

## **LLB - Laboratoire Léon Brillouin**

Rapport Hcéres

► **To cite this version:**

Rapport d'évaluation d'une entité de recherche. LLB - Laboratoire Léon Brillouin. 2014, Commissariat à l'énergie atomique et aux énergies alternatives - CEA, Centre national de la recherche scientifique - CNRS. hceres-02033498

**HAL Id: hceres-02033498**

**<https://hal-hceres.archives-ouvertes.fr/hceres-02033498>**

Submitted on 20 Feb 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



agence d'évaluation de la recherche  
et de l'enseignement supérieur

Department for the evaluation of  
research units

AERES report on unit:

Léon Brillouin Laboratory

LLB

Under the supervision of the following  
institutions and research bodies:

Commissariat à l'Énergie Atomique et aux Énergies  
Alternatives

Centre National de la Recherche Scientifique - CNRS

January 2014



agence d'évaluation de la recherche  
et de l'enseignement supérieur

Department for the evaluation of  
research units

*On behalf of AERES, pursuant to the Decree  
of 3 november 2006<sup>1</sup>,*

- Mr. Didier HOUSSIN, president
- Mr. Pierre GLAUDES, head of the  
evaluation of research units department

*On behalf of the expert committee,*

- Mr. Winfried PETRY, chair of the  
committee

---

<sup>1</sup> The AERES President "signs [...], the evaluation reports, [...] countersigned for each department by the director concerned" (Article 9, paragraph 3 of the Decree n ° 2006-1334 of 3 November 2006, as amended).



## Evaluation report

This report is the result of the evaluation by the experts committee, the composition of which is specified below.

The assessments contained herein are the expression of independent and collegial deliberation of the committee.

Unit name:	Léon Brillouin Laboratory
Unit acronym:	LLB
Label requested:	UMR
Present no.:	12
Name of Director (2013-2014):	Mrs Christiane ALBA-SIMIONESCO
Name of Project Leader (2015-2019):	Mrs Christiane ALBA-SIMIONESCO

## Expert committee members

Chair:	Mr Winfried PETRY, Technische Universität Muenchen, Germany
Experts:	Mr Loïc BERTRAND, IPANEMA, Gif-sur-Yvette (CoNRS representative)
	Mrs Elisabeth BOUCHAUD, ESPCI, Paris, excusée
	Mr Jean-Michel GUENET, Institut Charles Sadron, Strasbourg
	Mrs Claudine LACROIX, Institut Néel, Grenoble
	Ms Régine PERZYNSKI, PHENIX, Paris
	Mr Christian RÜEGG, Paul Scherrer Institute, Villingen, Suisse

### Scientific delegate representing the AERES:

Mr Serge BOUFFARD

### Representatives of the unit's supervising institutions and bodies:

Ms Maria FAURY, CEA/DSM  
Ms Susana GOTA-GOLDMANN, CEA/DSPG  
Mr Mehran MOSTAFAVI  
Michel Rosso, CNRS/INP  
Ms Patricia ROUSSEL-CHOMAZ



## 1 • Introduction

### Execution of the visit

The visit took place from 30<sup>th</sup> to 31<sup>st</sup> January 2014 in the buildings of the LLB. An extensive visit of the instrumentation around ORPHÉE was part of the programme. During the presentations Mr Klaus HASSELBACH, CoNRS section 05 and Mr Claude ARNOLD representative of CoNRS section 05 IT were present. On Friday, January 31, a phone conference took place with the chairman of the Scientific Advisory Board, Mr Ian ANDERSON, Oak Ridge National Laboratory.

The well-organized information sessions, intense and lively discussions after each presentation, together with the written reports, and the phone interview with the chairman of the Council for Science and Instrumentation (CSI), allowed the committee to obtain a very clear view of the original research done by the LLB staff and its users, but also of the organisation of the user service and its innovative instrumentation.

### History and geographical location of the unit

The Laboratoire Léon Brillouin is located within the “Centre CEA de Saclay” and is part of and profits from the exceptional scientific environment provided by the “Plateau de Saclay”, which includes the synchrotron radiation source SOLEIL and renowned universities and engineering schools. LLB constructs and operates instruments for research with neutrons around the national neutron source ORPHÉE, a 14 MW research reactor with a compact core and heavy water moderator in which two cold sources and one hot source are incorporated as so called wavelength shifters. Neutrons are extracted by 9 beam plugs, which again serve up to 27 instrument ports. The reactor provides neutrons since 1980 and is operated by the CEA. According to French nuclear regulation the next safety assessment (group permanent) is foreseen towards beginning 2019.

### Management team

The management team consists of the director and deputy director appointed by the Steering Committee, where the head belongs to one of the two shareholders, namely CNRS or CEA and the deputy head to the other. At present, the director of the LLB is Mrs Christiane ALBA-SIMIONESCO, CNRS, and the deputy director Mr Jean-Paul VISTICOT, CEA. The management is supported by the administrative group. According to its double mission of providing neutron instrumentation and initiating science with neutrons, the scientific life is structured along a 2-D matrix. Three Scientific Axes i) Magnetism and Superconductivity, ii) Materials and Nanosciences, and iii) Soft Complex Matter form the vertical science groups, cross cut horizontally by three instrument groups i) Large Scale Structures, ii) Diffraction and iii) Spectroscopy. This kind of matrix is found at comparable neutron as well synchrotron sources and certainly is very much appropriate.

Both, Steering Committee and the directorate are advised by a Council for Science and Instrumentation (CSI) and by a committee reviewing the instrumentation. Recent reports from the CSI date from Nov. 2012 and Nov. 2013. The upgrade and renewal of instruments has been reviewed by an external committee in 2010 and a midterm review of the overall activities of the infrastructure was conducted by the AERES in May 2011.

### AERES nomenclature

ST2



## Unit workforce

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	7	6
N2: Permanent researchers from Institutions and similar positions	35	28
N3: Other permanent staff (without research duties)		
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)	4	4
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	9	7
N6: Other contractual staff (without research duties)	1	1
<b>TOTAL N1 to N6</b>	<b>56</b>	<b>46</b>

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	15	
Theses defended	25	
Postdoctoral students having spent at least 12 months in the unit	18	
Number of Research Supervisor Qualifications (HDR) taken	10	
Qualified research supervisors (with an HDR) or similar positions	28	26

## 2 • Assessment of the unit

### Mission of the unit

ORPHÉE is the national French neutron source for beam hole experiments. The LLB as a joint undertaking of CNRS and CEA is the research infrastructure to exploit the neutron source. Since its foundation the mission of the LLB focuses on the following point:

- Research on its own scientific programs.
- Promotion of the use of neutrons within the French academic and scientific community, dissemination of knowledge around the use of neutron radiation, academic education.
- Development, construction and operation of an international competitive instrument suite at ORPHÉE.
- Open access of the instrumentation of LLB to the French and international user community under the condition of scientific merit, and providing full support for external users with the ultimate aim of publication of the scientific results achieved.



During the course of the year 2013 an additional task has been assigned to LLB:

- Being the French bridgehead for the scientific exploitation of the upcoming European Spallation Source (ESS) at Lund, Sweden.

### Strengths and opportunities related to the context

The backbone of LLB, namely its neutron source ORPHÉE, has undergone its last safety assessment in 2009, the next will be in 2019. It also has passed with excellence the “Fukushima” stress test imposed to all nuclear facilities in France in 2012. As out-come of this stress test, measures have to be undertaken within a cost volume of 1.2 M€. In the forthcoming years, a continuous exchange of most of the beam holes will be necessary and detailed planning for this is on the way. With other words, ORPHÉE is a modern and excellently maintained nuclear facility with no obvious limitation in the foreseeable future.

Own research: In its own research, the LLB focuses on the three topics “Magnetism and Superconductivity”, “Materials and Nanosciences”, and “Soft Complex Matter”. Accordingly, scientific life within the LLB is structured along these three topics. The Magnetism Group is world leading in its field, the Materials Group is very excellent, the Soft matter group is a very visible player, each time in comparison to the competitors at other national neutron sources. All three groups show a continuous development over the years. Magnetism has picked up extremely successful the most recent developments in superconductivity and even sets new trends, Materials has developed from classical materials sciences to Nanoscience and Soft Matter successfully moves towards Complex Soft Matter. For a detailed assessment see the reports to Theme 1 - 3. A very visible proof of the scientific excellence of the LLB are its 175 peer reviewed publications per year on average.

Dissemination and education: LLB supports an own PhD program with students distributed over the three scientific themes. Further, LLB organizes every year the post-doc training sessions “les FANS du LLB” (Formation A la Neutronique) including training on the instruments. Together with ILL, SOLEIL and ESRF, it participates in the training session of HERCULES. Regularly bachelor and master students from French universities come to LLB to perform experiments. 2/3 of the scientific staff at LLB is engaged in various teaching activities with French universities and engineering schools; moreover LLB is now an integrative part of the new University Paris-Saclay.

Competitive instrumentation: Staff at LLB understands very well, that an internationally competitive instrumentation is the base for its own research and for its task as service facility for the French neutron community. CAP 2015 followed by CAP 2017 are the answers to an instrumentation which dates back to the 80’s. Today, 12 instruments have been renovated, upgraded, replaced or moved to more intense beam ports resulting in an increase of measurable neutrons at the detector by a factor of 26 on average. Currently four instruments are under construction with a deadline for completion around 2017. For instance FA# - the X-ToF instrument under construction - has the potential to become world leading in its class. Again, for a more detailed assessment see the report to Theme 4.

Open access, user service to the French and international scientific community: The LLB has an excellently organized user program. Twice a year, users are asked to submit their proposals, the evaluation of which happens by international renowned experts. On average the 19 instruments open to access are oversubscribed by a factor 1.8, a figure totally comparable with those at other neutron sources like SINQ, FRM II or ILL.

ESS: To keep its leadership in science with neutrons, Europe has launched the project of the European Spallation Source (ESS). France engages at ESS as it recognizes the strategic importance of science with neutrons in addressing the Grand Challenges of a modern high tech society. In consequence the LLB has been assigned as bridgehead to coordinate the French contribution in designing, building and operating the instrumentation of ESS. This will include in-kind deliverables. Currently the LLB organizes the interest of French groups, and seeks for collaboration with expert groups within Europe. In a certain way CAP 2017 is part of this new mission, here LLB tests new instrument ideas and instrument components, which may enter into the future ESS instrumentation. The visiting committee highly welcomes this additional orientation of the LLB, in particular giving LLB a clear long-term perspective. LLB with its expertise in instrumentation and with its national and international user base is in an excellent position to fulfil this task.



## Weaknesses and threats related to the context

The age pyramid of LLB is such that from 2013 - 2015 LLB will lose 25 % of its research staff and person in charge of instruments due to retirement. The visiting committee has been told, that these departures will/can be replaced only partially. Further the visiting committee observed a heavy load on the scientific and technical staff with the clear risk of overload. The committee states that in case the above scenario enters into force the development of new instrumentation will become practically impossible and the scientific productivity of the laboratory and its French user community will be seriously compromised. Particularly the task as bridgehead to ESS will be in danger.

The visiting committee is concerned about the proposed shut down of ORPHÉE in 2020. Firstly, the French neutron community needs a local/national/easy accessible neutron source which serves as learning/training/preparing source for getting access at the international leading neutron source, namely the ILL. Today about 60 % of all French neutron experiments are performed at LLB, 30 % at ILL and 10 % abroad. The visiting committee doubts that creating more French CRGs at ILL can compensate the loss of ORPHÉE. Further, first neutrons at ESS will not be available before 2021 and another five years are necessary to develop an acceptable international user service. Also from that perspective a closure of ORPHÉE in 2020 is premature; France weakens its competitiveness just at the moment when the supposed to be world's best neutron source becomes available.

Comparing LLB with similar national neutron sources in Europe, the involvement of French universities at LLB seems to be less intense. Such an involvement may have multiple aspects like building innovative components for new instrumentation, building advanced sample environment, detaching thesis students for long term stays to LLB, visiting LLB with classes and training students at instruments, passing sabbaticals at LLB etc. Certainly all this happens to a certain extent at LLB, but from the viewpoint of the visiting committee, these contacts should be strengthened.

The discussion with the LLB thesis students showed an astonishing lack of vision of these students. The visiting committee believes this is also due to the lack of a coherent graduate education.

## Recommendations

The relations to French university and foreign partners should be strengthened. In the current period of budgetary austerity, diverse inputs from universities and the regions supporting them to LLB would be of prime importance.

The new University Paris-Saclay seems to be a great chance to anchor LLB more deeply in the French university landscape. Yet the visiting committee would like to see more intense engagement of all the staff of LLB in participating actively at Paris-Saclay.

Within this context LLB is encouraged to increase the number of PhD students and especially post-docs by increased collaborations with universities (e.g. joint operation of instruments, joint appointment of staff, joint research groups).

Due to numerous collaborations, thesis students at LLB are related to a variety of French universities, each of which has its own "Écoles Doctorales". This is the reason why the thesis students at or detached to LLB do not experience a coherent graduate education. LLB should compensate for this structural incoherence by initiating an own graduate education with seminars organized by the students, lectures about future perspectives in research or industry, motivation to go abroad for a post-doc position etc.

Industrial projects appear connected to a limited number of scientists and there is potential for further development.

The full operation of ORPHÉE until 2025 must be considered in order to give the French neutron community the means it needs to be competitive in the field of science with neutrons and to better bridge the gap to the start-up of ESS.

Recognizing that (i) ORPHÉE will have a finite live time, (ii) the French neutron community needs a local/national/easy accessible neutron source to be competitive on international level, (iii) France needs to train its user community for international scientific competition and has to provide a platform for instrument development, (iv) the development of a new neutron source from first ideas to realization takes at least 15 years, (v) such a source should emphasize spectral and directional brilliance and not intensity, it is highly recommended that France installs today a task force developing ideas for a future French neutron source, probably based on accelerator or laser technology.





Considering the LLB task to be the French bridgehead for the scientific exploitation of the future ESS, the largest efforts should be made to maintain the level of staffing in the current period of austerity and to increase it as soon as possible.

LLB has the strength to take a clearer lead on the development of one or several instruments at the ESS. This should benefit from stronger support from the LLB shareholders, including through in-kind participation to the ESS.



### 3 • Detailed assessments

#### Assessment of scientific quality and outputs

LLB and its users published over the last five years on average 175 peer-reviewed papers. The majority of these publications appear in journals of very good impact factor. According to its major internal scientific activities and those of its users, the scientific life at LLB is structured along three axes: (i) Magnetism and Superconductivity, (ii) Materials and Nanosciences, (iii) Soft Complex Matter. In a kind of matrix the underlying instrumentation is structured perpendicular to the scientific orientation in the groups (i) Large Scale Structures, (ii) Diffraction and (iii) Spectroscopy.

#### Assessment of the unit's academic reputation and appeal

The three research axes at LLB, are world leading, very excellent and a visible player within the leading neutron centers. Thanks to the instrumentation renewal programs CAP 2015 and CAP 2017, the instrumentation of LLB is international, very visible and competitive. New instruments like FA# might become world leading.

#### Assessment of the unit's interaction with the social, economic and cultural environment

Research with neutrons addresses the Grand Challenges of a modern high tech society and is therefore of strategic importance to France. The LLB is the leading French unit for research with neutrons, correspondingly is its social and economic impact. Via its user program LLB considerably interacts with various French universities. However the formation of Paris-Saclay is a unique opportunity for LLB to engage directly with its staff at a renowned university. This allows for LLB to have access to excellent students for bachelor, master and PhD thesis. LLB will be the bridgehead for the French scientific community to have optimal scientific access to the future European Spallation Neutron Source.

#### Assessment of the unit's organisation and life

The matrix structure with its two crosscutting levels of scientific and instrument groups is perfectly appropriate for the future challenges of this large-scale facility. Technical as well as scientific staff is highly motivated and near to work overload. Not this potential work overload is seen as greatest threat for the units internal life, but the uncertainty about the unit's future. Appointing LLB to the French bridgehead for the scientific exploitation of ESS has been very much appreciated by the staff of LLB. Yet, the non-replacement of retiring staff in the next years may make this important task impossible to achieve.

#### Assessment of the unit's involvement in training through research

LLB has an own PhD program with thesis students related to the three research axes. Further it receives bachelor, master and PhD students from French universities using the instrumentation of LLB. Further LLB engages in special training programs like FANS du LLB or HERCULES. The participation of LLB at the University Paris-Saclay will reinforce the partnership between the large-scale facility and university. The majority of the PhD students belong to the "Écoles Doctorales" ED 107 "Physique de la Région Parisienne" and ED 470 "Chimie Paris-Sud".

#### Assessment of the strategy and the five-year plan

Own in-house science, education and dissemination, neutron instrumentation and user service remain missions of LLB. The recently assigned additional mission as bridgehead for the scientific exploitation of the future ESS will set a new focal point. Renewing its own instrumentation becomes now also important for building instruments for the future ESS. Doing experiments at LLB will strengthen the competitive capability of the French community for exploiting the ESS. LLB will receive more and more users from the Nordic countries in order to enhance the competence of these communities, thereby strengthening their knowledge for hosting the ESS.



## 4 ● Axis-by-Axis analysis

**Axis 1:** Magnetism and Superconductivity

**Manager's name:** Mr Yvan SIDIS - Ms Isabelle MIREBEAU

### Workforce

Theme workforce in Full Time Equivalents	As at 30/06/2013	As at 01/01/2015
FTE for permanent professors		
FTE for permanent EPST or EPIC researchers	13.5	9.5
FTE of other permanent staff without research duties (IR, IE, PRAG, etc.)		
FTE for other professors (PREM, ECC, etc.)		
FTE for postdoctoral students having spent at least 12 months in the unit	1	
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students	4	4
FTE for other contractual staff without research duties		
FTE for doctoral students	2.5	
<b>TOTAL</b>	<b>21</b>	<b>13.5</b>

## ● Detailed assessments

### Assessment of scientific quality and outputs

The activities in Axis 1 “Magnetism and Superconductivity” at the LLB focus on a number of key topics in these fields. These include studies of high-temperature superconductors, exotic ground states in 4f-electron systems, frustrated magnets, multiferroics and magnetism in molecular magnets. Members of Axis 1 are world leading in studies of such systems by neutron scattering, which was demonstrated impressively in the presentations during the site visit, as well as in the written reports. Indicators for the strength and world leading position of these activities are, among others, the following:

- High-precision studies of spin fluctuations in the cuprates reveal that these are likely responsible for the high transition temperatures observed in these materials. They are sensitive fingerprints of the electronic correlations in such systems. Publications in this field are in journals with very high impact factor (Nature, Nature Physics, Phys. Rev. Lett.). LLB scientists have presented many invited talks at conferences and established collaborations with other world leading groups (MPI Stuttgart, Minnesota).



- First observation of symmetry breaking in the pseudogap phase of the cuprates. Using polarised neutrons, it was demonstrated unambiguously and systematically that time-reversal symmetry is broken in all known members of cuprate high-temperature superconductors. These results are of high visibility and importance, highest impact in the community, publication in best journals, many invited talks at all major conferences. They present a unique use of the instruments at LLB for high-precision polarised neutron diffraction studies.
- The complex ground states and excitations in frustrated pyrochlores with varying spin symmetry studied by neutron diffraction and spectroscopy. Members of Axis 1 have for years been contributing ground-breaking results to our understanding of frustrated magnets like  $\text{Er}_2\text{Ti}_2\text{O}_7$ ,  $\text{Er}_2\text{Sn}_2\text{O}_7$ , and  $\text{Tb}_2\text{Ti}_2\text{O}_7$ . Many of these experiments were done e.g. under extreme conditions (high pressure, low temperatures, magnetic fields). Once again these results are very important with high impact and recognition in the community.

Further important results were achieved in other areas covered by Axis 1. All of these activities have in common that the results are regularly published in journals with the highest impact factor, they are achieved using cutting edge experimental approaches that are often pioneered and brought to perfection by LLB, and they have above average impact in the broader scientific community. The international and national visibility of the activities of Axis 1 is very high.

### Assessment of the unit's academic reputation and appeal

Members of Axis 1 are world leading in their respective research fields, which makes them attractive partners in international and national collaborations. They are leading, involved in or regularly invited to multi-national projects e.g. with institutions in France, Germany, Switzerland, Japan and USA and are active in attempts to attract European funding.

Several researchers of Axis 1 contribute to the activities of the neutron scattering community as members of evaluation committees for beam time allocation at other neutron sources and as scientific and technical experts in advisory boards e.g. for the European Spallation Source ESS. Furthermore, they are active in program committees and advisory boards for conferences.

A number of highly-talented young researchers were educated at the LLB in this unit, or attracted to work there as post-docs. It is rare that researchers with a considerable amount of other duties at a large-scale facility (user service, instrument development) are able to build up and maintain an academic reputation and appeal as high and attractive as the members of Axis 1.

### Assessment of the unit's interaction with the social, economic and cultural environment

Many of the activities in Axis 1 are fundamental research, but are clearly of direct relevance and interest to people working in more applied areas of magnetism and superconductivity. These include the exploitation of related phenomena in future technologies (IT, energy, health). The culture and ambition of scientific excellence and innovation in Axis 1 is an asset to the social, economic and cultural environment in France that is independent of current politically motivated and short-sighted trends towards very applied topics in research.

### Assessment of the unit's organisation and life

The Axis 1 is part of the coherent strategy of the LLB to organise their researchers both in instrument groups and science groups (see also general part of the report). For Axis 1 this approach seems natural and efficient. Given the size of the unit no further organisation or hierarchy is needed. The unit is focussed on a number of key scientific questions and topics. The level of scientific exchange and discussions among members of Axis 1 and especially with younger researchers is very good.

### Assessment of the unit's involvement in training through research

General aspects of training have been addressed in the general part of this report (e.g. practicals, link to university education, PhD program, training courses). The success in training through research of Axis 1 is demonstrated further by the appointment of several of their former PhD students as permanent staff by CNRS. The careers of these indicate that young researchers working in Axis 1 are encouraged to meet international standards e.g. in terms of scientific quality, output, and postdoc mobility.



The various multi-disciplinary activities of Axis 1, e.g. numerical simulations, interactions with theory groups, solid-state chemistry and sample preparation, and engineering related to instrument upgrades, add to the potential and attractiveness of the training of students including their transferable skills.

### Assessment of the strategy and the five-year plan

Based on their previous successes, members of Axis 1 have clear visions both for their research program and for investments in instrumentation upgrades. The research program is well balanced between gain and risk and includes continuations of current studies of spin correlations and dynamics in frustrated magnets and superconductors, as well as more exploratory studies of materials showing topological effects.

The plan is feasible and based on the strengths of the involved researchers and instrumentation that is available at the LLB and elsewhere. Recent and future upgrades of instruments (e.g. 5C1, 6T2, 4F1) are well in line with the research strategy of Axis 1 and of the broader user community in France and internationally (new X-ToF spectrometer FA#).

### Conclusion

- **Overall opinion of the theme:**
  - Axis 1 is a flagship scientific activity at the LLB. Members of Axis 1 are world leading in terms of scientific excellence, output and reputation in their fields.
  - The proposed scientific program has the clear potential to be of clear benefit to the entire laboratory and to the broader user community of the LLB.
- **Strengths and opportunities:**
  - Strong in-house research with international visibility.
  - Strong national and international partners.
  - Excellent multi-disciplinary opportunities for the training of PhD students.
  - As scientific leaders and experts for instrumentation members of Axis 1 can be involved in the activities of the LLB for the ESS.
- **Weaknesses and threats:**
  - Interactions with local universities could be stronger.
  - The anticipated reduction of permanent staff from 13.5 FTE to 9.5 FTE by 2015 is the biggest threat.
  - The present number of PhD students and postdocs is low in comparison to the number of staff and the scientific reputation of the unit.
  - The scientific activities rely strongly on instruments at LLB (and ILL).
- **Recommendations:**
  - To maintain its world leading position, Axis 1 needs support of its research activities and funding at the level of today.
  - The number of PhD students and especially postdocs should be increased by collaborations with universities (e.g. joint operation of instruments, joint appointment of staff, joint research groups).
  - A long-term strategy should be developed for the unit taking into consideration the present instrumentation at LLB, and future developments at ILL as well as at the ESS.



**Axis 2:** Materials and Nanosciences - fundamental studies and applications

**Manager's name:** Mr Frédéric OTT / Ms Marie-Hélène MATHON

### Workforce

Theme workforce in Full Time Equivalent	As at 30/06/2013	As at 01/01/2015
FTE for permanent professors	2	2
FTE for permanent EPST or EPIC researchers	12.5	10.5
FTE of other permanent staff without research duties (IR, IE, PRAG, etc.)		
FTE for other professors (PREM, ECC, etc.)	3	3
FTE for postdoctoral students having spent at least 12 months in the unit	1	
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students	1	1
FTE for other contractual staff without research duties		
FTE for doctoral students	6.5	
<b>TOTAL</b>	<b>26</b>	<b>16.5</b>

## • Detailed assessments

### Assessment of scientific quality and outputs

Axis 2 “Materials and Nanosciences - Fundamental Studies and Applications” focuses on several aspects of material science. It covers research on composite materials, confined / host-guest systems, disordered systems (liquids, glasses), metallurgy and some magnetic nanostructures. An evolution can be observed over the period towards the study of nanosystems, leading to novel results on nanostructured composite materials, alloys nanostructure, mesoporous systems.

The extent of research topics studied within this research axis is very broad. It includes cutting-edge topics such as e.g. the study of multiferroic BiFeO<sub>3</sub> epitaxial thin films from polarized neutron reflectivity measurements (PRL, 2008), that of the structure of metal-organic frameworks studying the deformation under inclusion and removal of guest molecules (PCCP, 2009), and the modelling of the distribution regimes for nanoparticles dispersed within polymers and steels for mechanical reinforcement using scattering techniques (Macromolecules, 2011, with axis 3). It covers areas where the expertise of LLB is essential, and that lead to applied or industrial results, in particular strain measurements and refinement of crystal structure.

Axis 2 benefits from the very wide range of instruments at LLB, in particular small-angle neutron scattering, reflectivity, diffraction on single crystals, powders and liquids (in particular with the recently upgraded 4-circle spectrometer 6T2).



With ca. 200 papers published in international journals, the productivity and quality of this axis is excellent. The indicated average impact factor of journals is 3.3, a clear indication of the high standard of publication. It is also highly visible at the international level with ca. 150 oral communications, among which ca. 40 invited.

### Assessment of the unit's academic reputation and appeal

This axis is carried out in a strong collaborative context with academic and industrial partners from the international to the local level. Researchers from axis 2 have built partnerships with a large number of institutions (20 in France, 13 at the international level). An active partnership was launched in the period with the neighbouring SOLEIL synchrotron source.

Research was supported by a significant number of projects, including 3 European projects (FP7 NMI3), 9 ANR projects and 6 regional contracts (RTRA, C'nano).

5 students started working as a PhD in the 2008-2013 period in axis 2, and 5 other are shared between axis 1 and another axis. This is a quite limited number compared to the number of permanent staff members in the axis (16, among which 5 are also involved in other axes).

A Ph.D. student at LLB was awarded a prize in 2008 from Société Française de Neutronique on the coupling between ferroelectric polarisation and magnetic structure in BiFeO<sub>3</sub> single crystals (shared with axis 1).

### Assessment of the unit's interaction with the social, economic and cultural environment

Axis 2 leads to work for several industrial companies in particular strain measurements and characterisation of material reinforcement. Industrial partnerships were also supported within three industrial ANR grants (AMARAGE, PROMETFOR and AXTREM) on special steels (Aubert & Duval, Stévenin Nollevaux, Bourguignon Barré, Estamfor, La Foulerie, Raguét, Nitruvid Bodycote). Some of this work led to publication. A patent was filed in 2013 on the development of new cooling systems.

### Assessment of the unit's organisation and life

For this area, please refer to LLB general assessment.

### Assessment of the unit's involvement in training through research

For this area, please refer to LLB general assessment.

### Assessment of the strategy and the five-year plan

The scope of axis 2 was clarified gradually but increased visibility could be researched. The perspectives presented are prolongations of the lines of research of the last four years, taking into account the upgraded instruments that will be available within the future period. The current balance between fundamental and applied research is good and should be preserved. The launch of PA20 will allow renewed SANS measurements. The recent or on-going renovation of instruments is expected to provide new capabilities to LLB. Development of the novel imaging station IMAGINE could strongly benefit to axis 2, including for industrial use, as observed in several facilities at the international level (e.g. SINQ-PSI). Such developments should be supported with the aim at leading to world-class level.

### Conclusion

#### Overall opinion of the theme:

In summary, LLB is a well-identified player in the field of material research on materials and nanosciences. The level of interaction within international, national and local projects is very significant and the quality of the scientific production is very high. Works on nano/heterosystems, physical metallurgy and disordered systems demonstrate the renewal of the research carried out over the recent years with a stronger focus on hot topics such as nanocomposites / nano-objects and host-guest systems, on top of the excellent research regarding metals, liquids and glasses at LLB.



The effort of the team to recruit Ph.D. students in co-supervision and post-docs funded by ANR, CEA or Synchrotron SOLEIL should be strongly encouraged.

▪ **Strengths and opportunities:**

- Research carried out in axis 2 is well-recognised and visible at the local, national and international level;
- good complementarity between instruments allowing research to be carried out at several length scales from atomic to meso- and even macroscale;
- upgrading of the instruments should benefit strongly to the future of the research;
- interactions with the industrial sector are good and could further develop along the lines of expertise of the team;
- consolidation of the Paris-Saclay University may constitute a unique occasion to tighten links with academic partners at regional level and relax the constraints regarding hiring of students and post-docs;
- industrial projects appear connected to a limited number of scientists and there is potential for further development.

▪ **Weaknesses and threats:**

- Some instruments used by the group are not available any more, or may shortly be inaccessible, due to lack of staff to run them;
- imaging developments at IMAGINE could be better structured and should benefit from additional attention and support taking into account specific imaging requirements including data storage and processing. Evolution towards tomographic imaging could be planned;
- there is some degree of dispersion and overlap with other axes, e.g. regarding the study of magnetic materials;
- a too limited number of PhD students and post-docs participate to the axis research;
- the end of the NMI3 project may suppress a significant source of funding for the axis.

▪ **Recommendations:**

Researchers from the axis need clarification from CEA and CNRS on the future of the installation and on instrumental operation. In particular, lack of staff required to run several end stations of key importance for axis 2 puts at risk some of the projects for the future.





**Axis 3:** Soft Complex Matter

**Manager's name:** Mr Fabrice COUSIN /Mr Jean-Marc ZANOTTI

### Workforce

Theme workforce in Full Time Equivalent	As at 30/06/2013	As at 01/01/2015
FTE for permanent professors	5	4
FTE for permanent EPST or EPIC researchers	9	8
FTE of other permanent staff without research duties (IR, IE, PRAG, etc.)		
FTE for other professors (PREM, ECC, etc.)	1	1
FTE for postdoctoral students having spent at least 12 months in the unit		
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students	2	2
FTE for other contractual staff without research duties	1	1
FTE for doctoral students	3	
<b>TOTAL</b>	<b>21</b>	<b>16</b>

- Detailed assessments

#### Assessment of scientific quality and outputs

The topics investigated in this “Soft complex matter” axis are numerous, extending from supramolecular organization of mixed polymeric systems and bio-inspired materials such as foams based on green tensio-actives or self-organized cellulose whiskers, dynamics of water in 3D and 2D leading to bio-issues such as protein denaturation in relation with interfacial water and crowding, and pore opening in bio-membranes. A more recently opened topic, thanks to a recent arrival in LLB, concerns the local structuration in ionic liquids and their potential re-organization in 1D.

The strength of the group relies on their ability to synthesize the complex media they are working on with a good coordination between the various on-site neutron techniques and complementary studies performed outside through their numerous collaborations.

Herein, we highlight essentially those investigations presented to the committee that have led to the main success stories.



Soft matter is essentially made-up with carbon and hydrogen so that neutron scattering is an appropriate technique for the study of its local structure. In particular, when the deuterated or partially-deuterated counterpart of a component (the solvent, a polymeric chain...) can be synthesized this offers the possibility of studying multicomponent systems by means of contrast matching or contrast variation. This successful road was opened in the seventies in the field of polymer solutions through a fruitful collaboration between LLB and Institut Charles Sadron in Strasbourg. This story is still going on and has recently given very fruitful results.

This contrast matching has been applied to more complex systems such as composite materials made up with polymers and reinforcement fillers. Particularly clever choices of solvent allowing the extinction of the reinforcing fillers, which is frequently impossible, and also the fine chemical tuning of the structural organization of the filler have allowed one to follow the detailed conditions of reinforcement. The committee has unreservedly appreciated the nice piece of work carried out on mineral particles dispersed in a polymer matrix. Neutron scattering studies have been implemented by a complete battery of techniques (rheology, SAXS, TEM), which makes the study a very thorough one and by far a milestone in the field. This work has an impact both on fundamental science and on applied research. The involvement of Michelin as industrial partner in this work emphasizes clearly the latter point.

Another domain of interest is the study of long-lasting and stable foams recently developed and based on vegetal fatty acids in collaboration with INRA. A deep study carried out by small angle scattering and specular neutron reflectivity has determined both in bulk and at the interfaces, the thermal stability of the rod-like structures involved in the stabilization of the foam as crowding entities in the plateau borders. Even if the thermodynamic details of the rod/micelle transition leading to the foam destabilization remain to be explored, this seems to be a very promising direction to explore, which has created a buzz in popularization newspapers.

LLB possesses a deep experience in the study of the polyelectrolyte conformations and dynamics as a function of various parameters that is now extended to more complex systems by younger scientists exploring for example striking counterion effects in the chain-chain interactions in water. Now, they are also making nanomaterials by designing silver nano-objects or magnetic polymersomes for drug delivery control by hyperthermia. Polyelectrolytes remain beyond doubt a strong aspect of the science performed at LLB. It might be also of interest to study these polyelectrolytes in ionic liquids as scientists at LLB have now a new expertise on these peculiar and complicated liquids whose deuterated counterparts can be prepared on site.

### Assessment of the unit's academic reputation and appeal

The contribution of the scientific staff of this axis to soft complex matter problems is quite significant and more than often recognized worldwide. The committee members estimate that it should be rated as very excellent. This is supported by the number (of the order of 45 a year) and the quality of the publications from the group, the existence of collaborations with the best soft matter groups abroad and in France, and assessed by the significant number of invitations to international conferences for the permanent researchers.

The departure of major actors in this field, either through retirement or through appointment in other structures, may be detrimental to LLB. There are active young and dynamical researchers that may potentially bridge the gap but this might be a problem in the future, especially if the best elements are attracted elsewhere due to the blighted prospects ahead of ORPHÉE reactor with an expected closing-down in 2020.

Although excellent postdocs and Ph.D. students have been and are working at LLB, their number is relatively low in view of the potential attractiveness of the facility, and by comparison with Institutes of equivalent size and reputation. This is clearly due to the lack of funding from Universities for Ph.D. students and postdocs and from ANR grants directly coordinated by LLB. As was already emphasized in early reports LLB groups are not as successful as they should be at attracting competitive funding, chiefly because funding agencies assume that they enjoy full financial support by CEA and CNRS. There is clearly an underfunding but the LLB should probably improve its communication towards the French community to modify this deceiving image of money in plenty.

### Assessment of the unit's interaction with the social, economic and cultural environment

As a national large-scale facility LLB and more specifically axis 3 attracts users that collaborate directly with the permanent members as can be seen from the numerous joint publications. So most of the neutron users consider they need the expertise and knowledge of LLB members, involving them in ANR programs and contracts, they coordinate. Note the recent opening to a new research line in collaboration with AgroSup (Dijon) in food structuring involving a financed joined Ph.D., the collaboration with SOLEIL with joined Ph.D.'s and the voluntary engagement in



the framework of the RTRA "Triangle de la Physique". As to the economic impact of research carried out in axis 3 it is still limited as only two contracts with industrial partners (Michelin and IFPEN) have been obtained.

Although LLB is primarily a laboratory dedicated to basic research, its relation with industries should be improved. This is especially the case for axis 3 as soft condensed matter is a field where applications derived from basic research are often close at hand. This seems to be again a matter of communication: dissemination of the research carried out in this axis should be improved. Participation in Carnot Institutes might also be a way to get in touch with the appropriate industrial partners

### Assessment of the unit's organisation and life

The 3 axes have been created recently. The regrouping of researchers in axis 3 is utterly meaningful as it involves people with a similar approach to the problems in soft complex matter. This should be pursued, as it will be beneficial in the future. Although seminars specific to this axis are arranged on a regular basis, cross-collaborations appear to be not yet strong enough. There is a potential synergetic effect if interactions inside this axis are further developed. In any case, it is recommended to re-examine periodically which associations of researchers provide them with the best scientific interactions.

### Assessment of the unit's involvement in training through research

The members of axis 3 take their share for the training through research in the programs developed by LLB. It is noticeable that some of these members are particularly active in the framework of the "Société Française de Neutronique" and in the organization of their annual "Journées de la Diffusion Neutronique". Details are found in the general appreciation of this laboratory.

### Assessment of the strategy and the five-year plan

The 5-year project addresses major issues in soft matter and in biophysics. Nanocomposites and smart materials remains a domain of concern in axis 3. This is clearly a research field where they can make some breakthrough but where they have to seek collaboration with industrial partners.

There is also a clear orientation towards food science involving gelling agent or foam systems that are encountered in most nutriments. Although this is really complex matter, many scientists in this axis are capable of making significant contributions in what is regarded as "food structuring".

The 1-D confined of electrolytes in carbon nanotube might be a promising field with possible fallouts in the design of batteries. This appears to be a risky domain but this is part of fundamental research that should therefore be supported.

The project in biophysics is certainly interesting yet the number of scientists involved seems to be subcritical and outside collaborations missing. Studying the crowding on proteins in PEG is easy, but much trickier when it comes to use biological components. Involvement of biologists should be also sought there.

### Conclusion

- Overall opinion of the theme:

The research in Axis 3 has produced a remarkable set of results and publications on very diverse systems.

- Strengths and opportunities:

The research groups in axis 3 combine competences and techniques that are rarely found elsewhere: they can prepare nanocomposite materials, characterize their structure by making a clever use of neutron contrast to solve pending questions.

The new SANS PA20 should provide them with an instrument capable of virtually rivalling with ILL's D11 camera. The X-TOF (Fa#) and upgraded Spin Echo spectrometer (MUSES) will further address the needs of the soft matter community.



- **Weaknesses and threats:**

There might be a risk of dispersion on the study of too many materials and a global coherence should be maintained. For the biophysics group, there is a risk that they find themselves cut off from the teams that perform forefront research in biophysics.

The number of external visitors for long stays should be increased. A similar remark holds for PhD and post-doctoral students.

- **Recommendations:**

- Improve the collaborations within the theme for example through common ANRs or actions.
- Similarly focus on a more limited number of systems to keep a scientific coherence.
- Re-assess the opportunity of working on biological systems by establishing strong links with outside groups.



## Part 4: Instrumental & Technical groups

### • Detailed assessments

The neutron source ORPHÉE is the backbone of the Laboratoire Léon Brillouin (LLB). The neutron source itself is operated by CEA. ORPHÉE has been taken into operation in the year 1980 and continuous maintenance and investment into the nuclear facility makes it today an extremely reliable neutron source, equipped with a thermal heavy water moderator, two powerful cold sources and one hot source. Altogether, ORPHÉE is worldwide one of the leading national neutron sources providing high fluxes of neutrons outside of the reactor core and moderators. National neutron sources of similar quality, mission and international impact are ISIS (GB), SINQ (Switzerland), FRM II (Munich, Germany), NIST research reactor (USA), BER-2 (Berlin, Germany), Opal (Australia). The third decennial safety assessment (group permanent) of ORPHÉE will happen towards the end of 2019.

All this powerful national sources have in the one or other way comparable fluxes. Increasing efficiency in using neutrons for basic science, engineering and industry comes from progress in the neutron extraction and subsequent innovative instrumentation, i.e. operating instruments is a continuous development task.

The altogether 19 beam instruments open for user access are operated in 2013 by three instrument groups, (i) Large Scale Structures, (ii) Diffraction, (iii) Spectroscopy. Additionally, one diffractometer and one spectrometer serve internal test needs. Further CEA/DEN operates one neutron tomography station for industrial needs. Taking the three Scientific Axes as scientific structure perpendicular to the division in instrument groups LLB is structured in a 2-D matrix; vertically oriented are the science groups, horizontally cross-cutting the instrument groups. This kind of matrix is found at comparable neutron as well as synchrotron sources and certainly is very much appropriate.

Most important are the efforts and achievements of LLB to modernise its instrumentation. Historically seen LLB started in the 80's with a very modern and internationally extremely competitive instrumentation, thereby largely profiting from the almost revolutionary instrument innovations at the international Institute Laue Langevin. This was followed by a period of exploiting this instrumentation for excellent science, driven by in-house personnel and the larger French community with considerable contributions from international users, for instance Germany with its Karlsruhe outstation at LLB and transferring the Resonant-Spin-Echo-Technology from Munich to LLB. The outcome was and is the well-known and internationally highly appreciated excellent publication statistics of LLB. However, focussing on scientific output, the instrumentation of LLB risked to become less competitive towards the end of the 90's. This has been very successfully counter steered by first launching CAP 2015 and today CAP 2017, two successive campaigns to modernize the instrumentation. From 2004 to today, 12 instruments have been renovated, upgraded, replaced or moved to more intense beam ports. Today, CAP 2017 comprises the construction of four either completely or almost new instruments with a deadline for completion around 2017. All four instruments are of immanent importance for LLB. FA# has the perspective to be world leading for inelastic instrumentation combining single-crystal monochromatisation with time-of-flight inelastic analysis. PA 20 will bring back to LLB a SANS instrument which can compete with those at ILL or FRM II. IMAGINE is urgently needed to serve industrial demands for process controlling, making visible on a  $\mu\text{m}$  scale the inner life of complex work pieces or to follow e.g. the hydrogen filling of fuel cells. Finally the banana type diffractometer G4.4 will give LLB a very high-resolution diffractometer, complementary to the high flux powder diffractometer G4.1 with higher flux, but yet not sufficient resolution.

LLB has presented plans for a new imaging station in line with the major demand and already in use at several top end facilities (FRM-II, SINQ). This development was well appreciated by the committee that sees here a new perspective for non-destructive study of different kind of materials on the micrometer scale. This development should be encouraged. Particular attention should be paid to of the achievable spatial resolution, field of view and case studies. It should also be addressed how the infrastructure will take into account the present and future requirements of handling large imaging datasets, e.g. from tomography measurements.

Modernisation of neutron instrumentation also comprises better extraction of the neutrons and efficient transport to the sample and finally to the detector. The visiting committee greatly appreciates that the modernisation includes replacement of neutron guides by more efficient super-mirror guides, better extraction of neutrons for instance for the triple axis spectrometers, increased investment into neutron polarisation in order to feed the never ending demand in analysing magnetic properties of materials.



In view of the importance of neutron research for basic science, engineering and industrial applications, France has decided to be one of the key partners of the European Spallation Source, the ground breaking of which most probably will happen in June 2014. The LLB centralizes the French knowledge in neutron instrumentation and exploitation of neutrons for science and industry. Therefore it has been assigned as the bridgehead for the French contribution to build the instrumentation of ESS and for its future exploitation by French scientists. The committee notes two strategically important points: firstly, ESS as a true European endeavour aiming at leading the international scientific competition among neutron sources, strongly depends on the multitude of European expertise in neutron instrumentation and expertise in service to the community; secondly, the benefit of the respective national contribution to ESS strongly depends on the involvement of the national community in the instrumentation of ESS and later its operation. Taking this into account, it is of prime interest for France to have a powerful bridgehead at Lund. To the unilateral opinion of the visiting committee LLB is best suited to do so and with time this task will become dominating - or at least equivalent with respect to the others missions of LLB.

To fulfil this mission, LLB has several assets and options: a) modernize knowledge in instrumentation, b) develop innovative components of neutron instrumentation, c) mobilize French laboratories at universities, engineering schools, CNRS and CEA in its multitude etc. for instrument development, d) to actively seek collaborations with expert groups outside France. Components a) and b) are to a certain extent fulfilled by the current instrumentation program at LLB, c) has to be strongly reinforced. Compared to its neighbours, Germany, Switzerland, Great Britain and to a certain extent also Spain and Italy, the knowledge in innovative neutron technologies spread around France is yet insufficiently activated for the instrumentation of LLB and for the future instrumentation of the ESS. With respect to d) LLB is actively seeking collaboration with expert groups in other European countries.

Part of the successful use of neutron instrumentation is the availability of a large suite of sample environment like very low and high temperatures, huge magnetic fields, very high pressure, stress machines, etc. Also with the help of its users LLB continuously modernizes its sample environment suite and in total the available sample environment is absolutely state of the art.

## Conclusion

In summary, the modernisation of the instrumentation at LLB from 2006 to today has achieved an average gain in detectable useful neutrons by a factor of 26 for an investment of 11 M€, which is an extremely cost efficient modernisation. The suite of currently operating instruments fits quite well to the three scientific axes, thereby keeping in mind that the four instruments still under construction are very important to remain competitive on an international level. These additional instruments will also serve to compensate for the shut down of a few instruments over the last 10 years. Instrument beam time is overbooked continuously by a factor of 1.8.

With its new mission- being the bridgehead for French neutron instrumentation at ESS - LLB has a clear long term and also unique mission within the French neutron landscape. Important key recommendations to fulfil this mission are the following: explore now new neutron techniques to be innovative, incorporate to a much larger extent laboratories around France, in particular universities and engineering schools, continue international collaborations in the field of instrumentation.

One has to be aware that the new focus “instrumentation for ESS” will bind scientific as well as technical personnel at LLB, with the inevitable drawback that this activity goes on the expense of scientific publications - at least for a certain time period. But certainly, this is worth the effort. The condition to fulfil this task is a certain level of technical and scientific staffing. With the threat of not replacing staff, which will retire this and next year, this task is seriously endangered.

- Overall opinion of the theme:  
Well-adapted matrix structure for science and instrumentation.
- Strengths and opportunities:

International competitive instrumentation at LLB: The renovation and upgrading of instruments is urgently needed, on very good track and has to be continued. Being the bridgehead for the “French” instrumentation gives LLB within France a unique mission, which definitely is best filled by the competences of LLB.



- **Weaknesses and threats:**

**Threat:** In view of the impact of research with neutrons for modern society (energy, live & health sciences, mobility, sustainability, nano- & innovative materials, cultural heritage) France has decided to be one of the key partners of ESS. Key partners need access to a “home source” to be competitive in applying for beam time at the supposed to be best future neutron source. Without preparing its own national community for that competition, French investment at ESS will be used largely under value. The today envisaged closure of ORPHÉE around 2020 is definitely too early. The Institute Laue Langevin cannot replace a national “playground” for neutron science; on the contrary, early closure of ORPHÉE will also weaken the French position at ILL.

**Weakness:** The French user community (universities, engineering schools, but also CNRS and CEA) has to become more directly involved at LLB. The visiting committee is aware that the French higher education system with its division in first class engineering schools and a broad distribution of good (sometimes very good) universities has not always the resources to participate in the exploitation of the French neutron source. In the neighbouring countries Switzerland, Germany, Great Britain the involvement of university labs in exploiting its national neutron source is much advanced.

- **Recommendations:**

The development of an imaging instrument is likely to provide interest from academic and industrial users. LLB should clarify how it will handle large imaging datasets and image processing.

Also a quite modern and excellent maintained neutron source like ORPHÉE will come to the end of its life cycle. In view of the role of Spallation Sources will play to provide neutrons in the future, the shareholders of LLB (CNRS and CEA) should start now to develop long term perspectives for a replacement of ORPHÉE as national neutron source. Recently upcoming ideas of brilliant accelerator or laser driven neutron beams could be an ideally suited alternative for a strong and innovative future national neutron sources. It is recommended to install now a task force evaluating this opportunity.

Being aware of the problems to finance an appropriate number of staff of LLB, it is recommended to progress in small and achievable steps. The shareholders are kindly asked to bridge the forthcoming “hard” years by their best efforts. On the other side, LLB is asked to activate more actively contributions from the French user community, in particular universities, engineering schools, regional funds, European funds for instrumentation.

In this period of austerity, it is of prime importance to communicate to the personnel of LLB the long term perspectives.



## 5 • Conduct of the visit

### Visit dates:

Start: January 30<sup>th</sup>, 2014, 8:00

End: January 31<sup>th</sup> 2014, 17:00

### Visit site:

Offices of the Laboratoire Léon Brillouin at the Saclay site of CEA

### Institution:

Laboratoire Léon Brillouin

### Address:

CEA Saclay

LLB - Bât 563

91191 Gif sur Yvette Cedex

### Specific premises visited:

A visit of the instrumentation in both the reactor hall and the neutron guide hall and some of the chemical laboratories was integrated part of the visiting program.

### Conduct or programme of visit:

An extensive visit of the instrumentation around ORPHÉE was part of the visiting programme. During the presentations Mr Klaus HASSELBACH, representative of CoNRS section 03 and Mr Claude ARNOLD representative of CoNRS section 05 IT were present. On Friday 31<sup>th</sup> January a half hour phone conference took place with the chairman of the Scientific Advisory Board, Mr Ian ANDERSON, Oakridge National Laboratory.

The well organized information sessions, intense and lively discussions after each presentation, together with the written reports, and the phone interview with the head of the Scientific Advisory Board allowed the committee to obtain a very clear view of the original research done by the LLB staff and its users, but also of the organisation of the user service and its innovative instrumentation.





Thursday, January 30<sup>th</sup>

8H30 - 8H45	Welcome of the committee - coffee
8H45 - 9H15	Meeting of the committee (closed)
9h15 - 10h45 presentation + discussion	Presentation of the laboratory C. ALBA-SIMIONESCO, J.P. VISTICOT, A. MENELLE
10h45 - 11h00	Coffee break
11h00 - 12h10 presentation + discussion	Presentation axis 1: MAGNETISM & SUPERCONDUCTIVITY <ul style="list-style-type: none"> <li>• Activities overview: Y. SIDIS</li> <li>• Highlight 1: Physics of monopoles, S. PETIT</li> <li>• Highlight 2: Supra High Tc P.BOURGES</li> </ul>
12h10 - 13h30	Lunch
13h30 - 14h40 presentation + discussion	Presentation axis 2: MATERIALS AND NANOSCIENCES : FUNDAMENTAL STUDIES AND APPLICATIONS <ul style="list-style-type: none"> <li>• Activities overview : F. OTT</li> <li>• Highlight 1: Nanomagnetism, A. BATAILLE</li> <li>• Highlight 2: Nano-particle reinforced metal matrix composites, M.H. MATHON</li> </ul>
14h40 - 15h50 presentation + discussion	Presentation axis 3: SOFT COMPLEX MATTER <ul style="list-style-type: none"> <li>• Activities overview :J.M. ZANOTTI</li> <li>• Highlight 1: Membranes, D. LAIREZ</li> <li>• Highlight 2: Foams, F. COUSIN</li> </ul>
15h50 - 17h30	Coffee + Discussions around 14 Posters : 3 posters Axe1, 3 posters Axe2, 3 posters Axe3 3 instrumental posters (Instr. groups), 1 poster Technical groups; 1 poster platforms
17h30 - 18h30	Visit of the facility
18H30 - 19H30	Meeting of the committee (closed)

Friday, January 31<sup>th</sup>

8H30 - 9h40 40' presentation + 30' discussion	Presentations: Instrumentation, access & training <ul style="list-style-type: none"> <li>• The LLB instruments suite, access, A. MENELLE</li> <li>• The technical Groups : S. DESERT</li> </ul> Training and education: F. DAMAY
9h40 - 10H10	Meeting with the "conseil d'unité"
10h10 - 10h20	Coffee break
10h20 - 11h20	Meetings with the different "colleges"
10h20 - 10h40	Meeting with technicians
10h40 - 11h00	Meeting with PhD students & postdocs
11h00 - 11h20	Meeting with researchers/engineers
11h20 - 12h00	Meeting with CEA and CNRS representatives
12h00 - 13h00	Lunch: Buffet open to all
13H00 - 17H00	Meeting of the committee (closed)

Specific points to be mentioned:

No specific events are to be reported. The visiting committee congratulates the LLB team for the excellent organization of the visit and in particular for pedagogical excellent and very informative oral presentations and lively and critical discussion.



## 6 • Supervising bodies' general comments



Direction des Sciences de la Matière  
Institut Rayonnement Matière de Saclay

Le Chef d'Institut



M. Pierre GLAUDES

Directeur de la Section des Unités  
de Recherche  
AERES  
20, rue Vivienne  
75002 PARIS

Saclay, le 6 juin 2014

Objet : Rapport d'évaluation du LLB – Laboratoire Léon Brillouin – UMR 12

Réf. : IRAMIS-DIR/MS-CB/2014-029

Monsieur le Directeur,

Au nom des deux tutelles du LLB, le CEA et le CNRS, nous nous associons à la Directrice du LLB pour remercier le comité d'experts pour son analyse particulièrement détaillée et pertinente des activités multiples du laboratoire. Nous avons pris bonne note des recommandations du comité qui sont, dans leur ensemble, en parfaite adéquation avec le projet scientifique et instrumental défendu par les équipes. En ce qui concerne la recommandation particulière de rapprochement avec les universités, c'est effectivement un objectif prioritaire du laboratoire, qui a déjà été initié et que la direction du LLB souhaite amplifier en particulier dans le cadre de l'Université Paris-Saclay.

Nous avons noté les recommandations du comité sur la nécessaire prolongation du fonctionnement d'Orphée qui est une entité distincte du LLB. Cependant nous tenons à rappeler qu'en raison du statut particulier d'Orphée, qui est un TGIR (Très Grande Infrastructure de Recherche), cette décision est prise au niveau ministériel, dépassant ainsi le cadre des seules tutelles CEA et CNRS. La question de la prolongation du fonctionnement d'Orphée est actuellement traitée par le Comité Directeur TGIR. Par rapport aux deux scénarii considérés par le ministère de la recherche (arrêt en 2017 ou en 2020), le scénario préconisé par les tutelles CEA et CNRS est le maintien d'un fonctionnement nominal d'Orphée à 180 jours / an jusqu'à son arrêt en 2020.

Nous vous prions d'agréer, Monsieur le Directeur, l'expression de nos salutations distinguées.

Hervé Desvaux  
Chef d'institut

Maria Faury  
Directrice adjointe des Sciences de la Matière