Where and how to get your neutrons

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and
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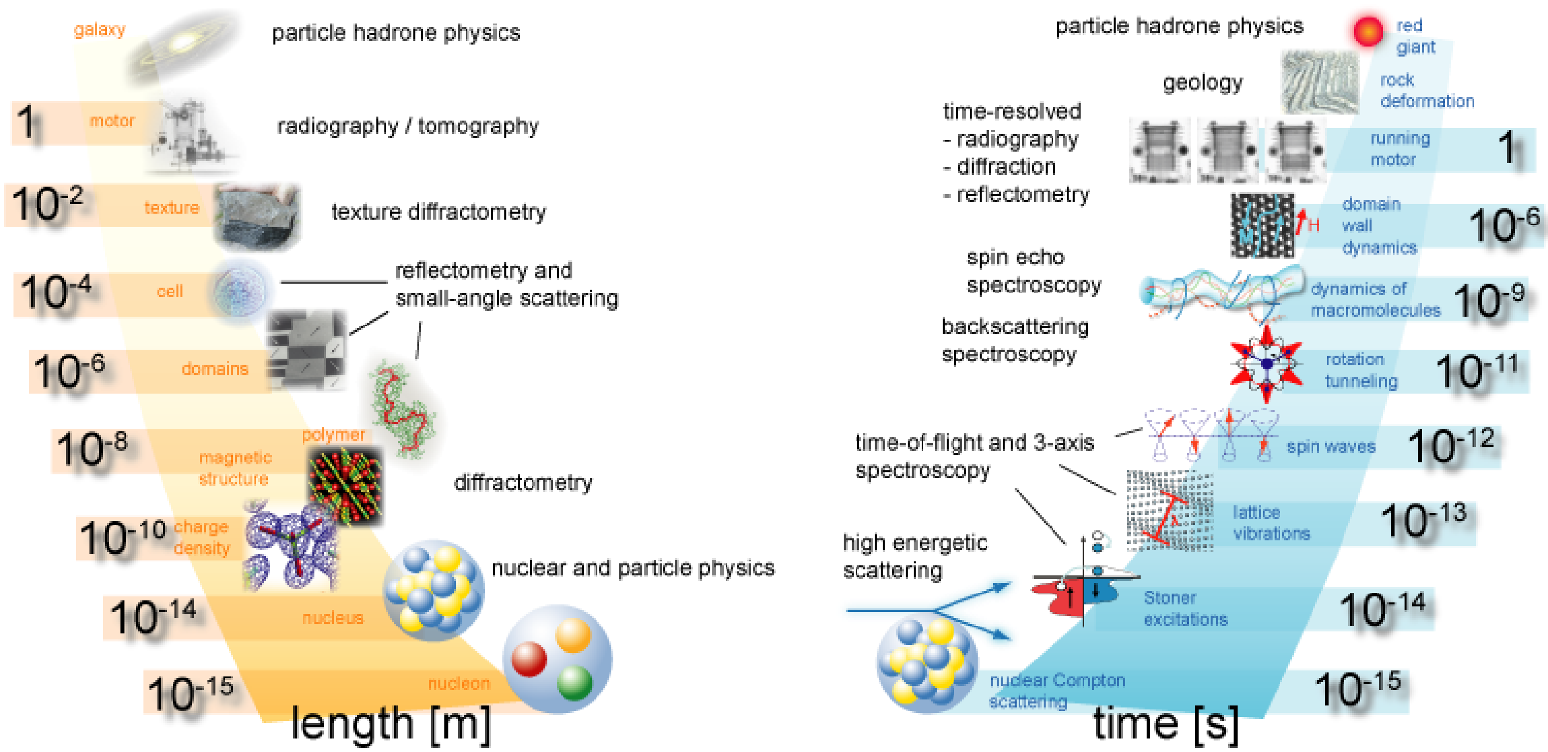
12th Oxford School on Neutron Scattering
September 2011
Oxford University

Overview

- Where – places to get neutrons?
- Who – eligibility to apply?
- How – gaining access?

Why?

- Huge sweep of science across many length and time-scales



Where in Europe ?

- Sources in Europe: European Neutron and Muon portal (NMI3/FP7)
  - http://neutron.neutron-eu.net/
- Specific search facility: neutron pathfinder
  - http://pathfinder. neutron-eu.net/idb/1023
    - Methods
    - Science
    - Experiment
    - Instrument
    - Facility

Access Guidelines

Access Activities allow scientists working in an EU member country or associated state (regardless of their nationality) to apply for beam time at one of the participating facilities. If the proposal is approved through this programme the user group can receive travel and subsistence support from the facility.

FACILITY	ORGANISATION	LOCATION	LINKS & ACCESS PROGRAMME	WHO CAN APPLY FOR FINANCIAL SUPPORT	WHEN	Deadline for submission of proposals:
BENSC	Berlin Neutron Scattering Centre	Helmholtz-Zentrum Berlin für Materialien und Energie, Berlin - Germany	nmi3 FP-6 BENSC	All scientists from the EU Member States or Associated States. Users from the host country are not eligible.	Reactor will be shut down from 1 January until 15 March 2009	~~[illegible]~~
BNC Budapest Neutron Centre	Budapest Research Centre	Budapest, Hungary	nmi3 Budapest Research Centre The BNC new web-page is ready!!	Scientists from EU member and associated are eligible to apply, users from the home country are not eligible.		15 May 2008 15 October 2008
FLNP Frank Laboratory of Neutron Physics	Joint Institute for Nuclear Research - JINR	Dubna, Russia				
JCNS FZ Jülich	Jülich Centre for Neutron Science - Forschungszentrum Jülich GmbH	Jülich, Germany	nmi3 Jülich Neutrons for Europe	All scientists from the EU Member States or Associated States. Users from the host country are not eligible.		~~08 April 2009~~ 14 Sept 2009
FRM-II Zentrale Wissenschaftliche Einheit Forschungsreaktor München–II	Technische Universität München	Garching, Germany	nmi3 Proposals to be submitted via the user portal e-mail address for users: userinfo@frm2.tum.de	Researchers working in EU Member States or Associated States other than Germany can apply for travel and subsistence reimbursement.	PDF 0.17) MBI Fifth call for proposals	~~14 January 2009~~ 17 July 2009
GeNF Geesthacht Neutron Facility	GKSS Forschungszentrum Geesthacht	Geesthacht near Hamburg, Germany	nmi3 Using our large scale facility	All scientists from the EU Member States or Associated States. Users from the host country are not eligible. Users, who are not eligible to the EU ACCESS program can apply for travel support from GeNF.	At any time.	~~[illegible] March 31st, 2008~~ (see proposal form available as Word or PDF-file)
ILL	Institut Laue-Langevin	Grenoble, France	ILL User Information	Invited scientists affiliated to ILL member countries	Twice a year: February / September	~~4 March 2009~~ 16 September 2009
			Standard Proposals			
			ILL User Information Submission of a proposal to the Director's Discretion Time (DDT)	Everybody Hot topics, new ideas, tests, new users	Submitted to the ILL Director at any time	No deadline
			Access for industrial users	Industry	Any time	No deadline
ISIS	Rutherford Appleton Laboratory	Oxford, UK	Applying for Beamtime	Scientists and engineers from the United Kingdom and from Partner Countries. Applications from other international users (non-EU or from countries without contractual access arrangement) will be accepted as part of the world	Round 2009/2	~~[illegible]~~

http://pathfinder.neutron-eu.net/idb/access 29/08/2009

Where in Europe ?

Centre	Organisation	Location	Web-site	Flux/power	Start-up
Spallation sources					
ISIS	Rutherford Appleton Laboratory	Oxford, UK	http://www.isis.rl.ac.uk/	0.16 MW	1985
SINQ	Paul Scherrer Institute	Nr Willigen, Switzerland	http://sinq.web.psi.ch/	1 MW	1996
ESS	ESS	Lund, Sweden	http://ess-scandinavia.eu/	5 MW	2019
High-flux reactor (>10^{15} n cm^{-2} s^{-1})					
ILL	Institut Laue-Langevin	Grenoble, France	www.ill.eu	58 MW	1971
Medium-flux reactor (10^{14} n cm^{-2} s^{-1} < n_{th} < 10^{15} n cm^{-2} s^{-1})					
BENSC	Helmholtz Zentrum Berlin	Berlin, Germany	http://www.helmholtz-berlin.de/	10 MW	1992 (after rebuild)
LLB	CEA/CNRS	Gif-sur-Yvette, France	http://www-llb.cea.fr/en/	14 MW	1980
FRM-II	Munich Technical University	Munich, Germany	http://www.frm2.tum.de/	10 MW	2004
Low-flux reactor ($n_{th} \leq 10^{14}$ n cm^{-2} s^{-1})					
BNC	Budapest Research Centre	Budapest, Hungary	http://www.bnc.hu/	10 MW	1992
RID	Delft University of Technology	Delft, Holland	http://www.tudelft.nl/	2 MW	1963
JEEP-II	Institute for Energy Technology	Kjeller, Norway	http://www.ife.no/	2 MW	1967
NPL - NRI	Nuclear Physics Institute of the Czech Academy of Sciences	Rez, nr Prague, Czech Republic	http://neutron.ujf.cas.cz/	10 MW	
FLNP	Joint Institute for Nuclear Research	Dubna, Russia	http://nfdfn.jinr.ru/	Mean 2 MW, pulse 1500 MW	1984, 2011

Where on Earth?

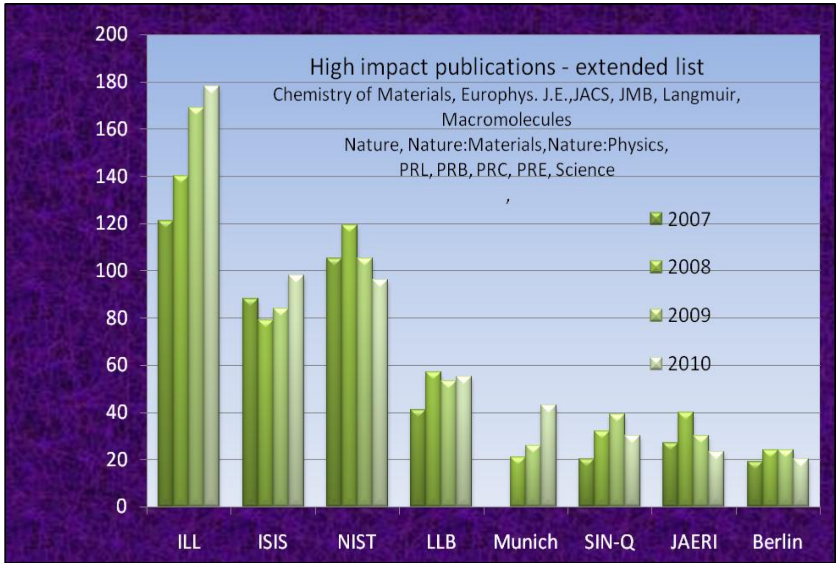
Centre	Organisation	Location	Web-site	Flux/power	Start-up
Spallation sources					
LANSCE	Los Alamos National Laboratory	Los Alamos, USA	http://lansce.lanl.gov/	0.16 MW	1972
SNS	Oak Ridge National Laboratory	Oak Ridge, USA	http://www.sns.gov/facilities/facilities_sns.shtml	0.8 MW (2009) ramping to 1.4 then 2-5 MW	2006
JSNS/MLF	J-PARC	Tokaimura, Japan	http://j-parc.jp/MatLife/en/index.html	0.2 MW (2011) ramping to 1 then 5 MW	2008
Various	Various	China		Various	> 2010
High-flux reactor (>10^{15} n cm^{-2} s^{-1})					
HIFR	Oak Ridge National Laboratory	Oak Ridge, USA	http://www.sns.gov/hfir/hfir_facilities.shtml	85 MW	1965 (1990 restart)
Medium-flux reactor (10^{14} n cm^{-2} s^{-1} < n_{th} < 10^{15} n cm^{-2} s^{-1})					
NRU	Chalk River Laboratories	Chalk River, Canada	http://www.nrc-cnrc.gc.ca/eng/ibp/cnbc/about/nru-reactor.html	125 MW	1962
NIST	National institute of Standards and Technology	Gaithershurg, USA	http://rrdjazz.nist.gov/	20 MW	1969
JRR-3M	Japan Atomic Energy Research Institute JAERI	Tokaimura, Japan	http://neutrons.issp.u-tokyo.ac.jp/modules/pico/index.php?content_id=16	20 MW	1990
OPAL	ANSTO	Lucas Heights Australia	http://www.ansto.gov.au/opal	20 MW	2006

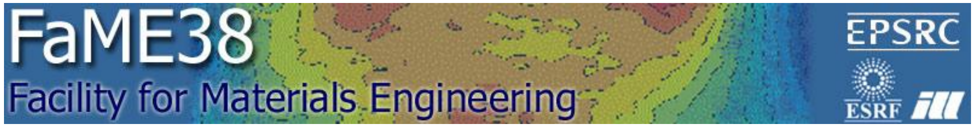
More information: http://www.neutron.anl.gov/

So where do you go ?

- Depends what you want!
- Where you can do the best science
  - Type and quality of instrument
  - Flux
  - Sample environment – T, P, H, ambient, chemical
  - Technical/user support/interface laboratories
- Proximity/ease of access
- Personal connections/collaborations

Does size matter?
Yes, but it’s not everything!





So where do you go ?

- Depends what you want!
- Where you can do the best science
  - Type and quality of instrument
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  - Sample environment – T, P, H, ambient, chemical
  - Technical/user support/interface laboratories
- Proximity/ease of access
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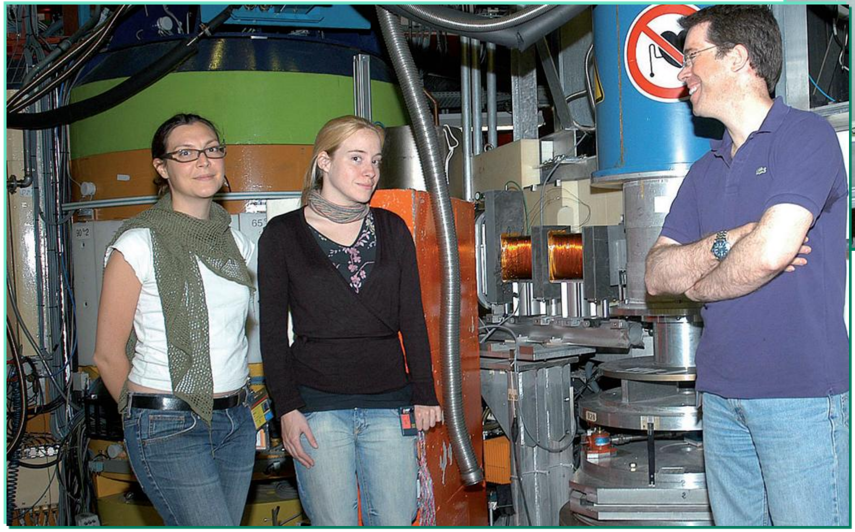
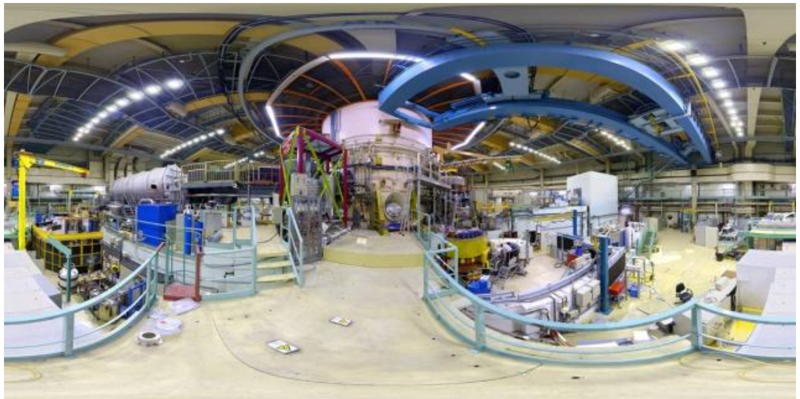
- Enjoyment!



ILL

- Institut Laue-Langevin, Grenoble
- World's most powerful neutron source (58 MW reactor)
- 27 public instruments + 10 CRGs
- Specialities
  - Single-crystal diffraction
  - Triple-axis spectroscopy
  - Structure and excitations in non-crystalline materials
  - Small-angle scattering
  - Magnetic polarisation techniques
  - Hot neutrons
  - Fundamental physics
  - Support for biology (D), engineering, soft condensed matter, computing
  - The great outdoors
- www.ill.eu



ISIS

- The ISIS Facility, Oxfordshire
- World's most effective spallation source, plus muons
- > 25 public instruments (and rising)
- Specialities
  - Spallation techniques in general
  - Spectroscopy with large-area detectors
  - Powder diffraction
  - Reflectometry
  - User support and software
  - GSOH
- http://www.isis.stfc.ac.uk/

SINQ

- Swiss Spallation Neutron Source
- Continuous spallation source next to muon and synchrotron facilities
- > 13 public instruments
- Specialities
  - Small-angle scattering (plus field)
  - Triple-axis spectroscopy
  - Imaging
  - Fundamental physics
  - Strong in-house science
  - Complementary facilities
  - Canteen
- http://sinq.web.psi.ch/

HZB (formerly HMI)

- Helmholtz Zentrum Berlin
- Relatively small reactor with some very strong niche facilities
- >18 public instruments
- Specialities
  - Sample environment
    - Low-temperature measurements
    - High-field magnetic measurements
  - Magnetism – strong in-house team
  - Berlin!

- http://www.helmholtz-berlin.de/userservice/neutrons/index_en.html

ESS

- European Spallation Source, Lund
- World's most powerful (5 MW) long-pulse (> 1ms) spallation source
- First neutrons by 2020
- Case for funding driven by what it gives to society
- Specialities – to be discussed, but likely:
  - Low-energy spectroscopy
  - Reflectometry
  - Small-angle scattering
  - Strong links to support/complemetary facilities

SNS

J-PARC

ESS

- http://ess-scandinavia.eu/

Others

- LLB, Paris
  - Established medium-flux reactor with good, all-round facilities
- FRM-II, Munich
  - New reactor, ~ 20 instruments and irradiation facilities, strong in spectroscopy, fundamental physics, applications (neutron therapy, isotope production)
- NIST, Washington
  - Established medium-flux reactor with tremendous output – particularly in soft matter (great support laboratories)
- SNS, Oak Ridge
  - Users for four years, working up to 24 instruments (backscattering, spin echo...) and 0.8 $\rightarrow$1.4 MW
- OPAL, Sydney
  - World-class instruments (>10...) optimised for medium-power; irradiation reactor
- JCNS/J-PARC, Tokaimura
  - Ramping up beam, user programme starting
- RIP (recently): Risø, IPNS, (NRU?)

Who is eligible?

- In general, scientists in universities, research institutes including central facilities and industry (fees may apply ~ 10 K€/day)
- PhD students 'through supervisors'
- Sometimes national membership restrictions, but:
  - Research centres will fight to give time to amazing science
  - FP7/NMI3 'Access' funding
  - Collaborations with 'members'

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Access: NMI3-funding for travel for scientists of EU and Associated States– not awarded to scientists from same country as the facility

DDT, LTP, EASY – ILL nomenclature for (i) rapid access for 'hot' science, (ii) long-term proposals and (iii) access for samples mailed to facility for relatively simple, rapid measurements

How?

- ‘Normal’ access – proposal plus peer review (75%)
- ‘Hot science’ – direct appeal to institute (<< 5%)
- Back door – collaborations/tests with institute scientists (5-10 %)
- For cash – for industry, no obligation to publish (< 1%, ~10 K€/day)
- Postal service – for relatively simple measurements (<1 %)
- Long-term proposals – for development work (<1 %)
- Others? – tickets, block grants...

Percent access figures for ILL – the difference between the sum and 100% reflects instrument set-up or repair/development

Proposal process

ILL process – common to most neutron institutes

- Call for proposals – twice a year
- The deadline is the deadline – no late submissions (tricks!)
- Internal classification (subject) and filtering (feasible, safe, ethical)
- Send out to external review panel members
  - 9 panels (subcommittees) for ILL – comprising broad range of experts
- Panel meeting to set priorities
  - driven by quality of science, balance instruments between panels, confidential,
- Balance (internally) – *e.g.* national funding
- Send out announcements

Putting it down on paper

- All on-line submission
  - Read the guidelines!
  - Ask for advice!
    - Supervisor and group
    - Instrument scientist/local contact
    - Facility user office

INSTITUT MAX VON LAUE - PAUL LANGEVIN (ILL)

Guidelines for the scientific background and detailed description of the proposed experiment

(For electronic proposal submission only)

Please remove this first page before creating your post-script file

The two pages of this form are to be filled in by all users or groups of users who apply for beamtime for experiments at the ILL via the Internet. Please print pages two and three of this document into a postscript file and attach it to your proposal on the Electronic Proposal System. This two-page description will be reduced by the system to a one-page, A4 format, and will be attached to your web proposal.

When preparing your description, please follow the instructions below:

- *Give a brief statement of the* ***background*** *and the general importance of the research.*
- *Give a clear account of the* ***aims of the proposed experiment*** *and a detailed description of the experiment; keep in mind that not all of the subcommittee members are experts in the field.*
- *Give* ***results of preliminary work*** *carried out, e.g. NMR, x-rays, light scattering, etc. and the relationship with your proposed experiment.*
- *Give the number of samples and* ***estimate the measuring time*** *for each sample; show how you calculate the beamtime requirements.*
- *State* ***why the ILL is necessary*** *for your experiment, especially with regard to the need of neutrons in particular.*
- *The description must be* ***typewritten in English****.*
- *A typeface such as "****Times New Roman****",* ***14 points*** *with at least* ***1 line spacing*** *is recommended because of the 70% reduction.*
- *Please* ***respect the available space*** *on the form .*

For submitting the description:

- *Fill in page 2 and 3 of the document,*
- *Print page 2 and 3 of the document into a* ***postscript*** *file* ***(according to the instructions given below)***
- *Attach it to your proposal on the Electronic Proposal System.*

To print into a postscript file in Microsoft Word:
- Choose print from the menu File
- Select a postscript printer from the list of printers
- Tick the box print to file, and click ok.
  On Macintosh you might find the option 'destination' change it from printer to file and click ok
- You will be asked to give a file name, click on ok to confirm.

(Detailed guidelines http://www.ill.fr/SCO/eps-guide.html)

Edition January 2001

Tips

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- *… te th … you*
- *… experiment, especially with regard to the need of neutrons*
- *… nglish.*
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What's the bigger picture – or is it just you who is interested?

Clear, readable, accessible: enthuse someone who is not an expert in the particular problem that this should be done *now*

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What are you going to measure and how (not everyone does this, and it's not the panel's job to write the proposal for you) ?

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There should be no doubt that you have – or will have – a well-characterised sample of sufficient quality. If the panel has an reason to believe that a sample is difficult to prepare they will expect a clear statement that it exists already

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If in doubt, talk to the local contact/instrument responsible about what is needed (panel may adjust this)

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If low-flux neutrons will suffice, or X-rays just as suitable to get the result panel will probably reject

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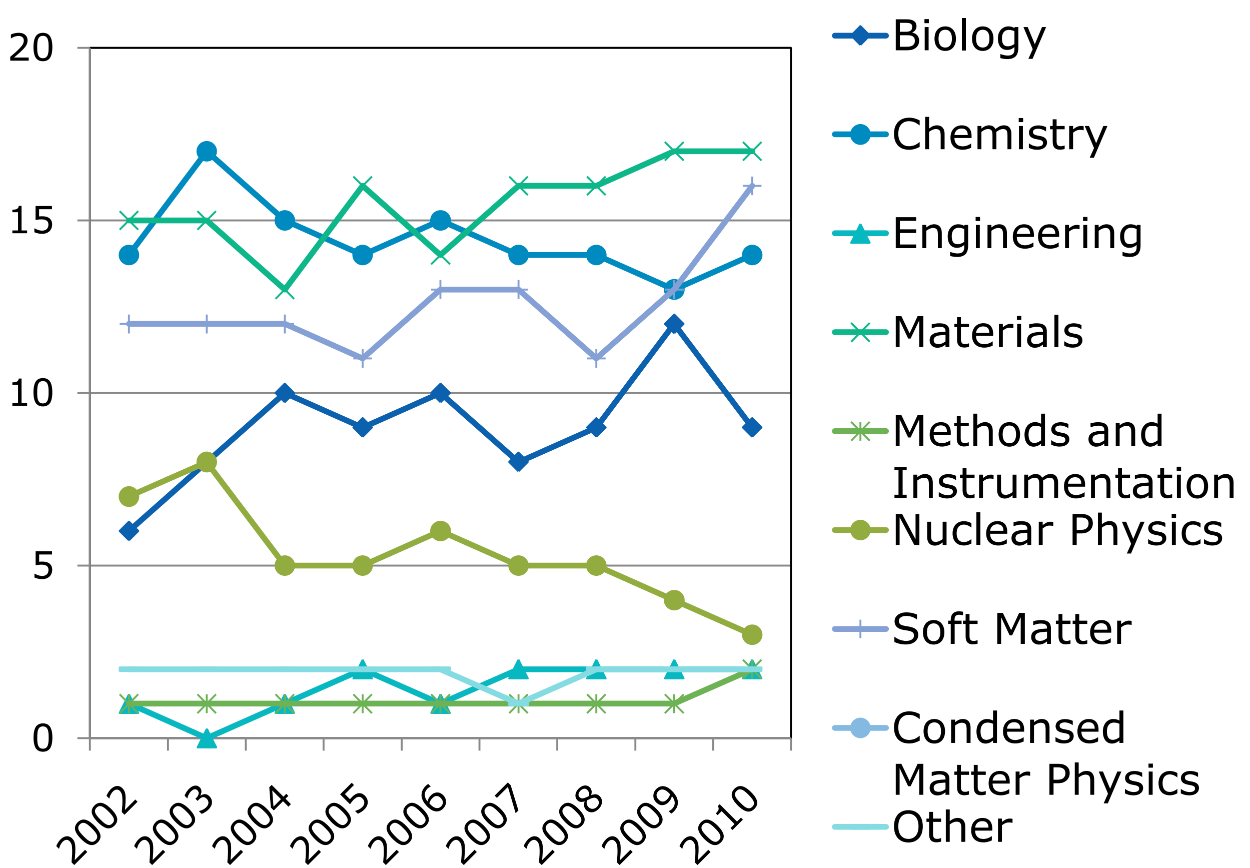
Few things irritate the panel more than trying to cram too much into the proposal !

Proposal process

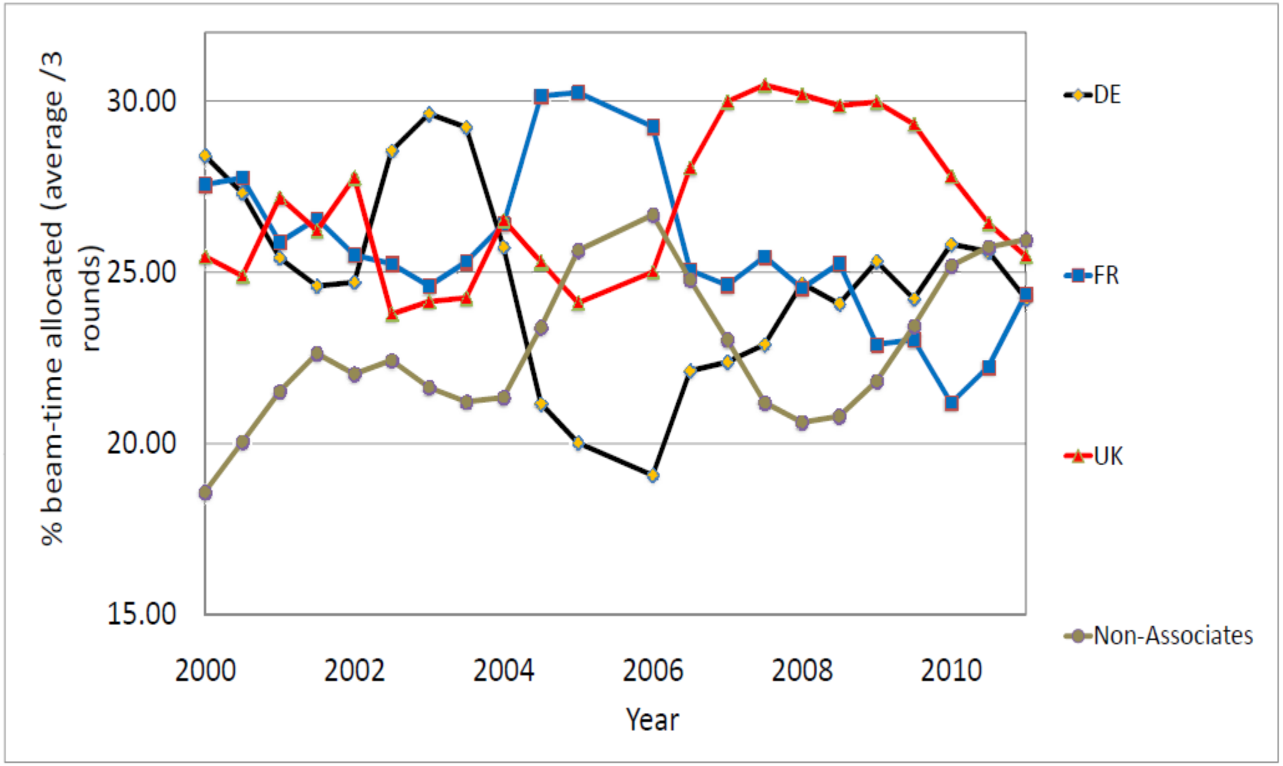
Statistics, distributions (ILL, 2000s)...



Instrument	Days requested	Days allocated	Overload factor
ADAM	16	30	0.53
D17*	102	75	1.36
FIGARO	54	25	2.16
D1A	46	50	0.92
D2B	139	72	1.93
D1B	49	39	1.26
D20	150	67	2.24
D3	119	78	1.53
D4	118	55	2.15
D7	100	65	1.54
D9	83	67	1.24
D10	62	70	0.89
D15	17	29	0.59
D19	63	65	0.97
D23	55	28	1.96
D11	98	58	1.69
D22	216	75	2.88
D16	33	70	0.47
DB21	42	42	1.00
LADI	149	80	1.86
SALSA	94	79	1.19
VIVALDI	125	80	1.56
IN1	36	24	1.50
IN8	104	68	1.53
BRISP	42	30	1.40
IN4	110	70	1.57
IN5	122	48	2.54
IN6	117	70	1.67
IN10	35	67	0.52
IN16	188	75	2.51
IN13	93	37	2.51
IN11	176	75	2.35
IN15	95	38	2.50
IN12	62	21	2.95
IN14	101	74	1.36
IN20	78	65	1.20
IN22	68	29	2.34

Proposal process

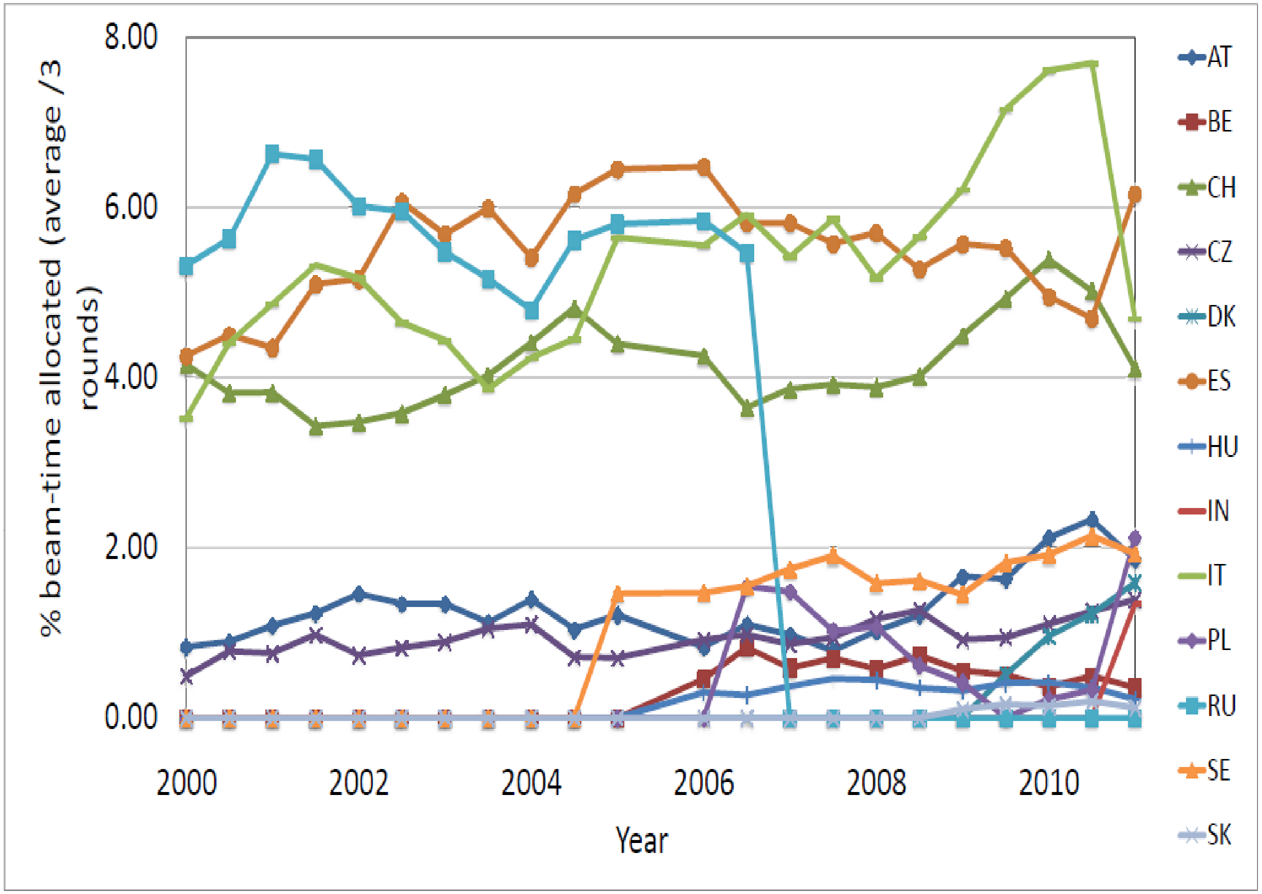
Statistics, distributions...



Beam-time request & allocation *Scientific Council April 2009*						
all countries			*before national balance*		*after national balance*	
country	**requested days**	**requested in %**	**allocated days**	**allocated in %**	**allocated days**	**allocated in %**
AE	0.29	0.01	0.29	0.01	0.29	0.01
AR	2.71	0.06	0.00	0.00	0.00	0.00
AT	**40.33**	**0.89**	**18.54**	**0.75**	**18.54**	**0.76**
AU	22.02	0.49	11.45	0.46	10.25	0.42
BE	**34.15**	**0.76**	**16.68**	**0.67**	**16.68**	**0.68**
BG	5.25	0.12	1.75	0.07	1.75	0.07
BH	0.86	0.02	0.86	0.03	0.86	0.04
BR	9.62	0.21	7.40	0.30	7.40	0.30
BY	1.00	0.02	0.60	0.02	0.60	0.02
CA	12.27	0.27	5.60	0.23	5.60	0.23
CH	**100.90**	**2.23**	52.60	2.11	**52.60**	**2.15**
CN	4.67	0.10	4.67	0.19	4.67	0.19
CZ	**26.17**	**0.58**	**16.58**	**0.67**	**16.58**	**0.68**
DE	**645.76**	**14.30**	**325.39**	**13.07**	**325.39**	**13.29**
DK	68.68	1.52	46.55	1.87	46.55	1.90
EG	2.00	0.04	0.00	0.00	0.00	0.00
ES	**207.30**	**4.59**	**98.77**	**3.97**	**98.77**	**4.04**
ESRF	**42.27**	**0.94**	**23.61**	**0.95**	**23.61**	**0.96**
FI	28.38	0.63	8.13	0.33	8.13	0.33
FR	**694.91**	**15.39**	**450.60**	**18.11**	**450.60**	**18.41**
GB	**764.95**	**16.94**	**474.86**	**19.08**	**474.86**	**19.40**
GR	0.67	0.01	0.33	0.01	0.33	0.01
HU	**11.93**	**0.26**	**3.25**	**0.13**	**3.25**	**0.13**
IE	5.53	0.12	2.87	0.12	2.87	0.12
IL	2.00	0.04	0.00	0.00	0.00	0.00
ILL	**812.61**	**17.99**	**474.79**	**19.08**	**466.79**	**19.07**
IN	46.33	1.03	15.17	0.61	15.17	0.62
IT	**319.70**	**7.08**	**141.45**	**5.68**	**141.45**	**5.78**
JP	44.54	0.99	21.94	0.88	15.94	0.65
KR	3.43	0.08	1.71	0.07	1.71	0.07
MY	40.00	0.89	0.00	0.00	0.00	0.00
NL	20.43	0.45	16.15	0.65	16.15	0.66
NO	6.27	0.14	3.00	0.12	3.00	0.12
NZ	0.43	0.01	0.43	0.02	0.43	0.02
PL	31.30	0.69	6.90	0.28	6.90	0.28
PT	5.93	0.13	4.77	0.19	4.77	0.19
RU	94.98	2.10	49.11	1.97	49.11	2.01
SE	**82.45**	**1.83**	**34.13**	**1.37**	**34.13**	**1.39**
SG	0.60	0.01	0.60	0.02	0.60	0.02
SK	**6.67**	**0.15**	**2.67**	**0.11**	**2.67**	**0.11**
TH	8.00	0.18	8.00	0.32	8.00	0.33
UA	4.55	0.10	1.20	0.05	1.20	0.05
US	237.77	5.26	123.91	4.98	98.11	4.01
ZA	15.92	0.35	11.50	0.46	11.50	0.47
total	*4516.50*	*100.00*	*2488.80*	*100.00*	*2461.25*	*100.00*

Proposal process

Statistics, distributions...



Beam-time request & allocation
Scientific Council April 2009

all countries			*before national balance*		*after national balance*	
country	requested days	requested in %	allocated days	allocated in %	allocated days	allocated in %
AE	0.29	0.01	0.29	0.01	0.29	0.01
AR	2.71	0.06	0.00	0.00	0.00	0.00
AT	**40.33**	**0.89**	**18.54**	**0.75**	**18.54**	**0.76**
AU	22.02	0.49	11.45	0.46	10.25	0.42
BE	**34.15**	**0.76**	**16.68**	**0.67**	**16.68**	**0.68**
BG	5.25	0.12	1.75	0.07	1.75	0.07
BH	0.86	0.02	0.86	0.03	0.86	0.04
BR	9.62	0.21	7.40	0.30	7.40	0.30
BY	1.00	0.02	0.60	0.02	0.60	0.02
CA	12.27	0.27	5.60	0.23	5.60	0.23
CH	**100.90**	**2.23**	52.60	2.11	**52.60**	**2.15**
CN	4.67	0.10	4.67	0.19	4.67	0.19
CZ	**26.17**	**0.58**	**16.58**	**0.67**	**16.58**	**0.68**
DE	**645.76**	**14.30**	**325.39**	**13.07**	**325.39**	**13.29**
DK	68.68	1.52	46.55	1.87	46.55	1.90
EG	2.00	0.04	0.00	0.00	0.00	0.00
ES	**207.30**	**4.59**	**98.77**	**3.97**	**98.77**	**4.04**
ESRF	**42.27**	**0.94**	**23.61**	**0.95**	**23.61**	**0.96**
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US	237.77	5.26	123.91	4.98	98.11	4.01
ZA	15.92	0.35	11.50	0.46	11.50	0.47
total	***4516.50***	***100.00***	***2488.80***	***100.00***	***2461.25***	***100.00***

For those who succeed…

- Fix a date with local contact/instrument scientists
- Make arrangements for sample environment, special technical support (generally via local contact/instrument scientists) well before
- Confirm travel and accommodation arrangements asap (user office)
- Insurance (work and medical care), visas, ID to enter site
- Ensure well-characterised sample of sufficient quality; bring any necessary supporting information with you and take care that there are not restrictions on taking it by plane (liquids, toxins, bioproducts..)

During and after the visit…

- Safety training on site is generally obligatory.
- Give the local contact the opportunity to be a full member of the experimental team.
- If necessary, learn how to correct and analyse data before you leave.
- Keep an accurate record of your experiment (instrument log and own copy).
- If experiment could not be completed, explore possibility of picking up some ‘test time’ for relatively short, additional access to beam
- Where appropriate, check samples for activity on departure – arrange for storage if too ‘hot’.
- Analyse and write up experiment asap after experiment – and wherever possible involve the local contact so that co-authorship is appropriate. Most institutes require a short experimental report in the year following the experiment.

Summary

- Wide range of central facilities (national/international, reactor/spallation, with different strengths)
- Take advice – discuss proposed experiment with facility scientists, supervisor, group…
- Proposals should be driven by excellent, timely science and written to enthuse non-experts that your experiment must be done as soon as possible
- Ensure high-quality, well-characterised sample, and state clearly that it exists – or that preparation is straightforward.
- Safety is paramount during the experiment
- Wherever possible and appropriate, involve the instrument scientist/local contact as a ‘proper’ member of the experimental team and provide him/her with the opportunity to contribute to co-authored publications
- Enjoy!