

# HCERES

High Council for the Evaluation of Research  
and Higher Education

Department of Research Evaluation

Report on research unit:

Grand Accélérateur National d'Ions Lourds

GANIL

under the supervision of  
the following institutions  
and research bodies:

Commissariat à l'Énergie Atomique et aux Énergies  
Alternatives – CEA

Centre National de la Recherche Scientifique – CNRS

Evaluation Campaign 2016-2017 (Group C)

# HCERES

High Council for the Evaluation of Research  
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*In the name of HCERES,<sup>1</sup>*

Michel Cosnard, president

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

Angela Bracco, chairwoman 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:** Grand Accélérateur National d'Ions Lourds

**Unit acronym:** GANIL

**Label requested:**

**Current number:**

**Name of Director (2016-2017):** Mr Florent STALEY (until 31/12/16)  
Mr Navin ALAHARI (since 01/01/17)

**Name of Project Leader (2018-2022):** Mr Navin ALAHARI

# Expert committee members

**Chair:** Ms Angela BRACCO, INFN, Italy

**Experts:** Mr Wilton CATFORD, University of Surrey, UK  
Ms Valérie CHAMBERT, IPNO (representative of the supporting personnel)  
Ms Sandrine COURTIN, IPHC  
Mr William LYNCH, MSU, USA  
Mr Jérôme MARGUERON, IPNL  
Ms Iolanda MATEA MACOVEI, IPNO (representative of the CoNRS)

**Scientific delegate representing the HCERES:**

Mr Yannis KARYOTAKIS

**Representatives of supervising institutions and bodies:**

Ms Ursula BASSLER, IN2P3/CNRS  
Ms Anne-Isabel ETIENVRE, DRF/CEA  
Ms Patricia ROUSSEL-CHOMAZ, DRF/CEA

**Heads of Doctoral School:**

Mr Denis LEBRUN, Doctoral school n° 591, “Physique, Sciences de l’Ingénieur, Matériaux, Énergie”, ED PSIME

Mr Wilfried PRELLIER, Doctoral school n° 591, “Physique, Sciences de l’Ingénieur, Matériaux, Énergie”, ED PSIME

## 1 • Introduction

### History and geographical location of the unit

GANIL (Grand Accélérateur National d'Ions Lourds) was founded in Caen, France in 1975 as a heavy ion-beam facility and institute for fundamental research to investigate the structure and properties of atomic nuclei through their interactions with matter. Construction of the facility began in 1979, the first beam was delivered in November 1982, and the first experiment was performed in January 1983. Since 1995 it is classified as a European large scale Facility. Starting out as heavy-ion laboratory with stable beams, it was one of the pioneering labs to produce short-lived unstable nuclei using projectile fragmentation. The facility was then augmented with a new facility SPIRAL1 in 2000 using the ISOL technique for reaccelerating short lived nuclei. GANIL is one of the main European beam facilities and research institutes and is one of the five largest laboratories worldwide that is dedicated to research with heavy-ion beams. The facility is now being further upgraded by the SPIRAL2 facility.

The GANIL facility is funded jointly (and equally) by the Division of Fundamental Research of the Atomic Energy and Alternative Energy Commission (CEA/DRF) and the National Institute of Nuclear and Particle Physics of the National Center for Scientific Research (CNRS/IN2P3). The legal structure is of an Economic Interest Group (GIE) that was recently renewed at the end of 2015 for 30 years.

### Management team

GANIL has a Board of Directors (CODIR) composed of 10 members, nominated in equal numbers by the two funding institutions CEA/DRF and CNRS/IN2P3. This Board nominates the GANIL director, presently Mr Navin ALAHARI, and deputy-director, presently Ms Héloïse GOUTTE, for a period of 5 years. The present management team has been appointed in January 2017. They are supported by a secretary general Mr Bertrand FRANEL, and a deputy Ms Christine LAURENT. The Physics Group at GANIL is led by Mr Abdelouahad CHBIHI and his deputy is Mr Pierre DELAHAYE. Mr Florent STALEY and Mr Marek LEWITOWICH were the former director and deputy director respectively for the last 5 years.

### Scientific domains

GANIL is a large heavy-ion accelerator complex delivering stable beams and beams of short-lived “exotic” nuclei ranging from a few keV to 95 MeV per unit mass. A large variety of experimental equipment for addressing questions in nuclear physics but also for atomic and condensed-matter physics as well as radiobiology are available to exploit the large variety of beams. The availability of stable, reaccelerated short lived nuclei produced by the isotope separation on line (ISOL) technique and the in-flight separation technique allowing to investigate at GANIL the nucleus under a variety conditions in excitation energy, angular momentum and neutron-proton ratios. Such investigation allows to address key questions and open questions in the field related to structure and dynamics like *How do regular and simple patterns emerge in the structure of complex nuclei and what are the key variables governing the dynamics between colliding composite systems of nucleon*. The new SPIRAL2 facility will further open new opportunities in this endeavor.

The present evaluation concerns the physics group of GANIL, which pursues research predominately along four major research axes: Nuclear Structure and Fundamental interactions, Nuclear dynamics and Applications, Theoretical Nuclear Physics and Nuclear Astrophysics.

Unit workforce

Unit workforce	Number on 30/06/2016	Number on 01/01/2018
N1: Permanent professors and similar positions	1	
N2: Permanent researchers from Institutions and similar positions	28	
N3: Other permanent staff (technicians and administrative personnel)	8	
N4: Other researchers (Postdoctoral students, visitors, etc.)	11	
N5: Emeritus		
N6: Other contractual staff (technicians and administrative personnel)		
N7: PhD students	11	
<b>TOTAL N1 to N7</b>	<b>59</b>	
Qualified research supervisors (HDR) or similar positions	12	

Unit record	From 01/01/2011 to 30/06/2016
PhD theses defended	21
Postdoctoral scientists having spent at least 12 months in the unit	20
Number of Research Supervisor Qualifications (HDR) obtained during the period	5

## 2 • Assessment of the unit

### Global assessment of the unit

The scientific and technological research activity at GANIL is outstanding in the international context. The laboratory has produced excellent results as testified by the corresponding high quality publications (450 from 2011 to 2016) and by the large number of invitations to international conferences and schools. The GANIL laboratory has a state of the art scientific program which is based on cutting edge technologies. The research is carried out using SPIRAL1 and fragmentation radioactive beams, a large variety of stable ion beams, and in the next years using the powerful SPIRAL2 facility which will provide unique opportunities for the study on nuclei far from stability. SPIRAL2, the new large scale project of GANIL, is presently being built and its construction is planned to be realized in different phases spanning a time period going beyond 2022. The ongoing completion of SPIRAL2 Phase 1 that includes the LINAC accelerator and two new experimental halls composed of the Neutrons For Science (NFS) and the Super Separator Spectrometer (S3) will in the near future enlarge significantly the range of experimental possibilities. In addition, the DESIR hall, already funded, will be constructed in the next years and this will increase further the competitiveness of the scientific program of GANIL.

In France, GANIL with SPIRAL2 is part of the national roadmap from the Ministry for higher education and research. It is today the main accelerator facility for nuclear physics and the only large research infrastructure in this domain in France. Since the beginning, both funding agencies, CEA and CNRS, have strongly supported GANIL and its development. The SPIRAL2 facility of GANIL as a landmark in the ESFRI list of 2016.

GANIL is a host laboratory for a large community of users performing research in nuclear physics but also for atomic and condensed-matter physics as well as radiobiology. Around 700 scientists, 250 foreigners from EU, Russia, Japan, India, U.S., etc.; 500 of them are coming at least once a year, and about 250 from outside France. The permanent staff amounts to 238 persons at the end of 2016: 28 physicists, 150 engineers or administrative officers and 60 technicians.

### Strengths

GANIL has strong networks of national and international collaborations providing contributions to the scientific programmes and to new technical developments. These collaborations enhance the productivity of the laboratory and partly compensate for the limited human and financial resources available to GANIL.

The past investment in innovative apparatus still remains a very valuable resource of the laboratory because LISE, SPEG, VAMOS and EXOGAM (in their upgraded forms) remain state of the art.

The Physics group at GANIL has an outstanding and rather young permanent staff. It has been successful in attracting and training excellent postdocs and PhD students. The strong collaboration between the members of the theory and experiment teams represents a strength. It is very fruitful for the realization of existing scientific programmes and for the definition of future plans.

The upgrade of SPIRAL1 and of several instruments, recently performed or ongoing at GANIL, provides excellent additional research capabilities to the laboratory which will complement well those of SPIRAL2.

### Weakness

The major weaknesses are related to the funding and to the timeline for the construction of the different phases of SPIRAL2. Delay in funding the experimental equipment of phase 1 (comprising subphases 1+ and 1++) and the decision to put on hold the SPIRAL2 phase 2, which is the core of the entire project, could result in a loss of scientific opportunity and loss of motivation of the scientists. There is a need to start defining the funding plans after 2022.

Another weakness is connected to the operation and exploitation of SPIRAL2 which needs a sizable reinforcement of the scientific personnel. If the number of permanent and temporary personnel is not increased, the present personnel will have to sacrifice their own scientific programmes in order to provide user support to the increased number of activities at GANIL and SPIRAL2. This will surely weaken the impact of the laboratory and its attractiveness to students and postdocs of the universities around GANIL.

The age structure of experimental group is viable, but that of the theory group portends retirements and eventual reduction in staff. As the theory contributes significantly to scientific environment, leadership and visibility of GANIL, such a reduction would probably have a negative impact on the overall scientific output and stature of the laboratory. The shortage of GANIL physicists that are qualified to supervise PhD could become a significant problem.

## Recommendations

The expert committee is impressed both by the excellent science currently produced by the GANIL facility and its scientific staff and also by GANIL's excellent prospects for future scientific leadership in the near and longer term. To achieve the future goals, the GANIL laboratory will need to balance the running of GANIL accelerators, the development of the new beams of SPIRAL1 (both things being essential for maintaining the scientific community) and also the construction of SPIRAL2, which is key for the future of GANIL and indeed nuclear science internationally. This requires attention to both near term and longer term issues.

For the near term, it is essential to maintain the strength of GANIL. This requires:

- resources to be put in place and managed to achieve the completion of the LINAC and NFS and the construction of S3 and DESIR within an agreed timeframe. A consolidated plan be communicated to the GANIL staff as soon as it is ready, so as to engage them in the realization of this plan;
- resources to be guaranteed for preventive maintenance and sufficient running of the existing cyclotrons and instrumentations.

The long term success is based on the realization of SPIRAL2 phase 2 for which it important to revisit the science and possible applications in the context of the existing delays. The document GANIL2025, which was requested by the GANIL management and discusses these issues, could serve as a useful basis and should be discussed within the community.

There is a need for permanent positions to fulfil the commitments for the near and long term plans. The extreme demands on manpower require also innovative solutions. GANIL provides an excellent environment for postdoctoral researchers and would benefit from increasing the number of these excellent early-career researchers above the current level (i.e. 4). GANIL has come to rely on temporary technical staff. This and other issues with staffing require careful attention:

- for many technical and construction challenges, the best solution would be an increase in the permanent specialist manpower. Meanwhile, the current provision of short-term contracted personnel places a great burden on the GANIL budget. This burden may be better mitigated in some cases by the redeployment of specialised staff from other laboratories. In any case, we recommend that there should be an additional budget provided to GANIL to fund these temporary positions;
- an important component of GANIL's success is the strong theory group which focuses international theory interest on the science of GANIL and enhances the science of both permanent and visiting experimenters. In view of the age structure of this group, additional theory staff will be needed to maintain the permanent theory staff at the present level (a group of four or more theorists being optimal).