IPNO - Institut de physique nucléaire d'Orsay

Rapport Hcéres

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

Department for the evaluation of research units

AERES report on unit:

Orsay Institute of Nuclear Physics

IPNO

Under the supervision of the following institutions and research bodies:

Université Paris-Sud

Centre National de la Recherche Scientifique - CNRS

December 2013

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[1]*,*

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

On behalf of the expert committee,

- Mr. Muhsin N. HARAKEH, chair of the committee

[1] 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 assessment contained herein are the expression of independent and collegial deliberation of the committee.

Unit name:	Orsay Institute of Nuclear Physics
Unit acronym:	IPNO
Label requested:	IPNO
Present no.:	UMR 8608
Name of Director (2013-2014):	Mr Faiçal AZAIEZ
Name of Project Leader (2015-2019):	Mr Faiçal AZAIEZ

Expert committee members

Chair:	Mr Muhsin N. HARAKEH, KVI, The Netherlands
Experts:	Ms Corinne AUGIER, IPNL, France (CNU representative)
	Mr Gilles BAN, LPC Caen, France (CoNRS representative)
	Mr Bernard CARLUEC, AREVA NP, France
	Mr Giacomo DE ANGELIS, INFN Padova, Italy
	Mr Andreas HAUNGS, KIT, Karlsruhe Germany
	Mr Nasser KALANTAR-NAYESTANAKI, KVI, The Netherlands
	Mr Mats LINDROOS, ESS, Sweden
	Mr Ermanno VERCELLIN, University and INFN Torino, Italy
	Mr Jochen WAMBACH,Technische Universität Darmstadt, Germany

Scientific delegate representing the AERES:

Mr Cristinel DIACONU

Representative(s) of the unit's supervising institutions and bodies:

Mr Etienne AUGE, University Paris-Sud

Mr Jean-Jacques GUILLEMINOT, CNRS

Mr Jacques MARTINO, IN2P3/CNRS

Mr Eric SIMONI, University Paris-Sud

1 • Introduction

History and geographical location of the unit

Created in 1956 on the initiative of Irène and Frédéric JOLIOT-CURIE, the Orsay Institute of Nuclear Physics (IPNO) is a Joint Research Unit (UMR 8608) of the French National Centre for Scientific Research or CNRS, which is the mother organisation of the French National Institute of Nuclear Physics and Particle Physics (IN2P3), and Paris-Sud University (UPS) (F91406 Orsay). The institute is located on the Orsay Campus. Since its foundation, IPNO has been a pioneer in technological developments operating in the fields of nuclear physics, hadron physics and accelerator technology. The fundamental research activities were complemented by applied nuclear science research activities. Its first accelerator, a synchrocyclotron, around which the institute was founded was operated and exploited for nuclear physics research. It was renovated in the mid 70's by IPNO staff to deliver 201 MeV proton beams making it suitable for proton therapy. It formed the basis of the activities of the adjacent proton-therapy centre of the Curie Institute. The Accelerator and Technical divisions of IPNO have played major roles in the design and construction of the GANIL accelerator facilities and of the advanced superconducting cyclotron AGOR (Accélérateur Groningen-Orsay), and contributed strongly to the design, construction and operation of advanced equipment at major laboratories worldwide. Presently, of the old accelerators only the Tandem accelerator remains and is used innovatively in multidisciplinary research including applications in different fields. Slightly over a decade ago, a new novel project was started by combining an electron linear accelerator together with the existing tandem to a new facility called ALTO (Accélérateur Linéaire et Tandem à Orsay). High-energy photons produced by electron beams are used to induce fission in a uranium target. The fission fragments could then be separated using the ISOL technique (i.e. Isotope Separation On line), which would allow cutting-edge research with exotic nuclei. This speaks to a highly qualified scientific, accelerator and technical staff.

Management Team

Mr Faiçal AZAIEZ – director of IPNO

Ms Valérie CHAMBERT – director of the Instrumentation and Computing divison

Mr Said ESSABAA – director of the Accelerators division

Mr Fadi IBRAHIM – director of the research division

Ms Lucette PORCHERON – administrator and director of the DALI division

AERES nomenclature : ST2

Unit workforce

Unit workforce	Number on 30/06/2013	Number expected on 01/01/2015[2]
N1: Permanent professors and similar positions	17	15
N2: Permanent researchers from Institutions and similar positions	56	56
N3: Other permanent staff (without research duties)	196	189
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)		
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	21	12
N6: Other contractual staff (without research duties)	13	
TOTAL N1 to N6	**303**	**272**

Unit workforce	Number on 30/06/2013	Number expected on 01/01/2015
Doctoral students during the evaluation period	34	
Theses defended during the evaluation period	53	
Postdoctoral students having spent at least 12 months in the unit during the evaluation period	9	
Number of Research Supervisor Qualifications (HDR) taken during the evaluation period	5	
Qualified research supervisors (with an HDR) or similar positions	43	44

2 • Assessment of the unit

IPN-Orsay is the largest nuclear, hadron and accelerator physics laboratory of CNRS-IN2P3 and in fact, one of the largest in Europe. IPNO is very well known worldwide and is a major international player in its fields of research. Its nuclear, hadron and astroparticle physics staff are recognised partners at major facilities worldwide. These groups together with Radiochemistry and Theory groups are 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 to a high international standing. The research groups have been involved in designing, constructing and exploiting major state-of-the-art equipment at national and international facilities. The excellent Accelerator and Technical (Instrumentation and Informatics) divisions open the way for many collaboration agreements to help build novel accelerator components and various research instruments for important institutions in Europe. In many of these cases, the research staff of IPNO participates in the scientific exploitation of these novel

[2] This is the number expected taking retirements into account and assuming no new appointments are made.

devices. The IPNO Theory unit is a strong asset of the institute both because of its developments and utilisation of advanced theoretical concepts and techniques and because of its strong collaborations with experimentalists. The staff took part in the organisation of summer schools and conferences. The number of supervised PhDs and the number of French and European projects are high, also attesting to IPNO's excellence in research and training.

Strengths and opportunities related to the context

The scientific groups have outstanding staffs that are actively involved in cutting-edge research at the most important national and international research infrastructures. IPNO staffs are on the average very productive scientifically as can be deduced from the number of publications in refereed journals and proceedings as well as their quality (publications in high-impact journals). The combination of fundamental and applied nuclear physics and radiochemistry towards addressing important societal problems such as environment, health and energy is among IPNO strengths. IPNO has been active in many topics and is performing excellently averaged over all these fields. This has been one of IPNO strengths in the last two decades. It is, of course, true that some of these topics could be considered top worldwide but there are a few that are less visible.

The IPNO groups have strong networks and national and international collaborations. These collaborations are not only based on contributions to the scientific programmes but also to the technical developments increasing the possibilities for strong impact on these programmes. Indeed, the Accelerator and Instrumentation and Informatics Divisions are excellent and form a source of strength to IPNO. Another strength is the collaboration between the members of the theory and experiment groups leading to joint projects and publications.

IPNO has been successful in attracting excellent postdocs and PhD students. The scientific atmosphere within the groups is very stimulating and the PhD students and the postdocs are treated as full members of their respective research groups. The students get excellent supervision with invariably high accessibility of the supervisors, and the post-docs, to varying degrees, are given room to develop their own ideas and projects.

The ability to work together with other laboratories of IN2P3 in the Orsay valley, such as with the creation of IGLEX centre hosting two Equipex, Andromède of IPNO and ThomX of LAL, is a strong opportunity for IPNO and fortunately promoted by IPNO's management.

The involvement of the staff in projects at the major facilities worldwide and with SPIRAL2 will lead to new opportunities of technical developments for and performing research with these national and international facilities, e.g., ALTO, SPIRAL2, JLAB 12 GeV, ALICE, FAIR (NUSTAR & PANDA), ESS, Pierre Auger Observatory, etc.

The decision to delay the construction of SPIRAL2 Phase 2 to 2020 opens locally a window of opportunity for developing research programmes with the ALTO Facility, which has been completed. This will allow IPNO to perform cutting-edge fundamental and applied research with radioactive beams and put IPNO at the forefront of international research in this field.

The opportunities provided by the technical platforms of IPN facilities are excellent in that they allow participating in novel accelerator and equipment design and construction on a worldwide scale.

The evolution from Paris-Sud University to Paris-Saclay University opens new opportunities for IPNO and other laboratories in the Orsay valley that have to work proactively and closely together to ensure research and training competitiveness within the new framework of the Paris-Saclay University. The cooperation between these laboratories is already being translated into the 'P2IO Valley-Plateau' project, which will promote the synergies between these laboratories. IPNO has played a key role in the preparation for this project.

Weaknesses and threats related to the context

The fact that IPNO has been active in many topics is also a weakness, in particular since the financial and human resources are dwindling, and some topics of research become less visible. The committee notes that a major threat for a number of groups is their relatively small size.

The major threat for IPNO is the evolution of budget and manpower. The decreasing financial and human resources will put a number of excellent scientific programmes and technical projects in jeopardy. Consequences of this can already be felt in the pressure on some of the smaller groups that have larger scientific programmes than they can carry on. Also, the number of technical projects is already too large for the number of people who have to plan and execute them, although these projects could financially be covered.

Another weakness is the relatively small number of professors that can teach at the university. A sizeable representation of IPNO at the faculty level is important to stay in contact with young students and to be able to attract the brightest for training and research at IPNO.

Though the delay of SPIRAL2 presents an opportunity to exploit ALTO scientifically for the coming seven years, it may turn into a weakness and a threat if the needed equipment to enlarge the scientific programme is not funded.

For a number of groups, the difficulty to attract long-term visitors because of lack of financial budgets made available for this purpose forms a weakness.

The increase in paper and administrative work for IPNO staff in applying for projects and administering them when approved requires a significant amount of time thus jeopardising the core business of research.

Recommendations

Considering the dwindling human and financial resources the IPNO Directorate should consider the reallocation and redistribution of manpower between the different teams. It will be necessary to embed smaller groups in larger units where more effective research programmes could be pursued. The committee understands that the Directorate is already engaged in such steps for which it should be encouraged to continue.

The Directorate should ensure that some of the essential technical groups do not fall below a critical level because of their importance for the execution and running of many projects.

The IPNO Directorate is encouraged to impress upon the groups to give more responsibilities to Postdocs to run their own research projects and help them reach scientific maturity. It would also be helpful to provide more help to these postdocs, a large number of whom come from foreign countries, in administrative matters and housing. Furthermore, a reimbursement for travel and moving costs should be applied to all postdocs for their first trip to IPN Orsay to assume their positions. This would be in agreement with the applied rules in other similar European institutions.

The committee advises the Directorate to provide the PhD students and postdocs with a meeting room where they can exchange ideas and discuss issues of mutual interest.

IPNO should try to formulate together with the supervising organisations (IN2P3 and university) a more ambitious policy concerning patents, in particular, in regard to research of sections, e.g. radiochemistry, which provide results close to industrial applications. This could allow improving the reputation of IPNO.

The committee notes the decrease in funding and personnel and is worried that some of the important major activities of IPNO could be threatened. IPNO is one of the few subatomic physics labs in France and in Europe that has the required size to be able to impact major projects such as the contributions to the building of GANIL, LHC and more recently SPIRAL2. It is also a key institute of nuclear Physics in Europe both in proposing and conducting research programmes in the field. A continuous decrease of the human and capital resources of the institute below a critical mass in certain fields should be part of a global strategy and redefinition of mission that needs to be elaborated and explained. For the recruitment of talented students an increase in the number of professors is desirable. The efficient exploitation of the ALTO facility should be ensured.

3 • Detailed assessments

Assessment of scientific quality and outputs

IPNO is a very large institute in its field of research on a European scale and it is the largest combined nuclear, hadron, astroparticle and accelerator physics laboratory of CNRS-IN2P3 and of Paris-Sud University. It is a very well-known institute worldwide and its scientific staff participates in research at national and international facilities and the Hadron and Astroparticle Physics groups, in particular, are members of large international collaborations at major international facilities. The different groups have managed to set up vibrant research programmes, leading to excellent track records in scientific accomplishments. During the evaluation period, this is witnessed by the large number of publications (895) most of which appeared in high-impact journals, and also by the large number of invitations to international conferences and schools (371; furthermore, 343 contributions to conferences and 118 seminars), which speaks to a high international standing. The Accelerator and Instrumentation and Informatics divisions are outstanding and are often asked to participate in large-scale international projects where their contributions are of high impact. These divisions open the way for many collaboration agreements to help build novel accelerator components and various research instruments for important institutions in Europe. The research groups have been involved, together with staff from the Instrumentation and Informatics Division, in designing, constructing and exploiting major state-of-the-art equipment at national and international facilities. The IPNO Theory unit is a strong asset of the institute since it has outstanding members who have high international visibility. Another important aspect in this context is the strong collaboration between the members of the Theory and Experiment groups, which enhances the research output both in quality and in quantity.

The number of supervised PhDs (84 defended and still ongoing during the evaluation period) as well as the large number of French and European projects won are high, again attesting to IPNO's excellence in research and training.

The review committee observes that the different units pursue cutting-edge research addressing a lot of topics of much current interest. This has been a strong point of IPNO. However, in the light of dwindling human and financial resources, it may become a point of weakness and may require a re-organisation of the units to concentrate on less topics in which IPNO can excel.

Assessment of the unit's academic reputation and appeal

IPNO is very well known worldwide and is a major international player in its fields of research. Its nuclear, hadron and astroparticle physics staff have achieved very high academic reputation and are welcome partners at major facilities worldwide. They have been leading scientists in important research projects and scientific collaborations. The large number of invitations to international conferences and symposia, as mentioned above, also reflects the high academic reputation of IPNO's staff members. Because of this high academic reputation, IPNO has been very attractive to outstanding scientists. Some have taken permanent positions at IPNO and others come for short visits. Unfortunately, the financial support for longer-term visits of excellent scientists is not easily available anymore. In addition to senior researchers, IPNO has been very attractive to foreign young scientists, PhD students and postdocs.

IPNO staff members have been very successful in applying for competitive funding. They participate in 21 funded ANR projects, some of which have an IPNO project manager. They have raised EU funds via several instruments of the EU Framework Programmes. IPNO participates in 26 of such projects. Furthermore, IPNO has 6 regional and 7 other public contracts.

Scientists of IPNO take responsibilities at the various international collaborations far above the average of other member institutions. Staffs of IPNO serve on scientific councils of several international institutes, evaluation committees of funding agencies, steering committees of international projects and in NuPECC (Nuclear Physics European Collaboration Committee). Several staff members have received honours and awards: Crystal Medal of CNRS, French Physics Society Awards, two Flerov Prizes, Ordre National de la Légion d'Honneur (Chevalier), Institut Universitaire de France Award, American Physical Society Fellow, and Ordre National du Mérite (Chevalier).

IPNO's local research facility (ALTO) with its ancillary equipment has also been very attractive for external users (national and foreign researchers) as can be deduced from the proposals for research at the facility.

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

IPNO's Accelerator and Instrumention and Informatics divisions have very strong relations with industry. They collaborate with industries on projects in which technological transfers play an important role. They train staffs of industries in advanced technological processes. Some of the industries also profit from access to the ALTO facility.

IPNO's units contribute to solving society-related problems. In addition to fundamental physics programmes, there are applied research programmes addressing energy issues, environmental issues especially connected with radioactivity, and health-related problems.

The outreach activities are varied and successful. They have the aim to reach and enthuse the public about nuclear physics research and its applications. Also, fields of hadron and astroparticle physics can speak to the imagination of the public. At the local level, the outreach activities include multiple visits of the ALTO facility by schools, associations, and national, regional and local political figures. They also include different types of activities, ranging from teaching and dissemination (seminars and schools) programmes with regular seminars, to articles published in widely circulated newspapers and the preparation of multi-media material for high-school students. At the national level, IPNO staff members actively contribute to the annual "Fête de la sciences". It should be noted, however, that the outreach activities could be more effective when the individual contributions of the staff members are collectively organised by the Directorate, through appointing an outreach manager who could oversee the whole effort.

Assessment of the unit's organisation and life

The re-organisation of IPNO is still ongoing since the present director took office. This re-organisation is dictated by the decreasing financial and human resources and by the changing environment around IPNO. Whereas the Accelerator, Instrumentation and Informatics and Administration Divisions are well organised with definite substructures and clear lines of communication and command, the Research Division has been organised for the AERES evaluation as six research teams composed of five thematic research topics. In particular, the topic "Astrophysics" is present in 4 of the 6 research teams because at IPNO Astrophysics covers a wide range of activities, with non-overlapping scientific questions. Although for the present evaluation the matrix allows a clear identification of topics and groups, it is advisable to simplify the structure further in the future. A point to consider is to relocate the sub-critical groups in the NIM unit (E6) into teams where they share themes and tools.

IPNO has access to good advice regarding its facilities and scientific programmes through its Scientific and Technical Council composed of members drawn from the (inter-)national scientific communities. The Council meets on a regular basis to consider internal as well as external developments that may affect the scientific and technical activities of IPNO.

For the changing environment, and in particular, the forming of the Paris-Saclay University, the Committee applauds the steps taken by the Directorate, in co-operation with other IN2P3 laboratories in the valley, to coordinate efforts towards training and education. In concrete terms, the Committee appreciates the changes made and the "Valley" project, and gives strong support for the configuration envisaged.

As an (inter-)national user facility with its own research groups, IPNO has a transparent organisational and managerial structure for ALTO. It is geared towards a user community, which is large with a strong international component.

The committee was impressed by its meetings with the PhD students and non-permanent staff including post-docs. Both groups seem to be satisfied and happy with their training and supervisors' accessibility. Since many members are foreigners, they face problems with the French administration partly because of the French language. It is important to offer these PhD students and postdocs help with housing and other administrative issues upon arrival in Orsay. Furthermore, a reimbursement for travel and moving costs should be applied to all postdocs for their first trip to IPN Orsay to assume their positions. This would be in agreement with the applied rules in other similar European institutions.

It is recommended to provide the PhD students and postdocs with a meeting room where they can communicate regularly on social and scientific issues of mutual interest.

In times of change, there is usually a feeling of insecurity among the staff as many do not know or fear the implications for their positions. Although the changes happening at IPNO are dictated by outside factors and the Directorate has reacted to these very adequately, it is nevertheless necessary to spend more time on communicating these steps to the employees and their representatives in the Council. This will help to quiet down feelings of insecurity.

Last but not least, an English version of the IPNO website is highly recommended. This concerns both, the external as well as internal parts of the website due to the high number of foreign scientists at all levels (PhD, postdocs, staff).

Assessment of the unit's involvement in training through research

There is strong involvement in numerous master programmes (M1 and M2 levels), general physics teaching, dedicated teaching in nuclear structure, nuclear engineering, radiochemistry, both in Licence and Master levels, at Paris-Sud University and also at engineering schools (nuclear physics in CNAM and nuclear energy physics at Ecole Polytechnique) and didactic sciences.

IPNO supplies one member of the Governing Board of Paris-Sud University, the vice-dean of the faculty of science of this university for research, and two members of the Council of the Department of Physics. Also, in the context of the new Paris-Saclay University, two IPN researchers were elected to the academic senate of the Paris-Saclay Campus.

IPNO also supplies the co-directors of the two doctoral schools “Physique Noyaux, Cosmos” (PNC, ED517) and “Modélisation et Instrumentation en Physique, Energies Géosciences et Environnement” (MIPEGE, ED534), as well as the implementation and management of the future PHENIICS doctoral school for Paris-Saclay University. In the master level, many IPNO staff members have responsibility for various M1 (Physique et Environnement) and M2 (Accélérateur de particules et Interactions avec la Matière; Physique et Ingénierie de l’Energie; International master in Nuclear Energy; Noyaux, Particules, Astroparticules et Cosmologie; Cycle du combustible) master specialities.

Numerous internships at different levels and a lot of PhD students are educated and trained annually at IPNO. There is strong involvement of the IPNO Directorate to keep master 2 level teaching close to the laboratory in the Valley in the context of P2IO (Physique des 2 Infinis et des Origines) Labex.

In the last few years, there has been a decrease in the number of teaching personnel at IPNO. This may lead to a problem in attracting new young researchers through university teaching in the future. There is a lack of professor positions, not only to promote assistant professors but also to ensure their capability to play a stronger role in the future Paris-Saclay University in competition with other local players. There are presently no more regular replacements of retirement positions, but only calls for BQR (Bonus Qualité Recherche) positions with specific research projects. Also, the teachers’ way of life could become difficult due to new teaching location in the Plateau instead of the Valley in the context of the new Paris-Saclay University. Due to the sheer size of the research unit, more people should be involved in teaching, university interactions and internship supervisions. In this respect, it could be useful to involve PhD Students and postdocs in teaching, because of the positive effect on their careers.

Assessment of the strategy and the five-year plan

The full realisation of the SPIRAL2 Phase 2 project will provide exciting opportunities for a broad physics programme with radioactive beams. This will entail investigating nuclear structure of exotic nuclei, r and p processes in nuclear astrophysics, and the role of isospin in the dynamics of nuclear reactions. IPNO staffs have been preparing scientific programmes and experimental equipment for that purpose. However, the decision to delay SPIRAL2 Phase 2 till 2020 jeopardises these plans. On the other hand, this development opens the opportunity to exploit the ALTO facility for the coming seven years fully and effectively. For that, investment money will be needed to build new equipment and modernise old instrumentation.

The strategy and five-year plans for the other units of IPNO are quite well defined except for the group involved in HADES at GSI, which plans to participate in PANDA at FAIR at a later stage. This is due to a lack of decision regarding the French participation in PANDA. With respect to participation in the upgrade of ALICE, the plans can be completed within the ALICE collaboration in time for the LHC intensity upgrade. The participation in the JLAB 12 GeV upgraded facility is well underway with strong involvement in technical refurbishing of the JLAB detectors for the higher beam energy. Also in astrophysics, very detailed strategies exist in all subtopics on how to continue the research. Details will depend on the existing and available international infrastructures and facilities, but IPNO has the expertise and capabilities to continue research in astrophysics on a very high international level. The Accelerator and Instrumentation and Informatics Divisions have already become involved in more than they can possibly handle of high-profile projects for facilities and equipment. All the other units have reasonable plans for the coming five years. A question could be raised as to what the group involved in JLAB 12 GeV will do after 2020. Will they work towards realising an electron-hadron collider or would they be interested in PANDA physics, relating to the time-like aspects of structure functions? In a similar case, what will the group involved in HADES do if it is decided by IN2P3 not to participate in PANDA? These are questions that will need to be addressed in the coming years.

The development of the plans of the experimental groups will go hand in hand with theoretical developments to address the interesting palette of proposed experimental projects. The fixed-target project at LHC that has been proposed by IPNO theorists deserves special attention and encouragement. The committee is pleased with the challenging but very interesting broad scientific programme proposed and in particular with the close cooperation between Theory and Experiment Units.

4 • Theme-by-Theme analysis

Theme E1: Nuclear Structure & nuclear astrophysics (Nester)

Manager's name: Mr David VERNEY

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors	0.5	0.5
FTE for permanent EPST or EPIC researchers	11.2	12.2
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 during the evaluation period		
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students Gales (2013)	1	1
FTE for other contractual staff without research duties		
FTE for doctoral students during the evaluation period	4	
TOTAL	**16.7**	**13.7**

• Detailed assessments

Assessment of scientific quality and outputs

The research is at the forefront dealing with various aspects of low-energy nuclear physics including nuclear structure of exotic nuclei and nuclear astrophysics. A main theme in nuclear structure is the study of the properties of nuclei as function of N/Z ratio and in particular the shell evolution away from the valley of stability. In nuclear astrophysics the most important question that is being addressed is the origin of the elements and which nuclear processes are at the basis of the nucleosynthesis.

Research activities based on local infrastructures: The research presented is original and of high quality. The research unit has been one of the main actors in the development of the ALTO facility, the only worldwide working facility providing radioactive ion beams based on photofission. Based on ALTO experience several other laboratories are planning future facilities using photofission. Core activity is the exploitation of the discovery potential of the ALTO facility. The research unit is worldwide one of the leading groups in the field of nuclear structure and reactions and nuclear astrophysics.

Research activities using external infrastructures: The group is involved in several projects with experiments performed at the best radioactive ion-beam facilities of the world. It is an active part of large international collaborations. Examples are the contribution to AGATA in LNL, GSI and GANIL or to EURICA in RIKEN.

A good measure of the high standing of the members of the NESTER Group is the large number of publications in high-impact journals (more than 150) and invitations to give seminars and talks at international conferences and lectures at schools (around 100) during the evaluation period. An important aspect in this is the strong collaboration between the members of the theory and experiment groups, which enhances the research output both in quality and in quantity.

Assessment of the unit's academic reputation and appeal

The research unit has achieved a very high academic reputation. Members of the unit are or have been leading scientists in important research projects at different scales. They are in scientific councils (ORSAY, SPIRAL2, RCNP), evaluation committees (DOE, ESPRC, STFC, OTKA, NRF), members of the steering committees of international projects (AGATA, PARIS, GASPARD, DESIR), members of European Committees (NuPECC), etc.

Three important awards (two Flerov Prizes and an Ordre National de la Légion d'Honneur) have been assigned within the research unit in the last years.

The combination of a locally based research activity (ALTO) with experiments performed at the best radioactive ion-beam facilities worldwide (GANIL, RIKEN, etc.) and the strong motivation of the group members have made this research unit of high interest for foreign postdoctoral students and researchers. The ALTO facility with its ancillary equipment has been very attractive for national and foreign researchers as could be deduced from the proposals for research at the facility.

The transition period, in which a strong effort is made to produce radioactive ion beams of different elements/isotopes at ALTO, may lead to a slowdown in publications rate.

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

The research unit has a standing and profitable contact with industries for the development of new instruments (GASPARD) and radioactive ion-beam extraction methods (the resonant laser ionisation scheme is an example). The production of radioactive ion-beams using photofission has been pioneered by the laboratory.

The research unit has a consistent teaching and dissemination (seminars and schools) programme with regular seminars and outreach activities.

However, the limited human resources available may also be limiting the possible outreach initiatives because of the unbalanced workload due to the exploitation of the radioactive ion-beam facility.

Assessment of the unit's organisation and life

The research unit is composed of young, motivated and active members sharing a heavy work load. They try to push several ambitious initiatives in parallel. This is true for both subgroups: Nuclear Structure and Nuclear Astrophysics. Although the physics questions addressed by the two sub-groups are different, the underlying physics and the methodology used are very similar.

The research unit is missing, however, a fully coherent structure with clearly defined priorities. Due to the sensitive reduction in personnel (because of retirements and/or because of occupation of heavy administrative positions by some members) the unit could reach a critical situation in case of some of the initiatives (e.g., GASPARD). The development of a better focussed strategy compatible with the available resources is advisable.

An important weakness is related to the consistent decrease of the members of the unit in recent years. The effective FTE numbers had a 30% reduction from 2008 to 2013.

Assessment of the unit's involvement in training through research

Members of the research unit have organised conferences (4), schools (Ecole Doctorale, Joliot Curie, NPAC), and have had many (16) PHD students etc. The theme is very good for training young researchers and for forming leading personalities. Several of the staff members are involved in teaching at the Master (M2) level, and coordinate M2 courses. They have several internships (6-8 per year) at different levels (L3, M1, M2) and several PhD students and postdocs.

The fact that that a number of senior scientists of the unit have taken administrative positions in recent could lead to a lack of manpower to do teaching and training.

Assessment of the strategy and the five-year plan

The research unit has a well-defined strategy:

Exploitation of the local radioactive ion-beam facility ALTO (beta decay station, ORGAM + Miniball).

Preparation for the research activity at SPIRAL2 through experiments performed at the best radioactive ion-beam facilities worldwide (e.g. RIKEN, and the development of GASPARD).

The fact that SPIRAL2 Phase 2 will be delayed to 2020 will present opportunities to exploit ALTO fully, which the unit is well aware of.

Long unexpected delays in the realisation of SPIRAL2 Phase 2 beyond the already foreseen delay can nullify part of the preparation efforts. Therefore, reorientation of the long-term activities to SPIRAL1, SPIRAL2 Phase 1 and HIE-ISOLDE can be a possible alternative solution.

A weakness is related to the low profile the research unit has had due to the construction of the ALTO facility, in particular concerning instrumentation. Even if the facility is basically unique in the world, the low level of investments in modernising the infrastructure (e.g. automatisation of the UCx target handling) and the use of outdated instrumentation may become a limiting factor for the scientific programme.

Due to the large discovery potential of the ALTO-based research of this unit, larger investments for modernising the infrastructures together with the use of more modern instrumentation are strongly advisable.

The delay of the SPIRAL2 Phase 2 facility is the most serious risk for the future programmes of the group. Time gaps between the Phase 1 and 2 of SPIRAL2 could be overcome by an increased activity of this research unit at SPIRAL1, at CERN HIE-ISOLDE and through a stronger exploitation of the ALTO facility than had been foreseen earlier.

Conclusion

- **Overall opinion of the theme:**

The research unit is one of the world-leading groups in the subfields of nuclear structure, nuclear reactions and nuclear astrophysics. The research performed is of very high quality, impacting on the research field on a worldwide scale. It is exploiting the worldwide first radioactive ion-beam facility based on photofission providing basic experience for several other infrastructures going in the same direction. The national and international visibility is very high.

The unit is training young scientists but suffers from the strong reduction in personnel that happened in the recent years. The research programme is based on priorities put on a national and international scale foreseeing SPIRAL2 as the major activity. Postponing the full realisation of SPIRAL2 constitutes a serious risk for the unit, which could be overcome by the complementarity offered by SPIRAL1 and HIE-ISOLDE, which could be a way of bridging this gap. A longer and stronger exploitation of ALTO facility than earlier planned could also be an alternative.

- **Strengths and opportunities:**

The research unit has a leadership position on a worldwide level concerning nuclear structure and nuclear reaction research of and with exotic nuclei as well as nuclear astrophysics. The members have been the major driving force behind the realisation of the only existing radioactive ion-beam facility based on photofission (ALTO). The members of the unit have a very high scientific profile with strong international recognition.

- **Weaknesses and threats:**

The limited human resources, especially on the short time scale, are not in balance with the duties related to the running of the radioactive ion-beam facility, thus limiting the exploitation of the device. Considering the discovery potential of the infrastucture an effort in increasing the international involvement in the ALTO facility would be essential.

Not only is the number of projects too large relative to the number of people, but also the available technical support is limited.

- **Recommendations:**

- Sustain the skill in the exploitation of a radioactive ion-beam facility based on ISOL method and photofission.

- Increase the composition of the research unit at least proportionally to the increased activities at the local and international levels.

Theme E2: Hadronic Physics & astroparticles (Phen)

Manager's name: Ms Dominique MARCHAND

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors	1.5	1
FTE for permanent EPST or EPIC researchers	14.8	12.8
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 during the evaluation period	4	
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students	2	1
FTE for other contractual staff without research duties		
FTE for doctoral students during the evaluation period	13	
TOTAL	**35.3**	**14.8**

• Detailed assessments

Assessment of scientific quality and outputs

This research group is involved in different state-of-the-art experiments aimed at studying hadronic matter and hadrons by means of complementary probes, ranging from electrons to hadrons and heavy-ion beams available at top-level accelerator facilities, as well as in non-accelerator high-energy cosmic-ray experiments. Such a broad and strong implication of the group, which is of high profile at international level, results in a well-established and on-going production of high-level scientific results, leading to a remarkable publication record of about 290 papers in high-impact international journals. Among these, there are several highly-cited papers. The group participates in international collaborations and has a high visibility leading to collaborative papers of hundreds of authors with group members as corresponding authors.

Assessment of the unit's academic reputation and appeal

In the large international collaborations/experiments, in which the members of this group are involved, they have been (and are) playing a relevant role in terms of involvement and commitment, ranging from the design/construction phase of the experimental systems to their exploitation and to physics analyses. Thanks to their long-standing and well-established expertise in the different subfields, members of this institute have covered/are covering several positions of responsibility and coordination in their experiments and also in the European and international community. The high level of visibility of the group is also witnessed by the large number of invited talks at international conferences, by the active role in the organisation of several workshops, conferences or schools and

by the editorial activity (international journals and scientific publications). In the same context, it is also worth mentioning the capability of the group in attracting resources in the frame of initiatives funded by the European Community. The high reputation in all collaborations gives also a high attractiveness for foreign students and postdocs to perform a career step with the group. However, the too small budget for long-term visitors could lead to a loss of appeal.

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

A rather ample outreach activity for high schools and general public has been carried out by the group. This includes different types of actions, ranging from participation in specific “open-day” (or similar) initiatives, to articles published on widely circulated newspapers and to the preparation of multi-media material for high-school students.

The amount of work power dedicated to these activities depends on individual initiatives. A better coordination and work distribution within the group and/or the entire lab should be envisaged.

Assessment of the unit's organisation and life

The subgroups participating in the different experiments have an excellent and well consolidated internal organisation. In particular, the wide field of activities of the group in various large-scale experiments provides the opportunity to work on overlapping topics to gain special expertises unique at the level of individual collaborations.

However, due to the relatively recent re-organisation, the potential of a better overall coordination of the PHEN group appears to be only partially exploited so far and deserves some more work in the near future to be fully established.

Assessment of the unit's involvement in training through research

The involvement of the group in training is excellent from all points of view. Several PhD students (about 20) have prepared or are preparing their theses under the supervision of members of this group and there are examples of co-tutorships with non-French institutes. The theses are characterised by a high scientific level, resulting in the fact that several former students have got postdoctoral positions and in some cases permanent positions in research. Members of this research unit are involved at directorial level both in the organisation of the doctoral school MIPEGE ED534 and of the Master (M2) School in physics and engineering of energy. Members of the group are also involved in strategic positions for the new and more global teaching activities in the Orsay area.

The high teaching duties do, however, reduce the time left for high-quality scientific work within the experiments.

Assessment of the strategy and the five-year plan

In general, the medium-term plans of the group are well defined and of high profile, not only for the physics goals but also for the related technological contributions on detectors and electronics. These plans are characterised by appropriate elements of continuity with the current activities and are at the same time potentially well suited for consolidating and strengthening the role of IPNO in the field. More in detail, the plans foresee the participation in the forthcoming physics programmes based on the JLab energy upgrade (12 GeV) as well as on the upgrade of the ALICE experiment at CERN. The former include the realisation of a couple of new devices (neutron detector and electromagnetic calorimeter), while an upgrade of the muon tracking electronics is needed for the latter, in view of the high-luminosity operation of the LHC which is expected to start in 2018. The group, currently active at GSI, has plans for continuing the activity at this laboratory. These include the forthcoming programme of the HADES experiment with pion beams, as well as the participation in the PANDA experiment at FAIR. For the latter, the physics topics and the technological contributions of interest for the group have been clearly identified, coherently with the expertises of the members of the group, and a quite remarkable amount of work has already been carried out. The astroparticle physics group has dedicated plans for the future with a strong participation in and contribution to the foreseen upgrade of the Pierre Auger Observatory. The group fulfils a key position in this upgrade project, in particular as responsible for the electronics of the surface detectors. As a second pillar, the group is involved in a scientifically very interesting new project, LHAASO, led by China, where their expertise is highly welcome.

A reason for concern about a part of the above plans is represented by the fact that an official decision on French participation in PANDA is still pending. A delay would have an impact not only on the on-going activity of the group but, at some point, also on the future of the group itself (which, in addition, will have some retirements in the next years). Although alternative opportunities (e.g. BES III) are being considered by the group for the short term, the group might be faced, in case of a negative decision concerning participation in PANDA, with the need to redefine its strategy with the aim of investing in the best possible way the wealth of expertise (and academic reputation) built-up so far. The relatively small group in astroparticle physics will experience difficulties to keep their visibility when both projects (Auger upgrade, LHAASO installation) will be internationally funded at the same time.

Conclusion

- **Overall opinion of the theme:**

The PHEN group is of excellent level in the international context. Its scientific output is remarkable, both in quality and quantity, and spans over different and complementary sectors and approaches of investigations, thanks to the fact of being involved in some of the top-level experiments in the field. Such a broad and at the time high-level approach represents a remarkable wealth for the laboratory.

- **Strengths and opportunities:**

Thanks to their well-established expertise in the field, members of this research unit have covered and are covering positions of responsibility and coordination in the international collaborations and beyond as mentioned above. This fact, as well as the significant number of invited talks at international conferences and other aspects such as editorial activities and organisation of scientific events, shows that the group has reached a high level of visibility in the international community. These considerations, already relevant by themselves, acquire an added value if one considers that the age of a significant fraction of the members of this unit is relatively low, which sheds a positive light on the future perspectives of this group. The expertise and experience of the group give also unique opportunities for contributions to next-generation experimental activities, which are reflected in the well prepared proposals for future research topics. The scientific research is complemented by a very good training activity, which includes coordination roles played by members of the group in the frame of doctoral and master schools.

- **Weaknesses and threats:**

If the future plans of the research unit are in general well defined, the specific point concerning the participation in the PANDA experiment is conditional to the decision to be taken regarding the overall French involvement in this experiment. This makes the working conditions of the concerned subgroup far from ideal and opens questions about its future.

The group is, despite the high quality of the various subgroups, far away from a homogenous unity. The diversity of the activities is still an advantage in the global visibility, but considering the available human and financial resources and the challenges of high-energy experiments this might not be the case in the future.

- **Recommendations:**

- follow up the PANDA group activities in the short term, until an official decision is taken. Take appropriate actions to ensure that, whatever such a decision will be, the expertise, the competences and the scientific investments of this group will not be lost;

- improve and strengthen the present level of coordination among the different subgroups comprising this research unit. This includes also the search for overlapping science topics between the subgroups to make use of the very broad expertise of the group;

- keep and increase the level of responsibility and visibility in astroparticle physics by the valuable contribution to both experiments, Auger and LHAASO. The Committee supports explicitly the engagement in LHAASO as here the IPNO can be a forerunner for many groups in Europe considering a closer cooperation with China.

Theme E3: Theoretical Physics (PhT)

Manager's name: Ms Marcella GRASSO

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors	1.5	1
FTE for permanent EPST or EPIC researchers	9.9	10.9
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 during the evaluation period	2	
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students	2	2
FTE for other contractual staff without research duties		
FTE for doctoral students during the evaluation period	6	
TOTAL	**21.4**	**13.9**

• Detailed assessments

Assessment of scientific quality and outputs

The research group covers a broad spectrum of theoretical strong-interaction physics ranging from hadron physics to nuclear structure and nuclear astrophysics and also including the properties of ultracold atomic Fermi gases. The latter adds a strong interdisciplinary component to the area of quantum many-body physics. With the most recent additions to the group, the activities of the group have become very coherent and span a wide range of topics in nuclear and hadron structure. Without exception, the group members work on state-of-the-art theoretical topics in strong-interaction physics using the most advanced methods and tools. The group is among the strongest in the world and leading in France. With around 240 publications in high-impact journals and over 70 conference proceedings the publication record is excellent.

Assessment of the unit's academic reputation and appeal

The members of the group have very strong scientific reputation and high international visibility. In the evaluation period there have been 90 invitations to conferences and about 30 invited seminars. The group is involved in a sizeable number of national and international collaborations and lends theoretical guidance to several experimental programmes and initiatives such as a proposed fixed-target experiment (AFTER) at the LHC. Members with expertise in nuclear structure also give strong support to the local experiments at ALTO.

The members of the group are particularly well known for their work on the 3D structure of the nucleon, perturbative QCD, chiral effective field theory, few-body physics, nuclear mean-field theory and it extensions, the neutron-star equation of state, the structure of neutron star crusts, alpha clustering in light nuclei and the BEC-BCS transition in ultracold fermionic gases.

With the addition of two young eminent theorists, the theory group has strengthened its research profile and enhanced further its international visibility. New opportunities in Lattice QCD have arisen from the recent movement of an expert from LPSC, Grenoble to the IPNO group.

For their scientific achievements, two members have been awarded by the Institut Universitaire de France and the American Physical Society.

The expertise on neutrino physics has recently been lost due to the departure of a group member to another laboratory. Also, the nuclear astrophysics programme has suffered from the departure of a second group member, although continued collaboration is envisaged.

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

The group holds memberships in several national and international expert committees and scientific councils, is involved in editorial board activities, has organised international conferences, schools and workshops and scientifically coordinates the Franco-American exchange programme FUSTIPEN. Group members direct the Ecole Joliot-Curie, and co-direct the 'Laboratoire Européen Associé COLLIGA'. The group is in the PAC of ALTO, and has spokespersons of several international agreements.

Group members are involved in various outreach activities for high school students and the general public. However, the outreach is largely driven by individual initiatives. A more coordinated effort by the group would be desirable.

Assessment of the unit's organisation and life

The theory group presently consists of 13 senior researches and 3 emeriti. It currently employs 3 post-doctoral researchers. Half of the researchers (this includes the emeriti) works in the area of nuclear physics and astrophysics while the other half works in hadron physics.

During the evaluation period there have been 7 retirements, 2 departures to other labs and 7 new arrivals. Two new positions have been created in 2010 and 2011. In total 8 post-doctoral researchers have worked in the group during 2008-2013 and 3 Habilitations have been granted.

Funding comes primarily from IN2P3 but there is also external funding through various projects.

The group features a rich scientific life with a regular nuclear physics seminar (about 25 per year), a hadronic physics weekly seminar (co-organised with the Ecole Polytechnique) and between 1 and 2 journal club per month.

There have been a sizeable number of external visitors to strengthen the research programme and enhance national and international cooperation. A viable visitor programme is vital for a strong theory group as the one at IPNO. Currently, there are only a small number of long-term visitors, which is caused by a lack of funds. This constitutes a threat to the scientific health and international visibility. Although there are various connections to experimental groups, the involvement of the theory group in the experimental nuclear physics programmes of the Laboratory could be further strengthened.

Assessment of the unit's involvement in training through research

The group has trained a sizeable number of PhD students (14 in the evaluation period). At present four PhD students are supervised at IPNO and an additional five in other laboratories. To involve students at an early stage several internships have been offered. Members of the group have taken a leading role in the creation and organisation of the new Doctoral school PHENIICS for the Paris-Saclay initiative, have taught theoretical nuclear physics at the Master level (M2), coordinated the Master programme (M1) in fundamental physics for double diploma (Ecole Centrale, Ecole Normale Supérieure, …) and co-directed the Doctoral school PNC.

There are only a small number of teachers in the group, which hampers the visibility at the university and the attraction of bright young PhD students to theoretical nuclear physics.

Assessment of the strategy and the five-year plan

In its projection for the next five years, the group will continue to rely on synergies between the various subprojects. The link between hadron physics and nuclear physics through chiral effective field theory (EFT) is intended to be further strengthened, including the impact of EFT on the structure of few nucleon systems with large neutron access and on Density-Functional Theory (DFT) for heavy nuclei. These topics are at the forefront of modern nuclear structure theory, pursued worldwide. The interdisciplinary connections to condensed-matter and atomic physics through EFT and DFT will be continued. The study of ultracold atomic gases is most noteworthy in this context. The many-body synergies between fermionic gases and nuclei are at the focus of many initiatives all over the world. Theoretical nuclear astrophysics will remain a cornerstone of the theory group and lattice QCD opens new opportunities.

The theory group is severely underfunded concerning travel money and long-term visitor funds. This threatens the forefront research projects, the scientific exchange and the visibility.

Conclusion

- **Overall opinion of the theme:**

A strong theory group is vital for the scientific programme of a large laboratory such as IPNO. The group at Orsay conducts a broad and active programme of frontline research in strong-interaction physics covering essentially all experimental initiatives of IPNO in hadron physics, nuclear structure and nuclear astrophysics.

- **Strengths and opportunities:**

The theory group is very strong internationally and a leader in France. It has a broad theory portfolio of nuclear physics topics, which it pursues at the highest level. Several group members have high international visibility. The group is scientifically very productive and participates strongly in the training of young theoretical physicists in France. It offers many interdisciplinary connections in quantum-many body theory, thus establishing links to condensed-matter and atomic physics. The group attracts a sizeable number of collaborating scientists worldwide.

- **Weaknesses and threats:**

At present the theory group has only one professor at UPS. This very low number of professors at UPS is neither good for the visibility of the research topics at the university nor for the recruitment of excellent PhD students. The level of funding of the group is insufficient given its status within IPNO and its international reputation.

- **Recommendations:**

- increase the travel budget of the senior group members to ensure adequate representation of the group's achievements at the national and international level;

- provide sufficient funding to ensure a viable long-term visitors programme;

- the group should increase its involvement in outreach programmes in a coordinated fashion;

- the group should further pursue their activities in proposing and investigating the possible science for the fixed-target experiment AFTER.

Theme E4: Physics of Nuclear Energy (PACS)

Manager's name: Mr Charles-Olivier BACRI

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors	1	1
FTE for permanent EPST or EPIC researchers	7	7
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 during the evaluation period		
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students		
FTE for other contractual staff without research duties		
FTE for doctoral students during the evaluation period	4	
TOTAL	**12**	**8**

• Detailed assessments

Assessment of scientific quality and outputs

The group is involved in three main topics:

- CACAO: a new facility for radioactive target fabrication.

- Nuclear data: participation in experiments at international facilities (n-TOF, SOFIA…).

- System and scenario studies: the goal is to assess the consequences for the society of different scenarios for deployment of nuclear energy in France, in particular, in terms of waste management. Innovative nuclear fuel cycle (Thorium-Uranium cycle) is also investigated.

The last topic related to system and scenario studies is singular compared to the other activities of IPNO, which are more focused on fundamental research. It allows the elaboration of an academic view on the French policy on nuclear energy developed by CEA and the nuclear power industry.

CACAO is a unique facility worldwide for fabrication of radioactive thin targets. The facility is still in the licensing process by ASN. Nevertheless, several users of such targets have already required their fabrication. CACAO will allow fabrication and characterisation of the targets through determination of their chemical and isotopic content. CACAO presents an opportunity for IPNO to become a worldwide leader in fabrication of radioactive targets. Such recognition on European scale has been achieved through setting up a work package in the new European CHANDA project, which started in December 2013.

Concerning the nuclear-data group, the reputation is excellent as shown by the active participation in international experiments such as n-TOF and SOFIA, and the physicists involved have a high international visibility. The group has oriented its international collaboration towards obtaining data on isotopes relevant for advanced nuclear reactors and waste management.

The system and scenario activities can take advantage of the capabilities provided within CNRS to use high scientific skills in all technical and social domains involved in the frame of nuclear power.

The scientific productivity of the group is excellent as shown by the high number of publications (62 in refereed journals during the evaluation period).

Assessment of the unit's academic reputation and appeal

CACAO is starting operation soon. Nevertheless, the reputation of the group is already recognised at the European level (becoming a work-package leader in the CHANDA project). In the future, CACAO can indeed become a reference for the communities using radioactive targets. The physicists performing experiments at international facilities, such as n-TOF and SOFIA, are internationally highly recognised. System and scenario activity is limited to analysis of the French policy and the research of the group is dedicated to French issues and therefore is not deeply involved in any international activity.

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

For the same reasons as those given in the previous sections, there is not enough international involvement in all topics. However, on the national level the social and cultural impact of the group is excellent.

The system and scenario team is developing computing tools in collaboration with IRSN. It is well recognised that the group is capable of providing an independent view on nuclear energy policy. Therefore, it is natural that the group is accepted as the unique academic advisory body of French political institutions (CNE, OPECST) on nuclear power issues.

Assessment of the unit's organisation and life

Due to the limited number of persons involved in each topic, there is no organisational difficulty within the groups involved. The links between the nuclear-data team and the system and scenario team are also excellent; e.g., experiments are performed by nuclear-data group on isotopes relevant for system and scenario studies. From another viewpoint, the system and scenario studies drive the experiments to be performed in the frame of obtaining relevant nuclear data. These experiments are then integrated in more general programmes.

CACAO is a new activity which has the potential to become an international leader for radioactive target fabrication. This activity is significantly different from the other activities of PACS and therefore its integration in the group should be improved. It should be clearly tied to the group although it has very good connections with other IPNO groups.

Assessment of the unit's involvement in training through research

During the evaluation period, a significant part of the research of the group has been performed by PhD students (7) and Post-doc (2), which indicates strong involvement in training of young scientists. Members of the group are also involved in important training on nuclear reactor physics both at the Master level at the university as well as at engineering schools. They provide indeed one of the main French academic teaching platforms on nuclear reactor physics. However, they have no professor in the group.

Assessment of the strategy and the five-year plan

The main goal for CACAO group is to achieve the full operation of the facility and to develop its capability in particular with the European project CHANDA, in which the group participates. The exploitation of CACAO relies on one researcher from the radiochemistry group that recently has moved to the PACS group (this initiative has been strongly encouraged by the directorate) and one technical staff member from the target lab within the accelerator division. Authorisation by ASN is still necessary for CACAO operation. This authorisation is needed to prepare targets for external 'clients'. IPNO has good experience in dealing with nuclear regulation for facilities dealing with radioactive beams, targets, materials, etc. and it shall give valuable support for obtaining the license for the CACAO facility.

The LICORNE facility (neutron production in inverse kinematics allowing a good characterisation of the secondary neutron beam energy and its collimation) will offer new capabilities for obtaining nuclear data at definite neutron energies. LICORNE is an important opportunity for continuing to be a major international actor on nuclear-data topic. However, the constant decrease of technical support, in general, and for nuclear-data experiments, in particular, may jeopardise the exploitation of the LICORNE facility and hence of its attaining the goals.

The nuclear-data group has also well-developed plans to participate actively in international collaborations performing experiments at international facilities in the frame of nuclear data.

System and scenario studies will continue developing new innovative models for scenario studies and continue to play the important role as advisor to the French authorities on nuclear-power issues.

Conclusion

- **Overall opinion of the theme:**

This is an excellent group with a high potential of excellence in the future. It has a promising local facility, CACAO, for production of thin radioactive targets, operates with high visibility at an international level concerning nuclear data and has a prominent role as academic advisor to French authorities on nuclear systems and scenarios.

- **Strengths and opportunities:**

The members of the group are strongly motivated and avail of excellent expertise in nuclear data and model building for scenario studies. The new CACAO facility provides an opportunity to excel in radioactive target production.

- **Weaknesses and threats:**

Although CACAO provides a great opportunity for production of thin radioactive targets its efficient operation has yet to be proven.

The system and scenario group has a strong advisory role to French authorities and therefore is dedicated for studies of French nuclear-power issues.

Some key members of the group are getting positions that carry important national responsibility, and therefore, are time consuming. This could decrease the scientific leadership of the group.

- **Recommendations:**

- some attention should be given in the future for authorisation of CACAO from ASN to allow for production of thin radioactive targets for external clients (national and international);

- IPNO should strive to integrate a professor within the team;

- the nuclear-data group should put an effort for publication of the models and methods developed for the scenario studies;

- it is advisable to associate radiochemists to the scenario studies (fuel cycles, waste storage).

Theme E5: Radiochemistry (RC)

Manager's name: Ms Sylvie DELPECH

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors	2.5	2.5
FTE for permanent EPST or EPIC researchers	3.8	3.8
FTE of other permanent staff without research duties (IR, IE, PRAG, etc.)	2	2
FTE for other professors (PREM, ECC, etc.)		
FTE for postdoctoral students having spent at least 12 months in the unit during the evaluation period		
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students		
FTE for other contractual staff without research duties		
FTE for doctoral students during the evaluation period	3	
TOTAL	**11.3**	**8.3**

• Detailed assessments

Assessment of scientific quality and outputs

Radiochemistry has been developed mainly by the nuclear industry, which supports very important labs (CEA, ITU), by means of equipment and manpower. Compared to these labs, the IPNO radiochemistry group is limited in resources. Nevertheless, the group has developed an academic expertise and its activities are dedicated to topics sometimes neglected by the other organisations (e.g., molten-salt chemistry). The scientific excellence of the group is demonstrated by the number of publications (82 in refereed journals during the evaluation period) compared to the size of the team (between 10 and 15 persons during the evaluation period). The excellence is also proven by the number of collaborative partners, both from industry and R&D institutions.

The group has initiated research on new topics in the frame of the subfield aqueous chemistry, e.g., interaction of actinides and biological molecules, actinides behaviour in the environment, and sonochemistry. In non-aqueous chemistry, the group studies chemistry in molten salts, and chemistry in ionic liquids (lab applications). Furthermore, the group has developed activities in solid-phase chemistry such as the investigation of 14C in spent-fuel cladding, He diffusion in minerals, and metal behaviour in concrete.

There is strong competition in this field in Europe, but the group maintains a good national and European scientific level.

Assessment of the unit's academic reputation and appeal

Despite the unbalanced competition with the bigger labs, the reputation of the group is proven by the high number of collaborative partners in industry (AREVA, EDF, SOLVAY, COMURHEX). However, their research activity has impact not only on industrial level but also on academic level. Several members of the group have international visibility. One member is a co-editor of a scientific journal. The group has also been active in (co)organising several workshops relevant to their field of research.

The group has been successful in obtaining many grants leading to contracts with national and European institutions. It has been attractive to PhD students (in total 17 during the evaluation period) and postdocs. Also, many master students have been attracted to do their training with the radiochemistry group.

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

The radiochemistry group has strong collaborations with industry and therefore contributes to technology transfer which could have further economic implications. The group participates in outreach activities, in particular, in the annual “Fête de la sciences”.

Assessment of the unit's organisation and life

The radiochemistry group is consistent and has very good organisation. It organises regular seminars. It attracts external funding for PhDs from industrial and national institutions. One of the members of the group is professor and is the vice-dean for research of the faculty of science of Paris-Sud University. After a top in 2010, the staff number has decreased significantly.

Assessment of the unit's involvement in training through research

The radiochemistry group has performed excellently in training of PhD students and postdocs. During the evaluation period 17 PhD students did their thesis research within the group and 12 of these graduated. At present, the group is training 5 PhD students, only one of whom is funded by the Paris-Sud University, while the other four are funded by contracts with industry. One member of the group is professor at Paris-Sud University and is the vice-dean for research of the faculty of science. In his function, he is strongly involved in teaching and in setting up the research policy and programmes of the faculty of science. There are currently 3 HDR (habilitation à diriger des recherches) and there will be 4 HDR in the group in 2014. This will increase the capacity for training within the group.

Assessment of the strategy and the five-year plan

The radiochemical programmes pursued by the group constitute key activities on a national scale and aim at world-unique technology. The strategy is based on the continuation of the present programmes to address very important problems making use of excellent skills acquired in the last decade in e.g., analytical chemistry (aqueous and non-aqueous), electrochemistry/corrosion, analytical and spectroscopic techniques, solid chemistry, and molecular simulation. The mapped strategy is fully in line with the national strategy on research in radiochemistry and nuclear chemistry.

Conclusion

- **Overall opinion of the theme:**

This is a very active and excellent group who has very good contacts with industry enabling its members to have many collaborations with industrial partners. It has also an excellent academic record witnessed by the number of publications and illustrated by the number of PhD and Master students who joined the group for training. Its members have many excellent skills in radiochemistry and related subfields allowing them to set up a broad and solid programme of research.

- **Strengths and opportunities:**

The group has many opportunities to collaborate with industry and it is using this maximally to its benefit both scientifically and financially. It has a richness of synergetic skills which are used effectively to pursue the three main activities and to cross-link them together. Furthermore, it is a reasonably young group with an average age of 42 years.

- **Weaknesses and threats:**

After reaching a top in 2010 of 15 staff members, the group has been decreasing significantly with the total number of staff reaching 10. The vitality of the group will be affected if further decrease occurs and if some sectors (engineers) are not strengthened. The group lacks internal theory activity to support the ongoing experimental programmes.

- **Recommendations:**

- the radiochemistry group should strengthen its links with networks in CNRS; in particular, it should seek support in theory where activity within the group is limited;

- the radiochemistry group, which provides results close to industrial applications, should have a more ambitious policy concerning patents.

Theme E6: Nuclear Dynamics & physics with nanoparticles (NIM)

Manager's name: Mr Marin CHABOT

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors	1.5	1.5
FTE for permanent EPST or EPIC researcher	3	3
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 during the evaluation period	1	
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students	2	2
FTE for other contractual staff without research duties		
FTE for doctoral students during the evaluation period	2	
TOTAL	**9.5**	**6.5**

• Detailed assessments

Assessment of scientific quality and outputs

This is a relatively small group, which is pursuing four main lines of research that could be classified as nuclear dynamics and thermodynamics, superheavy nuclei, astrochemistry and ion-surface interactions. With about 30 articles in refereed journals, the publication record is good.

The group working on nuclear dynamics has achieved many successes in the past on topics of liquid-gas phase transition and isospin diffusion investigated through multifragmentation in heavy-ion collisions and also investigation of the alpha-condensate (Hoyle state) in 12C. At present they are involved with the successful state-of-the-art FAZIA project. Although, very interesting work has been done up to now, there is a considerable risk that the impact will become less prominent in the coming years because the senior members have retired and there are no new positions to pursue this research further.

The work on superheavy elements (SHEs) has been novel in its approach – using blocking technique to determine lifetimes and X-ray fluorescence to determine the atomic numbers of the formed SHEs – and has received high international attention. In astrochemistry the research aims at studying fragmentation of molecules of interest to astrophysics through electronic excitation in inverse-kinematics reactions of accelerated molecules. The work is of good quality, performed within international collaborations and published in high-quality journals.

The last leg of research, i.e., ion-surface interactions has been performed in excellent international settings where a new instrument PEGASE was developed and installed at Texas A&M Laboratory to study secondary ion mass spectrometry of solids. This excellent work paved the way for the approval of the EquipEx project ANDROMEDE which will be built from scratch and housed together with another EquipEx project, ThomX, of LAL in the LAL IGLOO building. This promises to be a very fruitful and successful collaboration.

Assessment of the unit's academic reputation and appeal

The researchers of this group produce very well, but the contributions are sometimes not clear or prominent. The reputation of members of the group, especially of those belonging to nuclear dynamics and ion-surface interactions, is very good. They are invited to give talks at international workshops and conferences, and are lecturers and organisers of schools for young researchers. The excellent academic reputation built on an excellent research track record led, of course, to awarding the EquipEx to the ion-surface interaction subgroup. This is quite attractive to young researchers and external collaborators.

The group as a whole is small and has suffered from attrition in the last few years. This may affect the reputation and appeal of the group in the not-so-far future.

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

The group has contacts with industry and have secured contracts with Hamamatsu and Orsay Physics to develop a novel system for charged particle detection and production of nanoparticle beams, respectively. They participate as well in some of IPNO's outreach activities.

The contacts with Hamamatsu are maintained by the retired members of the group and it is a question whether new such contacts could be initiated.

Assessment of the unit's organisation and life

The group has no clear organisation. It is more or less composed of four independent entities, although grouping within two entities could also be imagined. The organisation within the subgroups is also not obvious. The impression an outsider gets is that it is individualistic organisation. Clearly a reorganisation of the subgroups into the larger IPNO groups with thematic overlap should be considered in the future to increase the visibility and impact.

Assessment of the unit's involvement in training through research

At present, the group has only one assistant professor but with a very strong involvement in teaching at CNAM (Conservatoire National des Arts et Métiers). Despite the few scientists involved in this group, they supervised 3 PhD students during the evaluation period as well as co-supervised 1 PhD student in the Accelerator Division. One of the members has been involved in teaching at Joliot-Curie International school and at doctoral school SIMEN.

Due to the CNAM location far from the Orsay site it is difficult for the assistant professor to attract young researchers to the group, and to prepare a habilitation (HDR) thesis. Supervising PhD students may become a problem in the future. Therefore, the committee is concerned that due to different research and teaching locations the possibility exists that there will be no faculty member in the short term.

Assessment of the strategy and the five-year plan

There is no clear strategy of the group for the coming five years except for the ANDROMEDE project. This may have partly to do with the recent emeritus status of two members of the group, whereas the ANDROMEDE project has started recently with a very promising scientific programme and a blossoming collaboration between IPNO and LAL.

Conclusion

- **Overall opinion of the theme:**

The group, as individuals, has done very good work during the evaluation period, but its organisation is not so clear and it is seen by an outsider as separate entities that may have little to do with each other. The effectiveness and impact of the members of the group could be improved if embedded in different configurations within IPNO.

- **Strengths and opportunities:**

The different members of the group are experts in their own fields but their impact is less obvious and could be made stronger through reorganisation within IPNO. The ANDROMEDE project provides a very important opportunity for some members of the group. A very interesting and productive scientific programme could be developed around the new facility.

- **Weaknesses and threats:**

The clear weaknesses of the group are its incoherence and its diminishing staff. The visibility as a group is not strong although some members have strong visibility and impact. There is a substantial risk that this group will be marginalised in the near future if no steps are taken either to make the group more coherent or to reorganise it in such a way to seek embedding of different members in larger IPNO groups with thematic overlap.

- **Recommendations:**

- the group together with the IPNO Directorate should seriously reconsider the structure of the group, where the two entities nuclear dynamics and superheavy elements with strong affinity to low-energy nuclear physics, could think of joining forces with other nuclear physics groups for better visibility towards students and more effectiveness and impact at international level ;

- pursue with vigour the completion of the ANDROMEDE project and develop its scientific programme in a fruitful collaboration with LAL ThomX project.

Theme E7: Accelerator Physics and Technology

Manager's name: Mr Said ESSABAA

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors		
FTE for permanent EPST or EPIC researchers	2.2	2.2
FTE of other permanent staff without research duties (IR, IE, PRAG, etc.)	17.9	17.9
FTE for other professors (PREM, ECC, etc.)		
FTE for postdoctoral students having spent at least 12 months in the unit during the evaluation period	0.7	
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students		
FTE for other contractual staff without research duties	1	
FTE for doctoral students during the evaluation period	2	
TOTAL	**23.8**	**20.1**

• Detailed assessments

Assessment of scientific quality and outputs

The unit has clear leadership for the development and construction of integral low-beta superconducting accelerating structures. Integral here refers to all systems necessary to develop, test, build and operate complete cryomodules. The unit has potential also to offer development of RF systems, RF controls and beam instrumentation. Examples of unique development are the novel tuning system for quarterwave cavities, cold tuning system for spoke cavities, several generations of integral cryomodules for quarterwave and spoke cavities including prototypes and two different designs for elliptical cavity cryomodules. For the last example, it should be mentioned that one design is an R&D project with CERN for a completely novel concept for elliptical cavity support systems and the other a state-of the-art design suitable for serial production. The work on target and ion-source development from Uranium Carbide targets for radioactive ion beams (RIB) has with ALTO reached a very high level with a strong team with complementary skills. Access to, e.g., labs for radioactive material handling, advanced analyses equipment, off-line separator and the on-line facility is enabling this programme. The ALTO facility is the first ever radioactive ion beam facility for fission products based on photofission, a technology and principle for RIB production which has been pioneered by the laboratory. The resonant laser ion source at ALTO is a very important complement and has big potential. The CACAO facility is unique and, with the EU supported network for similar facilities elsewhere, a very important and strategic resource.

There is too little time spent on R&D for the core skills of the unit independent of the on-going project related development. Considering the close proximity to other complementary accelerator units, there is considerable potential for closer collaboration and coordination of research activities. Following the tradition of the research field, the unit has many contributions to conferences and workshops and relatively few publications in peer-reviewed journals (about 34). This could be improved, although the unit is evaluated mainly on its technical innovations and involvement in key projects of accelerator facilities worldwide.

Assessment of the unit's academic reputation and appeal

The unit is a very attractive partner for major national and international projects and it has a leading role in several of these projects; examples are WP leader in TIARA, WP leader for the ESS spoke SCRF WP, WP leader in EURISOL and leading role in ENSAR/ACTILAB. The unit avails of excellent potential and facilities for both SCRF R&D and target R&D; examples are the SUPRATECH platform, the target laboratories and the off-line and on-line separators. The laboratory has sufficient weight to be a candidate for leading future EU supported projects, e.g., EUCARD-3.

There are only limited resources available for R&D and no clear funding is available for new researchers joining the facility. Also, the lack of formal links to regional accelerator activities can give the impression that the unit is isolated.

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

Unit members participate in national and international schools for accelerator science such as JUAS. The unit has strong links to national and international accelerator industry with most manufacturing of systems done in industry; examples are the manufacturing and industrialisation of super-conducting (SC) cavities with all major SC-cavity manufacturers and of couplers. The unit provides continuous training of industry for manufacturing of components.

There is not enough involvement with undergraduate and graduate students considering the potential of the unit. There is little return on techno transfer to industry and the unit often suffers from congestion due to strong competition for accelerator manufacturing resources.

Assessment of the unit's organisation and life

The unit has a logical and well-working organisation for all on-going activities and projects.

Unfortunately, there seems to be lack of structure for project-independent research, which also can serve as an embryo for future project activities.

Assessment of the unit's involvement in training through research

There is strong involvement in national and international specialised schools such as JUAS, IN2P3/CNRS accelerator school, and in both MIPEGE and PNC M2 doctoral schools. Members of the unit give specialised courses at the university such as cryogenics courses for IUT students. There are two CRs in the group.

There is too little training of graduate, undergraduate and young researchers considering the reputation and potential of the unit. There are a few internships per year and a few PhD theses were supervised (as at most similar units worldwide) considering the potential. There is no HDR in the Division who can act as qualified research supervisor.

Assessment of the strategy and the five-year plan

Clear priorities have been set by on-going projects but still with involvement in other possible future projects. The unit is now completing the assembly and testing of SPIRAL2 quarterwave cryomodules and is prototyping the ESS spoke cavity cryomodule. Developments are being done for future projects such as MYRRHA and EURISOL. The operation of ALTO has started and the target and ion source R&D is guided by the needs of the facility. This will consume a lot of effort especially in case a decision is taken to exploit ALTO fully scientifically in the coming 7 years, now that SPIRAL2 Phase 2 has been delayed.

Because of lack of manpower, there is unfortunately little project independent research and little time to follow developments such as beam-driven and laser-driven wake-field acceleration. There is urgent need of new posts to secure long-term future, replacement of retirees and for project-independent R&D.

Conclusion

- **Overall opinion of the theme:**

The IPNO accelerator division is world leading in many fields and is together with other accelerator activities in the region of Orsay and Saclay very competitive in most areas of accelerator science. It is very rare to find a regional strength in a multidisiplinary subject such as accelerator science and engineering outside major national and international accelerator laboratories. The division is involved in several international projects and also receives important external funding through these projects. The unit trains young scientist and engineers but suffers from limited time available for training activities. The R&D programme is mainly set by the priorities of the projects the unit is involved in and only small resources are available for independent strategic R&D activities. The target development programme for, in particular, radoactive ion beams is of impressive quality and remains very important as gains in overall efficiency for the target and ion-source systems are the most efficient way to assure high-intensity radioactive beams. The laboratory has pioneered the photofission principle and technology for radioactive beam production. The ALTO facility doesn't only offer good physics opportunities but as the operation of a university-based accelerator facility is becoming rather rare it also offers a great opportunity to involve students in R&D for the facility, operation and experiments. The unit has strong links to industry, trains industry for manufactuirng and has a continuous techno transfer to industry.

- **Strengths and opportunities:**

The unit has clear leadership for the development and construction of integral low-beta superconducting accelerating structures. Integral here refers to the multiple systems necessary to develop, test and build complete cryomodules potentially also for RF sources and controls, which can be developed and provided. The work on target and ion-source development from UC targets to radioactive beams has with ALTO reached a very high level, pursued by a strong team with complementary skills. Access to, e.g., labs for radioactive material handling, advanced analyses equipment, off-line separator and the on-line facility is enabling this programme. The continued development and operation of a university-based accelerator facility has high potential for close links to students. Close links to industry for on-going projects enable training and techno transfer.

- **Weaknesses and threats:**

Recruitment of qualified personnel is difficult due to lack of sufficient base funding for R&D activities and due to high living costs in the region. Considering the potential, there is only limited training in the related activities at Paris-Sud University. In this context specialised teaching activities must be preferred to general physics lectures at other universities. The funding for the many projects the unit is involved in becomes complex as most projects have independent funding or even multiple funding streams. Retirements are often not replaced and there is not enough time for R&D. Lack of formal recognition for extensive involvement with accelerator industry in which the unit provides both training and techno transfer.

- **Recommendations:**

- create a well-defined structure for the R&D and teaching activities. Look at all possible sources of funding for this;

- strengthen links to university to exploit the unique opportunity of a university-based accelerator facility and assure training and recruitment of the next generation accelerator scientists;

- create a loose but formal structure for accelerator science with neighbouring units and facilities to assure world leadership in many areas of accelerator science; e.g., create a regular Scientific and Technical Advisory board for University Paris-Saclay where the laboratories remain independent but strongly coordinated and visibly linked. This could include the creation and use of a common label for this regional accelerator centre to enhance the visibility and demonstrate the width of the programme and leadership in the field. Starting in a smaller informal cluster with LAL to work towards this is advisable;

- assure better return of training and techno transfer to industry; e.g., exploit open innovation approach to avoid patent costs but still secure that IPNO is recognised as the originator of many developments;

- appoint a person responsible for publications with the task to assure that as much as possible is published in peer-reviewed journals and consider to link promotions to publication rate.

Theme E8: R&D Instrumention and data acquisition

Manager's name: Ms Valérie CHAMBERT

Workforce

Theme workforce in Full Time Equivalents	Number on 30/06/2013	Number expected on 01/01/2015
FTE for permanent professors		
FTE for permanent EPST or EPIC researchers		
FTE of other permanent staff without research duties (IR, IE, PRAG, etc.)	11.8	11.5
FTE for other professors (PREM, ECC, etc.)		
FTE for postdoctoral students having spent at least 12 months in the unit during the evaluation period	1	
FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students		
FTE for other contractual staff without research duties		
FTE for doctoral students during the evaluation period		
TOTAL	**12.8**	**11.5**

• Detailed assessments

Assessment of scientific quality and outputs

The team is large enough and has had a wide range of expertise to select and perform projects in a coherent manner from the physics design specification to the installation of the experimental equipment. The main strength of the division is that it can carry out the complete development (from simulation of the setup to producing it) of a complete detection system with its data acquisition (DAQ). They also have capabilities in mechanical design and machining as well as thermal calculations. This can be seen by the installation and commissioning of the di-muon arm spectrometer of the ALICE experiment in 2008, design and construction of the prototype part of EMC made for the PANDA experiment, design of the FAZIA electronics and the involvement in the DAQ of AGATA. For the size of the group, the number of publications is reasonable.

Assessment of the unit's academic reputation and appeal

The Orsay group for the development of experimental equipment enjoys a high international reputation. The group has been involved in large and medium-size collaborations making an impact in the part of the project that they get involved in. These range from electronics development for detectors, to data-acquisition frameworks and detector integration. Within the international community, there are a large number of projects in which the IPN Orsay group can be involved with a large impact. The group is also active in memberships of international activities such as GEANT collaboration. The co-editor of the PANDA electromagnetic calorimeter TDR is from IPNO. They are also member of the PANDA technical board and are in charge of the mechanical integration of the calorimeter. In addition, they are member of ALICE computing board. The division was also part of three ANR grants and a NuPNET Grant.

The group has too many projects for the present size of the group. This will go at the cost of effectiveness and impact at some point in time.

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

The group has extensive contacts with industry for subcontracting (200 k€/year) but also for initiating and conducting common projects with industry (ANR PMM2 with Photonis). They are also involved in the open days of the laboratory for public where they present their work. In addition, they provided lectures, for instance at the school of engineers (CNAM). The group is primarily involved in technical developments and is not expected to be very effective in outreach activities. However, the division actively contributes to “Fête de la sciences”.

Assessment of the unit's organisation and life

The Divison has the proper internal structure, with three departments that complement each other very well, to pick up new projects and guide them through various stages of realisation. The integration of various departments in the past reorganisation has had a positive result despite the decrease in manpower.

The division head is aware of the fact that there is an imbalance between manpower versus the number of projects and that, therefore, choices have to be made in the near future. The choices will be driven by how the projects fit within the division, their funding and how they are organised.

The number of staff in the group has been continuously decreasing over the years. We can mention here technicians for the machineshop and electronics workshop and engineers for the computing department. This is starting to make the size of subunits (in particular machineshop and the electronics workshop) sub-critical for large projects which should fit into the mission of the laboratory.

Assessment of the unit's involvement in training through research

Unit members organise schools for data acquisition and help in the teaching and training activities.

Over the period of evaluation, the division hosted several apprentices; M1 and M2 interns and a current PhD is working on the electronics for LHAASO.

Due to the shortage of manpower, involvement in these training activities has a lower priority in this department.

Assessment of the strategy and the five-year plan

Due to a large number of emerging large-scale projects worldwide, the group should have no problems in getting involved in challenging projects and have a significant impact in every project they get involved in.

The division has a clear development plan and it will also respond to the demands of the laboratory. R&D includes fast scintillators, ASIC for nuclear physics, Narval, and parallel computing.

The shortage of manpower will limit the number of projects and thereby the impact of IPNO in the international projects. In particular, the mechanical and electronics workshops will have serious problems in the coming years.

Conclusion

- **Overall opinion of the theme:**

Instrumentation is one of the main basic ingredients of any large-scale laboratory. At IPNO, this topic and the group which deals with it have always been central making the laboratory's position very strong in a large number of international projects with a very high impact.

- **Strengths and opportunities:**

The inputs of the group into the ongoing discussions on IPNO's involvement in the international projects as well as its output have been highly valued by collaborators. The knowledge is up-to-date and the group is continuously upgrading its abilities on all fronts. The organisation of the group, namely placing all the technical departments under the same umbrella of "technology", has helped the group's visibility and impact. The division head is aware that with the manpower shrinking, the division will have to be very selective in various projects.

- **Weaknesses and threats:**

The decreasing number of staff members, especially technicians, is seriously alarming. The size of this group should be a reflection of the mission of the laboratory and its ambition in undertaking large projects on the international scene. The machinery in the mechanical workshop is rather old and some investment should be made to rejuvenate this facility and prepare it for the future activities.

- **Recommendations:**

- there is a need to invest in the infrastructure, in particular, in the mechanical department;

- the number of staff should not be reduced any further. In fact, a slight increase, in particular, in the mechanical and electronics workshops is desired;

- the IPNO management needs to define its strategy on how to stabilise the outflow of manpower and keep the attractiveness of the group;

- the merging of the machineshops of the local laboratories of IN2P3 could be a short-term solution;

- collaboration with industry should be pursued and where the developments benefit the industry, the company should be willing to compensate the manpower;

- the group should be more proactive in presenting their work at international conferences which should be possible given the present output of the group.

5 • Conduct of the visit

Visit dates:

Start: 16th of December 2013, at 12:30 pm

End: 19th of December 2013, at 12:30 pm

Visit site : IPNO – Paris-Sud University Campus

Specific premises visited: The commyitee visited the local facilities SUPRATECH, ALTO, CACAO.

Conduct or programme of visit:

2013, December, 16th

12:30 -2:00 pm	Closed session and Lunch - Salle des conseils + A015
	Open session – Auditorium Joliot-Curie
2:00 -3:30 pm	Results & Projects of IPNO - IPN Director
3:30 pm	Highlights & projects from topics & facilities
3:30 – 3:54 pm	Physics and Radiochemistry of Nuclear Energy
3:54 – 4:11 pm	The ALTO facility
4:11 – 4:28 pm	The ANDROMEDE project
4:28 – 4:45 pm	Astrophysics
4:45 -5:00 pm	Coffee break
5:00 – 5:17 pm	High power superconducting Linacs
5:17 – 5:34 pm	R&D related to the Accelerator technology
5:34 – 5:51 pm	R&D Instrumentation and Data acquisition
5:51 – 6:16 pm	Hadrons and Hadronic Matter
6:16 – 6:33 pm	Nuclear Structure and Dynamics
6:33 – 6:50 pm	Theory
6:50 - 7:20 pm	P2IO project
7:20 pm	Closed session - Salle des Conseils

2013, December, 17th

8:30 - 10:00 am	Theory
10:00 - 10:15 am	Coffee break - Salle des Conseils
10:15 - 1:15 pm	Accelerator Division (DA)
1:15 - 2:15 pm	Lunch
2:15 - 3:45 pm	NESTER group
3:45 - 5:45 pm	PHEN group
5:45 - 6:00 pm	Coffee break - Salle des Conseils
6:00 - 7:00 pm	NIM group
7:00	Closed session - Salle des Conseils

2013, December, 18th

8:30 - 10:00	Instrumentation and Computing Division (D2I)
10:00 - 11:30	PACS group
11:30 - 11:45	Coffee break - Salle des Conseils
11:45 - 1:15 pm	Radiochemistry group
1:15 - 2:15 pm	Lunch
2:15 - 3:00 pm	Meeting with DALI and Dosimetry, Radioprotection and Communication teams
3:00 - 3:30 pm	Meeting with university members and faculty researchers
3:30 - 4:00 pm	Meeting with Ph.D. students
4:00 - 4:30 pm	Meeting with temporary employees (Post-docs…)
4:30 - 4:45 pm	Coffee break - Salle des Conseils
4:45 - 5:15 pm	Meeting with the laboratory's council
5:15 - 6:00 pm	Meeting with IN2P3 (CNRS) and the University of Paris-Sud representatives
6:00 - 7:15 pm	Meeting with IPN Orsay directorate
7:15 pm	Closed session

2013, December, 19th

8:30 - 12:30 am	Closed session - Salle des Conseils

6 • Supervising bodies' general comments

UNIVERSITÉ PARIS SUD

Comprendre le monde, construire l'avenir®

Le Président de l'Université Paris-Sud

à

Monsieur Pierre GLAUDES
Directeur de la section des unités de recherche
AERES
20, rue Vivienne
75002 Paris

Orsay, le 2 mai 2014

N/Réf. : 122/14/JB/LM/AL

Objet : Rapport d'évaluation d'unité de recherche
N° S2PUR150007943

Monsieur le Directeur,

Vous m'avez transmis le 9 avril dernier, le rapport d'évaluation de l'unité de recherche « INSTITUT DE PHYSIQUE NUCLEAIRE d'ORSAY» - IPNO – N° S2PUR150007943, et je vous en remercie.

L'université se réjouit de l'appréciation portée par le Comité sur cette unité et prend bonne note de ses suggestions.

Monsieur Faiçal AZAIEZ, Directeur de l'unité de recherche, n'a pas souhaité apporté de commentaires.

Je vous prie d'agréer, Monsieur le Directeur, l'expression de ma sincère considération.

UNIVERSITÉ PARIS SUD
PRÉSIDENCE
Bâtiment 300
91405 ORSAY cedex

Jacques BITTOUN
Président

Siège :
Université Paris-Sud
15 rue Georges Clemenceau
91405 Orsay cedex
www.u-psud.fr

Tél : 01 69 15 74 06 – Fax : 01 69 15 61 03 - e-mail : president@u-psud.fr