ILLnews
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In brief

• ILL under new management: on 1st October, Prof. Helmut Schober became the new Director of the ILL, taking over from Prof. Willima G. Stirling, who retired at the end of September (more on p.3).

• We have published a new topical brochure: "Neutrons Unravelling the Secrets of the Laws of Nature'. The booklet is the 8th in a series devoted to neutron techniques in different research areas. (http://www.ill.eu/quick-links/publications/topical-brochures/)

• The laureates of the Nobel Prize in Physics 2016 are David J. Thouless, F. Duncan, M. Haldane and J. Michael Kosterlitz, for "Theoretical discoveries of topological phase transitions and topological phases of matter". Neutrons are at the heart of the experimental investigations on these systems. In addition Duncan Haldane worked as a post-doc in ILL's theory group. Read our special ILLnews issue to find out more.

• The ILL has a new logo: the broader 'NEUTRONS FOR SOCIETY' has just replaced the previous 'NEUTRONS FOR SCIENCE'.

NEUTRONS
FOR SOCIETY

CONTENTS

The ILL will soon celebrate its 50th birthday

The ILL was founded 50 years ago, on 19 January 1967, with the signing of an agreement between the governments of the French Republic and the Federal Republic of Germany. The aim of this ambitious project was to create an intense, continuous source of neutrons devoted exclusively to civil fundamental research. What began under the impetus of Franco-German reconciliation is now a shining example of international cooperation, an Institute which both reflects and drives European integration.

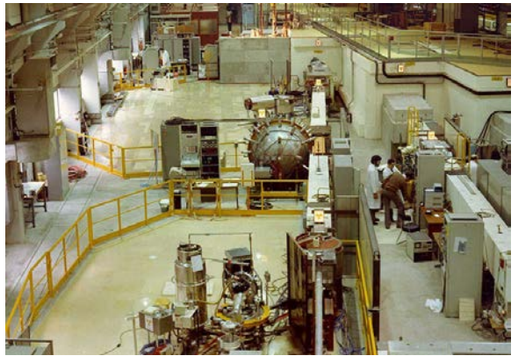
The ILL was one of the first research facilities in the world to be given the innovative status of "service institute", a model which has since been copied by countless laboratories around the globe. In 1971, the first neutron beams were produced and two years later the UK joined the partnership as the Institute's third Associate member country. Since then, the ILL has taken on a truly international dimension with the signing of Scientific Membership agreements with many other countries, starting with Spain in 1987.

The ILL owes much of its long-lasting success to its ability to adapt quickly in an ever-changing research environment. By constantly upgrading and developing its facilities, the ILL has ensured that its instrumentation defines the state-of-the-art. Consequently, the demand for beam time at the ILL is as high as ever, as is the quality of the science performed at the Institute.

As a neutron source, the ILL is in a league of its own thanks to the outstanding reliability and safety record of its High-Flux Reactor.

"It is absolutely clear to me that Europe's scientific community needs the ILL's unsurpassed reactor source and instruments, operated with the ILL's special attitude towards service, well into (and beyond) the decade of the 2020s" stated Bill Stirling, in his Director's report in the 2015 ILL Annual Report.

And indeed, despite the increasing complexity of operating a nuclear facility and the ever more stringent demands of the safety authorities, the ILL is and will continue to set the standards for other future neutron sources.



Bill Stirling on retirement

After his come come back of 33 months as Director of the ILL, Bill Stirling celebrated his retirement on Thursday 29 September with ILL and ESRF staff.

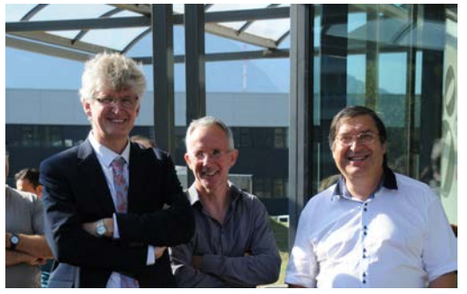
Bill has known our Institute for a very long time. Shortly after the UK became an Associate of the ILL, Bill took a job as an instrument scientist, designing and building instruments, some of which are still in operation today. He later went on to sit on a number of ILL advisory committees while he was professor of physics at Keele and Liverpool Universities, before being appointed Director General of the ESRF in 2001.

Bill was Director General of the ESRF for nine years. It was a time when our two institutes began to cooperate much more closely and, thanks to the CPER contract, set in motion the creation of the EPN campus. From 2009 to 2013 Bill then worked in the GIANT team at the CEA-Grenoble, placing his experience of the international science scene and his local knowledge of Grenoble at the service

of the burgeoning campus. His work contributed to the development of countless collaborations and partnerships between the various members of GIANT and to marketing the strengths of the Grenoble campus internationally.

Bill always thought of the ILL as a special facility: "The ILL was the most powerful instrument of its kind when it opened, the fact that it has retained that position almost 50 years later is remarkable and a testament to the work of those who built it, and to the policy of maintaining it through regular upgrades. On a personal level the ILL gave me my first job in science; it's where I learned the trade and began to understand what it is to be a scientist. When I was invited to become Director I saw it as an opportunity to give something back after all the ILL has given me."
And indeed, since Bill's return to the ILL as Director in January 2014 he has done much to put the Institute back on a sound footing in these challenging times.

All the best to Bill on his retirement and welcome to the new management team.



The new management team. From left to right Helmut Schober (Director), Mark Johnson (Head of Science Division) and Charles Simon (Head of the Projects and Techniques Division).

A very cheap upgrade

R. Cubitt, R. Campbell, P. Gutfreund, and T. Saerbeck (ILL)
R. Barker (University of Dundee, UK)

Reflectometry is a powerful technique for studying surfaces and interfaces such as polymer coatings or microelectronic layers. It involves measuring the reflected fraction of a neutron beam and for years we have always designed instruments with a very nearly parallel beam. It turns out that, with a simple piece of software this need not be the case, leading to large gains in the performance of the technique. In addition we found we can analyse samples that are bent without loss of information. Something that was always a problem in the past and often led to the failure of experiments.

Neutron reflectometry involves small-angle reflections from a few degrees down to about a half a degree. In order to have a good quantity of data we require the uncertainty in the range of angles in the beam to be much less than the reflection angle. Traditionally this has been done by simply collimating the beam to a very small angle. Naturally with such fine collimation there are few neutrons available. Hamilton [1] was the first to suggest the traditional approach was not generally correct. He realised the sample acts as a pinhole and because every neutron is reflected, rather than going through some random scattering process, no information is lost when interacting with the sample. Then the uncertainty in the reflection angle could be determined not by the collimation but by the angular resolution of the detector. A pinhole camera is a good way to think about this. The resolution of the image is determined by the size of the pinhole and camera sensor pixels not by the angular size of the object viewed.

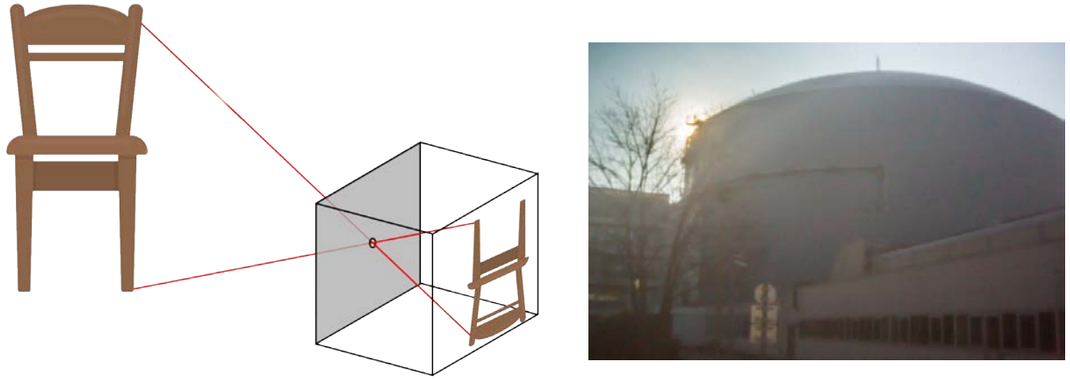


Figure 1: The left panel shows the principle of pinhole photography with a real pinhole image of the ILL on the right.

In fact the motivation for this work came from the problem of bent samples. Frequently when layers are deposited on a thin silicon substrate, bending occurs as the stress is released. This results in a spread of angles on the detector and a serious reduction in the quality of the data with traditional analysis. We wrote a small addition to the data reduction software that used the detector resolution to recuperate the information that would have been lost. If the sample is flat then we found we could open up the angular range of the incoming beam and use the same method to not pay a price in bad resolution. Figure 2 shows the considerable improvement in data quality for both cases.

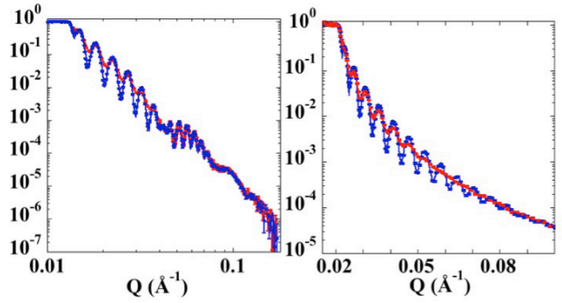


Figure 2: The left panel is data from a bent sample and the right is a flat sample with a divergent beam. In both cases the red data is traditional analysis and the blue is treated using our method.

Finally when fully opening up the source slit on D17 to the present maximum of 10 mm we could obtain very good resolution data in only 360 ms (figure 3). In fact this is restricted for purely radioprotection reasons. If this can be resolved we could gain an additional factor of three in intensity and measure the data shown in figure 3 in 120 ms, less than two ESS pulses making D17 competitive with instruments at the next generation neutron source.
Our method is published [2] and the software modifications are fully available for the users to analyze their data.

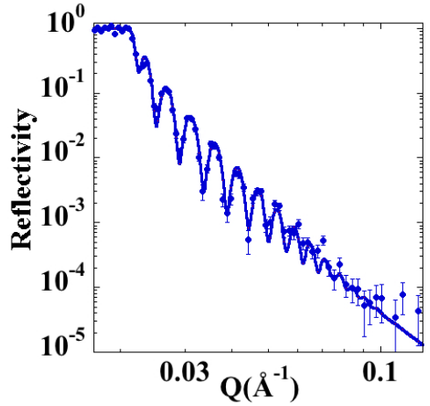


Figure 3. Data from a 100 nm layer of Ni on glass measured in just 0.36 s.

References:
[1] W.A. Hamilton, J.B Hayter and G.S. Smith, J. Neutron Research V2 N1 1-19 (1994)
[2] R. Cubitt *et al.*, J. Appl. Cryst. 48, 2006-2011 (2015)

FIPPS goes online

P. Mutti, C. Michelagnoli, E. Ruiz-Martinez, A. Blanc, U. Köster and M. Jentschel (ILL)

Back in 2012 an array composed by 8 EXOGAM high efficiency germanium detectors plus 6 GASP coaxial germanium detectors and 2 Lohengrin clover detectors was installed at the PF1B cold neutron beam. The set-up was dedicated to spectroscopy of stable as well as of very neutron rich isotopes produced from neutron induced fission of ^{235}U and ^{241}Pu.

The EXILL (EXOGAM@ILL) measurement campaign lasted 2 ILL reactor cycles and produced the extraordinary amount of 60 TB of raw data in 100 days of measurement. The richness of the information was preserved avoiding any type of hardware trigger and recording every single gamma event reaching the detectors. From the analysis of this huge amount of data the user community produced so far about 50 scientific papers and the data analysis is still ongoing. The EXILL campaign demonstrated on one hand the potential physical output from (n, γ) and (n, f) reactions and on the other hand the interest of the nuclear structure community in this type of experiment. Despite the undoubted success of EXILL, we learned, as well, that there was space for further improvements of the experimental set-up. One of the major problems arising from the analysis of the (n, f) data is the lack of a clear identification of the fission events. This information is very important if one wants to study the less populated nuclei in the fission fragment distribution as well as the kinematics of the fission process itself and therefore determine the mass and the kinetic energy of the fission fragments. In addition, the spectroscopy of neutron rich isotopes requires at least triple gamma coincidences to allow an unambiguous identification of the nucleus of interest. The possibility of an additional mass of information would improve significantly the capability of the germanium detectors array to identify new gamma-rays. From all these considerations, we decided to propose the construction of a new ILL instrument combining an EXILL-like germanium array with the mass resolving power of a gas filled magnet. FIPPS, FIssion Product Prompt gamma-ray Spectrometer, is now part of the ILL Endurance phase one, the next ILL instrument upgrade programme started this year and running until 2019. FIPPS initial set-up will be very similar to the one of EXILL. 8 high efficiency germanium clover detectors have been purchased this year to form the central ring of the spherical detectors array. The remaining space around the target will be filled with additional detectors depending on the specific set-up required for the experiments. Therefore, not only more segmented germanium detectors are foreseen to complete the setup but also BEGe (broad energy germanium) that could significantly improve the resolution at very low energy to identify very weak low energy transitions. From the FATIMA collaboration, a set of $LaBr_3$(Ce) scintillators for picosecond timing studies are also expected to be installed as well as a set of neutron detectors for the study of the fission process. FIPPS has been located at the end position of H22 thermal neutron guide in ILL 7 and the construction of the instrument is almost complete (figure 1). A new collimation system has been placed at the exit of the H22 guide to reduce the beam size down to 1 cm^2 and to avoid divergence as much as possible to prevent neutrons hitting the detectors. The commissioning of the instrument started mid-December 2016, and FIPPS will be officially operational for users' experiments at the beginning of the first reactor cycle in 2017. In the last proposals round of November 2016, assigning beam time only for the first reactor cycle 2017, 8 experiments were submitted for FIPPS for a total of 108 days of beam time, meaning more than a factor of 2 overbooking; clear indication of the interest of the nuclear physics community. For the second phase of Endurance that will be launched in 2019, the FIPPS team, in collaboration with the "Laboratoire de Physique Subatomique et Cosmologie" (LPSC), is already at work to prepare the design of the gas filled magnet that will further increase the capabilities of the instrument.

FIPPS phase 1 will permanently add unique possibilities for in-beam high resolution nuclear studies at ILL and its capabilities will be even more enhanced once the gas filled mass separator is in place.

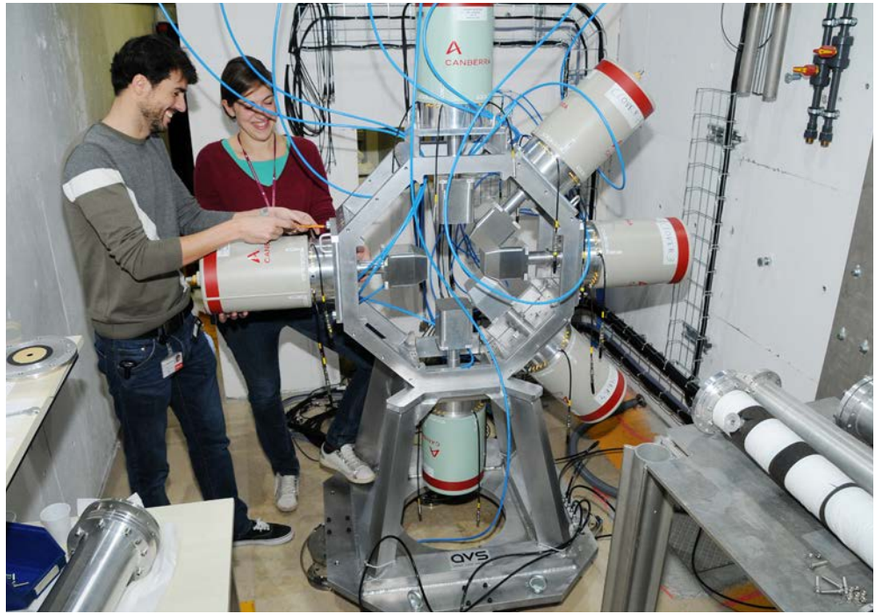


Figure 1: FIPPS instrument responsible C. Michelagnoli and FIPPS technical project leader E. Ruiz-Martinez are mounting one of the 8 germanium clover detectors on the central ring of the detectors' array.

New trends in magnetic structure determination

12-16 December, ILL

J. Rodriguez-Carvajal, O. Fabelo (ILL) and J.M. Perez-Mato (TU Vienna)

The aim of this workshop was to contribute to the training of scientists in the treatment of neutron diffraction data for magnetic structure determination, placing the emphasis on the new improved methods and tools made available in the last years. This event has put together developers of crystallographic tools and refinement programs with a wide user community in order to present new features and discuss the next necessities.

Forty scientists from 15 different countries met at the ILL during this Workshop. The lectures were given by internationally recognised experts, J. Manuel Perez-Mato and Luis Elcoro (Bilbao Crystalographic Server) from Universidad del Pais Vasco (Spain), Branton J. Campbell and Harold T. Stokes (Isodistor) from Provo University (USA), Juan Rodriguez-Carvajal from ILL (France), Vaclav Petricek from Czech Academy of Sciences (Czech Republic) and Laurent Chapon from Diamond (UK) complete the list of speakers.

During the workshop, the developers of the different crystallographic tools (Isodistort, Bilbao Crystallographic Server, FullProf Suite, Jana2006, etc.), presented the mathematical formalism for the magnetic structures analysis as well as the news features of the different tools. Finally, some practical sessions were carried out to have the opportunity to interact with the different tools and with the developers.

At the end of the workshop, different points of view were shared on the improvement of the tools available and the use of them, as well as the development of new workshops dedicated to the training of new and not so new users.

The excellent feed-back from the neutron community and from the participants to the meeting encourages us to think of organising a second session of this event.

More information can be found at https://indico.ill.fr/indico/event/53/

Group photo.

4th International Soft Matter Conference (ISMC2016) 12-16 September, Grenoble

G. Fragneto and P. Lindner, on behalf of the organising committee

The 4th International Soft Matter Conference (ISMC2016) was held at the Alpes-Congrès (Alpexpo) in Grenoble from 12 to 16 September 2016. This conference was co-organised by ILL (chair P. Lindner) and ESRF (co-chair T. Narayanan) together with the Grenoble University (chair of programme committee J.-L. Barrat), CEA, and CNRS under the auspices of the SoftComp consortium. Over those five sunny days in Grenoble, the conference brought together nearly 700 scientists working in the soft matter field of which more than 200 students. Thirty-seven different nationalities were represented.

With 8 plenary and 21 keynote lectures, 116 contributed talks (selected from 800 submitted abstracts) and 480 posters, the conference covered both the fundamental and applied aspects of soft matter and complex systems.

The opening ceremony on 12 September featured short presentations by Professor C. Ferrari, president of Grenoble Alpes Métropole, Professor P. Levy, president of the ComUE of the Université Grenoble Alpes, Professor W.G. Stirling, Director of ILL and Dr. F. Sette, Director General of ESRF. Plenary speakers included the Lucasian Professor of Mathematics M.E. Cates (Cambridge), SoftComp founder Professor D. Richter (Jülich), Professor F. Sciortino (Rome), Professor J. Brujic (New York), Professor M. Ballauff (Berlin), Professor I. Musevic (Ljubljana) and Dr. J. Cabral (Imperial College, London). In addition, there were three award ceremonies; the European Physical Journal E sponsored Pierre-Gilles de Gennes prize awarded to Professor von Klitzing (TU Berlin), Soft Matter Lectureship award sponsored by the Soft Matter Journal to Professor Damien Baigl (ENS Paris) and IUCr supported Young Scientist travel awards to three Ph.D. students from India and Taiwan.

Programmable self-assembly and dynamics of active matter featured in many presentations. Many new ideas were presented ranging from the use of DNA to tune interactions and self-assembly as well as to produce DNA-made nanoparticles that closely match idealised colloids, to new methods to understand anti-biotic resistance, developments in microfluidics, new nanoparticle properties, new materials inspired by Nature.

As underlined by many participants, overall the conference was a great success in terms of quality of presentations, technical organisation, and scientific exchanges. The conference made a good impact of the large scale facilities, ILL and ESRF, among the broader soft matter community. Financial contributions by 36 sponsors from institutions and private companies are gratefully acknowledged and that helped to keep the cost of the conference down.

We are very grateful to ILL for all the administrative support and to the other Grenoble research institutions for the contribution to the organisation.

Closing session: farewell of the local organising committee (from left: Giovanna Fragneto, Bruno Jean, Bianca Tatu, Sandrine Lyonnard, Theyencheri Narayayan, Peter Lindner, Diego Pontoni (hidden) & Jean-Louis Barrat).

• You can now flip through our User Handbook (with practical information for your stay at the ILL) on the web.
http://www.ill.eu/fileadmin/users_files/documents/users/user_guide/User_Handbook_web.swf

• Check out our **reimbursement procedures**! Before each visit to ILL, we advise that you should consult our User Guide to check on any changes to our procedures as these do evolve. This is valid for everyone, whether a new or regular user. This will avoid any surprises when it comes to submitting your reimbursement claim. https://www.ill.eu/users/user-guide/.

• Good news for our users! The laboratory next to D11 in ILL7 has been completely renewed and will be ready for operation with the first cycle in 2017.

Industry sponsored academic research

In a research and innovation environment, it is essential to demonstrate the long-term impact of academic research and the medium and short-term impact of research with industry. Neutrons have significant, specific applications for industry like doping of silicon crystals for the semiconductor industry and production of radio-isotopes for imaging and therapy. Neutron beam time can be sold directly to industry for proprietary research, in which case the experimental data is not made publically available, and this access mechanism accounts for less than 1% of beam time.

According to a recent study at ILL, the use of neutrons by industry via academia is however estimated to be much higher, possibly 25% of beamtime. In this case, the experimental data becomes publicly available and the results of successful experiments should be published.
Given the volume of this industry-relevant access to neutron beam time, ILL would like to measure more accurately the number and nature of industry-via-academia experiments with a view to promoting this use of neutrons and potentially enhancing it in the future.

We are therefore particularly keen to know if your academic research is directly linked to industry. This is most obvious if you have industry sponsorship, for example, for students or samples.

Please use the tick-box on the proposal form and give appropriate information in the text box, including when possible the name of the company you are working with.

Call for proposals

The next deadline for the submission of proposals is **Tuesday, 14 February 2017, midnight (Central Europe).**
The web system **opens on 3 January 2017**.

Proposals will be reviewed over February/March and the Subcommittee Meetings will meet to assess them on **4-5 April 2017.**

Proposals must be submitted via the Electronic proposal submission (EPS) system on our User Club (https://userclub.ill.eu/userclub/). Log in with your username and password.

The detailed guidelines for the submission of a proposal at the ILL can be found on the website:
http://www.ill.eu/users/applying-for-beamtime/electronic-proposal-system/.

If you have any problems, you will receive full support from the User Club team. Please allow sufficient time for any unforeseen computing hitches. For other queries, contact the User Office (user-office@ill.eu).

Instruments available

The following instruments will be available for the forthcoming round.

- powder diffractometers: D1B*, D2B, D20, SALSA
- disordered materials diffractometer: D4
- polarised neutron diffractometers: D3, D23*
- single-crystal diffractometers: D9, D10
- large scale structure diffractometers: D19, LADI
- small-angle scattering: D11, D22, D33
- reflectometers: SuperADAM*, D17, FIGARO
- small momentum-transfer diffractometer: D16
- diffuse-scattering spectrometer: D7
- three-axis spectrometers: IN1-LAGRANGE, IN8, IN12*, IN20, IN22*, ThALES
- time-of-flight spectrometers: IN4, IN5, IN6, BRISP*
- backscattering and spin-echo spectrometers: IN11, IN13*, IN15, IN16B
- nuclear-physics instruments: PN1
- fundamental-physics instruments: PF1B, PF2, S18*
- fission product prompt gamma-ray spectrometer: FIPPS

* Instruments marked with an asterisk are CRG instruments, where a smaller amount of beamtime is available than on ILL-funded instruments, but we encourage applications for these.

The list of **operating CRGs** is as follows (status December 2016):

CRG-A: D1B, IN13
CRG-B: BRISP, D23, SuperADAM, IN12, IN22, S18
GRANIT jointly funded with LPSC (UJF, CNRS)

You will find details of the instruments on our website at
http://www.ill.eu/instruments-support/instruments-groups/

Scheduling period

The proposals accepted at the next round will be scheduled in the two last reactor cycles in 2017.

Other access routes

Director's discretionary time (DDT) – We remind you that 5% of ILL beam time is reserved for proposals that do not fall within the usual rules of proposal submission.

Primarily these proposals concern urgent experiments that cannot wait for the twice-yearly proposal rounds. Proposals can be submitted at any time and they will be reviewed by the chair and relevant members of the proposal sub-committee concerned and the ILL science director. If successful, beam time will then be awarded on the requested instrument as soon as possible.

NEW ! DDT may also be used to award beam time to excellent proposals which do not satisfy the rule in which two-thirds of the proposers must come from ILL's Associate and Scientific Member countries. These proposals can therefore be submitted by any team with an excellent idea for an experiment and this must be done through the usual proposal rounds so that the level of excellence can be judged by comparison with other proposals (https://www.ill.eu/users/applying-for-beamtime/director-discretionarys-time-ddt/).

EASY access: We remind you that room temperature, powder diffraction measurements on the high resolution diffractometer can be requested at any time (https://www.ill.eu/users/applying-for-beamtime/easy-easy-access-system/).

College Secretaries

College 1 - Applied metallurgy, instrumentation and techniques: *Emmanuel Fahri*
College 2 - Theory: *Marie-Bernadette Lepetit*
College 3 - Nuclear and particle physics: *Tobias Jenke*
College 4 - Magnetic excitations: *Jacques Ollivier*
College 5A - Crystallography: *Estelle Mossou*
College 5B - Magnetism: *Navid Qureshi, Thomas Saerbeck (vice secretary)*
College 6 - Structure and dynamics of liquids and glasses: *Gabriel Cuello*
College 7 - Spectroscopy in solid state physics and chemistry: *Andrea Piovano*
College 8 - Structure and dynamics of biological systems: *Anne Martel*
College 9 - Structure and dynamics of soft-condensed matter: *Orsolya Czakkel, Yuri Gerelli (vice secretary)*

Calendar

Important dates:

Spring 2017 council
Proposal deadline: 14 February 2017 (midnight Central Europe)
Subcommittee meetings: 4-5 April 2017
Scientific Council: 6-7 April 2017

Autumn 2017 council
Proposal deadline: 14 September 2017 (midnight Central Europe)
Subcommittee meetings: 14-15 November 2017
Scientific Council: 16-17 November 2017

2017 provisional reactor operating schedule

Cycle n° 181	from to	19/01/2017 08/03/2017	48 days
Cycle n° 182	from to	01/09/2017 18/10/2017	47 days
Cycle n° 183	from to	03/11/2017 21/12/2017	48 days

The dates for future reactor operations can be found at
http://www.ill.eu/reactor-environment-safety/high-flux-reactor/cycles/

Forthcoming Workshops

List of workshops organised at the ILL (or surrounding area) in the first semester of 2017:
- CheMWood (March 2017)
- Workshop on fission and neutron-rich nuclei (April 2017)
- Optics and neutrons experimental approaches to THz spectroscopy – SON2017 (April-May 2017)
- Advances Neutrons in Structural Biology (June 2017)

Editor: Giovanna Cicognani
Layout: Virginie Guerard
Photos: S. Claisse, R. Cubitt

Institut Laue-Langevin
Scientific Coordination Office
CS 20156 - 38042 Grenoble Cedex 9 – France
Tel: +33 476 20 71 79 - Email: cicognani@ill.eu

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