

# Access to Major International X-Ray and Neutron Facilities

Committee on International Scientific Affairs (CISA)  
American Physical Society

[http://www.aps.org/programs/international/  
resources/facilities.cfm](http://www.aps.org/programs/international/resources/facilities.cfm)

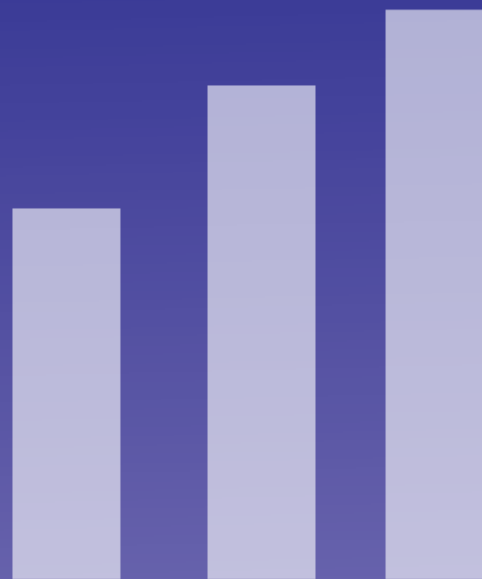


Henry R. Glyde  
European research Facilities  
Lund, 27 October, 2009



# Major International Facilities

Access To Major  
International X-Ray  
and Neutron Scattering Facilities



<http://www.aps.org/programs/international/resources/facilities.cfm>



# Major International Facilities

## Committee on International Scientific Affairs of the American Physical Society

Report Authors: Robert M. Briber, Henry Glyde (Chair), Sunil K. Sinha

Approved by the APS Committee on International Scientific Affairs, 9 September 2008

Endorsed by the Neutron Scattering Society of America, 16 July 2008

Approved by the APS Executive Board, 30 April 2009

<http://www.aps.org/programs/international/resources/facilities.cfm>



# Major International Facilities

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## Highlight Today:

1. Mechanisms of Access
2. Availability of Facilities
3. Instruments Scientists
4. Support for Investigators/Users
5. Features Valued Most at Facilities
7. Foreign Facilities, Use and Access

<http://www.aps.org/programs/international/resources/facilities.cfm>

# Major International Facilities

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## Goals and Scope of the Study:

1. Examine access mechanisms world wide. How do they compare with those in USA? How is access is evolving in time? What is the impact on US scientists?
2. Asia, Europe, North America.
3. Includes mechanisms of access, How is the user community evolving? Role of instrument scientists, availability of facilities, support for users.
4. Includes national and international access.
5. Includes what users value most at facilities.

# Major International Facilities

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## What did we do?

1. Questionnaire to Facilities  
-32 responses
2. Questionnaire to User Groups and Societies.  
- 17 responses
3. Interviews with Facilities and Users
4. Read Previous Reports

## Major International Facilities

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### Characteristics of an X-Ray and Neutron experiments.

1. Team of 2-5 investigators.
2. Experiment time: 2-10 days.
3. One to several experiments per year.
4. Collaborate with an instrument scientist who is a staff member at the facility.
5. Most do NOT build equipment at the facility.

# Mechanisms of Access

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## **All 32 Facilities responding operate a proposal program:**

1. Proposal program (60 -100 %)
2. Collaborative Research groups (PRTs, CATs) (20 %)
3. Facility Instrument Scientists (15-20%)
4. No User Fees
5. All proposals are reviewed for science within the same process
6. Facilities track national origin of proposals and foreign use. Origin of proposal can affect award of time after review.



# Mechanisms of Access

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- While the proposal system is expected to remain the major mechanism for access, establishing a funding mechanism in the USA for PRTs or CATs would greatly improve and expand this flexible component of access.

- Improvements in “Cyber Access” to instruments that would allow members of a research team not at the site to participate in the experiment remotely would be a major advance in access.

# Major International Facilities

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## Availability of facilities:

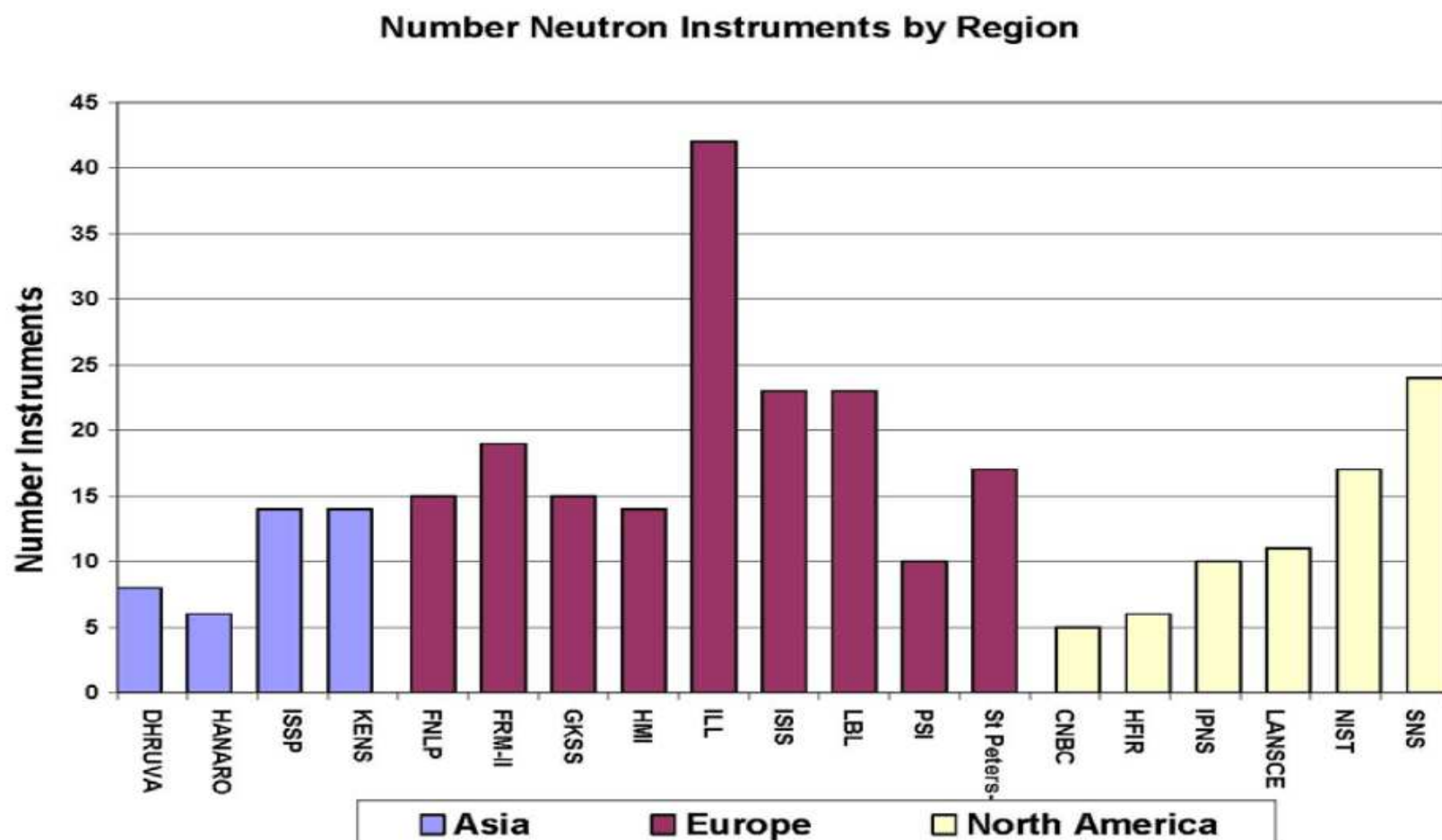
Scientific activity at a facility correlates very well with the number of beamlines/instruments at the facility.

- e.g. number of accepted proposals (experiments) per year, number of users or visitors, number of publications per year correlates with number of instruments.

Resources devoted to guide halls, to beamlines and instruments, to sample environment facility and to upgrades most directly expand availability.

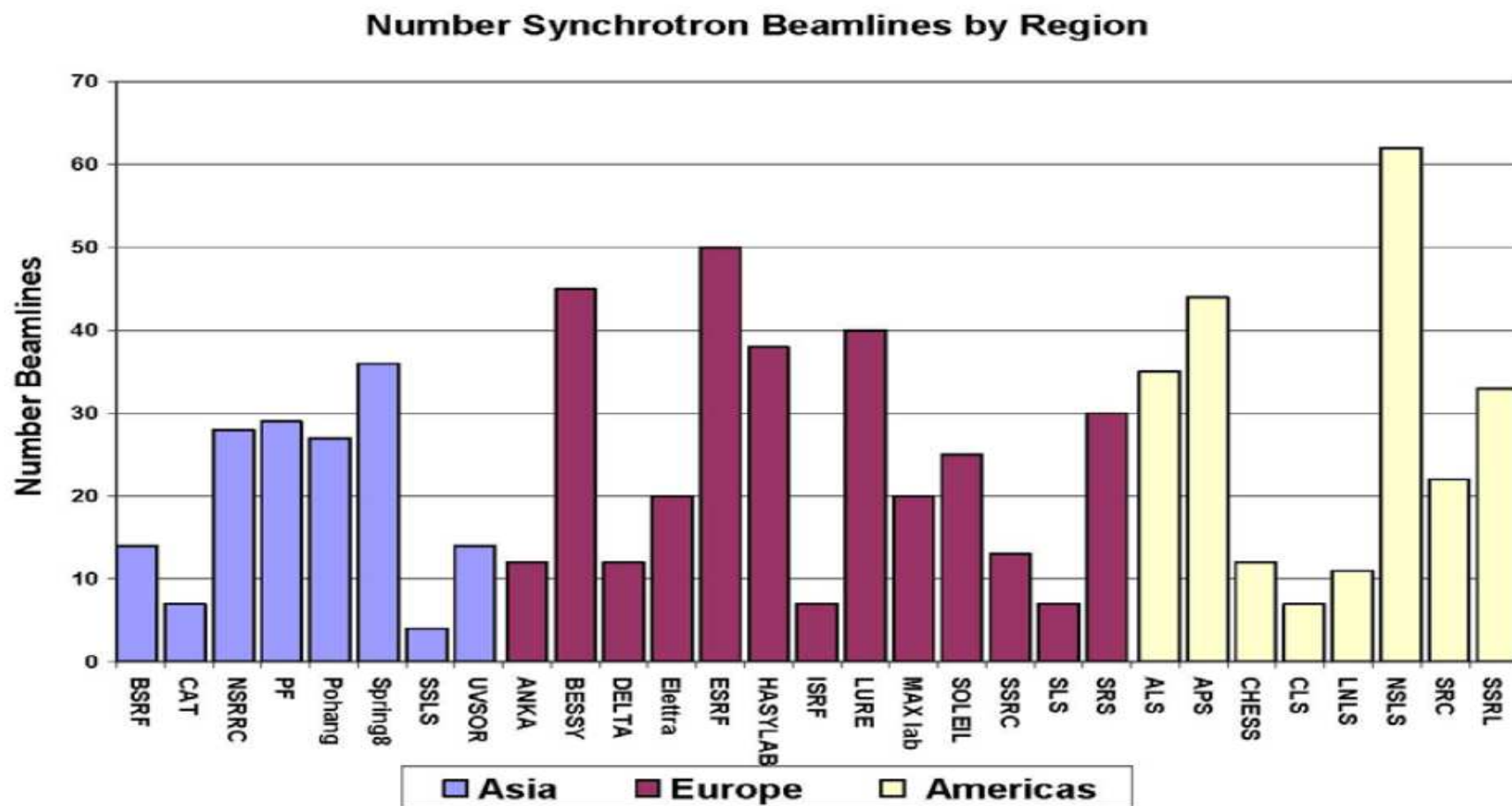
# Access to Major International Facilities

- Availability of Instruments 2007

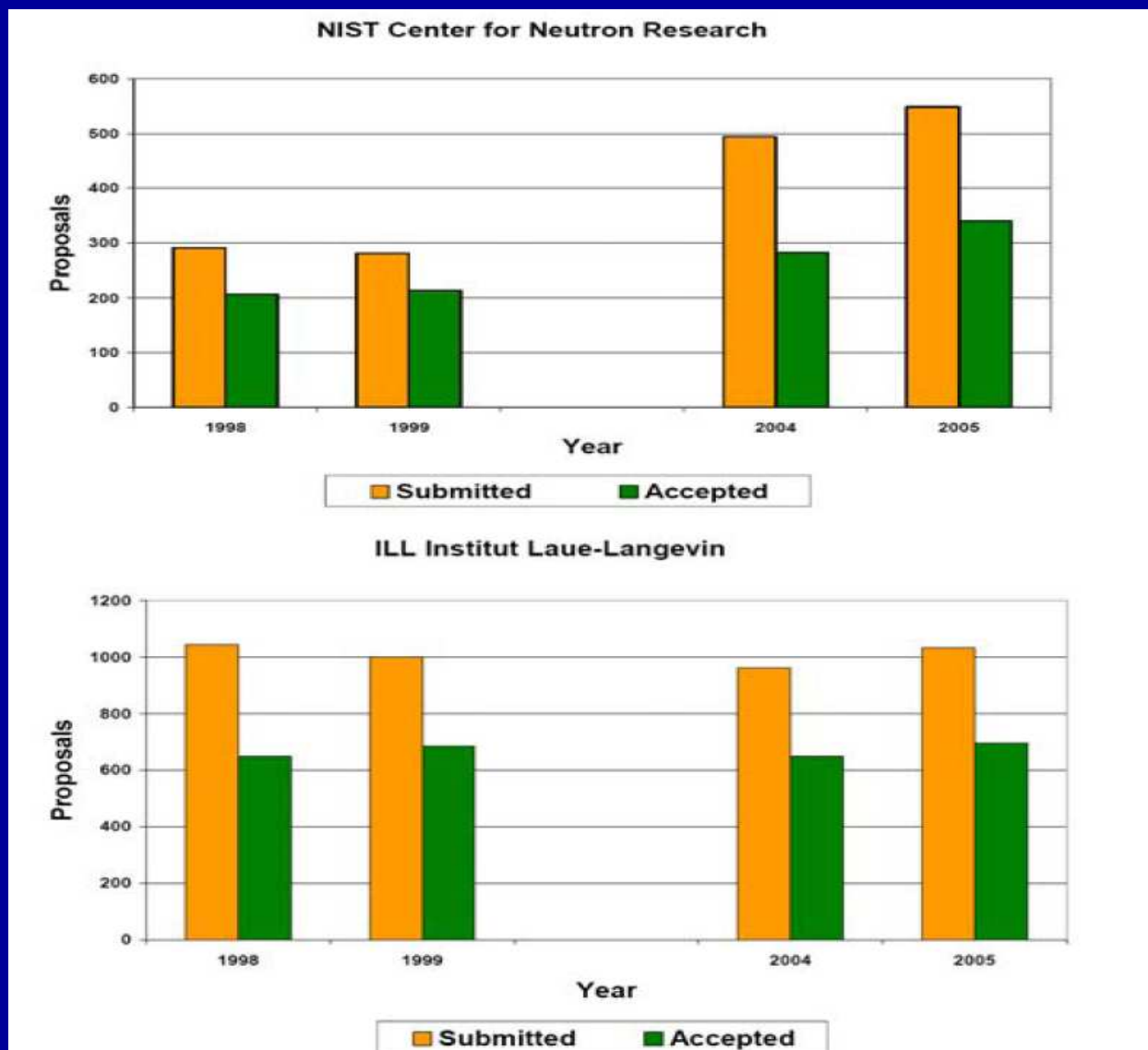


# Access to Major International Facilities

## Availability of Beamlines 2007



# Access to Major International Facilities





## Major International Facilities

### Selected Ratio of Accepted Proposals to Instruments: 2004

	<u>Accepted</u>	<u>Instruments</u>	<u>Ratio</u>
NIST	282	17	16.6
ILL	650	42	15.5
ISIS	665	23	28.9
Lujan	221	11	20.1
CNBC	63	5	12.6
LLB	323	23	14.0
<b>Total</b>	<b>2,204</b>	<b>121</b>	<b>18.2</b>

### Selected Ratio of Accepted Proposals to Beamlines: 2004

	<u>Accepted</u>	<u>Beamlines</u>	<u>Ratio</u>
APS	538	44	12.2
SRS (Daresbury)	488	30	16.3
NSLS	694	62	11.2
ESRF	786	50	15.7
<b>Total</b>	<b>2,506</b>	<b>186</b>	<b>13.5</b>



# Major International Facilities

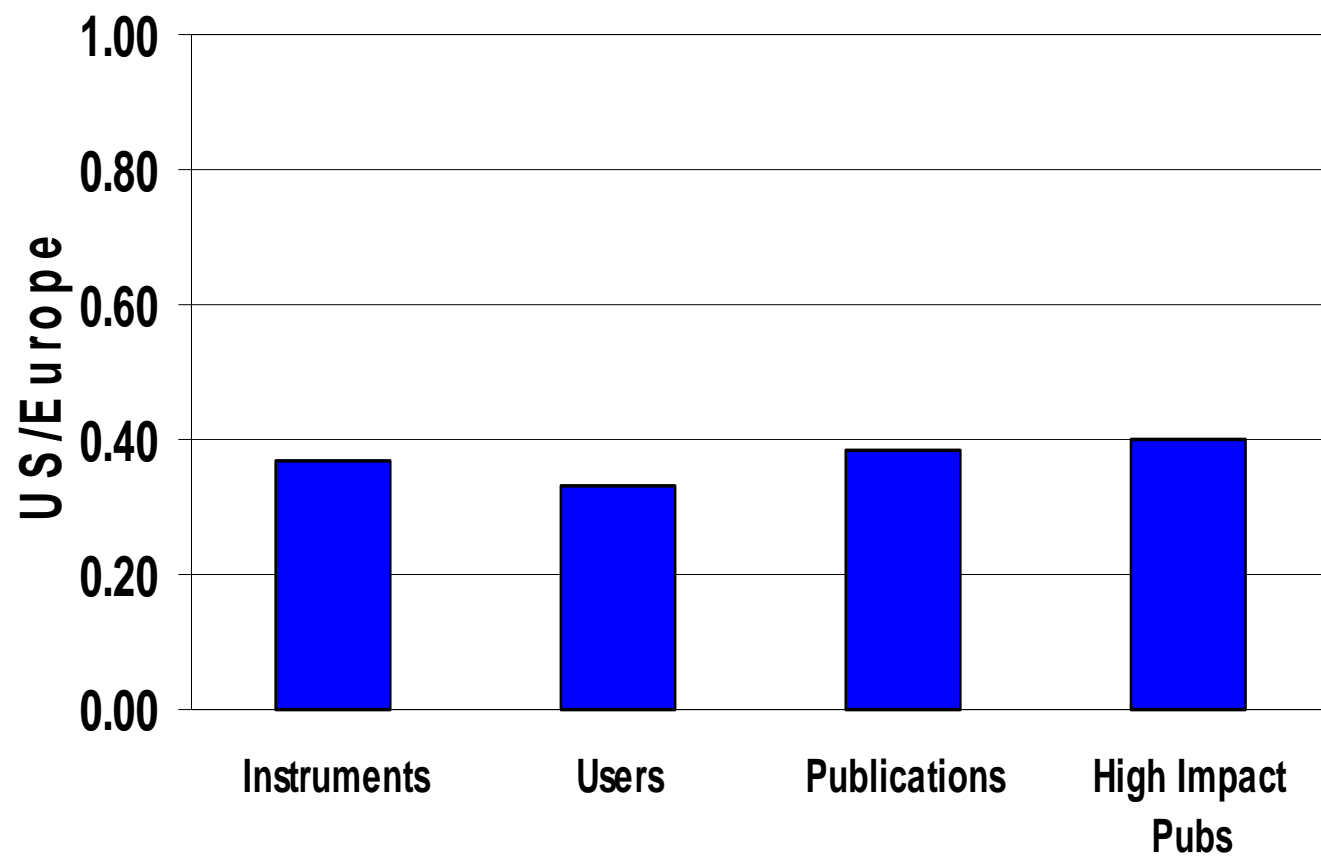
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	<u>Visitors</u>	<u>Instrument</u>	<u>Ratio</u>
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ILL	1,679	42	40.0
ISIS	1,500	23	65.2
Total	<b>4,067</b>	<b>86</b>	<b>47.3</b>

## Selected Ratio of Visitors to Beamlines: 2004

	<u>Visitors</u>	<u>Beamlines</u>	<u>Ratio</u>
APS	8,459	44	192
SRS (Daresbury)	2,189	30	73
SLS (Swiss)	1,443	7	206
ESRF	5,488	50	110
Total	<b>17,579</b>	<b>131</b>	<b>134</b>

# Current Status – US and Europe



By basically any measure, the US neutron scattering community is ~35% of that in Europe.

High-impact journals  
(as defined by Vettier).

The US neutron community would almost certainly grow and produce more great science if it had more good neutron scattering instruments.

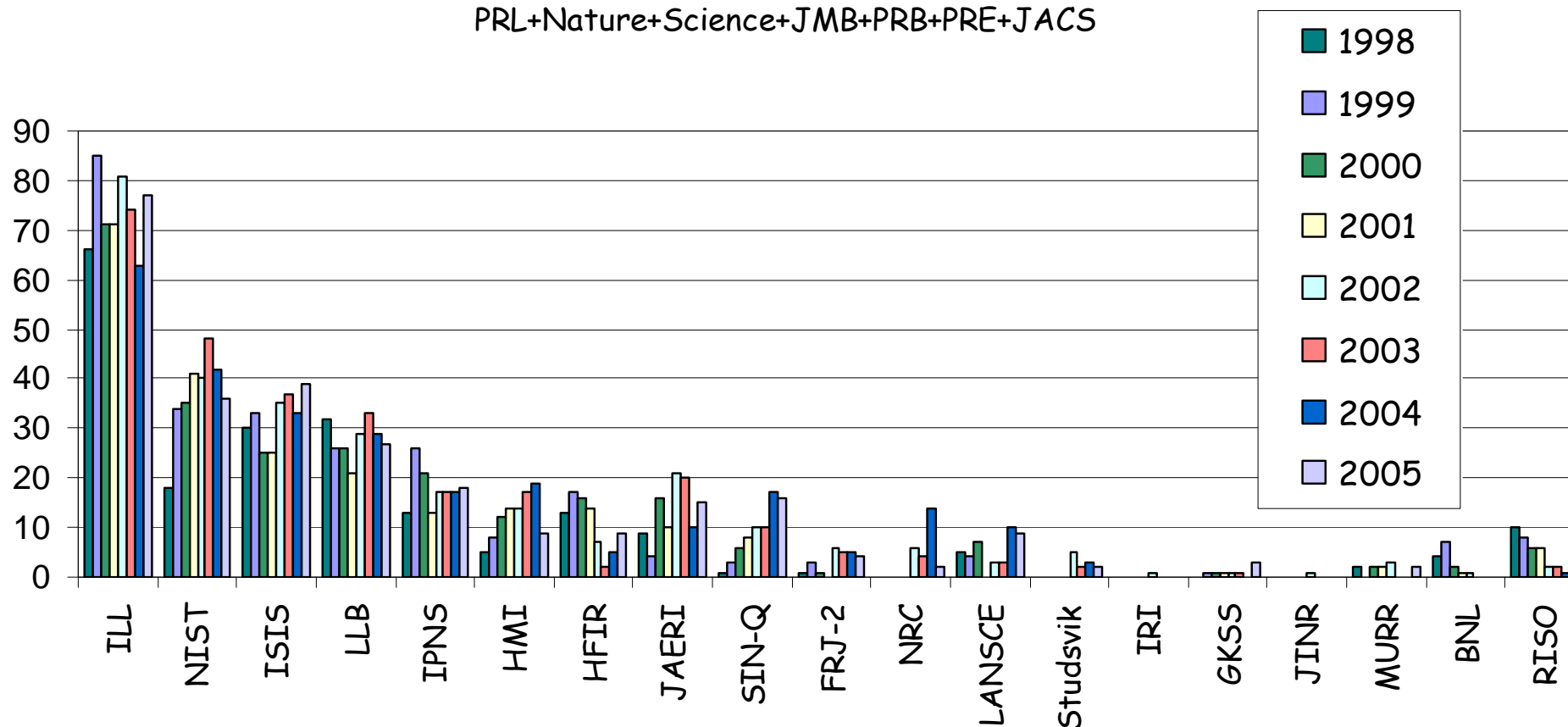




# Access to Major International Facilities

Number of articles based on data taken at the leading neutron facilities from 1998 to 2004 in Nature, Science, Physical Review Letters, PRB, PRE, JACS & J. Mol. Biology

PRL+Nature+Science+JMB+PRB+PRE+JACS



# Critical role of Instrument Scientists

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## **Nature of the scientific community using X-Rays and neutrons is evolving:**

- In the past, users were experts in Neutron or Light Scattering.
- Now, most are experts in their own field (materials, biology), not in neutron or light scattering. Community also expanding, most new uses are not experts in scattering.
- Instrument scientists at facilities even more important now and in the future in enabling scientific access for users, for designing best possible experiments.



## Critical role of Instrument Scientists

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increase. In this environment, users will depend increasingly on facility instrument scientists for (1) scientifically insightful planning of experiments, (2) distinguishing important discovery from spurious instrument effects (3) data reduction and (4) data analysis so that their "access" leads to a scientifically successful outcome (see section 6.5.3 and 6.6). Instrument scientists have always been the key contacts for users. The fraction of users who can conduct experiments largely independently and who require little assistance is expected to decrease. Specifically,



## Critical role of Instrument Scientists

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Scientifically successful access today, especially for new users, depends on the active assistance and collaboration of facility instrument scientists at a scientific level. This requires an increased number of instrument scientists and ensuring that they can remain scientifically active. This depends on (1) the education and training of fresh instrument scientists within the universities (2) the creation of attractive job opportunities, good promotion prospects and a satisfying career path for instrument scientists within the facilities and (3) ensuring that they have time and resources to develop and maintain their own scientific program.

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# International Use of Facilities

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## Extensive foreign use within Europe:

Swiss, SINQ -75 %, SLS- 75 %

Germany, HMI- 65 % BESSY- 50 %

France, LLB- 38 %

Spain, LNLS-15 %

## Less use of US facilities by scientists from institutions abroad:

e.g. 10 % at IPNS, ALS. 12 % at NIST.

## Little use of facilities abroad by US scientists:

3 % at ESRF, 5 % at ILL (down from 11 %, 15 years ago)

# International Use of Facilities

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## Means of Access to Facilities Abroad

1. Submit proposal to general facility proposal program - has limits
2. Collaboration abroad, submit a joint proposal with collaborators abroad.
3. Collaboration with an instrument scientist at facility
4. Build an instrument at facility  
PRT, CRG
5. Bilateral agreement

# International Use of Facilities

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## Why we want access to foreign facilities:

- Heavy competition for available facilities in the USA.
- Specific instruments or sample equipment are not available in the USA or are better abroad.  
e.g. currently there are few inelastic time of flight neutron scattering instruments in the USA.
- There are scientific programs or fields of science at foreign facilities that are not pursued in the USA.
- Attractive collaborations possible at foreign facilities that significantly enhance science.

# Major International Facilities

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## Access to both domestic and foreign facilities:

Building Instruments at foreign facilities.

e.g. VULCAN instrument at SNS- Canada

Spin Echo instrument at SNS- Germany

There is no funding mechanism for US scientists to build instruments or beamlines (PRTs) at facilities outside the USA.



# Major International Facilities

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## National - Multinational Facilities

### National Facilities:

- Nation to nation access policy:
  - Facilities of one nation are open to use by scientists from another. Reciprocal use of national facilities (informal policy, US policy)
  - Operates well between nations and where there is an approximate balance in availability of facilities (e.g. within Europe for many nations).

# Major International Facilities

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## National and Multinational Facilities:

- Multinational facilities are created and operated by a consortium of nations coming together to support a large facility (e.g. ILL, ESRF).
- Access is intended primarily for scientists from the supporting nations (10 % set aside for others).
- There is a mismatch between the nation-nation reciprocal use policy and multinational facilities with their support structure and access intended for supporting nations.
- This mismatch needs to be recognized simply as a mismatch of policy with the goal of a negotiated solution to access.

# Major International Facilities

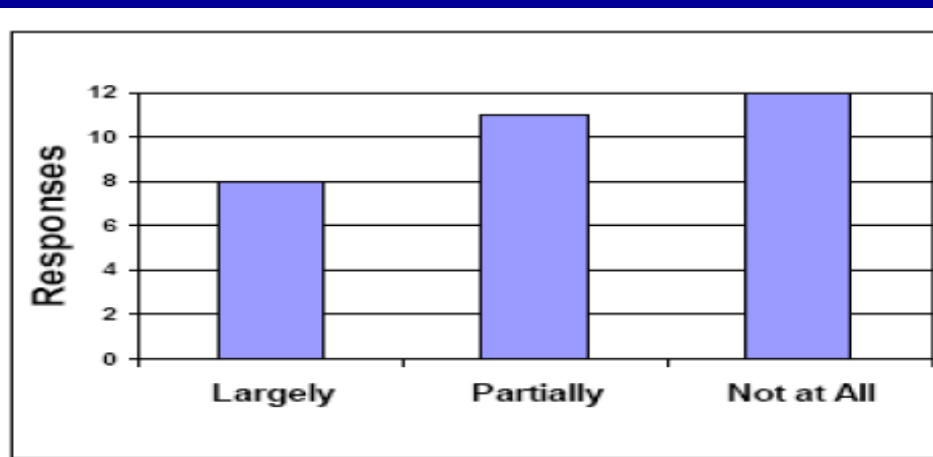
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## Support for Investigators

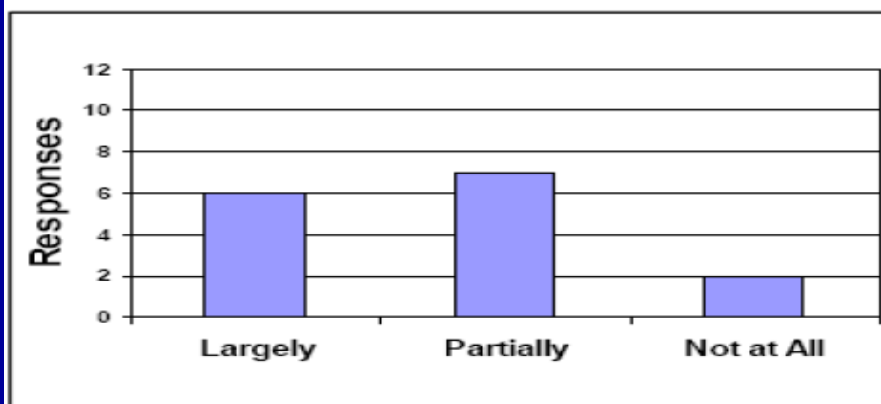
To attract gifted scientists and maintain a healthy user base, support for individual investigators and groups of investigators their graduate students and post doctoral associates to conduct research at facilities is essential.

- To create and ensure a world class and vital user community, support for the research programs of individual users in universities must remain strong and in reasonable balance with support for major facilities and other research centers.

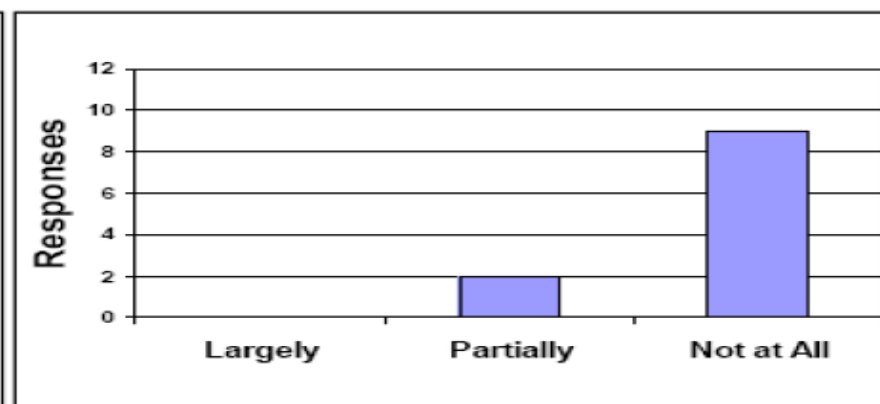
# User Travel and Living Expenses Paid by the Facility



## WORLD WIDE



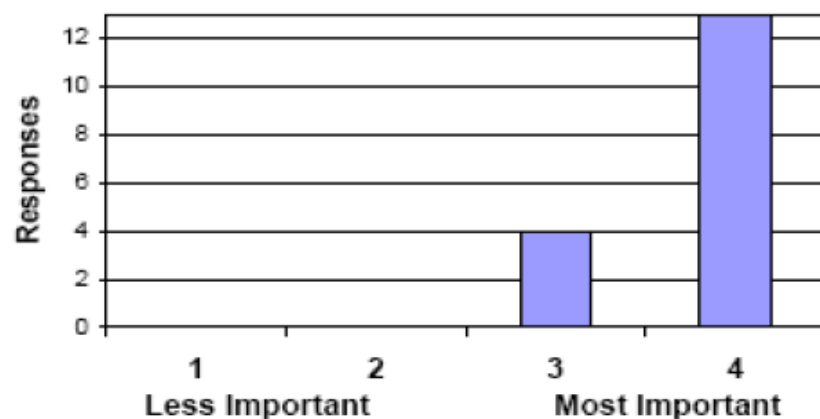
## EUROPE



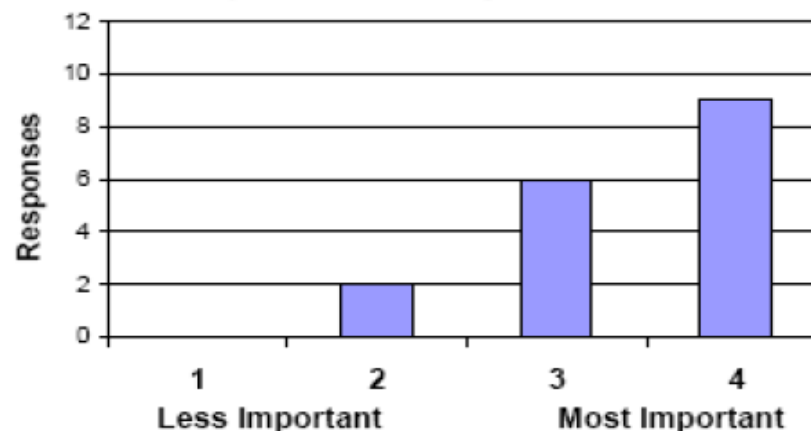
## USA

# Features of a Facility Regarded as Most Important by Users

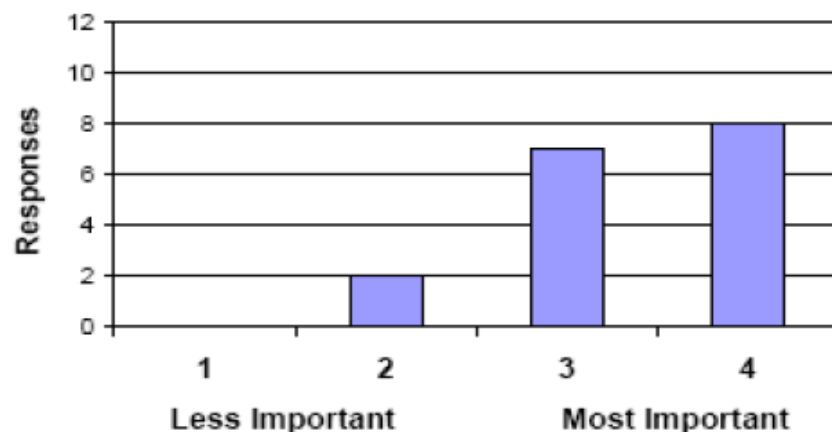
Reliability of Facility



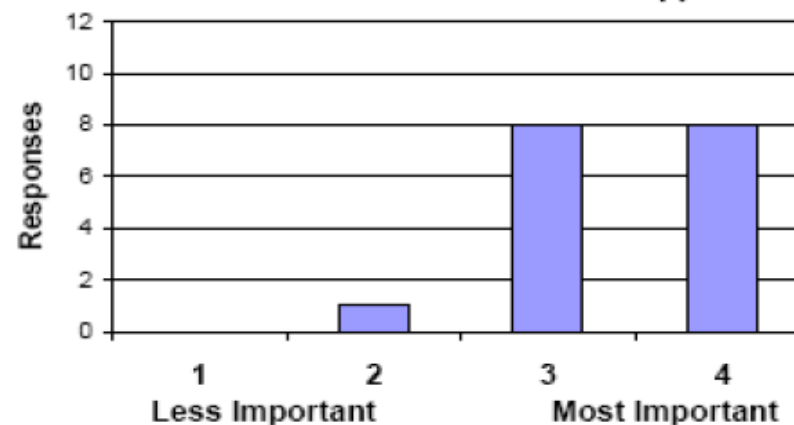
Uniqueness of Facility Instruments



Sample Environment Equipment



Technical Personnel and Lab Support



# Major International Facilities

## Summary of some Access Issues

- Basic Access Mechanisms.
  - Proposal program remains dominant.  
Openness and fairness not an issue.
  - Collaborative Research Group (CRG) remains an important mechanism
  - Remote access is a future mechanism
- Bilateral Access and Multinational Facilities
  - US access policy to foreign facilities is a bilateral nation-nation policy - reciprocal use.
  - There is mismatch between a nation-nation policy and Multinational facilities.
  - Both national and multinational facilities will remain important.
  - Currently significant international use within Europe, little involving the USA.



# Major International Facilities

## Summary of some Access Issues

- Why we want Access.
  - Unique Instruments or specialty instruments.
  - Unique Sample Environment Facilities
  - Unique or specialty scientific programs
- Means of Obtaining Access (international).
  - Scientific collaboration
  - Cooperative agreements
  - Building beamline\Instruments or SEFs
  - Collaborating in CRGs, PRTs or CATs
- Barriers to access
  - knowledge of facilities, of potential collaborations
  - Visa restrictions, security reviews

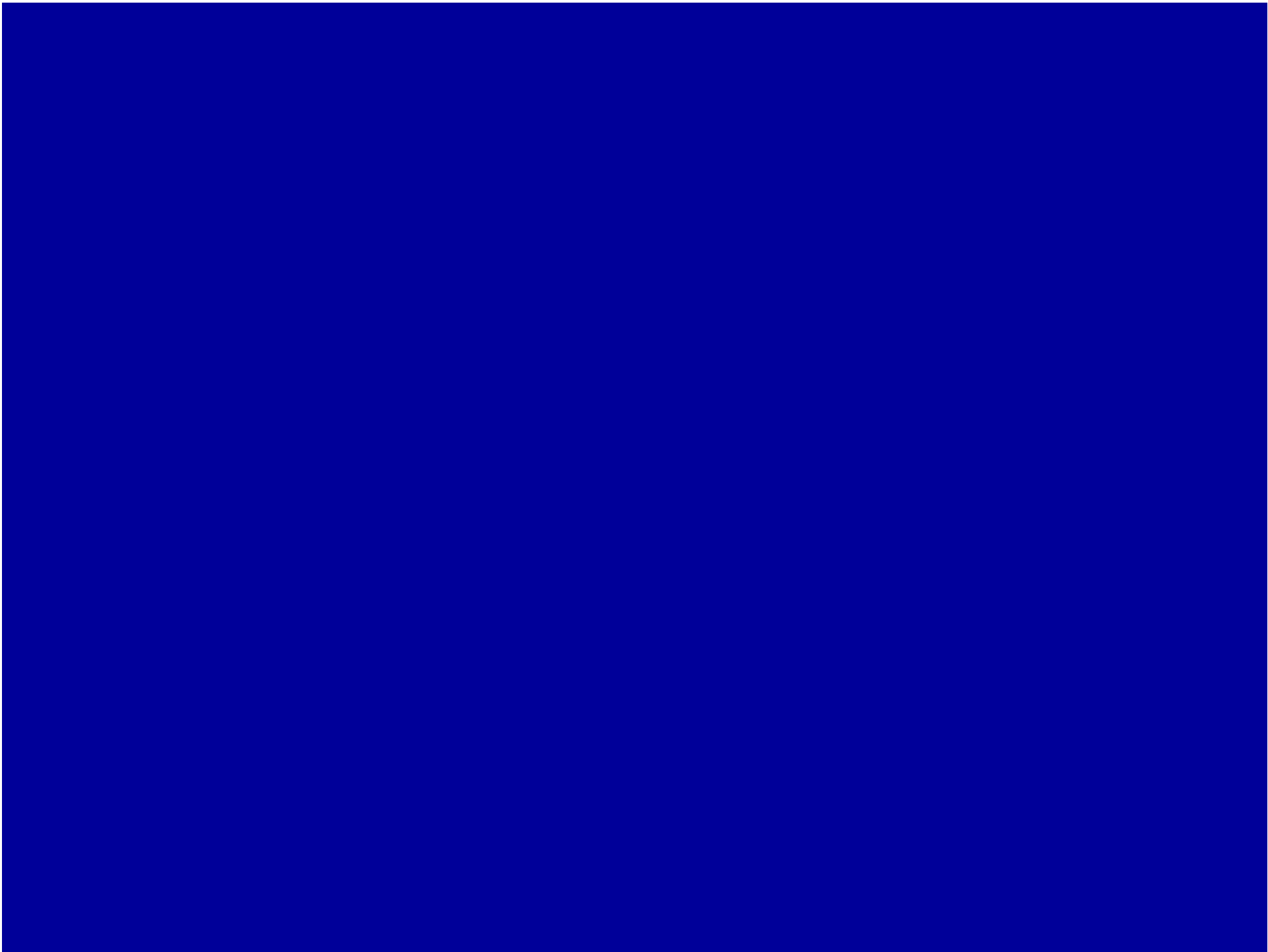


# Major International Facilities

## Summary of some Access Issues

- Availability of Facilities.
  - Availability set by number of beamlines/instruments.
  - Number of neutron instruments low in USA
  - Major shift in availability to the East.
  - Regular upgrades of beamlines/instruments/SEF maintains facilities at cutting edge and expands availability.
- Critical Role of Instrument Scientists
  - User community is evolving. Users are experts in their fields, less so in X-rays/neutrons.
  - Instrument scientists at facilities increasingly critical for scientifically successful access to facilities.
  - Education/training, rewarding career path, time to maintain their own scientific program.

















# Major International Facilities

## Summary of some Access Issues

- **Why we want Access.**
  - Unique Instruments or specialty instruments.
  - Unique Sample Environment Facilities
  - Unique or specialty scientific programs
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  - Set by number of beamlines/instruments
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## Access to Major International Facilities

### Selected Ratio of Users to Instruments: 2004

	<u>Users</u>	<u>Instrument</u>	<u>Ratio</u>
NIST	854	18	47.4
Lujan	262	11	23.8
ILL	1,164	42	27.7
ISIS	1,000	23	43.5
Total	<b>3,280</b>	<b>94</b>	<b>34.9</b>

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# Access to Major International Facilities

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# Access to Major International Facilities

## Planning Includes Upgrades

Projects (in alphabetical order per discipline)	Estimated Construction Cost (M€)*	First possible operations for users
ELI	150	2013
ESRF Upgrade	230	2007-2014
ESS: The European Spallation Source	1050	2017
European XFEL	986	2013
ILL 20/20	160	2012-2017
IRUVX-FEL	760	2006-2015
PRINS	1110	2008-2013

# **Major International Facilities**

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## **Summary of some Access Issues at Neutron and Synchrotron facilities:**

- **Availability of Facilities.**
  - Largely set by number of instruments
- . **Reliability of Facilities.**
- **Access through collaboration.**
- **National-Multinational Facilities.**
  - access agreements would be very helpful.
- **No funding mechanism for US scientists to build instruments or beamlines at facilities outside the USA.**
- **Instrument Scientists at facilities critical for effective scientific access to facilities.**

# Major International Facilities

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## Summary of some Access Issues

- **Availability of Facilities.**
  - Set by number of beamlines/instruments
  - Availability of neutron instruments in USA still low
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Glyde presented a summary of an extensive report entitled *Access to Major International X-Ray and Neutron Facilities*. The report was prepared by a subcommittee of CISA, chaired by Glyde. He described the goal of the study and process used by the subcommittee to explore how access to major international X-ray and neutron scattering facilities is evolving both in the US and internationally. Glyde also presented the major findings of the study. He said the report had been vetted in several different venues including discussion groups at the March meeting and has been approved by CISA.

Concerns were raised in the discussion following Glyde's presentation regarding some of the recommendations. Procedural questions were also raised about approving the report and how it should be used. Bienenstock appointed an ad hoc committee of Murray, Lubell, Bienenstock, and Goldston to review the report and make recommendations at the November Executive Board meeting. The recommendations will address approval of committee reports and the questions raised concerning this particular report.

# Major International Facilities

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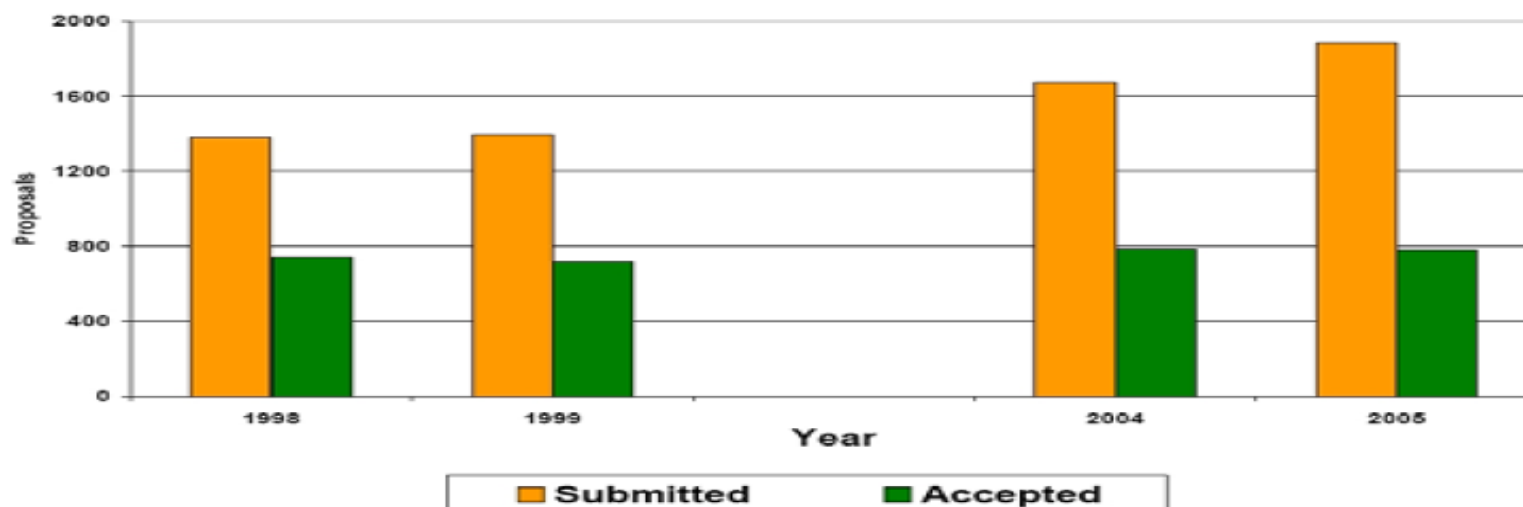
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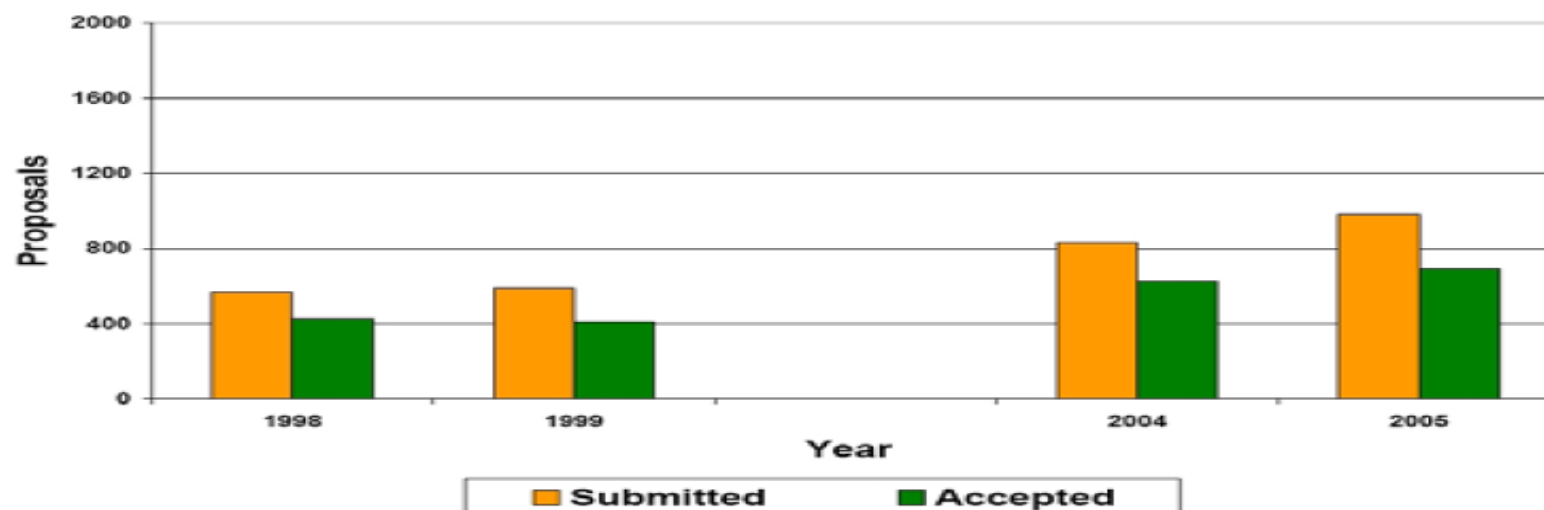
<http://www.aps.org/programs/international/resources/facilities.cfm>

# Access to Major International Facilities

ESRF European Synchrotron Radiation Facility



NSLS National Synchrotron Light Source







# **Major International Facilities**

**Committee on International Affairs**

**American Physical Society**

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## **PREAMBLE**

**The ability to conduct world-class research depends increasingly on access to major scientific user facilities worldwide. The Committee on International Scientific Affairs of the American Physical Society therefore decided to examine the evolving conditions for access to major international scientific user facilities and the projected international interdependence of major user facilities.**

# **Major International Facilities**

**Committee on International Affairs**

**American Physical Society**

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## **GOALS AND SCOPE**

**The central goal is to provide an assessment of the issues involved with access to major facilities. Terms of access to these facilities appear to be evolving. This evolution appears to be in different regions of the world. The aim is to provide information on the availability of facilities and conditions and requirements for getting access in different regions of the world and to assess its impact on access for US physicists.**



# Access to Major International Facilities

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# **Major International Facilities**

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## **6. How to get access to foreign facilities:**

- **Scientific collaboration.**
- **Bilateral and multinational agreements between nations.  
e.g. Japan-UK, Japan-US**
- **Building Instruments at foreign facilities.  
e.g. VULCAN instrument at SNS- Canada  
Spin Echo instrument At SNS- Germany**

**There is no funding mechanism for US scientists to build instruments or beamlines (PRTs) at facilities outside the USA.**

# **Major International Facilities**

**Committee on International Affairs**

**American Physical Society**

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## **GOALS AND SCOPE**

**The central goal is to provide an assessment of the issues involved with access to major facilities for physics research. Terms of access to these facilities appear to be evolving. This evolution appears to be different in different fields of physics and in different regions of the world. The aim is to provide information on the conditions and requirements for getting experiments approved in different fields and in different regions of the world and to assess its impact on access for US physicists.**



# **Major International Facilities**

**Committee on International Affairs**

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## **GOALS AND SCOPE**

**What is the process and what are the conditions that must be met to get an experiment proposal approved? This includes the review process for proposals, possible requirements of collaboration with local scientists, acceptance of proposals from non-participating countries, success rates of proposals, etc.**



# CISA Subcommittee on Access to Major International Facilities

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Ratio of Accepted Proposals to Beamlines/Instruments: 2004

## Synchrotron Facilities

	<u>Accepted</u>	<u>Beamlines</u>	<u>Ratio</u>
Europe	2,617	264	9.9129
Americas	2,355	206	11.4320
Asia	1,826	77	23.7143
Total	6,798	547	12.4278

## Neutron Facilities

	<u>Accepted</u>	<u>Instruments</u>	<u>Ratio</u>
Europe	2,337	203	11.5123
Americas	822	49	17.0000

# **Major International Facilities**

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## **Synchrotron and Neutron Scattering Facilities**

### **Major Multinational Facilities:**

- **European Synchrotron Research Facility – Grenoble, France**
- **Institut Laue Langevin – Grenoble**
- **Franck laboratory – Dubna, Russia.**

**Also: Elletra (Italy), SESEME (Jordan)**

**Most new facilities coming on line will be national,  
e.g. Japan, China. Major shift of facilities to East**



# Major International Facilities

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## Neutron Scattering and Synchrotron Light Scattering Facilities

- \* National and Multinational Facilities
- \* National – supported by one nation.
- \* Multinational – supported by a consortium of collaborating nations.
- Most facilities are national - (All US facilities). There are key, large multinational facilities.
- Availability of facilities is an important ingredient of access

# Mechanisms of Access

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**All 32 Facilities responding operate a proposal program:**

- 1. Proposal program (60 -100 %)**
- 2. PRTs (CRGs) (20 %)**
- 3. Instrument Scientists (20%)**
- 4. No User Fees. All proposals are reviewed for science within the same process.**
- 6. Facilities track foreign use. Origin can be a factor in award of time.**

# Major International Facilities

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## 1. Process for access to facilities:

- Contact Instrument Scientist at facility to discuss experiment.

- Write a scientific proposal for beamtime on a specific beamline/instrument.

- Proposal reviewed by external committees with recommendation for beamtime (e.g. 3-7 days) based on the science.

- No User Fees. Access at no charge for research in the public domain

**(Universal practice world wide)**



# Access to Major International Facilities

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