



# LPC - Laboratoire de Physique Corpusculaire

Rapport Hcéres

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# HCERES

High Council for the Evaluation of Research  
and Higher Education

Research units

HCERES report on research unit:

Laboratoire de Physique Corpusculaire de Caen

LPC Caen

Under the supervision of  
the following institutions  
and research bodies:

École Nationale Supérieure d'Ingénieurs de Caen –  
ENSICAEN

Université de Caen Basse-Normandie – UCBN

Centre National de la Recherche Scientifique – CNRS

Evaluation Campaign 2015-2016 (Group B)

# HCERES

High Council for the Evaluation of Research  
and Higher Education

Research units

*In the name of HCERES,<sup>1</sup>*

Michel Cosnard, president

*In the name of the experts committee,<sup>2</sup>*

Giacomo De Angelis, chairman of the  
committee

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Under the decree No.2014-1365 dated 14 november 2014,

<sup>1</sup> The president of HCERES "countersigns the evaluation reports set up by the experts committees and signed by their chairman." (Article 8, paragraph 5)

<sup>2</sup> The evaluation reports "are signed by the chairman of the expert committee". (Article 11, paragraph 2)

## Evaluation report

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

The assessments contained herein are the expression of an independent and collegial reviewing by the committee.

**Unit name:** Laboratoire de Physique Corpusculaire de Caen

**Unit acronym:** LPC Caen

**Label requested:** UMR

**Current number:** UMR 6534

**Name of Director  
(2015-2016):** Mr Dominique DURAND

**Name of Project Leader  
(2017-2021):** Mr Gilles BAN

## Expert committee members

**Chair:** Mr Giacomo DE ANGELIS, Laboratori Nazionali di Legnaro, INFN, Italy

**Experts:**

- Mr Yorick BLUMENFELD, CNRS/IN2P3, Orsay (representative of the CoNRS)
- Mr Pierre DESEQUELLES, Université de Paris-Sud, Orsay (representative of the CNU)
- Mr Cheikh DIOP, CEA-Saclay, Gif sur Yvette
- Mr Marcos DRACOS, CNRS/IN2P3, Strasbourg
- Mr Christian MOREL, Université Aix-Marseille, CNRS/IN2P3, Marseille

**Scientific delegate representing the HCERES:**  
Mr Michel GARÇON

**Representatives of supervising institutions and bodies:**

Mr Jean-Marc DANIEL, CNRS

Mr Marco DATURI, ENSICAEN

Ms Anne GUESDON, UNICAEN

Mr Jean-François HAMET, ENSICAEN

Mr Serge Kox, CNRS/IN2P3

**Representative of Doctoral School:**

Mr Wilfrid PRELLIER, Doctoral School n°181 "SIMEM"

## 1 • Introduction

### History and geographical location of the unit

The research unit was created in 1947 but the “modern era” started with the realization of the first accelerated heavy ion beam of GANIL in the 80’s. At that time all the members of the research unit gathered in a unique activity, “Nuclear Dynamics and Thermodynamics”, aiming at the development of an ambitious program based on the construction and operation of large detectors (first Nautilus and later INDRA placed in dedicated experimental areas in GANIL) for the detection of light and heavy fragment nuclei. The primary goal was the study of the collision of heavy ions focusing on the dynamics and thermodynamics of nuclei. Later in the 90’s the new groups of “Nuclear Structure”, “Theoretical and Phenomenological Physics”, “Electronuclear Cycle” and “Fundamental interactions and the nature of the Neutrinos” were created. More recently, around 2005, the laboratory has opened a research line dedicated to applications of nuclear technologies with the creation of a unit dedicated to “Medical and industrial applications”. The laboratory is located in Caen, hosted by the “École Nationale Supérieure d’Ingénieurs de Caen” (ENSICAEN), principal regulatory authority together with the University of Caen - Normandie (UNICAEN). The two institutions are now members of the community of establishments of Basse and Haute Normandie, so-called “Normandie Université”. The other supervising institution is CNRS/IN2P3.

### Management team

Mr Dominique DURAND - director of LPC Caen.

Mr Rémi BOUGAULT - deputy director.

Ms Aurélie GONTIER - administrator.

### HCERES nomenclature

Domaine scientifique principal: ST - ST2 - Physique.

Domaines applicatifs:

P : Énergie nucléaire.

S : Santé humaine et animale.

### Scientific domains

Today the scientific domains of LPC Caen can be categorized into three main themes:

1. the structure and the dynamical and thermodynamical properties of the atomic nucleus investigated through nuclear reactions;
2. the study, in low energy processes, of fundamental interactions (mainly weak interaction at the nuclear level) between quarks and leptons with the aim to search for deviations/extensions of the standard model;
3. applications of Nuclear Technology in the medical, industrial and energy domains.

These three themes are the objectives of the six research teams of the laboratory:

1. Medical and Industrial Applications;
2. Electronuclear Cycle;
3. Nuclear Dynamics and Thermodynamics;
4. Fundamental Interactions and Nature of Neutrinos;
5. Theory;
6. Nuclear Structure.

The scientific strategy of the research unit is based on applied and fundamental research, operated at local level (partnership in all local projects based on nuclear science) and at national level (partnership in major projects of IN2P3). The link with the socio-economical tissue is performed through collaboration contracts with local and national industries, in particular for what concerns the application of nuclear methods to medicine.

At the local level (on site) the research unit is strongly involved in providing support to the national projects realized in GANIL (SPIRAL1, SPIRAL2). Resources are also provided to the project of excellence DESIR aiming at the use of the radioactive beams of SPIRAL1 at low energy, and those produced by SPIRAL2 after separation in S3. Other activities are the construction of an RFQ for the high-resolution spectrometer of DESIR and the ANR REGLIS3 for extracting the radioactive ions from S3 in SPIRAL2. In the near future the research unit will be strongly involved in the ARCHADE and PMRT projects, combining competences of physics and radiobiology, and in REC-HADRON and FRANCE-HADRON, focusing on instrumentation for radiobiology and building a network of laboratories for providing beams for hadron-therapy. LPC Caen is also strongly involved in a network of industries with local implantation like AREVA or EDF. Together with ENSICAEN, collaborations have been developed focusing on interdisciplinary activity.

At national and international levels (off site) the laboratory is involved in collaborations with programs financed by France or by the European Community. Examples are the INDRA-FAZIA program, aiming at the construction of a novel type of detector for heavy ions, the "EXPAND" program at RIKEN (Japan), an experimental program for nuclear reactions with exotic nuclei, the nEDM program at PSI (Switzerland) for the measurement of the electric dipole moment of the neutron, and the SuperNEMO (demonstrator) at LSM Modane and the SoLiD programmes at the BR2 reactor in Mol (Belgium) for investigating the nature of the neutrino. In all these activities the laboratory is collaborating with other groups of IN2P3 and with national and international institutions often assuming direct responsibilities for part of the realization and in some cases playing a leading role in guiding the collaboration.

Unit workforce

Unit workforce	Number on 30/06/2015	Number on 01/01/2017
N1: Permanent professors and similar positions	17	17
N2: Permanent researchers from Institutions and similar positions	13	13
N3: Other permanent staff (technicians and administrative personnel)	36	36
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)	1	
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	1	
N6: Other contractual staff (technicians and administrative personnel)		
N7: PhD students	12	
TOTAL N1 to N7	80	
Qualified research supervisors (HDR) or similar positions	17 (*)	

Unit record	From 01/01/2010 to 30/06/2015
PhD theses defended	18
Postdoctoral scientists having spent at least 12 months in the unit	2
Number of Research Supervisor Qualifications (HDR) obtained during the period	6 (*)

(\*) These numbers include one HDR obtained in July 2015.

## 2 • Overall assessment of the unit

### Introduction

LPC Caen is an important unit of the IN2P3 with dedicated programs in nuclear structure and reactions, nuclear theory, fundamental interactions and medical and industrial applications, and nuclear data and reactor physics. The scientific strategy is based on fundamental research and applied research at the local and global levels. For the basic research, the laboratory is supporting the national projects realized in GANIL (SPIRAL1, SPIRAL2 or connected to those facilities like DESIR). LPC Caen is involved in international collaborations with programs financed by France or by the European Community. Examples are for basic nuclear physics the construction of the FAZIA multidetector array, a novel type of detector for heavy ions allowing isotopic identification and the experimental program for nuclear reactions at RIKEN performed under the contract "EXPAND" and aiming at nuclear structure studies, for fundamental interaction studies the nEDM at PSI for the measurement of the electric dipole moment of the neutron, SuperNEMO (LSM Modane) or SoLiD at the BR2 reactor in Mol (Belgium), investigating the nature of the neutrino and the LPC Trap activity for the measurement of the neutrino-ion angular correlation for  $\nu_{ud}$  determination. Concerning applications, there is a strong involvement in the nuclear data using the NFS facility at SPIRAL2 or in the ARACHADE and PMRT projects, combining competences of physics and radiobiology, and in REC-HADRON and FRANCE-HADRON, focusing on instrumentation for radiobiology and building a network of laboratories for providing beams for hadron-therapy. LPC Caen is also connected to a network of local/national industries like AREVA or EDF and is doing research on accelerator driven systems (ADS) in collaboration both with LPSC (Grenoble) and SCK/CEN (Mol, Belgium). Since the last report new opportunities have arisen as for example SoLiD, Expand and SuperNEMO.

### Global assessment of the unit

LPC Caen is very well known in its areas of research. Its nuclear, fundamental physics and applied physics staff members are well recognized in the international community and valuable partners at major facilities worldwide. The research unit is outstanding with an excellent track record in scientific accomplishments: the publications are numerous and of high quality and the large number of invitations to international conferences and schools speaks for a high international standing. The staff have been involved in the organization of many conferences and schools, often with leading roles. The research teams have been involved in designing, constructing and exploiting major state-of-the-art equipment at regional, national and international facilities. The technical services have been contributing to the developments of instrumentation used in the previously mentioned facilities. The number of participations in national and international projects, awards and academic contracts is high as well as the number of supervised PhD students, again attesting to LPC Caen excellence in research and training.

The scientific activity of the laboratory shows a strong dynamism and a high-level production in all the tasks undertaken, together with an excellent international outlook.

### Strengths and opportunities in the context

The scientific teams have outstanding staff that are actively involved in cutting-edge research at the most important regional, national and international research infrastructures. LPC Caen is on the average very productive scientifically as can be deduced from the number of publications in refereed journals and proceedings as well as from their quality (publications in high-impact journals). The combination of fundamental and applied physics towards



addressing important societal problems such as health and energy is among the LPC Caen strengths. The LPC Caen teams have strong networks and operate in national and international collaborations. Also the number of collaborations with industries is high. These collaborations are based not only on contributions to the scientific programmes but also on technical developments allowing a larger impact on those programmes. The age pyramid of the staff is rather favorable and the researchers have a high reactivity in participating in national competitions. LPC Caen has developed an interesting strategy for increasing the attractiveness of the laboratory for PhD students dedicating particular care to their needs. The ability to work together with GANIL and with other laboratories in the Caen area is a strong opportunity for LPC Caen to play a major role in main scientific infrastructures like SPIRAL1 and SPIRAL2 and in the near future ARCHADE.

### Weaknesses and threats in the context

The fact that LPC Caen is active in many topics is also a weakness, in particular since the financial resources are dwindling, and some topics of research may become less visible (one example could be the Nuclear Dynamics and Thermodynamics in case the FAZIA project is not completed). For some teams the number of technical projects is already too large for the number of people who have to plan and execute them. The human resources have a stable profile but the generalized absence of promotions and the large delay of major projects could lead to a certain disengagement of the staff. Insufficient efforts are made to obtain grants for postdoctoral researchers. Also the close collaboration with the GANIL laboratory, which offers many opportunities, can cause a reduced visibility of the laboratory which seen from afar may not show a specific identity. A weakness is also the inadequacy of the infrastructure to host new large instrumentation or new collaborating groups. A threat for LPC Caen is the evolution of the budget. The dwindling financial resources allocated by the supervising institutions induce an increased reliance on contractual funding which can put a number of excellent scientific programmes and technical projects in jeopardy. Also the delay of SPIRAL2 phase 2 is a big threat since part of the future programmes are based on this facility. In view of this delay, the related instrumentation to enlarge the scientific program may not be funded and part of the staff could disengage from this significant project. The medical application activities are very dependent on the timely advancement of the ARCHADE project. Also the long-term future of the ADS activity will rely on the approval of the MYRRHA project. Finally, due to the high fragmentation of the research activities, together with the large involvement of the staff members in research and teaching, there is a lack of scientific animation of the laboratory.

### Recommendations

The laboratory, within ENSICAEN, should try to increase the available space with the creation of dedicated areas. This should allow to have a proper technical workshop as well as rooms for hosting and testing new instrumentation. The research unit should actively pursue the opportunities offered by the relocation of some ENSICAEN laboratories.

To cope with the dwindling financial resources, the laboratory should try to increase its own resources by increasing the participation to national and international calls for projects. The availability of new areas to host large instrumentation will be a prerequisite to increase the number of industrial partnerships which could bring additional resources.

The scientific animation of the laboratory should also be improved through the organisation of seminars and lectures. This could also facilitate the synergy among different research teams.

The close collaboration with the GANIL laboratory in many projects can sometimes overshadow the contribution of the laboratory members. A clear identification and better presentation of the mutual responsibilities within the projects could enhance the visibility of the laboratory. A modernization of the web page of the laboratory is advised.

The LPC director is encouraged to impress upon the groups the importance of increasing the number of requests of postdocs and visitors grants. It would also be helpful to provide more information to PhD students concerning the job opportunities after their thesis. The director is also encouraged to pay attention that all staff members get equal opportunity for training and continuing education.

The expert committee noted a strong gender imbalance, in particular among technical staff. The importance of gender balance should be kept in mind when hiring new staff members.