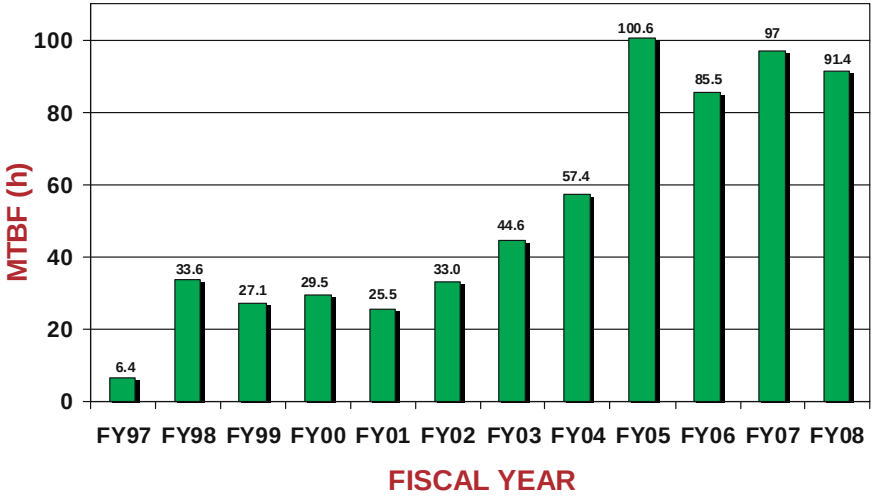
Kwang-Je Kim,[1] Yuri Shvyd'ko,[1] and Sven Reiche[2]
[1]*Advanced Photon Source, Argonne National Laboratory, Argonne, Illinois 60439, USA*
[2]*UCLA, Physics and Astronomy Department, Los Angeles, California 90095, USA*
(Received 14 March 2008; published 17 June 2008)

We show that a free-electron laser oscillator generating x rays with wavelengths of about 1 Å is feasible using ultralow emittance electron beams of a multi-GeV energy-recovery linac, combined with a low-loss crystal cavity. The device will produce x-ray pulses with 10^9 photons at a repetition rate of 1–100 MHz. The pulses are temporarily and transversely coherent, with a rms bandwidth of about 2 meV, and rms pulse length of about 1 ps.

DOI: 10.1103/PhysRevLett.100.244802 PACS numbers: 41.60.Cr, 41.50.+h, 42.55.Vc

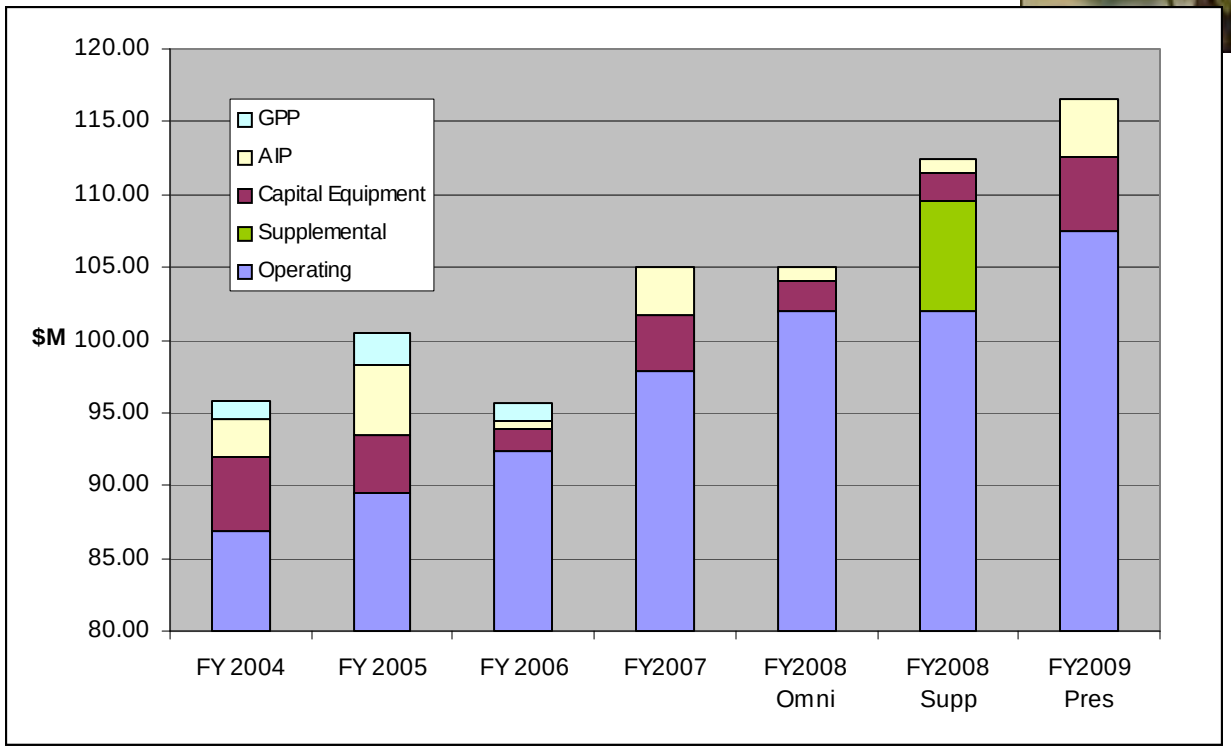
FY2008 Reliability and Availability





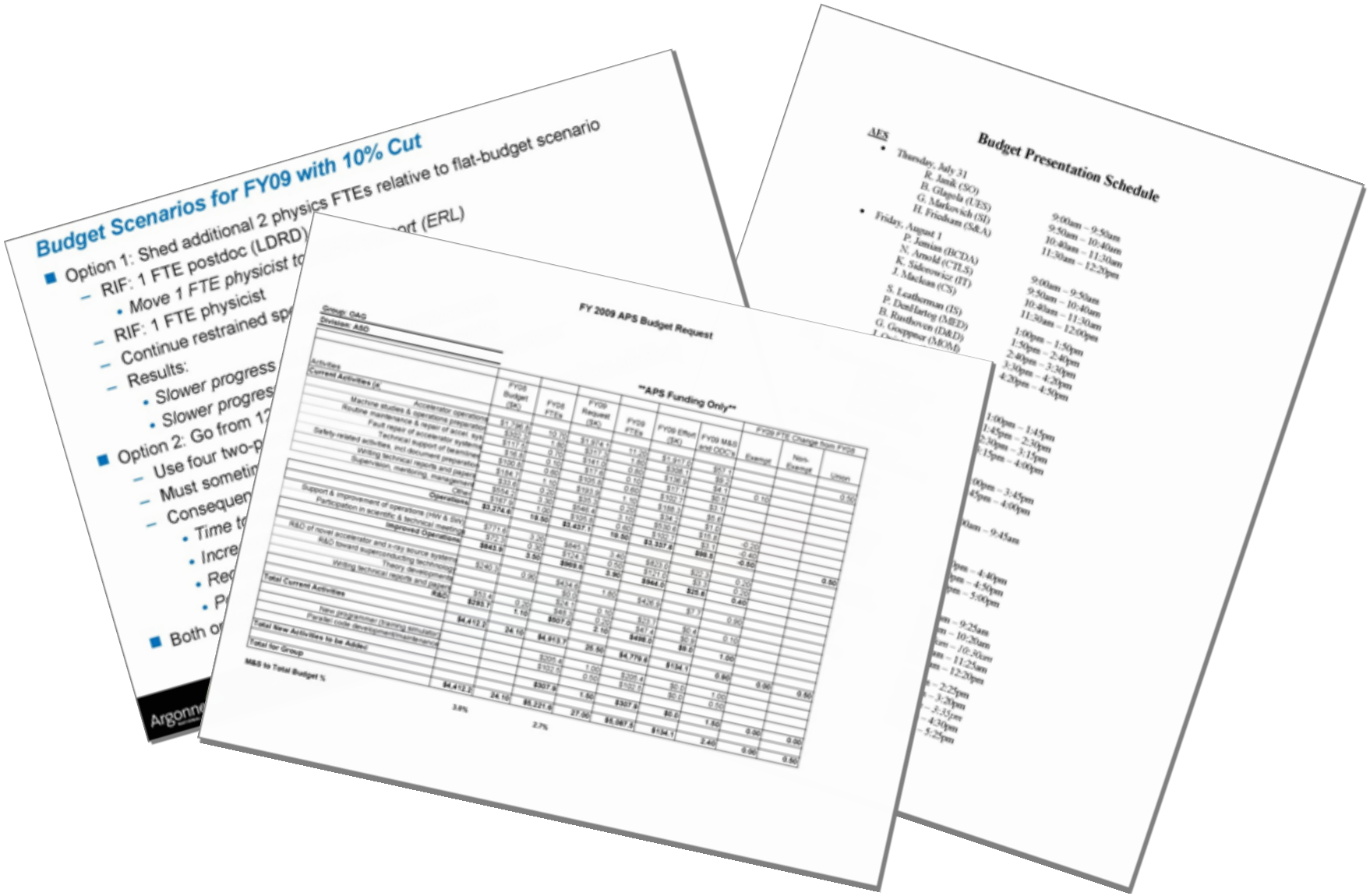
The Cavalry to the rescue

Congress allocates +$7.5M
for APS in supplemental bill (end FY07)



allows return to normal ops for now

APS bottoms-up budget planning exercise for FY2009



Group level requests, rolled up

existing activities and staff only

	Effort	M&S	Total	M&S fraction
AES	34,250.0	5,809.5	40,059.5	14.5%
ASD	18,126.7	5,074.1	23,200.8	21.9%
XSD	29,531.5	7,181.6	36,713.1	19.6%
CC172	0.0	18,000.0	18,000.0	
	81,908.2	36,065.2	117,973.4	

Even though the bottom-line looks large, I appreciate that groups have been realistic

including all new proposed activities and hires

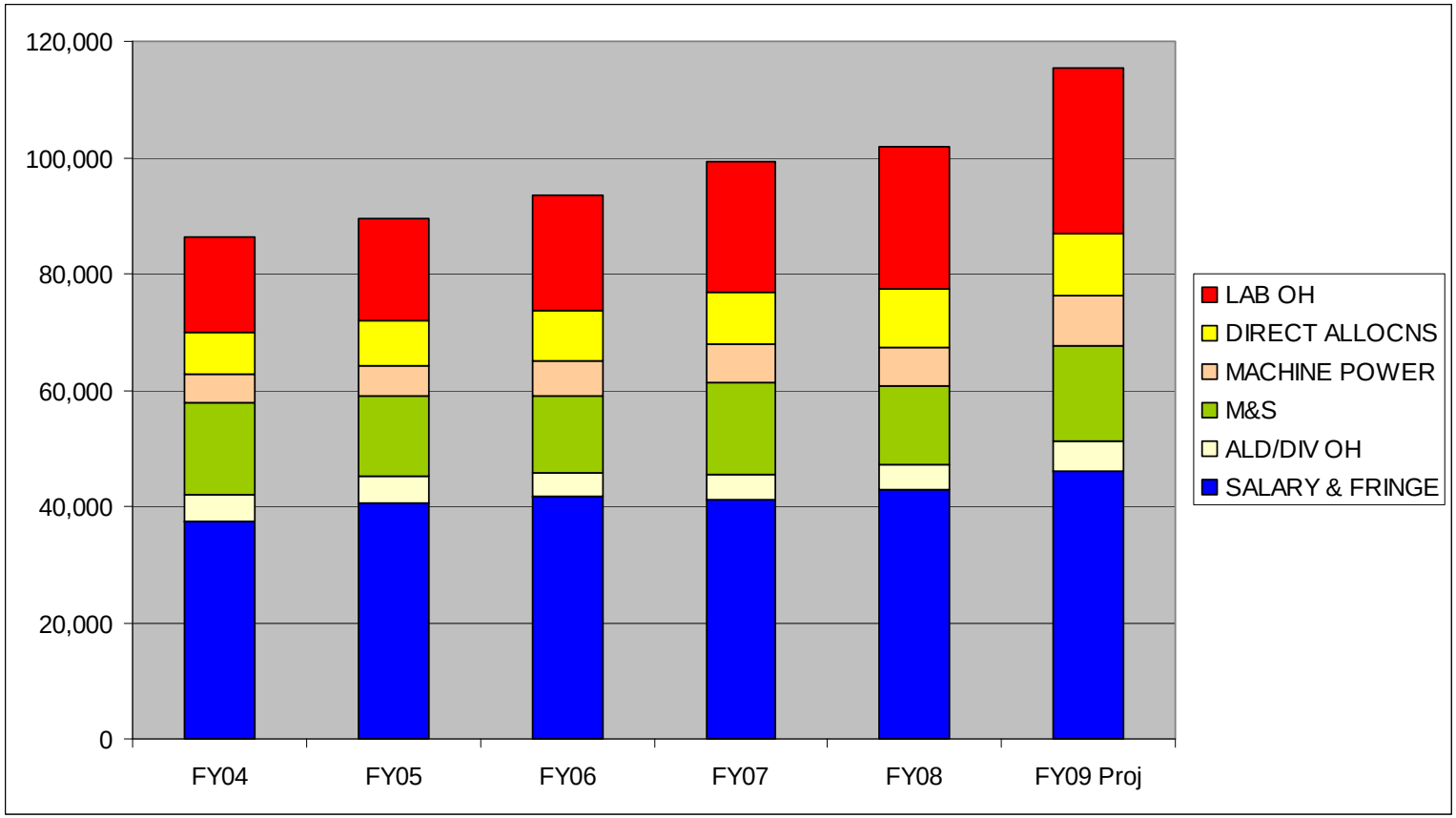
	Effort	M&S	Total
AES	35,889.3	6,718.7	42,608.0
ASD	19,733.1	5,970.3	25,703.4
XSD	31,952.6	10,326.6	42,279.2
CC172	0.0	18,000.0	18,000.0
	87,575.0	41,015.6	128,590.6

What we have “in the bank” for FY’09 is

$106,290K *(and an additional $6M AIP + Capital)*

The exercise has been very helpful in setting appropriate **divisional** M&S budgets

The budget exercise shows that APS needs ~$115M operations funding in FY 2009, with flat headcount (~440 FTEs)

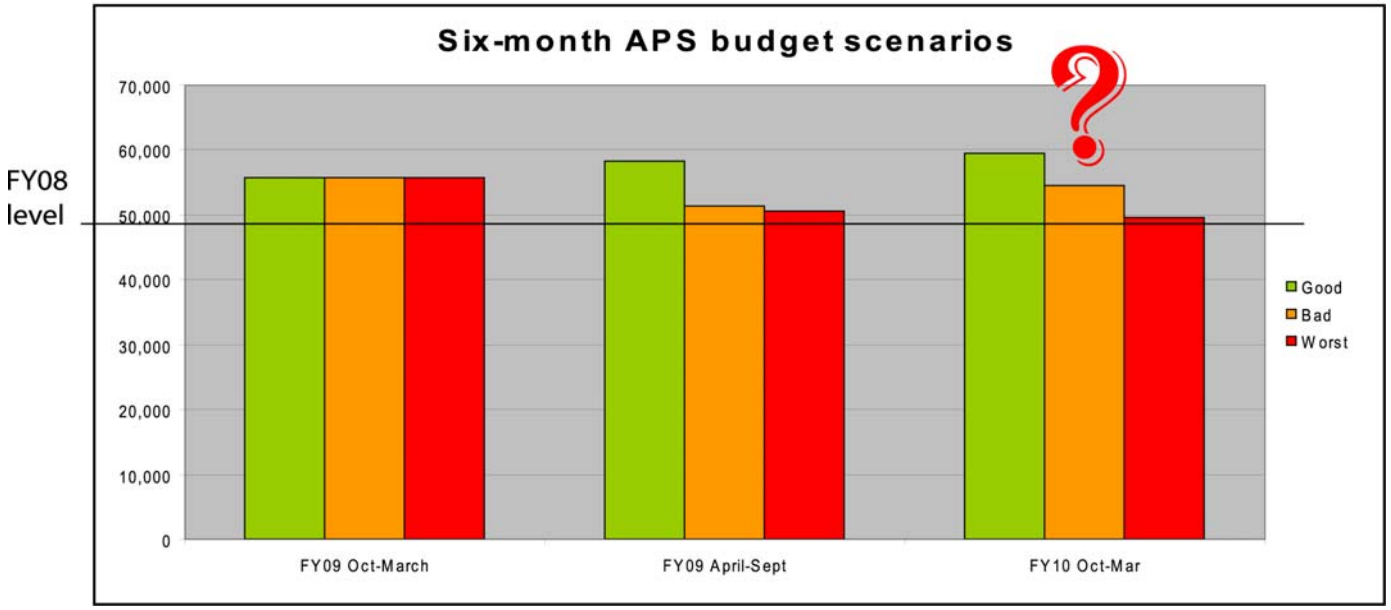


This year we have $106.5M ops (plus $6M capital/ARIM)
But our base budget only $99M ops

Prepared scenarios, using six-month budgets

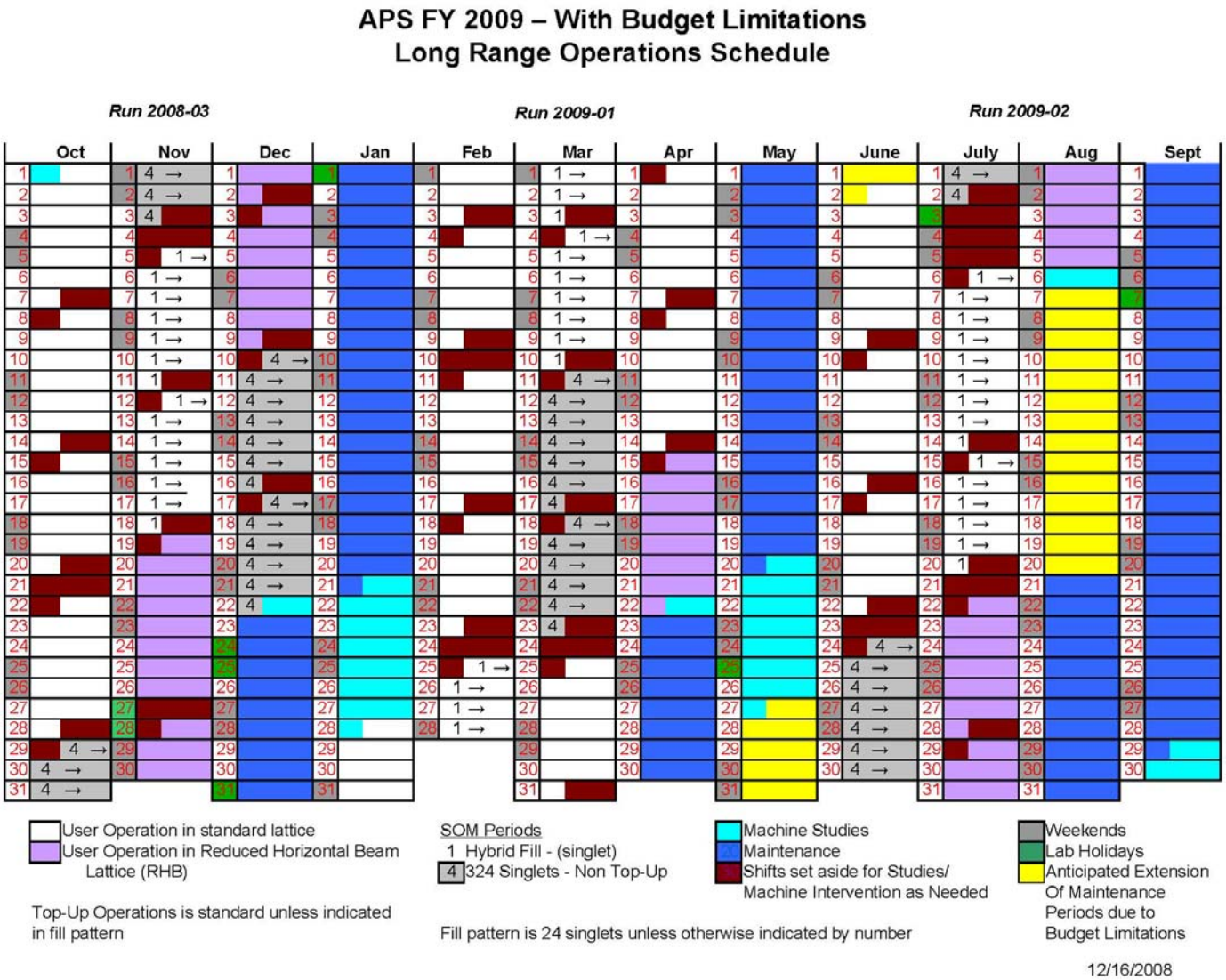
Scenario	**Oct-March**	**April-Sept**	**Year**
Bad	55,800	51,500	107,300
Good	55,800	60,500	116,300

Planned in the Fall for scenarios “Good” and “Bad”,
operate “normally” for Oct-March, be prepared for layoffs if bad (~40)



Worst assumes return to $99,000K ops for ‘010 ($49.5 six months)

2009 Run Schedule has flexibility for bad budget scenario



Key events in next few weeks which affect planning

- (1) Omnibus bill expected at start of new administration will provide final FY09 budget
- (2) Stimulus bill expected in February might provide operations supplements
- (3) FY2010 DOE budget should be public in early Feb

- Outcomes
  - (1) or (2) provide $10M supplement for ’09 and (3) provides increase over ’08 budget by ~$15M GOOD
  - No extra money for 09 from (1) or (2) but (3) provides increase on $15M
  - (1), (2) and (3) provide no increases BAD

XSD Division Director Search

- Committee chaired by Denny Mills
  - Dennis M. Mills, (APS)
  - Samuel D. Bader, (MSD)
  - Kathy Harkay, (ASD)
  - Dion L. Heinz, Associate Professor, Department of the Geophysical Sciences, James Franck Institute, and the College, The University of Chicago
  - Miles V. Klein, Research Professor of Physics and Center for Advanced Study Professor of Physics Emeritus, University of Illinois at Urbana-Champaign
  - William G. Ruzicka, (AES)
  - Steven K. Streiffer, (CNM)
  - Stefan Vogt, (XSD)
- Ads placed in Science et.c.
- Preliminary interviewing by telephone
- Still open to additional external candidates
  - Willing to be flexible regarding balance of research/administration

Progress on life sciences director

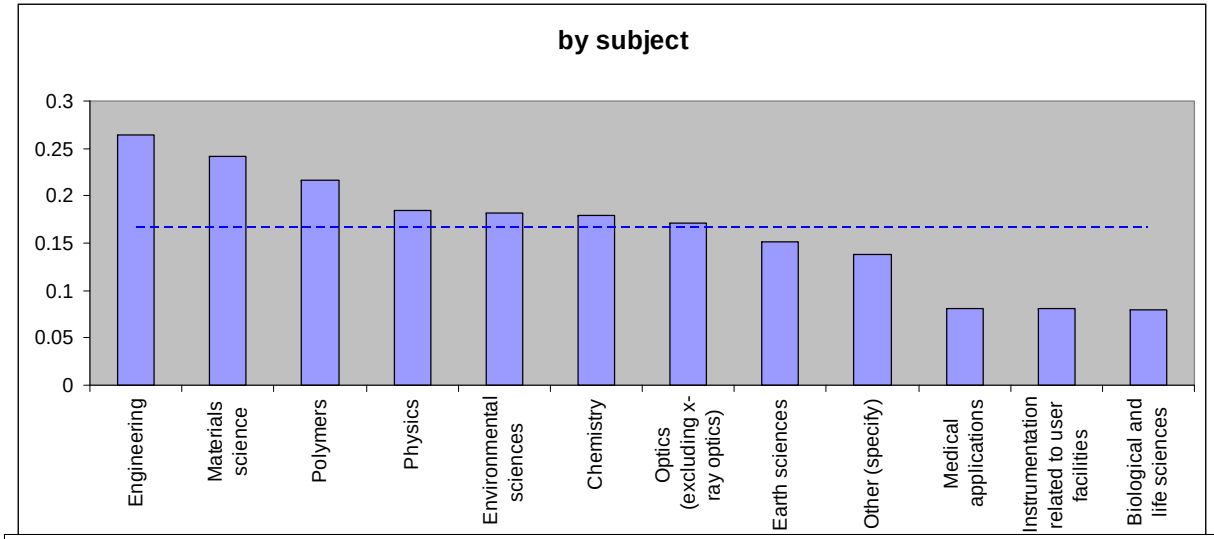
- Role within organization has been debated
  - APS wanted as an ADD within XSD
  - Advice from Life Sciences Council, SAC to make a position within ALD office
- Compromise with joint position
- Have ANL's provisional support for startup funds
- Due to budget uncertainties, have not begun search but hope to begin in good scenario after February

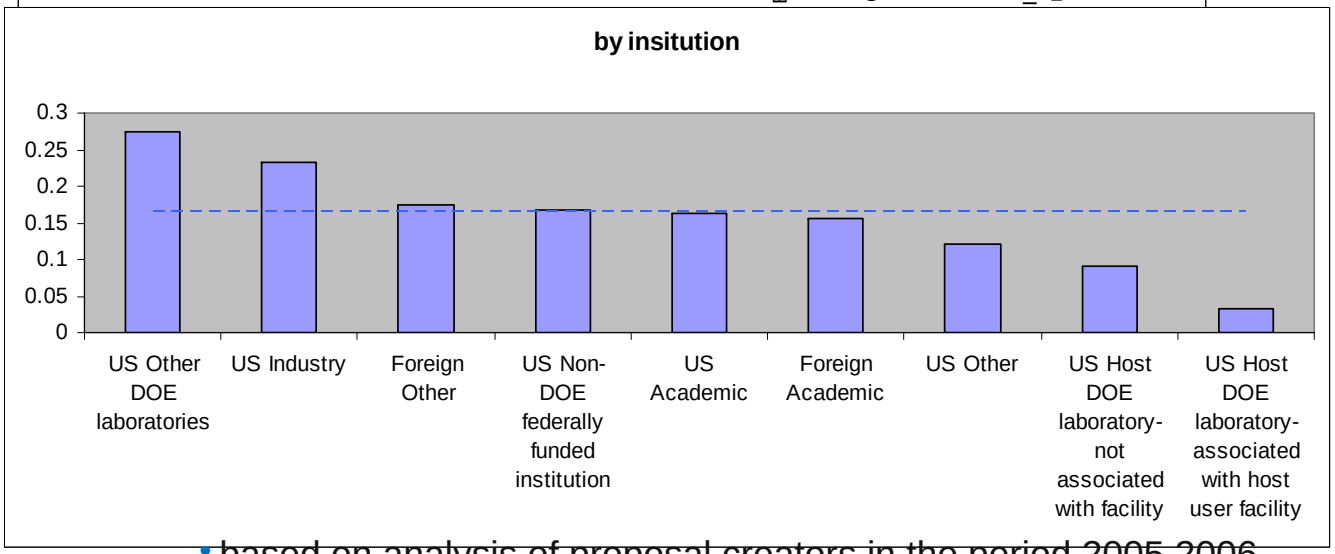
Industrial usage of APS

- We would like to reduce barriers to access
- Seeking input through NUFO workshop this summer

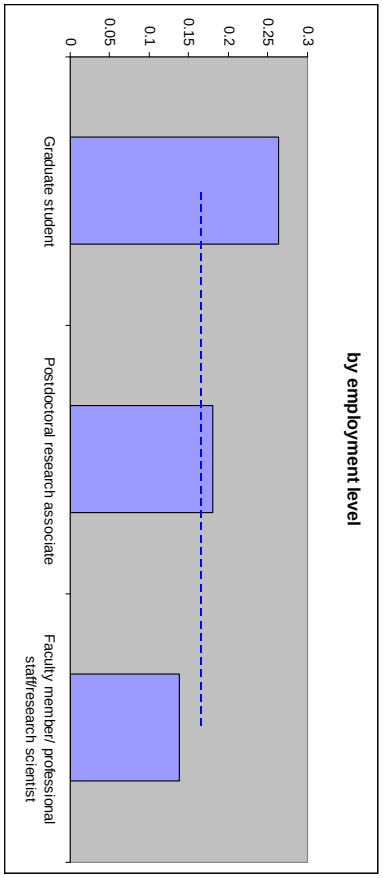
- Wish to enhance applications of APS in the energy arena
  - Fits well with ANL strategic planning

Don't get no time?
Some interesting general user statistics





17% of proposers do not get time at all at APS ♣



♣based on analysis of proposal creators in the period 2005,2006

Cf 38% BTR rejection rate for same period

Proprietary Rate Formula Change Imposed by DOE

- Based on findings by the Office of Inspector General during an audit of proprietary data, the APS has been transitioning to a new formula for calculating the proprietary rate.

- The original formula used the full APS budget, the total number of beam lines at full capacity and 6000 operating hours per year.

- The new formula uses the APS Operations budget (the APS budget less the R&D portion of approximately 10%), the actual number of beam lines in operation, and actual number of operating hours per year.

PROPRIETARY RATES (per hour)

FY06	***FY07***	***FY08***	***FY09*** *(Estimated)*
$225.80	*$255.87*	*$346.20*	*$358.59*

Operational Beam Lines Used in Calculation

70	*68*	*62*	*58*

Note: FY09 will be the first year using actual number of beam lines in operation

Proprietary Rates and Transition Formula

FY06: cost/hour/beamline = $\dfrac{\text{APS Full Budget}}{\text{(70 beam ports) (6000 hours/year)}}$ = $225.80/hour

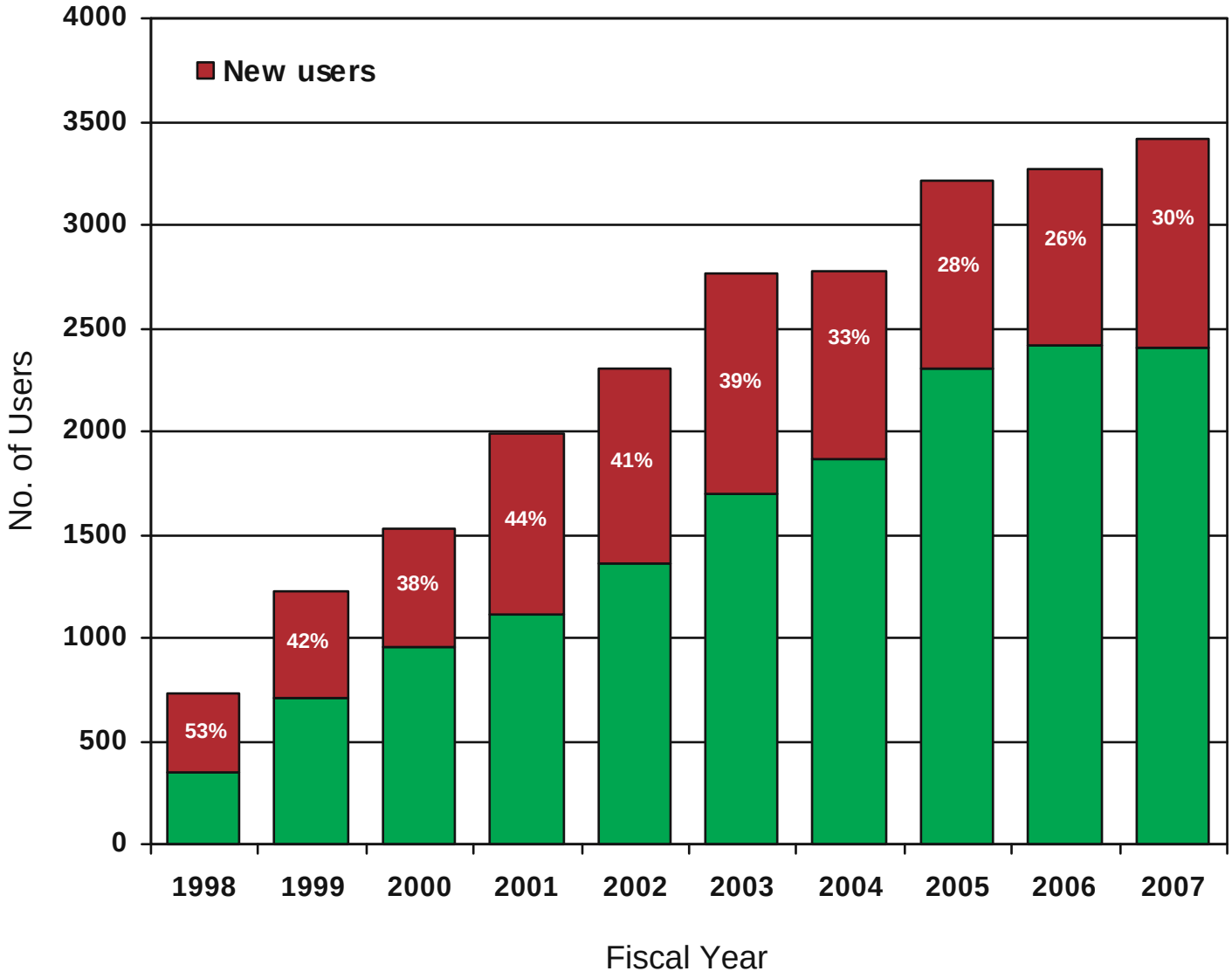
FY07: cost/hour/beamline = $\dfrac{\text{APS Operations Budget}}{\text{(68 beam ports) (5000 hours/year)}}$ = $255.87/hour

FY08: cost/hour/beamline = $\dfrac{\text{APS Operations Budget}}{\text{(62 beam ports) (4448 hours/year)}}$ = $346.20/hour

FY09: cost/hour/beamline = $\dfrac{\text{APS Operations Budget}}{\text{(58 beam ports) (5000 hours/year)}}$ = $358.59/hour

NOTE: FY09 Rate will increase if the number of operating hours are less than 5000 or if the beam ports are reduced

Our growing unique user population isn't static – many first time users come each year



New General User Program Advisory Committee

- Reports to APS Deputy Director , X-ray Science

- Members
  - Bruce Bunker (PUC)
  - Keith Brister (Life Sciences Council/chair of former GUPEC)
  - Jonathan Lang (XOR)
  - Robert Leheny (GU)
  - Steve Sutton (PUC/NUF)
  - Jon Tischler (BAC)
  - Paul Zschack (co-Chair original AU Advisory Committee

  - Susan Strasser, *ex-officio*
  - Meg Vigliocco-Hagen, *ex-officio*

Current GUP Issues

- Project Status for GU proposals
  - Still needed?
  - If not this, how to deal with special circumstances
- Proposal Score Aging: correct increment? timing?
- Issues Raised by BAC
  - Multiple proposals for same work at different beamlines
- MX Issues
  - Should MX time be all rapid access?
  - Should the APS consider an ESRF BAG-type system?
- Canceled Beam Time*
  - Charged against the proposal?
  - Is beamline penalized?

* Issue for discussion by APSUO and PUC

User Agreements

- To facilitate access to DOE national user facilities, DOE has created new standard master proprietary and non-proprietary user agreements
- Argonne's master agreements will cover research by all investigators from a single institution at all Argonne user facilities.
- Current multiple agreements with individual institutions will be replaced with master agreements over the next 18-24 months.
- Until a master agreement is in place, current agreements will stay in force
- Bottom line: very little impact on APS users.

APS Renewal – a real opportunity to bring APS beamlines to the state of the art and develop new capabilities

APS Renewal | Advanced Photon Source - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.aps.anl.gov/Renewal/

Inside Argonne | APS Storage Ring Sta... | ALD Suggestion Admi... | Login - SBC Yahoo! | ICMS | Faye's calendar | Argonne National Lab... | Sun Java ™ System ... | X-ray Science Division...

AT&T Yahoo! Mail - j.murray.gibson@... | Sun Java(TM) System Communications... | APS Renewal | Advanced Photon...

Argonne NATIONAL LABORATORY

Advanced Photon Source

A U.S. Department of Energy, Office of Science,
Office of Basic Energy Sciences national synchrotron x-ray research facility

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Argonne Home > Advanced Photon Source > Renewal >

APS Users Organization

Partner Users Council

Scientific Interest Groups

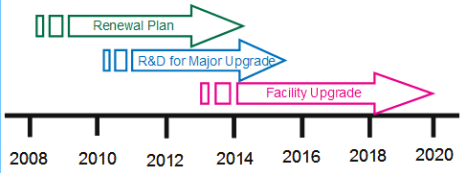
APS Renewal

Message from Murray Gibson:

Renewing and upgrading the Advanced Photon Source: a real opportunity for user engagement

May 22, 2008

Now in its twelfth year of operation, the Advanced Photon Source (APS) annually provides almost 3500 users with brilliant x-rays that lead to more than 1000 refereed publications each year covering many areas of science and engineering. Nevertheless, the facility, like any scientific instrument, is showing its age, and we have been working for several years on renewal and upgrade plans. These plans have recently received a boost because our sponsor - the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences - has asked us for a detailed, science-driven plan for the renewal of APS to cover the next five years. This renewal plan will encompass innovations in the beamlines and the x-ray source that are needed for major improvements in important areas of user science. We are engaging our users and staff *ab initio* in building this APS renewal plan, and we will use our Scientific Advisory Committee (SAC) and other outside experts to help us craft a plan with maximum scientific impact. A planning milestone will be a workshop to be held October 20-21, 2008 near the APS, at which the SAC will take a first complete look at the plan and give their advice. At present we continue to solicit proposals from our beamline staff, users, and accelerator and other APS staff. These proposals will be filtered by science-focused user groups, and they will also be analyzed in a matrix fashion by technique coordinators. More information, as well as details about how you can take part in the planning and communicate your perspective, can be found on this Web site.



The renewal of APS is the first component of a strategic plan for the APS that aims to provide our users with the best hard x-ray source in the nation, and beyond, by the year 2020. During the renewal period, we will be evaluating, with

SAC-approved Letters of Intent (LOIs) or Proposals for New and Redeveloped Beamlines:

- Advanced X-ray Imaging Collaborative Development Team (AXI-CDT)
- BioNanoProbe
- Sector 8-BM Redevelopment
- X-ray High Field Collaborative Development Team (XHF-CDT)
- X-ray Interfacial Science Collaborative Development Team (XIS-CDT)

Medium-Term Proposals:

- Beamlines | Call for Proposals (pdf)
- Accelerator Systems | Call for Proposals (pdf)

APS 2020 Upgrade Plan:

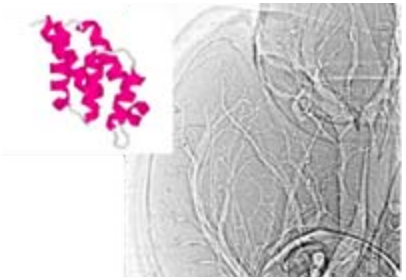
- APS Upgrade Options

Steering Committee Members:

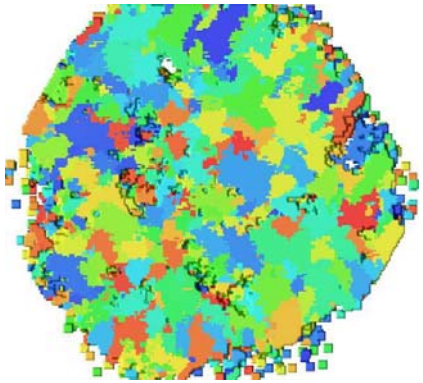
- Denny Mills
- Rod Gerig
- George Srajer
- John Maclean
- Denis Keane (APS PUC Chair)
- Paul Fuoss (APSUO Rep)
- Bob Fischetti (Life Sciences Council Chair)
- Dan Neumann (SAC Member)

APS Renewal Themes

- Mastering hierarchical structures through x-ray imaging

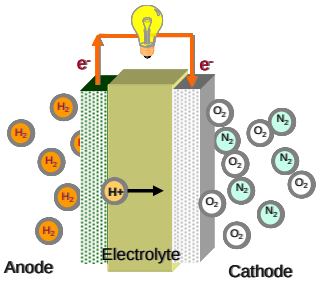


Images from proteins to living organisms will help connect the dots in understanding how genetics controls health and disease (image courtesy W.K. Lee)

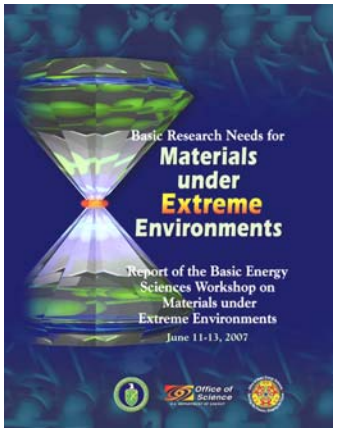


3-D distribution of grains in a 1 mm cube of Al (courtesy R. Suter)

- Real materials in real conditions in real time



Schematic of an H_2 fuel cell



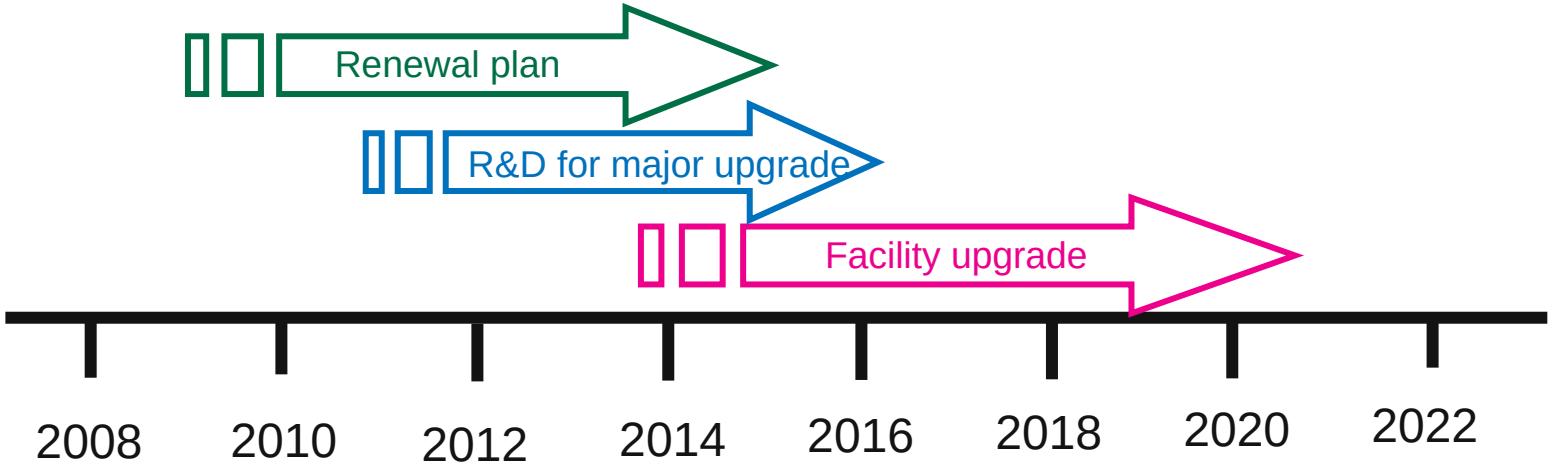
The cover of this BESAC report shows a diamond anvil cell. APS has been the most prolific source of high-pressure science.

Components of the developing APS 2020 strategic plan

- The APS 2020 plan is an high-priority component of the ANL 2020 Plan, recently submitted to DOE, that (among other things) describes the laboratory's major activities over the next decade and beyond.

"All that is human must retrograde if it does not advance."
Edward Gibbon, *The History of the Decline and Fall of the Roman Empire*

- The APS 2020 plan aims to revolutionize the scientific impact of APS and has several components:
  - APS renewal plan - a 5 year science-driven investment plan that will focus on beamlines, optics, detectors, and source improvements (includes new beamline proposals)
  - R&D for major upgrade - a plan that focused on the R&D required for a major facility upgrade that will build on the renewal plan that will take SR sources to the next level
  - Facility upgrade - a project that, once defined and approved by funding agencies, would keep the synchrotron radiation facilities at ANL at the state-of-the-art to 2020 and beyond.



National planning for upgrades (DOE workshop in Oct 08)

Charge to workshop from the BESAC New Era Committee

Identify the properties of future light sources that will be required to help accomplish the scientific challenges described in previous workshops on Basic Research Needs and Grand Challenges.

Consider the following "photon attributes"

- Energy range (from vacuum UV to hard X-rays)
- Coherence (both transversal and longitudinal)
- Intensity (photons per pulse and photons per second)
- Brightness (ultrahigh brightness + low electron emittance)
- Temporal structure (nano- to attoseconds)

NSF also planning stewardship of new light sources

“4-lab” whitepaper being prepared on next generation sources

- Draft for BES

Science and Technology of Future Light Sources

A White Paper

Report prepared by scientists from ANL, BNL, LBNL and SLAC. The coordinating team consisted of Uwe Bergmann, John Corlett, Steve Dierker, Roger Falcone, John Galayda, Murray Gibson, Jerry Hastings, Bob Hettel, John Hill, Zahid Hussain, Chi-Chang Kao, Janos Kirz, Gabrielle Long, Bill McCurdy, Tor Raubenheimer, Fernando Sannibale, John Seeman, Z.-X. Shen, Gopal Shenoy, Bob Schoenlein, Qun Shen, Brian Stephenson, Joachim Stöhr, and Alexander Zholents. Other contributors are listed at the end of the document.

Argonne National Laboratory

Brookhaven National Laboratory

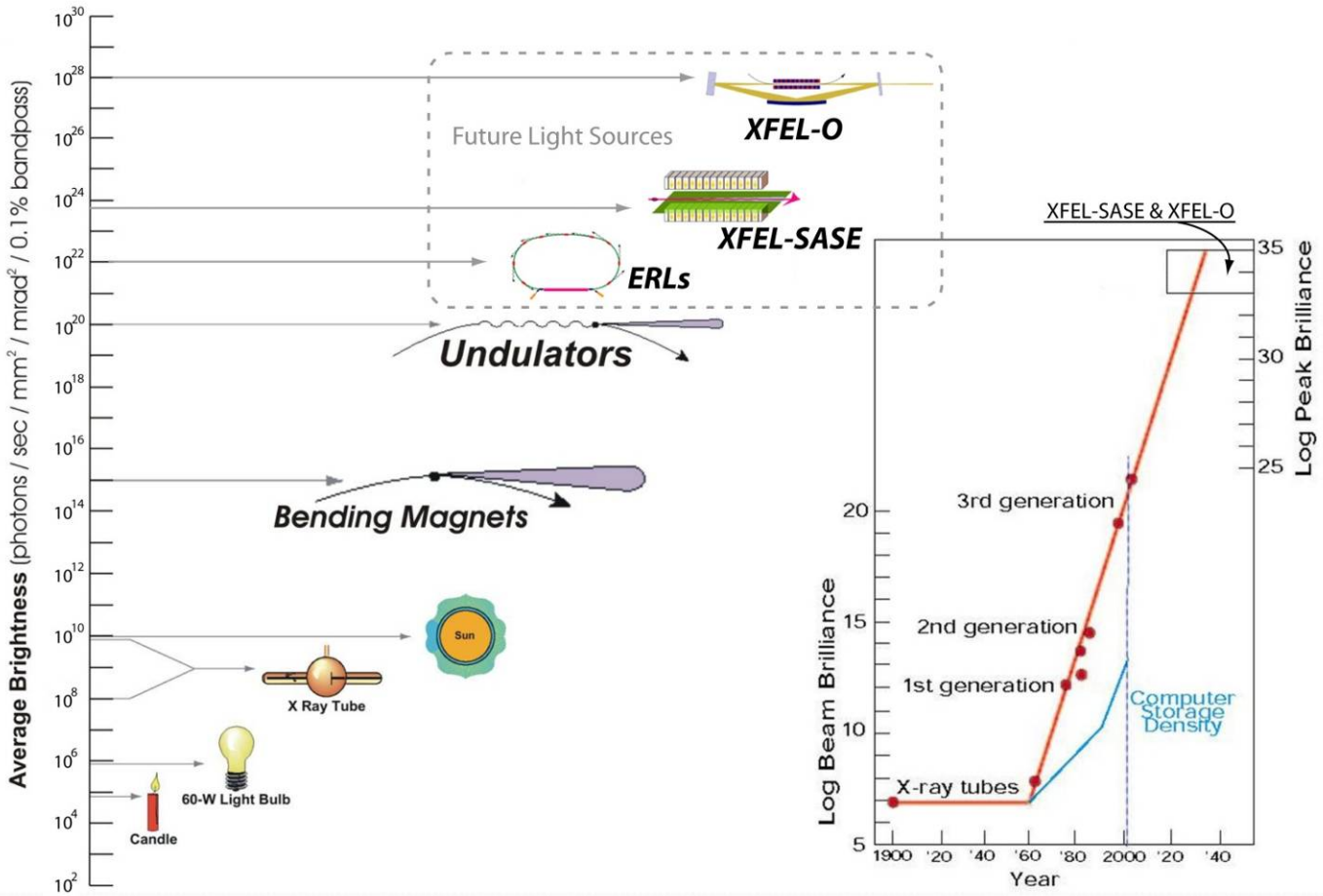
Lawrence Berkeley National Laboratory

SLAC National Accelerator Laboratory

December 2008

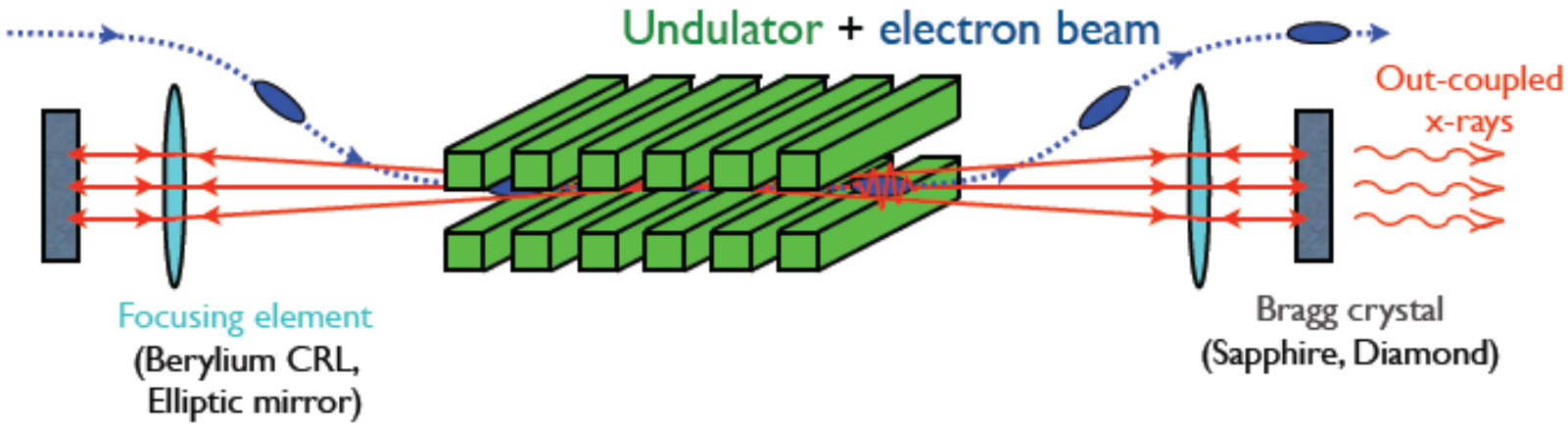
New possibilities for future sources/upgrades?

K.J. Kim and Y. Shvydko, PRL in press



Offers far higher brilliance and shorter pulses

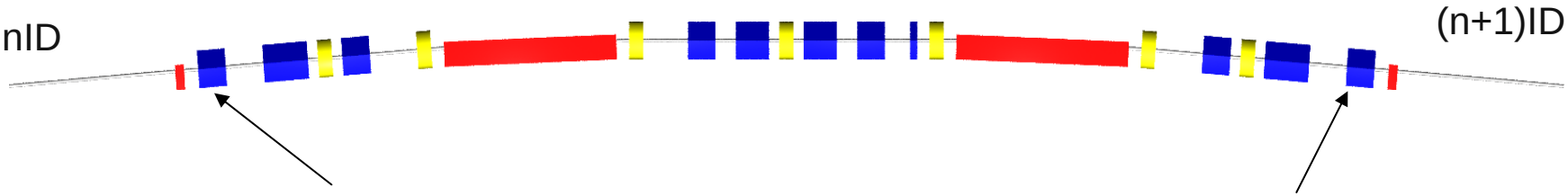
X-Ray FEL Oscillator



- **Concept for XFELO using Bragg crystals as high-reflectivity mirrors was first proposed by R. Colella and A. Luccio , Opt. Comm. 50, 41 (1984) at the same time when the high-gain FEL, SASE & seeded, was proposed.**
- **Electron beams suitable for x-ray high-gain FELs have been developed. All XFEL projects proposed or in construction are HG type.**
- **An XFELO requires different electron beam: low intensity, ultralow emittance, *low energy, and CW*.**
- **With electron beams, such as planned for high energy ERLs, an XFELO was shown to be feasible (KJK, Y. Shvyd'ko, and S. Reiche, PRL, 100, 244802 (2008)**

Possible upgrade of accelerator to include with renewal

- Lattice of N long straight sections N=4,5,8,10….



Removing these quadrupoles plus two steering magnets gives space for 7.7-m-long IDs

- Higher current
  - benefits flux hungry experiments such as inelastic scattering
  - 200mA front ends, and optics upgrades for beamlines

- With modest N, could be done for ~$100M on top of renewal funds

APS Renewal – a real opportunity to bring APS beamlines to the state of the art and develop new capabilities

APS Renewal | Advanced Photon Source - Mozilla Firefox

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http://www.aps.anl.gov/Renewal/

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Argonne NATIONAL LABORATORY

Advanced Photon Source

A U.S. Department of Energy, Office of Science,
Office of Basic Energy Sciences national synchrotron x-ray research facility

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APS Users Organization

Partner Users Council

Scientific Interest Groups

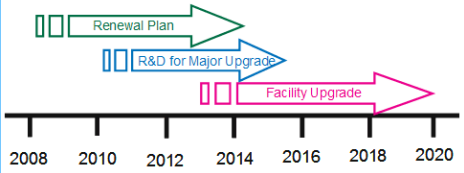
APS Renewal

Message from Murray Gibson:

Renewing and upgrading the Advanced Photon Source: a real opportunity for user engagement

May 22, 2008

Now in its twelfth year of operation, the Advanced Photon Source (APS) annually provides almost 3500 users with brilliant x-rays that lead to more than 1000 refereed publications each year covering many areas of science and engineering. Nevertheless, the facility, like any scientific instrument, is showing its age, and we have been working for several years on renewal and upgrade plans. These plans have recently received a boost because our sponsor - the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences - has asked us for a detailed, science-driven plan for the renewal of APS to cover the next five years. This renewal plan will encompass innovations in the beamlines and the x-ray source that are needed for major improvements in important areas of user science. We are engaging our users and staff *ab initio* in building this APS renewal plan, and we will use our Scientific Advisory Committee (SAC) and other outside experts to help us craft a plan with maximum scientific impact. A planning milestone will be a workshop to be held October 20-21, 2008 near the APS, at which the SAC will take a first complete look at the plan and give their advice. At present we continue to solicit proposals from our beamline staff, users, and accelerator and other APS staff. These proposals will be filtered by science-focused user groups, and they will also be analyzed in a matrix fashion by technique coordinators. More information, as well as details about how you can take part in the planning and communicate your perspective, can be found on this Web site.



The renewal of APS is the first component of a strategic plan for the APS that aims to provide our users with the best hard x-ray source in the nation, and beyond, by the year 2020. During the renewal period, we will be evaluating, with

SAC-approved Letters of Intent (LOIs) or Proposals for New and Redeveloped Beamlines:

- Advanced X-ray Imaging Collaborative Development Team (AXI-CDT)
- BioNanoProbe
- Sector 8-BM Redevelopment
- X-ray High Field Collaborative Development Team (XHF-CDT)
- X-ray Interfacial Science Collaborative Development Team (XIS-CDT)

Medium-Term Proposals:

- Beamlines | Call for Proposals (pdf)
- Accelerator Systems | Call for Proposals (pdf)

APS 2020 Upgrade Plan:

- APS Upgrade Options

Steering Committee Members:

- Denny Mills
- Rod Gerig
- George Srajer
- John Maclean
- Denis Keane (APS PUC Chair)
- Paul Fuoss (APSUO Rep)
- Bob Fischetti (Life Sciences Council Chair)
- Dan Neumann (SAC Member)