LAL - Laboratoire de l'accélérateur Linéaire

Rapport Hcéres

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

Department for the evaluation of research units

AERES report on unit:

Linear Accelerator Laboratory

LAL

Under the supervision of the following institutions and research bodies:

Centre National de la Recherche Scientifique - CNRS

Université Paris-Sud

November 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. Tatsuya NAKADA, 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:	Linear Accelerator Laboratory
Unit acronym:	LAL
Label requested:	UMR
Present no.:	8607
Name of Director (2013-2014):	Mr Achille STOCCHI
Name of Project Leader (2015-2019):	Mr Achille STOCCHI

Expert committee members

Chair:	Mr Tatsuya NAKADA, EPFL Switzerland
Experts:	Mr Alain BLACHARD, MIP, Toulouse
	Mr Augusto CECCUCI, CERN, Geneva, Switzerland
	Mr Philippe CHARPENTIER, CERN, Geneva, Switzerland
	Mr Jean-Pierre DELAHAYE, SLAC, Stanford, United States
	Mr Bernard ILLE, IPNL Lyon (representative of the CNU)
	Mr Imad LAKTINEH, IPNL Lyon (representative of the CoNRS)
	Mr Christian MOREL, CPPM Marseille
	Mr Luigi PALUMBO, Rome University La Sapienza, Italy
	Mr Piergiorgio PICOZZA, Rome University Tor Vergata, Italy
	Mr Patrick SUTTON, Cardiff, United Kingdom

Scientific delegate representing the AERES:

Mr Cristinel DIACONU

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

Mr Jean-Jacques GIRERD, Université Paris 11

Mr Jacques MARTINO, IN2P3

1 • Introduction

History and geographical location of the unit

The Laboratory of the Linear Accelerator (LAL) is a fundamental research laboratory focused on « the two infinites » physics, that is in physics of the infinitely small to the infinitely large. The laboratory is fully involved in the major challenges of our times: new physics beyond the Standard Model, understanding of the laws governing the universe and study of its characteristics, societal applications derived from fundamental research, etc. We thus face a promising future, full of discoveries and scientific progress, either fundamental or applied. As its name suggests, since its creation in 1956, LAL has been closely linked to particle accelerators, both at the physics research and the associated technological developments levels.

LAL is a joint research unit of the Institut National de Physique Nucléaire et de Physique des Particules (IN2P3) of the Centre National de la Recherche Scientifique (CNRS) and of the Paris-Sud University and is located in Orsay Campus. The laboratory physicists are thus either CNRS researchers, or teaching researchers. Generally speaking, LAL is involved in teaching activities at all levels – Bachelor's degrees, masters, engineering schools – and a dozen of students start a thesis each year.

Management team

Mr Achille STOCCHI, Director

Mr Fabien CAVALIER, Deputy Director

Mrs Brigitte RENARD, Administrator

Mr Bruno MANSOUX, Technical Director

AERES nomenclature

ST2 Physique

Unit workforce

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	11	14
N2: Permanent researchers from Institutions and similar positions	48	48
N3: Other permanent staff (without research duties)	171	167
N4: Other professors (Emeritus Professor, on-contract Professor, etc.)	4	4
N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.)	25	25
N6: Other contractual staff (without research duties)	17	20
TOTAL N1 to N6	276	278

Unit workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	33	
Theses defended	50	
Postdoctoral students having spent at least 12 months in the unit	49	
Number of Research Supervisor Qualifications (HDR) taken	10	
Qualified research supervisors (with an HDR) or similar positions	49	

2 • Assessment of the unit

LAL is a world-class laboratory participating in various top class international projects investigating the properties of the most elementary constituents of the universe and interactions among them. The programme covers all the most important aspects of the field: laboratory physics at the highest energy, precision measurements and at search for rare phenomena, and studies of gravitation and particles from the universe. In all the projects, LAL groups are playing leading roles. One of the most recent examples is the unprecedented discovery of the Higgs boson by the ATLAS experiment at CERN where the LAL group contribution to the electromagnetic calorimeter and analysis effort was crucial for the discovery. Many LAL physicists are well known internationally and playing leading roles in their corresponding fields. They are regularly giving invited talks and serving in the organising committees for prestigious international conferences. LAL provides excellent technical support in mechanics, electronics and computing with well-qualified staffs and good infrastructure. While giving excellent services to the physics projects, the LAL service units in electronics and computing are also making some research activities. They are also active and successful in knowledge transfer to the industry. Accelerator science activities at LAL are very precious: Construction of a small but unique in-house facility and contribution to large European projects, in addition to various accelerator R&D works. Recently, LAL is working with the nearby CNRS institutes and university to form a coherent unit and share competences and resources (known as P2IO and University Paris-Saclay).

Strengths and opportunities related to the context

Participating in top class international projects covering all the important issues in particle physics. On the other hand, a sensible choice was made such that most of the LAL groups are beyond the critical mass and playing essential roles in those projects, contributing to many high quality publications as principal authors. Many LAL members are known as world experts in different fields, not only in particle physics but also those area necessary for building up particle physics experiments: e.g. detector R&D and construction, phenomenology for physics analysis, statistical treatment of data, advanced computing method, high power laser physics, low temperature material science, and others. As a result, they have been serving in many advisory committees of other institutes including CERN, and organisation and advisory committees of numerous international conference and workshops. As indicated in the European Strategy for Particle Physics adopted by the CERN Council where France is a member, awareness on the social relevance is becoming mandatory to the researchers, and Communication, Outreach and Technology Transfer are the key ingredients to exercise. LAL has been very active in continuously stimulating the public interest by hosting many events and providing educational programmes to young pupils and students. They explain not only the fundamental value of basic science as a foundation of civilisation, but also demonstrate more direct usefulness by producing devices which were originally developed for the particle physics experiments but became extremely beneficial to the society and industries. LAL members, including the PhD students, are expressing general satisfaction in their working environment at the all level. Staffs are given enough opportunity to improve and benefit from their skill. Interaction between the staffs and the management on the scientific and personnel issues are well organised and understood. A large fraction of the LAL scientific staffs are actively involved in the university education at the all level, even those who are employed by the CNRS and have no teaching duty. At the master level, they are also

participating in the discussion of curriculum and organising new courses to improve the education and to attract more students. Judging from the numbers of Master thesis and students who wish to make PhD thesis at LAL, their work has been very effective. The future scientific programme of LAL is a right combination of harvesting physics results from the projects that will produce data abundantly, exploring very difficult but highly rewarding efforts, and R&D for the long term future. A unique advantage of LAL is that it can pursue both particle physics and accelerator activities, which is extremely valuable. The project P2IO is very important action to optimize the interactions between the Laboratories on the campus and within the future University Paris-Saclay

Weaknesses and threats related to the context

There is an uncertainty in the future of the team working on Auger/JEM-EUSO. The committee understands this is due to the uncertainty of the entire project caused by the different priority settings of the various Space Agencies, which are beyond the control of the LAL group. Although the LAL group has been one of the leading member of the global effort for the International Liner Collider (ILC) in both accelerator and detector studies, their prospect for the current detector and physics efforts is rather limited due to the present status of the ILC project. Even for the most optimistic case, possible realization of the ILC would take very long and the group's activity has to remain in the detector R&D and physics studies based on simulation for sometime. This unfortunately is too limited, particularly for educating young scientists. The theory group consists with a single permanent researcher. Although she has been making a remarkable achievement, she has to rely heavily on the external relationship and it is difficult to build up own culture. Various generic detector R&D activities in the electronics-detector service unit are now emerging and providing some interesting results. But the group is still rather small and needs to develop a strategy. For the recently established Accelerator Department, their reporting line to the management and relation to the other existing structure of LAL is somewhat unclear and may require some adjustment after gaining operational experience. The committee noticed that due to the different reporting lines for the CNRS employees and universities, the university employed technical staffs might encounter some difficulties in their promotion.

Recommendations

For the scientific programme, the committee recommends that an early decision to be taken whether to participate in the Auger Upgrade in a substantial way or not. In order to give more balanced scientific opportunity, the ILC team is recommended to participate in a running experiment. Since LAL has worked for the INFN Super B factory effort on physics, detector and accelerator, a B-factory upgrade project at KEK (the Super-KEKB accelerator and Belle II experiment) could be a possibility where synergy might be built up with the theory and accelerator groups. This could make the ILC group more attractive to young students. Although the theory group consists of a single permanent researcher, the committee thinks that it is worth maintaining this group. The experimental groups are benefiting enormously to have a phenomenology group next door and it is connecting LAL with other theory groups outside of LAL. The committee suggests that enough resources should be given so that it can communicate with other theoreticians through visiting and inviting them frequently. Generic detector R&D could be strengthened by combining more formally this activity with the electronics R&D that is already going on well in the same service unit. This would also increase the output of the LAL technology transfer. As a possible way to consolidate the Accelerator Department, the LAL management may consider to place them at the same level as the service units and Physics Research Groups, receiving necessary technical support from the service units in the same way as the Physics Research Groups. The committee strongly support the LAL effort to integrate the nearby laboratories and the university more closely that will allow to share extended competences and more efficient resource exploitation. Lastly, the committee thinks that it is important to find a way to provide more PhD student positions. With the LAL high reputation, much more PhD students can be attracted not only in the pure science research in particle physics, astro particlephysics and cosmology, but also in computing, electronics and accelerator science.

3 • Detailed assessments

Assessment of scientific quality and outputs

LAL has achieved outstanding scientific outputs in physics at the highest energy, in precision measurements and in search for rare phenomena, and in studies of gravitation and universe. One the most prominent example is the unprecedented discovery of the Higgs boson by the ATLAS experiment at CERN. The LAL group contribution to the electromagnetic calorimeter construction and analysis effort were crucial for the discovery. It was also wise to integrate the LAL researches from the D0 experiment who had made important contributions at the Tevatron proton antiproton collider in the US. In a similar manner, major contribution by the LAL to the BABAR experiment in the US has been recapitalised by the LAL-LHCb team by successfully exploiting the analysis knowledge and technique gained there. In all the other experiments, which are by themselves the world leading experiments in their field of researches and producing new results, the LAL teams are playing leading roles. Particularly the strong point of the LAL teams is that their contribution is always in multiple areas; instrumentation, software and computing, and physics analysis. This makes the contribution of the LAL very unique and robust. This applies for not only for the particle physics projects but also for astroparticle physics, gravitation, and cosmology programmes. LAL contributions to the Auger and Planck results are notable examples. Another unique scientific activity of LAL is in the accelerator domain. Many interesting achievements have been made and some of them are really particular to LAL. Finally, it is worth noting that the Nobel Prize was awarded to Englert and Higgs in 2013 was based on the work by the ATLAS experiment. The work by the BABAR experiment was also essential for the Nobel Prize warded to Kobayashi and Maskawa in 2008.

Assessment of the unit's academic reputation and appeal

Many LAL physicists are well known internationally and playing leading roles in their corresponding fields. They are regularly giving invited talks and serving in the organising committees for prestigious international conferences. Several members have served in the CERN Scientific Policy Committee, which is the highest scientific body advising the CERN Council, including as the chair. They are also in many scientific advisory bodies of institutes and laboratories in France and worldwide. Some of their members have been recognised their contribution with receiving awards, medals and prizes. A total of 17 national or international awards were given to individual LAL members, LAL groups, or collaborations where the LAL group was a prominent member over the last ten years. The laboratory was the main organiser of the prestigious International Conference on High Energy Physics in 2010 in Paris.

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

Importance in transmitting the research results to wider public has been well recognised by LAL. The laboratory management and all the research groups at LAL are fully engaged in the outreach activities. Again one of the notable examples is how the discovery of the Higgs particle was communicated: It showed that it was possible to attract the general public with such an abstract subject like the Higgs boson. About 500 people visited the laboratory for various public outreach events. They also produced public brochures such as "Quark poker" and "Passeport pour les deux infinis". LAL's strong capability in instrumentation has generated many development works resulting in technology transfer to industries, particularly in the area of electronics. Also technology related to the accelerator science is a source for the technology transfer including the superconductivities. Having an in-house accelerator facility has been resulting in sizable purchases of high technology products to the industries. And development in X-ray and laser technologies has many applications in material science, biology and medical researches.

Assessment of the unit's organisation and life

The laboratory has a clear structure well suited to conduct scientific research programme. It has appropriate committees where the scientific values and available resources, as well as personnel issues can be competently evaluated and they provide sound and informed advices to the laboratory management. It is particularly important to note that there exists a close connection between the project leaders, the heads of the service units and the laboratory management. The administrative structure covering all the necessary areas, including the health and safety, is functioning efficiently.

Assessment of the unit's involvement in training through research

Members of the laboratory have ceveral responsibilities in the university : Department of Physics, Preparation to Admission ”Grandes Écoles” at L2, IFIPS, Magistère d’Orsay M1, Master2 : NPAC, APIM. They are strongly involved in the organisation of the doctoral schools: “Physique Noyaux, Cosmos” (PNC, ED517) and “Modélisation et Instrumentation en Physique, Énergies Géosciences et Environnement” (MIPEGE, ED534). The laboratory sustain pedagogical platforms around the local experimental facilities and memebrs of the laboratory participate to national and international schools. The laboratory is strongly involved in the transition towards Paris-Saclay University.

Not only the university staff, but also many of the CNRS members are involved in teaching at the university, mostly at the Master level of lectures. Some of them are even serving in various curriculum committees. The laboratories and its research groups are offering additional training courses in instrumentation and accelerator science, which is unique to a research laboratory with large infrastructure. Numerous numbers of master students and doctoral students have experienced their research works at LAL fully supervised by the LAL scientists. In addition, many LAL researchers have been invited to teach national and international schools for doctoral students and young postdoctoral researchers. The number of internships has been well above 30 per year in average since 2008, and an average of 10 PhD theses per year have been produced at LAL.

Assessment of the strategy and the five-year plan

All the research programmes engaged by the LAL groups are running under various international frameworks as a long-term project. The research groups are also making sure that their experiences are well exploited in their programme by smooth transition of ending and new research programme. The laboratory's initiative to start a detector development group and accelerator R&D department opens up a new and promising avenue for the coming five years. The construction of an in-house accelerator is complementing well the particle physics projects which are taking place outside. Another interesting development is to enforce local connection with nearby CNRS institutes and universities, which are known as P2IO and University Paris-Saclay. In the era of globalisation, this is definitely the right strategy.

4 ● Theme-by-Theme analysis

The laboratory is presented in terms of 12 themes. The evolution from the past situation and the future one is presented in the following tables. In the following, when the notation **E1, E12** is used, it refers to the themes for the future contract of the laboratory.

Themes of the Laboratory during contract 2009-2010/2014

N°	Person in charge	Group name
(E1)	B. KEGL	APPSTAT/AUGER
(E2)	A. SCHAFFER	ATLAS
(E3)	S. DAGORET-CAMPAGNE	JEM EUSO
(E4)	N. ARNAUD	SUPERB
(E5)	M. JAFFRÉ	D0
(E6)	R. ANSARI	DARK ENERGY
(E7)	E. KOU-BOURHIS	THEORY
(E8)	R. POESCHL	ILC
(E9)	MH. SCHUNE	LHCb
(E10)	L. SIMARD	NEMO/SUPERNEMO
(E11)	O. PERDEREAU	PLANCK HFI
(E12)	P. HELLO	VIRGO
(E13)	A. VARIOLA	R&D ACCELERATORS (DEPACC)
(E14)	C. LOOMIS	COMPUTING GRID

Themes for the future contract 2015/2019

N°	Person in charge	Group name
E1	B. KEGL	APPSTAT / GRID
E2	D. ROUSSEAU	ATLAS / SUPERLHC
E3	R. ANSARI / O. PERDEREAU	COSMOLOGY, DARK ENERGY, PLANCK HFI
E4	F. ZOMER	PHOTON/ELECTRON INTERACTIONS
E5	E. KOU-BOURHIS	THEORY
E6	R. POESCHL	ILC
E7	S. DAGORET-CAMPAGNE	JEM-EUSO / AUGER
E8	MH. SCHUNE	LHCb
E9	A. VARIOLA	R&D ACCELERATORS
E10	V. PUILL	R&D DETECTORS
E11	L. SIMARD	SUPERNEMO
E12	P. HELLO	VIRGO / ADVANCED VIRGO

Theme 1 : (E1)

(2009-2014) APPSTAT/AUGER → APPSTAT/GRILLES (« Autour du calcul »)

Manager's name :

Mr Balazs KEGL

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions		
N2: Permanent EPST or EPIC researchers and similar positions	1	1
N3: Other permanent staff (without research duties)	4	5
N4: Other professors (PREM, ECC, etc.)	1	
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	2	1
N6: Other contractual staff (without research duties)	3	
TOTAL N1 to N6	11	7

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	4	
Postdoctoral students having spent at least 12 months in the unit	5	
Number of Research Supervisor Qualifications (HDR) taken		
Qualified research supervisors (with an HDR) or similar positions	3	3

• Detailed assessments

Assessment of scientific quality and outputs

The group is acting in a variety of domains, from mathematical software (AppStat) to Grid and Cloud site operations. As far as software development is concerned, the AppStat project is contributing to physics analysis of several experiments, mostly Auger, but also the LHC experiments. It is also participating in Core software developments used by several LHC experiments at CERN (CMT, graphics, etc.). These activities provide a very good visibility to the group outside the laboratory. Considering the evolution of distributed computing towards "cloud infrastructures", the group is leading the development of a cloud interface (StratusLab) that starts being used elsewhere, included by commercial clouds (HelixNebula). It is also used as an interface to the cloud facility that was started at LAL for providing easy access to computing resources to several small communities in addition to the HEP community. As part of the GRIF federation (Grilles de la Région Île-de-France) consists of 6 laboratories from the Paris region with 8000 of CPU cores and 4 PB of disk capacity, LAL with its ~30 % contribution has a very good performance record in the Worldwide LHC Computing Grid (WLCG).

Assessment of the unit's academic reputation and appeal

Several members of the team are regularly giving contributions at International Conferences on Computing and are well respected in the field. The head of the Computing Service is currently chairing the WLCG Grid Deployment Board and represents the over 100 Tier2 sites at the WLCG Collaboration Board. The emerging development on the StratusLab cloud interface is led by a renowned computer scientist who was amongst the very few early testers of the Grid middleware in the early 2000's. The variety of activities of the group makes it quite attractive for computing physicists and computing scientists to join.

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

The main interaction outside the HEP field is via the StratusLab development that starts to be used outside the HEP computing domain including commercial clouds. The strategy to group in the VirtualData all computing resources of the P2IO community and of the university is very rational and effective from economical point of view. The new computing room recently put in operation has excellent energy efficiency, which is very good for the environment.

Assessment of the unit's organisation and life

Various activities of the group are well organised. The group has a very good connection with the physics groups, from software development to provision of computing resources. Despite being essentially a single-person activity, the AppStat is extremely efficient in providing support to the physics groups. The LAL computing service plays a leading role in the GRIF consortium and in organising the computing at the level of P2IO and University Paris-Saclay.

Assessment of the unit's involvement in training through research

From the academic point of view, one PhD work is completed every year in average supervised by members of the group. Many postdocs have been involved in the group's activities in the recent past, mostly for software development.

Assessment of the strategy and the five-year plan

The group's strategy is very clear: federating the computing resources on the Paris-Saclay campus (at least within P2IO to start with, but also beyond), with the creation of two poles, one at LAL (VirtualData) and one at LLR, École Polytechnique. VirtualData is a very strong asset for LAL in its strategy for providing easy access to computing resources to eScience on the campus. The contribution to statistical analysis of HEP experiments' data by the AppStat group is also part of the program.

Conclusion

- **Strengths and opportunities:**

Very clear strategy for both providing computing resources and software development. Clear opportunity to federate computing resource on a large campus, thus rationalising computing deployment

- ***Weaknesses and threats:***

The AppStat activities rely mostly on one person. A possibility that the StratusLab development not being adopted by a large community, leading to a relative isolation of LAL Could resources within the community.

- ***Recommendations:***

Strengthen the AppStat activities by adding postdocs and permanent staff. In the coming years, monitor the adoption rate of StratusLab by the Cloud community and evaluate the benefit of keeping the development and support in-house.

Theme 2 (E2)

ATLAS/SUPER LHC

Manager's name :

Mr Arthur SCHAFFER / Mr David ROUSSEAU

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	4	4
N2: Permanent EPST or EPIC researchers and similar positions	17	18
N3: Other permanent staff (without research duties)	6	
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	5	6
N6: Other contractual staff (without research duties)		1
TOTAL N1 to N6	32	29

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	11	
Theses defended	19	
Postdoctoral students having spent at least 12 months in the unit	7	
Number of Research Supervisor Qualifications (HDR) taken	3	
Qualified research supervisors (with an HDR) or similar positions	17	19

• Detailed assessments

Assessment of scientific quality and outputs

ATLAS, together with CMS, is the leading international experiment in the domain of high energy particle physics and will remain so probably for the next ten to twenty years. The LAL-ATLAS team is certainly one of the strongest team in France and well known internationally in the field. It had extremely important instrumental commitments for the ATLAS experiment: It had a leading role in the design, construction and operation of the liquid argon calorimeter (so called accordion LAr), which is crucial for the search of the 'Higgs boson' (SM Higgs) or for new particles search (BSM, SUSY search). The team had heavy responsibilities in the construction, commissioning, maintenance, in-situ calibration, deep understanding of the running and the performances of the calorimeter. The LAr electromagnetic calorimeter achieved remarkable performances in the energy scale and resolution, as well as the long term stability. The team also contributed recently to the ALFA detector dedicated to the measure of absolute luminosity and total cross section in ATLAS. Besides these instrumental achievements, the team had important roles in building up the core software and software tools of ATLAS, also in contributing in many computing national efforts like the GRIF-Tier2 and the French grid cloud. For the coming ATLAS detector upgrade the LAL teams works for the trigger upgrade of the LAr calorimeter, and the High Luminosity LHC phase with the replacement of the LAr electronics and R&D studies on the future Si pixel detector. Being experts in electromagnetic particles and leptons reconstruction, the team had a major role in the discovery of the Higgs boson via its decay into two gammas, into four leptons (H->ZZ), and into two leptons and missing energy (H->WW). This is the most important breakthrough in particle physics since the discovery of W and Z bosons.

Assessment of the unit's academic reputation and appeal

Members of the LAL-ATLAS team have a high national and international visibility: The P.I. of LAr was awarded the Prize J. Ricard 2012 of SFP (for the LAr accordion), a member of the team was awarded the Prize Thibaud 2008 of Académie des Sciences, Art et Belles Lettres of Lyon (one awarded physicist per year from Europe working in French particles, nuclei and astroparticles laboratories) and another one was awarded the 'Silver Medal' of CNRS in 2011. The ATLAS collaboration, of which the LAL team is an important member, was awarded the EPS 2013 Prize (European Society) for the discovery of a Higgs Boson. A public presentation of the ATLAS results in December 2012 at CERN concerning the Higgs search was made by a member of the team, on behalf of the ATLAS collaboration. The LAL-ATLAS members have given about 20 talks or seminars per year, and given many lectures at postgraduate schools: they have been principal editors of several papers per year, where ATLAS has published more than 270 papers in the high level refereed journals. They had responsibilities in various steering and working groups or scientific committees in ATLAS. More than 20 foreigner scientists visited the team during the past period. Some members are organizers of major High Energy International Conferences like ICHEP, HCP, Moriond, PLHC, and in particular it is worth mentioning the initiative of the 'Higgs Hunting Workshop' at LAL since 2010 that gathers 130 to 200 participants. Some of the LAL-ATLAS team were members of the scientific committees in various laboratories including CERN, Frascati, etc., and have responsibilities in several National Boards dedicated to Research and Education (like Scientific Direction of IN2P3, University and CoNRS Committees), GDRs (SuperSymétrie, Terascale) and ANRs, responsibility of the global ATLAS France consortium (gathering six laboratories).

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

Because of the fundamental nature of the team's research, the interaction of the group with environment is mainly focused on dissemination of scientific knowledge and new ideas in fundamental physics, and international collaboration. Physicists of the team are member of the LHC-COM network and editor of a popular science magazine for the general public ('revue élémentaire' of LAL), also contributing to the 'CERN Master classes'. The LAL routinely organizes conferences for the general public with the participation of the ATLAS team: contribution to 'Fête de la Science', to the 'Journées du Patrimoine', to the 'CNRS-CERN-Industry colloquium on LHC spinoffs' in 2013, to the organization and participation to 'Nuit des Particules' outside the laboratory (cinéma REX, 2010). During the 2012-2013 period, the discovery of a new particle by ATLAS (and CMS) was a worldwide scientific event, which attracts attention not only from the scientific community, but also from the general public. There were a lot of talks and articles in the media (radio, TV, science popularisation journals), conferences, seminars, lectures in schools, with a strong participation of the ATLAS team, Members of the team initiated or contributed to collaboration agreements with foreign countries, such as China, Japan and Korea with the FCPPL/FJPPL/FKPPL (International Associated

Laboratories), some also participated to academic training in foreign countries (Vietnam, Czech Republic, French Ukrainien School, European Schools, and in France (in the frame of the 'formation permanente' of the CNRS). The R&D effort of the team (electronics, trigger and instrumental developments) is elaborated in collaboration with the service units of the whole laboratory that eventually take care of the related spinoffs or patents.

Assessment of the unit's organisation and life

The team is composed of permanent searchers (mostly from CNRS) who supervise young doctoral students and postdoctoral researchers, with the addition of some dedicated engineers for the computing and upgrade activities. The change of team leader is reasonably frequent (about every four years). The members of the team meet regularly about one day each month. There are meetings with other French or foreign laboratories on specific detectors or analysis items, overall ATLAS-France yearly meetings and every three months meetings at the level of the whole ATLAS collaboration. In such large collaboration, a continuous activity is going on through frequent working group presentations, usually at CERN, often by video, where in particular the doctoral students present their works. The team is well represented at most of the steering and decision making committees of these different bodies. The support for the upgrade activities makes a good use of the existing technical strengths and the existing equipments of the laboratory, which will be reinforced by the future Captinov platform. The sharing of activities between the data analysis and instrumentation work is well balanced among the senior physicists and doctoral students.

Assessment of the unit's involvement in training through research

A large fraction of the permanent searchers are engaged in teaching (international schools, postgraduate schools, outreach). Some of them are teachers at Paris 11 University with heavy teaching tasks (in Master 1 and Master 2) or high level administrative functions (Deputy President of the University, Council of the University). This permits the team to attract many doctoral students. The research subjects and the recognized quality/visibility of the team are very attractive to them. Presently there are 11 doctoral students, some of them from foreign universities. There is one supervisor per doctoral student, which guaranties the effectiveness and quality of the student guidance and supervision.

Assessment of the strategy and the five-year plan

In the next 15 years, the experimental particle physics will be dominated by the LHC. Continuing efforts on the precise determination of the properties of the Higgs boson, together with continuing efforts on the search for new particles is an excellent strategy for what concerns the physics program. On the other hand, the involvement in the detector upgrade is mandatory to face the near and mid term future with the LHC running at increased luminosities. Thus, involvement in the upgrade of the pixel tracker and the level-1 trigger of the calorimeter is an excellent strategy. R&Ds on the pixel sensors prepare for a more distant future (~ 2023), so called Phase II upgrade, is of strategic importance for the team and has to start now. The existing physics and technical personnel, with the support of the new platform Captinov, are able to begin serious development works needed for the pixel sensors and the new electronics. In summary, excellent and clear strategy, coherent with the on going activities and composition of the team is planned.

Conclusion

Thanks to its major contribution to the LAr calorimeter, to the Higgs discovery and its characterization, to the new particles search, the LAL team has succeeded to reach an excellent positioning in ATLAS. Their activities including the ALFA luminosity detector ensure a bright future of the team in the ATLAS collaboration. The team is well aware of the effort needed to maintain a strong involvement in the ATLAS upgrade and has already begun to work on the new pixel detector and the new calorimeter and pixel electronics.

- ***Strengths and opportunities:***

The physics analysis topics, which are central issues for Particle Physics in the coming years and chosen in conjunction with the technical and physics expertise of the team. Reinforcement by senior physicists coming from the D0 experiment. Involvement in pixel sensors preserving the future. Very good expertise and support in computing helping the team to have a good positioning in ATLAS.

- ***Weaknesses and threats:***

Possible shifts in the LHC schedule and uncertain funding for the Phase II upgrade: This is however beyond the control of the LAL-ATLAS group.

- ***Recommendations:***

Maintain the group at the present level now, and reinforce the involvement in the Si pixel activity in the coming years.

Theme 3 (E3)

(2009-2014) Dark Energy→ Planck/LSST/BAORadio ("Cosmology")

Manager's name :

Mr Résa ANSARI / Mr Olivier PERDEREAU

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	1	1
N2: Permanent EPST or EPIC researchers and similar positions	6	6
N3: Other permanent staff (without research duties)	9	
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	2	
N6: Other contractual staff (without research duties)	1	
TOTAL N1 to N6	19	7

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	1	
Postdoctoral students having spent at least 12 months in the unit	2	
Number of Research Supervisor Qualifications (HDR) taken		
Qualified research supervisors (with an HDR) or similar positions	3	4

• Detailed assessments

Assessment of scientific quality and outputs

The Planck experiment has provided many key measurements for modern Cosmology and represents a fundamental step in the advance of the field with many publications in referred top ranked international journals. The DPU building and map-making work were the particular contributions from the LAL cosmology group to the project. They also lead a frequentist analysis of the constraints on the cosmological parameters. The effort is now going on for the polarisation data. Balanced involvement in instrumentation, data management and scientific exploitation puts the LAL group in a advantageous position in the community for the exploration of dark energy, in particular with participation to major large projects like the Large Synoptic Survey Telescope (LSST).

Assessment of the unit's academic reputation and appeal

The LAL cosmology group enjoys high international reputation and is well recognised in the world most important projects of the field such as Planck and LSST. This has lead to more than 70 referred papers and nearly 40 communications. Members are actively and regularly participating in the organization of international conferences (Moriond, NNN08, Vietnam, Blois, etc.) and workshops. Members participate to scientific council of various national units. Several international collaborations have been developed with partners from USA, China, Iran and Portugal. One member was awarded Lagarrigue prize (2013).

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

Cosmology is a naturally attractive subject for the general publics and there is a noticeable activity of communication through public conferences, where some of them are for the high school and secondary school pupils, and popular articles. One of the team members is chief editor of “Images de la physique”.

Assessment of the unit's organisation and life

The LAL cosmology team is composed of permanent researchers supervising young postdoctoral researchers, and doctoral and Master students. Their activities are well coordinated such that the LAL cosmology group can play a major role in a large project such as the LSST. They maintain an appropriate level of exchanges and collaborations locally, nationally and internationally ensuring a high international visibility.

Assessment of the unit's involvement in training through research

There is a good record of PhD students finishing their works over the past five years and the group members are teaching at various levels and participating in the organisation of the courses at the university, as well as at national and international specialised schools.

Assessment of the strategy and the five-year plan

Research in cosmology is evolving rapidly with the advent of very large-scale international experiments dedicated to Dark Energy research, in particular the European space project, EUCLID, and the US ground-based project, LSST. The current involvement of the LAL cosmology group is well balanced with its participation in a mature project, LSST, and the R&D activity in the baryon acoustic oscillation study with radio that can potentially evolve in a large-scale international project. Therefore, the five-year plan is very appropriate. Constraints on dark energy can be obtained only through combinations of probes. In this respect, the Planck activity is needed for a long period, which is another key element of the LAL cosmology team.

Conclusion

- ***Strengths and opportunities:***

A well-organised group with balanced activities between the scientific exploitation of the experiment presently taking data and the R&D effort for future large-scale projects.

- ***Weaknesses and threats:***

No concrete plan for future projects, which can capitalise the competence of the group. The number of relatively young researchers in the group is small.

- ***Recommendations:***

Investigate more actively the participation in new projects, e.g. EUCLID, while keeping an appropriate level of involvement in the current programme. Keep and further develop the contacts with theorists in the field of dark energy.

Theme 4 (E4)

PHOTON/ELECTRON INTERACTIONS

Manager's name :

Mr Fabian ZOMER

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions		2
N2: Permanent EPST or EPIC researchers and similar positions		1
N3: Other permanent staff (without research duties)		2
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)		3
N6: Other contractual staff (without research duties)		1
TOTAL N1 to N6		9

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students		
Theses defended		
Postdoctoral students having spent at least 12 months in the unit		
Number of Research Supervisor Qualifications (HDR) taken		
Qualified research supervisors (with an HDR) or similar positions		4

• Detailed assessments

Assessment of scientific quality and outputs

The level and depth of the research program of the team in the field of Compton Scattering radiation sources is impressive and of the highest caliber internationally. New concepts, new devices and new machines are being developed with a strong impact on the national and international scientific community. The quality of the research is well witnessed by the number of peer reviewed scientific papers and invited talks at International Conferences. Since 2008, seven papers have been published. They have also made one patent.

Assessment of the unit's academic reputation and appeal

The research activity strengthens the already existing links of the group with the academia, spreading the interaction to a wider field of interdisciplinary sciences. The research explores technological frontiers of optical-mechanical systems for laser pulse transport and manipulation that can attract young researchers.

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

High intensity pulsed X-ray radiation has numerous potential applications to diverse fields, including security, healthcare, nuclear fusion, cosmology, and non-destructive imaging from medicine to cultural heritage. The application of X-ray radiation to tissue diagnosis and imaging has potential for groundbreaking result, high social and cultural impact. It has a noticeable, well organized and fruitful collaboration among Laboratory, Academia and Industry. The new optical-mechanical technology developed for multi-pass laser pulses in electron-photon collisions has a high potential value for industrial exploitation.

Assessment of the unit's organisation and life

The team has installed a well-established organization for TOM-X, involving many French institutions.

Assessment of the unit's involvement in training through research

The team collaborates to teaching activities in master and doctoral courses at the university in particular in courses of “Particle Accelerators” and “Grand Instruments”. For example, five PhD theses have been made.

Assessment of the strategy and the five-year plan

The team has a clear research program for the construction, commissioning and operation of the Tom-X facility, expected to start in 2016. In addition, they are collaborating for the proposal of the European nuclear physics laser facility in Romania that will be developed with a time scale of five years, 2014-2018.

Conclusion

- ***Strengths and opportunities:***

A very high level of expertise in the photon-electron interaction, producing new ideas, new techniques and devices, with a recognized international reputation. Well balanced composition of the team. Opportunities to develop industrial applications.

- ***Weaknesses and threats:***

Available human resources in long term for the participation in two major facilities.

- ***Recommendations:***

Maintain the current level of the group in order to keep the leadership in the development of laser pulse multi-pass devices. Evaluate the necessary human resources to face the future programs.

Theme 5 : (E5)

THEORY

Manager's name :

Ms Emi KOU-BOURHIS

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions		
N2: Permanent EPST or EPIC researchers and similar positions	1	1
N3: Other permanent staff (without research duties)		
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)		
N6: Other contractual staff (without research duties)		
TOTAL N1 to N6	1	1

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	1	
Postdoctoral students having spent at least 12 months in the unit	1	
Number of Research Supervisor Qualifications (HDR) taken	1	
Qualified research supervisors (with an HDR) or similar positions	1	1

• Detailed assessments

Assessment of scientific quality and outputs

Physics outputs demonstrated by the publications in highly ranked international refereed journals are remarkable for a group essentially consists of a single permanent researcher. While the major work is in the field of

phenomenology, published papers covers more formal aspect of theory as well. The group made 17 publications in high quality refereed journals and 14 in conference proceedings since 2008.

Assessment of the unit's academic reputation and appeal

The permanent researcher of the activities particularly in theoretical work of phenomenology is well known and appreciated in the community, resulting in numerous talks in various international workshops, symposium and conferences.

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

Not applicable for this activity.

Assessment of the unit's organisation and life

Not Applicable for such a group.

Assessment of the unit's involvement in training through research

Although there is only one relatively young permanent researcher, a few PhD works have been completed in the group under her supervision. She has been invited to give numerous lectures in various French and international schools for doctoral students and young post doctoral researchers in particle physics.

Assessment of the strategy and the five-year plan

It will continue to give valuable services to the experimental groups by providing phenomenological support and developing new ideas for their data analysis. Collaboration with the other institutes in the framework of P2IO and Paris-Saclay will increase the horizon of the activity.

Conclusion

- ***Strengths and opportunities:***

A very energetic and enthusiastic researcher is driving the activities. Close collaboration with other theoretical groups of the institutes nearby, in France and worldwide. Working together with experimental groups in developing their physics programme.

- ***Weaknesses and threats:***

Only a single permanent researcher in the group.

- ***Recommendations:***

Provide sufficient resources for travelling and inviting other theoreticians. Give institutional support for the grant applications for doctoral students and post doctoral researchers.

Theme 6 : (E6)

ILC

Manager's name :

Mr Roman POESCHL

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	1	
N2: Permanent EPST or EPIC researchers and similar positions	3	1
N3: Other permanent staff (without research duties)	1	
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	3	1
N6: Other contractual staff (without research duties)		
TOTAL N1 to N6	8	2

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	3	
Theses defended	3	
Postdoctoral students having spent at least 12 months in the unit	6	
Number of Research Supervisor Qualifications (HDR) taken	1	
Qualified research supervisors (with an HDR) or similar positions	5	2

• Detailed assessments

Assessment of scientific quality and outputs

Despite of the relatively small size of the group, its more senior members are highly recognized in the community and have provided invaluable contributions to evaluating the physics potential of a high energy electron-positron collider. LAL has been involved for very long in the International Linear Collider (ILC) studies, and played a leading role in the development of the ILC programme in Europe and worldwide. Besides physics studies, the group is conducting innovative R&D for a highly segmented electromagnetic calorimeter and, together with the LAL electronics group, to its associated electronics. The group produced two physics papers and two instrumentation papers.

Assessment of the unit's academic reputation and appeal

Four very senior and highly recognised physicists (although only one is full time in the project) have been participating to the group's activity and have largely contributed to shape the ILC project as a whole in the European level and worldwide. They made a large number of contributions at conferences and workshops several times in a year. They also played a leading role in the definition of the European Strategy on the ILC.

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

Members of the LAL-ILC group have been giving presentations to the general public about the current status of High Energy Physics and its future prospects.

Assessment of the unit's organisation and life

Despite being very active, the LAL-ILC group is small, with only one permanent scientist. However, the activities are well structured, and the group manages to pursue detector R&D activities, in full synergy with the detector group of LAL.

Assessment of the unit's involvement in training through research

The group has a very good record on hosting internships, doctoral students and postdoctoral researchers, which is remarkable for such a small group. Four PhD theses have been made and five in preparation, and six Master works have been made. The topic is clearly very attractive for young scientists, but it is difficult to keep them in the group, due to the uncertain future of the project.

Assessment of the strategy and the five-year plan

The future of the group is pending for the decision on the ILC that will probably take few more years. Even with a positive decision, actual realisation of the ILC will take long time. Therefore, the scope of the group activities will be limited to the simulation studies of physics prospect and detector R&D for sometime. Although the group considers a possibility of participating in shorter term experiments, such as Belle II at KEK in Japan, that would allow bridging the gap between now and the real start of an ILC detector collaboration, no clear plan is present.

Conclusion

- ***Strengths and opportunities:***

Active participation of highly senior scientists, although only one is full time on the project. The ILC project: if realised, it will be truly a global project.

- ***Weaknesses and threats:***

Small size of the group. Direct coupling of the group activities to the ILC project that has not been approved: this could however radically change in the event of a clear decision on the ILC itself.

- ***Recommendations:***

Keep attractiveness of the group to young scientists and consider injecting additional permanent members so that the group can resume its leading position in the ILC project once the project is approved: for this the group should participate in running or short term experiments, such as Belle II, for the medium term future.

Theme 7 : (E7)

(2009-2014) JEM-EUSO → AUGER/JEM-EUSO ("Rayons Cosmiques")

Manager's name :

Ms Sylvie DAGORET-CAMPAGNE

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	1	1
N2: Permanent EPST or EPIC researchers and similar positions	1	1
N3: Other permanent staff (without research duties)	2	1
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	2	1
N6: Other contractual staff (without research duties)		
TOTAL N1 to N6	6	4

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	1	
Postdoctoral students having spent at least 12 months in the unit	1	
Number of Research Supervisor Qualifications (HDR) taken		
Qualified research supervisors (with an HDR) or similar positions	2	2

• Detailed assessments

Assessment of scientific quality and outputs

The research activity of the LAL cosmic ray groups is mainly focused on the Auger experiment in Argentina and the JEM-EUSO mission on-board the International Space Station. The role of LAL cosmic ray group in the Auger experiment in the last five years has been remarkable in the data analysis to extract the nuclear composition of the

cosmic rays at the highest energies with a particular contribution of studying the effect of the aerosols on the detection of the shower light by the telescopes. The LAL provides a storage mirror site of the Auger data. R&D studies on shower detection with radio by the group are in progress. For the intermediate steps of the JEM-EUSO project, the LAL is developing several key parts of the front-end electronics, in particular the ASIC, named SPACIROC. The LAL group has also the responsibility of assembling and integrating the multi-anode photo-detector and an apparatus for the measurement of the fluorescence of air that could give an important improvement to the energy determination of the primary cosmic rays. The LAL cosmic ray group is one of the main contributors to the numerous important publications of the Auger and JEM-EUSO in highly ranked refereed journals and proceedings of international conferences, (14 papers and 20 conference contributions).

Assessment of the unit's academic reputation and appeal

The LAL cosmic ray group members are regular speakers at various international conferences and participating in their organisation. They are also present in various scientific committees in France and worldwide.

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

Not applicable to the group activities.

Assessment of the unit's organisation and life

The number of people working for JEN-EUSO is quite small, but very effective, well organized and collaborative. It has been able to make many scientific and technological achievements. It enjoys a good and tight collaboration with the electronic service of the laboratory. The current resources are sufficient for a significant position in the intermediate steps. However, it needs to increase in number of researchers for the ISS space mission. For the Auger project, the number of LAL collaborators has been reasonable in the last five years. However, the group is shrinking now thus jeopardizing possible participation in the upgrading of Auger.

Assessment of the unit's involvement in training through research

The number of doctoral students and postdoctoral researchers trained in the last five year by the LAL cosmic rays group evidences a notable appeal of the research activity. Three PhD theses have been made. Several small experiments developed in preparation of the JEM-EUSO mission allows young researchers to have a full view of their research activity, even if they are focused on some particular aspect. These medium-term JEM-EUSO related projects will help the group to be ready for large missions.

Assessment of the strategy and the five-year plan

The strategy of the LAL cosmic ray group for the JEM-EUSO project for the next five years is good. Through its intermediate steps, key parts of JEM-EUSO will reach the technical readiness level necessary for the ISS mission. Furthermore, the optimization of the final apparatus should enjoy the data that will be collected by the intermediate steps. Certainly, when JEM-EUSO will be approved, LAL should play a key role in the electronics system development. The future of Auger at LAL depends by the final decision on the LAL participation to the upgrade of the apparatus.

Conclusion

The LAL cosmic rays group consists of very high level researches. Their involvement in Auger and JEM-EUSO has been focused on crucial issues. Their role in the both collaborations is clearly visible. New methods in Auger data analysis and in JEM-EUSO electronics development are the best examples. The group is quite small, but well organized and able to fulfil their duties. Their involvement in doctoral students and postdoctoral researchers training in these years has been a good level.

- ***Strengths and opportunities:***

Participation in the Auger, which is the most performing experiment in the ultra high energy cosmic ray field and will remain so for sometime. Participation in the JEM-EUSO, which will open a new window in this field.

Involvement in the intermediate steps of the JEM-EUSO project, placing the LAL cosmic ray group in a leading position when the project is approved for the space mission

- ***Weaknesses and threats:***

Small number of people participating in the Auger programme, not permitting a significant presence in the Auger upgrade. Dependence of the long-term research activity of the LAL group in JEM-EUSO on the final approval of the space mission by the Japanese space agency JAXA or by the NASA (the Roscosmos has express interest in the mission). The current number of people participating in the JEM-EUSO project too small once the space mission is approved.

- ***Recommendations:***

Consider carefully whether sufficient resources are available to participate in the Auger upgrade without jeopardising opportunities in data analysis. Maintain a strong presence in the intermediate steps of the JEM-EUSO project. Follow closely the evolution of the JEM-EUSO and increase the effort within a reasonable time scale if the space mission is approved.

Theme 8 (E8)

LHCb

Manager's name :

Ms Marie-Hélène SCHUNE

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions		
N2: Permanent EPST or EPIC researchers and similar positions	7	6
N3: Other permanent staff (without research duties)	7	
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	6	6
N6: Other contractual staff (without research duties)		
TOTAL N1 to N6	20	12

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	4	
Theses defended	11	
Postdoctoral students having spent at least 12 months in the unit	4	
Number of Research Supervisor Qualifications (HDR) taken	2	
Qualified research supervisors (with an HDR) or similar positions	10	11

• Detailed assessments

Assessment of scientific quality and outputs

The LAL-LHCb group is one of the leading members of the LHCb experiment, which is a flagship flavour physics experiment at CERN producing a series of unique precision measurements in the b- and c- quark sectors. The LHCb collaboration has published more then 150 papers in high class refereed journals where LAL-LHCb group members have been the main authors of a dozen of those publications

Assessment of the unit's academic reputation and appeal

The LAL-LHCb group is very visible in the particle physics community in general. Members are well recognized and some have received awards. They have been members of various local, domestic and international scientific committees. In the experiment, they are responsible for calorimeter electronics and tracking algorithms.

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

The group members have been Involved in several outreach activities at the P2IO and National Level. Examples are Passeport pour les deux infinis 2010 2012, Dunod Editions La nuit des 2 infinis Exposition ZOOM Exposition ZOOM “Du sens du temps à la violation de la symétrie CP" in " Pour la Science", 2010 “Tout s’explique”, 2010, France Inter Participation to a DVD “Images de Sciences”, Cité des Sciences,…

Assessment of the unit's organisation and life

The team appears to be well structured and balanced in terms of permanent posts and students. Lack of postdoctoral researchers is probably related to the specificity of the French CNRS system. They have established a fruitful collaboration with the LAL theory group in phenomenology.

Assessment of the unit's involvement in training through research

Several members are teaching classes at the Master level. State-of-the-art data sets of LHCb and analysis expertise of the LAL-LHCb group are attractive for students. The group attracts doctoral students from France, Europe and beyond. Interesting and fruitful Collaboration has been made with China. A total of 11 PhD theses have been completed during the past five years.

Assessment of the strategy and the five-year plan

The physics analysis plan and participation in the LHCb upgrade seems to be well prepared and in line with the competence of the group and the laboratory and the flavour physics programme in Europe.

Conclusion

- ***Strengths and opportunities:***

Being one of the leading groups in the LHCb collaboration in both hardware and physics analysis, also exploiting the experience gained from the BABAR experiment. The large number of doctoral theses completed during the period under review. Ample opportunities in flavour physics by the LHC run 2 and the proposed upgrade of the electronics and trigger, leading to even more flexible data taking and physics analysis conditions.

- ***Weaknesses and threats:***

A possible reduction in the number of postdoctoral students in high energy physics, which is not specific to LHCb. Possible slippage in the schedule and in the appropriation of the resources for the proposed electronics upgrades in view of competition by the Belle II experiment expected to become online in 2016.

- ***Recommendations:***

Maintain the current level of the group in order to keep the leading position in the LHCb experiment, where the foreseeable reduced impact of the emeritus (four people) participants is taken into account. Make sure that the upgrade activities are focused so that the group's leadership in the experiment is preserved.

Theme 9 (E9)

R&D ACCÉLÉRATEURS

Manager's name :

Mr Alessandro VARIOLA

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	2	
N2: Permanent EPST or EPIC researchers and similar positions	4	4
N3: Other permanent staff (without research duties)	14	14
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	3	1
N6: Other contractual staff (without research duties)	7	4
TOTAL N1 to N6	30	23

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	4	
Theses defended	5	
Postdoctoral students having spent at least 12 months in the unit	6	
Number of Research Supervisor Qualifications (HDR) taken	1	
Qualified research supervisors (with an HDR) or similar positions	3	3

• Detailed assessments

Assessment of scientific quality and outputs

The LAL accelerator related activities are coordinated by a newly created unit, the Accelerator R&D Department, which gathered all accelerator experts. This allows an efficient organization of the corresponding activities and projects, especially the best use of the available resources and a cross fertilisation between the projects of the members skill and expertise. The present activities are impressive: Excellent start of the heavy

responsibility about the X-FEL RF couplers industrial follow-up and RF conditioning with 44 (over 670 to 800) already produced, which makes confident that the planed production rate of 8 couplers/week will be achieved soon: Operation from a few years of a user-oriented multi-disciplinary experimental platform, PHIL, based on a high performance Photo-Injector, also used as a technology platform to develop and test high brilliance electron sources: R&D on novel beam diagnostics techniques with promising performances on ultra-short bunch length measurement (ETALON), alignment and stabilisation with high resolution and stability in the 10nm range, luminosity measurement: And promising results on optical cavities with high gain and recirculation providing optimum laser-electron interaction by Inverse Compton Scattering (ICS) for applications on positron and γ rays generation. The Thom-X project based on ICS interaction between a laser beam in an optical cavity and a stored beam in a low energy ring has recently been approved. It is funded as EQUIPEX as a technology platform. It will allow to develop the ICS technology providing an X ray source at high repetition rate and high flux at a reasonable and affordable cost. They have also an excellent publication record, with 26 refereed journal articles and 87 conference proceedings.

Assessment of the unit's academic reputation and appeal

The Accelerator R&D department is strongly involved in international projects with high level of responsibilities: such as X-FEL, R&D for Linear Colliders (ILC, CLIC), ATF2 at KEK in Japan, ELI (NP) in Romania, and SuperB machine studies. The team expertise is well recognized by the worldwide scientific community. Its members are regularly invited to participate to high level international conferences and to organise them. The excellent reputation of the department attracted top level PhD students (7), post docs (2) or projects CDD (5), some of them from foreign institutions (Japan, China). The department is strongly involved in very fruitful international collaborations especially KEK/Japan and LNF/Italy.

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

The department is developing and operating user-oriented multi-disciplinary experimental platforms, namely PHIL presently and ThomX in the future which could be extremely useful to test methods with great societal impacts and provide opportunities in the fields of medical science, cultural heritage, material science, biology, metallurgy, and lithography. These platforms are built in a multidisciplinary approach in strong collaboration with industrial companies, medical science and cultural heritage laboratories and/or industrial partnerships like PMB, Sigmaphi, Champalle, Codra, Alsyom, Amplitude systems.

Assessment of the unit's organisation and life

The department is well organized in a matrix approach with three groups made of the experts with a common expertise (beam dynamics, beam diagnostics, RF & Infrastructures), thus pooling resources and addressing the various projects in a very efficient and cross-fertilisation way. For the sake of efficiency, a few key technology experts are included in the department in order to provide a link to the support groups outside the department like Informatics, Electronics and Mechanics. Close contacts and discussions within and outside the department are regularly organized via various group meetings at appropriate levels. Respectively, the department is strongly involved in the laboratory life and organization by representation and participation to the laboratory council, the scientific committee, the CSRD committee of the P2IO initiative, the security board and the LAL seminars.

Assessment of the unit's involvement in training through research

The Accelerator R&D department is strongly involved in teaching through courses (one Master in NPAC, two Master in APIM, various others at specialized schools on Accelerators, Detectors, Particle matter interaction, lasers, Instrumentation, etc.) and defining a new Master “Grand Instruments” launched in the frame of the P2IO initiative. It supports the University Paris 11 in Optonic field and participation in the new École Doctorale Phenics, Magistere de Physique, Conseil des Études et de la vie Universitaire, Finance and Pedagogic committees and HDR council. The group is hosting and supervising seven doctoral students. The technology platforms, PHIL presently and Thom-X in the future, are used in parallel with physics for technical training providing an invaluable practical experience to personnel and students on real accelerators. PHIL will become a “Travaux Pratiques (TP)” platform for the new Master “Grand Instruments”.

Assessment of the strategy and the five-year plan

The Accelerator R&D department has defined a very consistent and original strategy over the next several years with an appealing vision in the future. It developed a corresponding work plan with well identified milestones and deliverables including seven R&D Projects; PHIL, Thom-X&Mighlaser, X-FEL RF couplers, Positron sources, ATF2&SuperKEKB, ETALON, UA9: a well ballanced programme between the inhouse and outside activities.

Conclusion

- ***Strengths and opportunities:***

The newly created department concept allowing to coordinate efficiently several projects with limited resources sharing skills and expertise covering a broad range of core activities and systems. The X-FEL RF couplers providing a great opportunity to become a key player in future projects like he ILC if and when decided. The project ThomX, which is an ideal local project with a reasonable cost & size and multi-disciplinary challenges. The ICS technology which could be adapted, if proved to be feasible, on a chain of future projects with increasing complexity and performance from ThomX to ELI-NP to Mightylaser.

- ***Weaknesses and threats:***

Being new, still needing to find its own way of working and the right balance between core expertise in the department and efficient support by technology groups outside the department. The highly visible work in the RF couplers with tight delivery schedule during the next few years. The ICS technology requiring outstanding performances well above the current state of the art of laser storage in cavities and beam-laser interactions.

- ***Recommendations:***

Consider promoting the Accelerator department at the same level as Physics Groups, Engineering Services and Administration in the LAL management and organization, avoiding the creation of an independent unit but relying as much as possible on support technology groups. Clarify the LAL organigram accordingly with a clear and simple identification of the reporting lines.

Theme 10 (E10)

R & D DÉTECTEURS

Manager's name :

Mrs Véronique PUILL

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	1	1
N2: Permanent EPST or EPIC researchers and similar positions	1	1
N3: Other permanent staff (without research duties)	1	2
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	2	3
N6: Other contractual staff (without research duties)		
TOTAL N1 to N6	5	7

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	2	
Postdoctoral students having spent at least 12 months in the unit	1	
Number of Research Supervisor Qualifications (HDR) taken		
Qualified research supervisors (with an HDR) or similar positions	2	2

• Detailed assessments

Assessment of scientific quality and outputs

The activities of the Detector Research and Study Group (GRED) constitute a new theme within the future contract 2015/2019. For the period 2009-2010/2014, the GRED was mostly active on R&D for SuperB and took part the redaction of its TDR. After the stop of SuperB in December 2012, it continued to perform survey and monitoring of technological developments on photodetectors (especially for fast Cherenkov detectors, TOF-PET, etc.) and to provide

support for the development and integration of new detectors in experiments (ATLAS-pixel, EUSO-Balloon, ATF2). The GRED has scientific responsibilities within the SONIM and SIPMED interdisciplinary projects dedicated to biomedical imaging and ensures the development and operation of the platforms CORTO (cosmic ray test bench using large Micromégas detectors), LEETECH (to irradiate scintillation and quartz detectors with low energy electrons from PHIL), and CAPTINNOV (probe station and wire bonding machine). They have 23 publications, among which 17 have a first author from the GRED, mainly in NIMA and JINST. Its members gave 18 conference talks, among which one was an invited talk at the IEEE NSS, and presented 6 posters.

Assessment of the unit's academic reputation and appeal

GRED members have responsibilities at the international level as project leader for the CERN UA9 collaboration, SIPMED (portable gamma camera) and SONIM (intraoperative beta probe), both involving a research group of FERMILAB, and the platform CORTO for cosmic ray detection, in collaboration with CERN and universities in Seoul and Kiev. They also endorse responsibilities as project leader for the electronic and integration of EUSO-Balloon (CNES) and have a technical responsibility for the ATLAS-pixel development, thus demonstrating a high level impact at the national and European level. GRED members took part to the organisation of 4 conferences and workshops at the national level…

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

The detector R&D carried on by the GRED comprises demonstration projects (SIPMED, SONIM) that can possibly involve valorisation actions and subsequently generate a very good impact for the team.

Assessment of the unit's organisation and life

The GRED is integrated in the Service for electronics, detector development, and integration (SERDI) of LAL that counts three other groups (electronics, systems, and CAO/production). It remains unclear though how decisions are taken on what technologies will be monitored by GRED out of R&D performed for running experiments.

Assessment of the unit's involvement in training through research

GRED members have ensured teaching within two international schools, and one national school (IN2P3). It counts one PhD student (2016), one HDR (2013). It intends to organise practical training (TP) on the platforms CORTO and LEETECH. However, GRED have not yet supervised internships neither for master nor for bachelor students.

Assessment of the strategy and the five-year plan

The GRED plans are to characterize and simulate photodetectors (such as SiPM, or MCP-PMT) up to demonstration test cases. It will carry on the CERN UA9 experiment with the design and integration of the detection chain and test SiPMs, PMTs, and quartz detectors. It is involved with the development of pixel detectors for ATLAS and with the integration of EUSO-Balloon (CNES). Finally, it will provide services for research and teaching while integrating and operating the platforms CORTO, LEEECH, and CAPTINNOV.

Conclusion

Since it is a new theme within the future contract 2015/2019 of LAL, it was decided to not provide a quantitative evaluation of the Detector Research and Study Group (GRED) activity for the period 2009-2010/2014. Nevertheless, given the achievements and publication record reported by the GRED for this period, a very good standard of scientific production and a good visibility of the GRED at the national and international level are acknowledged.

- ***Strengths and opportunities:***

Participation to international collaborations (UA9, ATLAS-pixel). Making R&D on detectors comprising demonstration projects (SIPMED, SONIM) with possible valorisation actions. Integration and operation of platforms that will eventually be used for practical training with students

- ***Weaknesses and threats:***

Survey and monitoring of technological developments on photodetectors being quite generic and not quite original. Unclear process to define and evaluate generic R&D programme on detectors.

- ***Recommendations:***

Develop more focused R&D programme on photodetectors by identifying specific experiments who need them. Try providing services on platforms to external users (e.g. CORTO for characterizing time performance of fast detectors)

Theme 11 (E11)

NEMO/SUPERNEMO

Manager's name :

Mr Laurent SIMARD

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	2	2
N2: Permanent EPST or EPIC researchers and similar positions	3	3
N3: Other permanent staff (without research duties)	10	
N4: Other professors (PREM, ECC, etc.)		
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	3	1
N6: Other contractual staff (without research duties)		
TOTAL N1 to N6	18	6

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	1	
Theses defended	2	
Postdoctoral students having spent at least 12 months in the unit	2	
Number of Research Supervisor Qualifications (HDR) taken	2	
Qualified research supervisors (with an HDR) or similar positions	5	5

• Detailed assessments

Assessment of scientific quality and outputs

The NEMO group of LAL has pioneered the $\beta\beta0\nu$ decay research in France. Determining the neutrino property is one of the most important areas of research in the elementary particles physics today. The group had a leadership role in the previous NEMO experiments by developing a very original technique to search for the search for $\beta\beta0\nu$

decays by combining tracking and calorimetry. The experiment achieved a competitive result among other various ββ0ν experiments in the world. In the successor, SUPER-NEMO, project that intends to increase the NEMO experiments sensitivity, the group continues to play an essential role in the preparation. A total of 7 papers have been published in refereed journals.

Assessment of the unit's academic reputation and appeal

The scientific reputation of the NEMO group was acknowledged by the community when it was granted the ANR contract to develop and build the BIPO detector essential for the SUPER-NEMO detector. The LAL group also succeeded to attract strong English and Spanish groups in addition to those of the previous partners of the NEMO experiments to develop and build the other parts of the detectors. Their impact in the double beta decay research field is recognized by their important participation to international conferences and the rôle they play as conveners of several working groups of national and European networks.

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

The involvement of some members of the group in outreach activities is at a satisfactory level. More actions could however be undertaken for such an appealing research topic of the group.

Assessment of the unit's organisation and life

The NEMO experiment is a small-scale experiment that does not requires a large organisation. The NEMO group promoted its young members and allowed them to play important role within the NEMO experiments and the SUPER-NEMO project. Responsibilities within the NEMO LAL group are well shared among its members. This applies for both NEMO collaboration activities and the LAL decision instances.

Assessment of the unit's involvement in training through research

The NEMO team is strongly involved in the teaching and training activities thanks to the presence of two university staffs in the group. Group CNRS researchers contribute also to these activities by taking part to laboratory tutorials for the master level teaching. In addition, the team members supervised several internships and two doctoral students were defended in the period between 2008-2013. This is rather a satisfactory number taking into account the limited source of thesis funding.

Assessment of the strategy and the five-year plan

The strategy of the group for the five coming years is well defined. The R&D of the SUPER-NEMO demonstrator is being completed; the next step will be the installation of the demonstrator in the Frejus site followed by a calibration period preceding the exploitation of the collected data. The analysis of the data will determine whether the NEMO concept can be one of the future European large scale ββ0ν decay experiments.

Conclusion

The NEMO team plays an essential role in the field of the ββ0ν decays. Its members are young and active. They contributed strongly to the data collected by the previous NEMO experiments and they are participating actively to the SUPER-NEMO project. The group succeeded in the period 2008-2013 to maintain an excellent reputation. The activity of the group in the five coming years should be concentrated on the SUPER-NEMO demonstrator.

- ***Strengths and opportunities:***

Long experience with the ßß0ν decays study and a good knowledge of the so-called calometer-tracking technique, allowing the group to maintain a leadership role in the SUPER-NEMO project. Young, active and well motivated members.

- ***Weaknesses and threats:***

The size of the group compared with many responsibilities within the SUPER-NEMO project (BIPO detector, SUPER-NEMO demonstrator mechanics and electronics readout...).

- ***Recommendations:***

Provide the technical support necessary for the group to maintain its leadership in the SUPER-NEMO project. Share some of the responsibilities with other SUPER-NEMO groups in case its size is not increased in the two coming years.

Theme 12 (E12)

VIRGO / Advanced VIRGO

Manager's name :

Mr Patrice HELLO

Workforce

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
N1: Permanent professors and similar positions	1	1
N2: Permanent EPST or EPIC researchers and similar positions	4	5
N3: Other permanent staff (without research duties)	3	
N4: Other professors (PREM, ECC, etc.)	1	1
N5: Other EPST or EPIC researchers (DREM, Postdoctoral students, visitors, etc.)	2	
N6: Other contractual staff (without research duties)		
TOTAL N1 to N6	11	7

Theme workforce	Number as at 30/06/2013	Number as at 01/01/2015
Doctoral students	2	
Theses defended	1	
Postdoctoral students having spent at least 12 months in the unit	2	
Number of Research Supervisor Qualifications (HDR) taken		
Qualified research supervisors (with an HDR) or similar positions	3	4

• Detailed assessments

Assessment of scientific quality and outputs

The detector characterisation work is regarded internationally as of the very highest level, and has a high impact across the Virgo project. Likewise, the data analysis for gravitational-wave detection is at a very high level, with LAL leading on two high-profile searches in Virgo-LIGO (cosmic strings, gamma-ray bursts). Finally, the instrumental work on vacuum controls and lock acquisition has earned LAL important roles in the commissioning of Advanced Virgo. A total of 59 articles have been published as well as 33 conference proceedings.

Assessment of the unit's academic reputation and appeal

The Virgo LAL group has a very strong reputation in the LIGO-Virgo community, with LAL personnel taking high-level roles in Virgo and LIGO-Virgo joint activities. Of particular importance, over the evaluation period LAL personnel held the chair positions of the Data Analysis Council and the Burst Working Group, and sat on the LIGO-Virgo Detection Committee. LAL members are active in organizing international conferences, and teach at national and international summer schools. LAL members are also hold positions of esteem outside the gravitational-wave community; for example, they include a member of the CNRS National Commission 01, and members of the Scientific Council for several outside institutions. Unit members are also active in administration and committees locally.

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

The LAL Virgo group is active in outreach, such as by giving talks to school students and visitors to LAL. A LAL Virgo member also serves as the Outreach Coordinator of LAL. There is an excellent future potential to exploit the Einstein General Relativity centenary and the expected first gravitational-wave detection in the next few years: the LAL Virgo team may be able to profit from how the LAL Atlas team has exploited the Higgs discovery for public outreach purposes.

Assessment of the unit's organisation and life

The unit has an informal but effective organization. This is thanks in part to the use of shared offices, which allows group members to meet daily. Another strength is that several of the personnel are active across the two main themes of data analysis and instrument development, and most personnel are involved in a range of activities.

Assessment of the unit's involvement in training through research

In the team, several members contribute to masters and doctoral teaching. In particular the members of the group have leading position in the university structures (vie-president of the physics department) and are members of the future Paris-Saclay University instances (physics department, senate). They teach at national and international summer schools. The CALVA apparatus is used effectively for the second goal of training students in additional to Virgo research; to date approximately 12 students have trained on the system, notably including 3-4 Virgo members from outside LAL. The unit has a strong and increasing level of internships. While the unit suffers from a small number of doctoral students, it should be noted that 3 of the 4 members leaving group in 2008-13 now have permanent research/academic positions.

Assessment of the strategy and the five-year plan

The unit’s five-year plan encompasses a healthy mix of activities: data exploitation (burst searches), commissioning of Advanced Virgo (detector characterization, vacuum control, locking), and longer-term R&D for upgrades to Advanced Virgo or third-generation detectors (TDM). These data exploitation and commissioning activities are both high priority and high profile, and in particular, the feedback of detector characterisation to commissioning may prove vital to maximizing the scientific return from Advanced Virgo.

Conclusion

- ***Strengths and opportunities:***

Strong contributions to detector characterization and data analysis with the initial Virgo detector, putting them well placed to exploit successful Advanced Virgo operation.

- ***Weaknesses and threats:***

Lack of postdoctoral fixed term researcher positions, which is a general problem.

- ***Recommendations:***

Make the successful operation of Advanced Virgo as the absolute highest priority for the LAL–Virgo unit with an aim to maximize the scientific exploitation of Advanced Virgo.

5 • Conduct of the visit

Visit dates

Start:	Monday, 25, November, 2013, at 09:00
End:	Wednesday, 27, November, 2013, at 16:00

Visit sites:	Linear Accelerator Laboratory
Institution:	CNRS and Universite de Paris-Sud 11
Address:	Batiment 200, F-91898 Orsay cedex, FRANCE

Conduct or programme of visit

2013, November 25th, Monday

09:00	Results and projects (Director)
10:30	Pause
Presentations	
10:45	ATLAS
11:10	LHCb
11:30	ILC
11:45	« Phénoménologie/Théorie »
11:55	SUPERNEMO
12:10	« Interactions Laser-Faisceau de particules »
12:25	Cosmic Rays
12:40	Cosmology
13:00	Lunch
14:00	VIRGO
14:15	R&D Accelerators
14:35	Détectors and Plateforms
14:50	« Autour du calcul »
15:05	Pause
15:15	Meeting with the Laboratory Council
15:45	Meeting with the Scientific Council
16:15	Meeting with the PhD
16:40	Meeting with the Post-doctorants
17:05	Teaching

17:30	Project P2IO Vallee/Plateau
18:00	Closed Session

2013, November 26th, Tuesday

Meeting with the teams

09:00	ATLAS
10:00	LHCb
10:45	Pause
11:00	ILC
11:30	« Phénoménologie/Théorie »
11:50	SUPERNEMO
12:20	VIRGO
12:50	Lunch
14:00	Cosmic Rays
14:30	Cosmology
15:15	« Autour du calcul »
16:00	Pause
16:15	Laser- particle beam interaction
16:45	R&D Accelerators
17:15	R&D Detectors et Plateforms
17:45	Meeting with CNRS and Paris-Sud University representatives

2013, November 27th, Wednesday

08:00	Meeting with the technical staff
08:30	SERDI (Electronic and Detectors)
09:00	DepAcc (Accelerator Departement)
09:30	SI (Informatic)
10:00	Pause
10:15	SDTM (Mechanichal)
10:45	SMI (Infrastructures)
11:00	Meeting with the Administration
11:30	Meeting with the directorate
13:00	Closed session

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 juin 2014

N/Réf. : 142/14/JB/LM/AL

Objet : Rapport d'évaluation d'unité de recherche
N° S2PUR150007944

Monsieur le Directeur,

Vous m'avez transmis le 28 avril dernier, le rapport d'évaluation de l'unité de recherche « LABORATOIRE DE L'ACCELERATEUR LINEAIRE» - LAL- N° S2PUR150007944, et je vous en remercie.

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

Monsieur Achille STOCCHI, Directeur de l'unité de recherche, n'a pas souhaité apporter de commentaires.

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

UNIVERSITÉ PARIS SUD
PRESIDENCE
Bâtiment 309
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