

LAPP - Laboratoire d'Annecy-le-Vieux de physique des particules

Rapport Hcéres

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

Section des Unités de recherche

AERES report on
the unit :

LAPP – UMR 5814

under the supervisory authority of the
following institutions and bodies :

CNRS

Université de Savoie

Juillet 2010



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

Section des Unités de recherche

Rapport de l'AERES sur l'unité :

LAPP – UMR 5814

Sous tutelle des établissements et
organismes

CNRS

Université de Savoie

Le Président
de l'AERES

Jean-François Dhainaut

Section des unités
de recherche

Le Directeur

Pierre Glorieux

Juillet 2010



Research Unit

Name of the research unit : LAPP CHAMBERY

Requested label : UMR

Name of the director : Mr Yannis KARYOTAKIS

Members of the review committee

Chairman :

Mr. Mario CALVETTI, Centre Européen de Recherche et Formation Avancée en Calcul Scientifique, Italie

Experts :

Mr. Claude VALLEE, CNRS

Mr. Bernard DEGRANGE, CNRS

Mr. Wolf-Dieter SCHLATTER, CERN, Suisse

Mr. Eckhard ELSSEN, Deutsches Elektronen-Synchrotron, Allemagne

Mr. Christophe YECHE, CEA Saclay

Committee members suggested by CNU, CoNRS :

Mr. Marc WINTER, CoNRS

Mr. Pierre ANTILOGUS, CNU

Observers

AERES scientific advisor :

Mr. Claude LECOMTE

University, School and Research Organization representatives :



Report

1 • Introduction

- Date and execution of the visit :

The visit took place on the 18th and 19th of February. The Agenda was well prepared. After a preliminary discussion with the directorate and the representatives of the Savoie University, the committee listened to 12 seminars describing the organization of the laboratory and its scientific activities. The seminars were well prepared. The committee met the members of the Laboratory Council, had an interview with the PhD students, and visited the workshops. In a dedicated final meeting the committee members exchanged their views and a common opinion was reached.

- History and geographical localization of the research unit, and brief presentation of its field and scientific activities:

LAPP was founded in 1976. It is an “ Unité Mixte de Recherche (UMR)” CNRS/IN2P3 and the University of Savoie since 1995.

- Management team :

- Directeur Adjoint : M. Jean Pierre LEES
- Directeur Technique : Mme Nadine NEYROUD
- Directeur Administratif : M. Lionel BERT-ERBOUL
- Assistante de direction : Mme Chantal CLAUS
- Secrétaire du Conseil de Laboratoire e Comité scientifique : M. Dominique DUCHESNAU, Adjoint : M. Alain MASSEROT
- Communication : M. Jean-Pierre LEES
- Enseignement : M. Daniel DECAMP
- Formation Permanente : M. Pierre DELEBECQUE
- Qualité : Mme Vanessa RIVA
- Valorisation : Mme Frédérique CHOLLET



- Staff members (on the basis of the application file submitted to the AERES) :

	Dans le bilan	Dans le projet
N1 : Nombre d'enseignants-chercheurs (cf. Formulaire 2.1 du dossier de l'unité)	8	8
N2 : Nombre de chercheurs des EPST ou EPIC (cf. Formulaire 2.3 du dossier de l'unité)	32	31
N3 : Nombre d'autres enseignants-chercheurs et chercheurs (cf. Formulaire 2.2 et 2.4 du dossier de l'unité)	7	5
N4 : Nombre d'ingénieurs, techniciens et de personnels administratifs titulaires (cf. Formulaire 2.5 du dossier de l'unité)	73	73
N5 : Nombre d'ingénieurs, techniciens et de personnels administratifs non titulaires (cf. Formulaire 2.6 du dossier de l'unité)	5	3
N6 : Nombre de doctorants (cf. Formulaire 2.8 du dossier bilan de l'unité et formulaire 2.7 du dossier projet de l'unité)	11	9
N7 : Nombre de personnes habilitées à diriger des recherches ou assimilées	27	25

2 • Overall appreciation on the research unit

- Summary :

The research program of the laboratory is well structured, it contains experimental Particle Physics with accelerators, without accelerators and a strong technical R&D. LAPP is in ATLAS and LHCb at CERN, and the two experiments have "complementary" physics programs. The study of B rare decays, with LHCb at LHC, continues the tradition and keeps the competences of the lab on heavy flavour physics, after the end of the BABAR experiment at SLAC. The lab participates in the VIRGO and Advanced-VIRGO projects. Advanced VIRGO has a high discovery potential for gravitational waves; it could initiate a new kind of gravitational wave astronomy. LAPP has been one of the initiators of VIRGO and continues to play a leading role. LAPP also makes important contributions to the AMS, HESSII, CTA experiments and astroparticles physics in space and on earth. A small but significant participation in the OPERA experiment, in the underground Gran Sasso laboratory, leaves the opportunity to discover direct neutrino oscillations, to keep the "culture" on neutrino physics in the lab and to put the base for possible future neutrino experiments. The physics program is accompanied by a substantial R&D on detectors. The inner tracking and the new electronics of the ATLAS ECAL on SLHC, the future calorimeter for the Linear Collider experiment, the beam instrumentation and precision mechanics for future accelerators are part of the program. The Technical Services are well organized, very competent and motivated. The lab is run successfully by consensus in a nice ambiance; the Scientific Committee is part of the Laboratory Council. The PhD students can write excellent thesis. The lab has very good relationships with the "Université de Savoie" and the local institutions.



- **Strengths and opportunities :**

- LHC physics: The participation in ATLAS and LHCb, including future detector upgrades, will provide many years of excellent research.
- Gravitational Cosmology: In case the Advanced Virgo Project discovers the gravitational waves, LAPP will be at the cutting edge of this new astronomy for many years.
- Astrophysics: The participation in AMS, HESSII and the CTA diversifies the lab programme, brings in an "astroparticle" culture and put the base for future activities, depending on the results of the present generation of experiments.
- R&D: A robust technical R&D program keeps the Technical Services at the technology forefront. In particular it is to be mentioned the construction of a prototype of the calorimeter for the future Linear Collider experiment, the CALICE project. It is about one cubic meter of hadronic calorimetry, with large Micromega chambers and integrated on board electronics. The technology could be used also in medical applications or in the LHC detectors upgrades. The technology that is necessary to stabilize in space, at the nanometer level, heavy and light objects is being developed in the framework of the VIRGO, HESSII, CTA, CTF3, LaVISTA projects. These studies are pursued in collaboration with the University of Savoie and the local industries.
- Technology: The Technical Services, mechanics, electronics and computing, are excellent, the best resource of the lab. They give substantial contributions to the local University research and to the local economy. The construction of a new building in the LAPP campus, called the "Mecatronique House" is a very important development. The building is dedicated to R&D on precision mechanics and the related active electronics. This is a way where more solid connections between research, local industries and the University can be built. The "Mecatronique House" will also host the Computer Centre, the "Mesocentre", which will be part of the LHC computing GRID and run by the LAPP Technical Services. The Mesocentre is open to the University research laboratories and will be open to the local industries, a very important contribution to the local economy.
- Living in the Annecy area is compatible with spending sufficient time at CERN, to participate and to contribute to its scientific life. The local Universities can have teachers which are at the cutting edge of particle physics. The PhD students can work on their thesis in Annecy while being active in the running of the experiments at CERN.

- **Weaknesses and threats :**

- Personnel Recruitment: It is necessary to increase the number of physicists to support the astroparticles physics branch of the lab. The lab took advantage of its expertise in precision mechanics to play an important role in the building of HESS II, CTA and Virgo detectors, but it is now important to have enough physicists to get the best scientific reward from those experiments.
- Technology Transfer: The quality of the LAPP staff is so high that an attempt to improve the connection of the lab with the local Universities and industries is possible and worthwhile; it should be one of the priorities of LAPP. A success could bring important contributions to the LAPP research program.
- Relation with the University: The relations with the surrounding large Universities should be strengthened. LAPP is a real opportunity. It is important to have University teachers working at LAPP. Physics courses, at the Doctorate level, should be organized at LAPP. Research activities in collaboration with the Universities should be favoured.
- Relations with the LAPTh : Intense contacts with the theory laboratory are key in the emerging phase of analysis of LHC data. Since theory is typically an attractive element for students LAPP should seek to maintain and possibly expand the scientific exchange between the departments.
- LHC running time: A large part of the LAPP physics program is based on the running of the LHC at CERN, there is the risk of further delays in reaching the nominal luminosity.



- VIRGO: The Advanced Virgo project is not yet funded. Further delays could imply to lose the competition with LIGO and miss the discovery.
- Linear Colliders: It is not known when and where a future Linear Collider will be built. The detector R&D for the linear colliders risks not having a specific application for many years.
- AMS: The AMS detector is under a final global test before being launched into space.
- HESSII: There are delays in the construction of the telescope mechanics, not a responsibility of LAPP. There might be further delays.
- Astroparticle physics: The team working on astroparticle physics is small. It is necessary to add some PhD students and one or two staff physicists to it, especially if AMS is launched and an interesting and competitive analysis emerges.
- Neutrino physics : the team working in the OPERA experiment is small, the participation to the analysis should be improved with the addition of a PhD student and/or a Postdoc.

- Recommendations to the head of the research unit :

- Scientific Priorities: Keep priorities on the LHC experiments and on the VIRGO project.
- Technical Services: Continue the R&D programs on detectors, advanced mechanics and computing, improve the collaboration with the regional Universities and Industries. The technical services are very good, keep selecting very good people and maintain the high standards.
- Future programs: Give support to future detector upgrades for LHC. Develop the Astroparticle Physics program of the lab. Continue the R&D for future accelerators and detectors.
- Personnel: The replacement of retired people is crucial. The lab is very active and well organized but a reduction in the number of researchers, or university professors, could have serious consequences. It is mandatory to keep at least constant the number of researchers. Try to have more support from the University, more university professors means also a more strict collaboration with the University. The committee considers it important to establish a stronger connection with the Grenoble University Campus and the LAOG (Laboratoire d'Astrophysique et Observatoire de Grenoble) since a close collaboration with the academic world and other laboratories can be very beneficial for all institutions.

- Production results :

(cf. http://www.aeres-evaluation.fr/IMG/pdf/Criteres_Identification_Ensgts-Chercheurs.pdf)

A1 : Nombre de producteurs parmi les chercheurs et enseignants chercheurs référencés en N1 et N2 dans la colonne projet	37
A2 : Nombre de producteurs parmi les autres personnels référencés en N3, N4 et N5 dans la colonne projet	14
A3 : Taux de producteurs de l'unité $[A1/(N1+N2)]$	95 %
Nombre d'HDR soutenues	6
Nombre de thèses soutenues	23
Autre donnée pertinente pour le domaine (à préciser...) 6 postdocs	5



3 • Specific comments

- Appreciation on the results :
 - Relevance and originality of the research, quality and impact of the results :

The research program of the lab is of top level quality. The most promising scientific results obtained include the discovery of CP violation in the B meson decays and the precision measurements of the Cabibbo Kobayashi Maskawa quark mixing matrix parameters. Kobayashi and Maskawa received the Nobel Prize for their contribution to the underlying theory. The contribution of LAPP to the construction and running of the electromagnetic calorimeter of the ATLAS experiment is outstanding. The LAPP ATLAS team, besides running the detectors, provides also the calibration constants for the energy measurement. They are ready to analyse the data.

The VIRGO detector has reached the predicted performance, in terms of background levels, to search for gravitational waves. A successful construction of the "Advanced VIRGO" detector will lead, very likely, to the discovery of the gravitational waves. All this is of fundamental importance and it will remain in the history of physics. The participation in the AMS, HESSII CTA experiments, part of the international astroparticle physics program, is challenging and promising in terms of scientific return.

- Number and quality of the publications, scientific communications, thesis and other outputs :

The LAPP had about 80 publications per year, averaged over the last 10 years, two thirds of which from the BABAR collaboration. The quality of the publications is top level. A reduction of the BABAR publications is expected but also an increase due to the start up of the LHC experiments. About four theses have been defended every year over the last ten years. Twelve PhD students are working every year at LAPP.

In the coming three years twelve theses will be defended, two on B physics, one in astroparticle physics, one on neutrino physics, one on the detection of gravitational waves, six on ATLAS and one on detector R&D.

- Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners:

The lab has a very strong connection with CERN; the proximity of CERN brings to Annecy very brilliant people. LAPP has also a very strong participation in the EGO Observatory in Italy. It shares with the Italian national institute of nuclear physics (INFN) the responsibility to run the VIRGO project. LAPP is part of the international community working in astroparticle physics. LAPP has very strong relations with the local "Université de la Savoie" and very good relations with the local political authorities.

- Ability to recruit high levels scientists, post-docs and students, and more particularly from abroad :

Among the PhD students working at LAPP six are from abroad, one from Grenoble, three from Lyon, one from Paris and two from other provinces. The French students, most likely, prefer to stay more centrally in France.

The quality of research at LAPP is top level.

- Ability to raise funds, to successfully apply for competitive funding, and to participate to scientific and industrial clusters :

82% of the budget is CNRS/IN2P3, 18% of the research budget is external. Total budget about 4 M euro in 2009.

The 18% is made of 8% Collectivités, 4% ANR and 6% the rest.



LAPP is involved in four European projects, EUROTeV(FP6), EUCARD(FP7), EGEE and ET (Einstein Telescope, FP7).

- Participation to international or national scientific networks, existence of stable collaborations with foreign partners :

All activities at LAPP are of international level. LAPP has a strong participation in the LHC experiments and collaborates with the R&D for future accelerators and detectors, still at CERN. LAPP has been a major actor in the creation and running of the Gravitational Waves Observatory "EGO", the VIRGO experiment, in collaboration with the INFN in Italy. It is involved in the Advanced VIRGO project.

- Concrete results of the research activity and socio-economic partnerships :

LAPP is geographically somewhat isolated in France. It is not easy for the lab to collaborate with the Universities of Lyon, Grenoble or Geneva, because of their distance from Annecy and the central attractiveness of CERN. Nevertheless LAPP is of extreme importance for the region of Annecy-le-Vieux and for the local University of Savoie. LAPP has, indeed, very good relations with the University and with the local authorities. Two examples are to be noticed, the construction of the "MUST" (Mésocentre de calcul et de stockage pour l'Université de Savoie), where the computing infrastructure necessary for the analysis of the ATLAS and LHCb experiment, part of the computing GRID of EGEE, is made available to the University. 75% of the university researchers in the scientific domains have access to this computing facility. Ten laboratories of the university are members of the MUST.

The second example to mention is the construction, again in collaboration with the "University of Savoie", of a new laboratory dedicated to R&D on advanced mechanics, microelectronics and controls, " La maison de la Mécatronique". Via such initiatives, the Technical Services of LAPP can give important contributions to the University Campus and to the local economy.

- Appreciation on the strategy, management and life of the research unit:
 - Relevance of the research unit organization, quality of the management and of the communication policy :

The lab organization is excellent. The technical services are very good and efficient, their design and construction capacity, excellent. They have built big and precise mechanics, sophisticated detectors and electronics, complex and powerful software. The ratio 2:1, engineers vs. physicists, seems to be optimal. The Scientific Committee, part of the Laboratory Council, gives the scientific advice to the Director. The Laboratory Council proposes how to use the financial and human resources, writes a "Contract d'Objective" for each initiative and nominates a "Chef du project". The "Chef du Project" prepares the planning in collaboration of the "Quality Engineer" of the lab. All this seems to work very well.

- Relevance of the initiatives aiming at the scientific animation and at the emergence of cutting edge projects :

LAPP is the centre of the « Centre International de Physique des Hautes Energies d'Annecy-le-vieux (CIPHEA) ».

- Contribution of the research unit staff members to teaching and to the structuration of the research at the local level :

Four Professors and four "Maîtres de Conférences", teach at the « UFR de Sciences Fondamentales et Appliquées (SFA) », at the « IUT d'Annecy-le-Vieux » and at the « Ecole Supérieure d'Ingénieurs Polytech'Savoie ».

Two Masters in Physics are organized, "Champs, Particules, Matière Condensée" with the ENS-Lyon and the University of Lyon1 and "Physique Subatomique et Astroparticules " in collaboration with the University of Grenoble1 and Grenoble2 INP.

One "Ecole Doctorale de Physique et d'Astrophysique (PHAST) is « co-accreditée » between « Université de Lyon1 », « ENS Lyon » and « Université de Savoie ».

4 • Appreciation team by team and/or project by project



Name of the team : VIRGO

Name of team leader : Mrs Frédérique MARION

	Dans le bilan	Dans le projet
N1 : Nombre d'enseignants-chercheurs (cf. Formulaire 2.1 du dossier de l'unité)	1	1
N2 : Nombre de chercheurs des EPST ou EPIC (cf. Formulaire 2.3 du dossier de l'unité)	6	6
N3 : Nombre d'autres enseignants-chercheurs et chercheurs (cf. Formulaire 2.2 et 2.4 du dossier de l'unité)	2	2
N4 : Nombre d'ingénieurs, techniciens et de personnels administratifs titulaires (cf. Formulaire 2.5 du dossier de l'unité)	6.45	7
N5 : Nombre d'ingénieurs, techniciens et de personnels administratifs non titulaires (cf. Formulaire 2.6 du dossier de l'unité)	1	1
N6 : Nombre de doctorants (cf. Formulaire 2.8 du dossier bilan de l'unité et formulaire 2.7 du dossier projet de l'unité)	0	1
N7 : Nombre de personnes habilitées à diriger des recherches ou assimilées	6	6

- Assessment on scientific quality and production :

The contribution of the LAPP group to the VIRGO project, a French Italian laboratory to search for gravitational waves, is outstanding and attested by the role played in the design and construction of the VIRGO interferometer. LAPP has built the detection system, the data acquisition system, developed the calibration methods and the necessary software for the online quality control of the data. The members of the LAPP team have been Spokesperson of VIRGO, Coordinators for the commissioning of the interferometer, Coordinator for the commissioning of the Electronics and the Software. One member of the group has also been deputy Director of EGO.

The VIRGO detector has reached the expected performances in terms of background levels.

At the moment LAPP is involved in the data analysis, and has the coordination of analysis group dedicated to the search for "coalescences binaries".

The group is now heavily involved in the design of an upgrade of VIRGO, the "VIRGO+" to reduce the shot noise and all the other sources of noise. They are preparing to replace the front-end electronics, the related software, put the detection system in vacuum and upgrade the calibration system.

Furthermore, the LAPP team is preparing for the "ADVANCED VIRGO" project, an upgrade that will increase the sensitivity of the experiment by three orders of magnitude. With such sensitivity it ought to be possible to detect the gravitational waves and to start the observation of the universe using them, in collaboration with the LIGO experiment in America.

- Conclusion :

The contribution of LAPP to VIRGO is outstanding and of very high quality. The group has succeeded to improve continuously the detection systems. With the ADVANCED VIRGO project they will be in the condition to discover the gravitational waves.



Name of the team : ATLAS

Name of team leader : Mrs Lucia DI CIACCIO

	Dans le bilan	Dans le projet
N1 : Nombre d'enseignants-chercheurs (cf. Formulaire 2.1 du dossier de l'unité)	2	1
N2 : Nombre de chercheurs des EPST ou EPIC (cf. Formulaire 2.3 du dossier de l'unité)	9	9
N3 : Nombre d'autres enseignants-chercheurs et chercheurs (cf. Formulaire 2.2 et 2.4 du dossier de l'unité)	2	2
N4 : Nombre d'ingénieurs, techniciens et de personnels administratifs titulaires (cf. Formulaire 2.5 du dossier de l'unité)	9 .85	1 0
N5 : Nombre d'ingénieurs, techniciens et de personnels administratifs non titulaires (cf. Formulaire 2.6 du dossier de l'unité)	0	0
N6 : Nombre de doctorants (cf. Formulaire 2.8 du dossier bilan de l'unité et formulaire 2.7 du dossier projet de l'unité)	6	4
N7 : Nombre de personnes habilitées à diriger des recherches ou assimilées	7	6

- Assessment on scientific quality and production :

The LAPP had a major contribution to the construction of one of the key components of the ATLAS detector, the liquid argon electromagnetic calorimeter, by assembling one third of the barrel modules and building part of the front-end electronics (Read-out Drivers). During the 2006-2009 period, the main activity on the calorimeter shifted to the detector commissioning with test beams, cosmic rays and first collisions, in which the LAPP group continued to play a leading role. They set up the basis of the calorimeter online calibration and were among the main contributors to the understanding of its response to photons and electrons, based on the various types of commissioning data. Their results are very important for the qualification of the detector for future physics measurements and discoveries. In parallel with these detector oriented activities, the LAPP group strongly contributed to the preparation of the longer term data analysis, both on the technical level by developing computing GRID tools, and on the physics side by investigating the potential of discovery for several channels, among which the Higgs boson in its two-photon decay. Overall the high productivity of the LAPP ATLAS group on the 2006-2009 period is manifest in the defence of five theses, more than 20 presentations to international conferences, and a strong contribution to many ATLAS internal notes and publications, including the first ones based on real data.

The recognition of the LAPP group within ATLAS is attested by the many central responsibilities taken by the group within the Collaboration, among which the coordination of the whole liquid argon calorimeter project, the management of the liquid argon online software, the convening of the Standard Model analysis group, or the management of the data distribution. The strong visibility of the group in the Collaboration helps to compensate for the relative distance of the laboratory to large University centers to attract students and visitors. The attraction of the group also benefits from the LAPP-LAPTH Physics centre CIPHEA and from its proximity to CERN. More than half of the many PHD students and post-doctorate scientists of the group are of foreign origin. The central contributions of the group in ATLAS by themselves imply a heavy and tight collaboration with many foreign institutes worldwide, but the group has also established privileged cooperation with several laboratories on specific topics, some of them being formalized in cooperation agreements such as with Asian or Polish laboratories. The group has also succeeded to benefit from non-CNRS funds like those from ANR to develop physics studies, and is actively looking for further funding opportunities to develop future upgrades of the detector.



The plans of the LAPP ATLAS group develop first along their expertise acquired on the liquid argon calorimeter. Their primary goal is to make the best use of the LHC data expected in the coming years, focusing on physics channels involving photons and electrons. They plan to concentrate first on high statistics Standard Model channels to understand the response of the detector, and to move progressively to searches for new physics as the luminosity increases. This is an optimal strategy, which will allow the group to strengthen its expertise and central role in physics based on calorimetry. The analysis activities of the group will further benefit from the development of the LAPP computing "mesocentre" MUST, to which the group already strongly contributed. In the longer term, the group naturally considers contributing to an upgrade of the liquid argon front-end electronics, which they built. Since the liquid argon calorimeter itself is likely to remain unchanged on the whole lifetime of the LHC program, they also intend to contribute to the necessary future upgrades of the ATLAS central tracker, in line with a general strategy of the Laboratory to develop an expertise in silicon detectors. This is a major inflexion in the technical program of the group, which however has a high chance of success since the group has started to develop tight collaborations with other French laboratories already strongly involved in those detectors within ATLAS. This project can therefore be encouraged.

- Conclusion :

The past and planned activities of the LAPP ATLAS group are of very high standard and characterized by a healthy balance between technical contributions, physics analysis and longer-term developments. The group has succeeded to maintain a strong internal coherence between its various activities and to take a central role in the Collaboration. The group is encouraged to further develop its high level of excellence along these lines in the new era opened by the LHC start.

Name of the team : LHCb/BABAR

Name of team leaders : Mr Boleslaw PITRZYK and Mr Jean-Pierre LEES

	Dans le bilan	Dans le projet
N1 : Nombre d'enseignants-chercheurs (cf. Formulaire 2.1 du dossier de l'unité)	2	2
N2 : Nombre de chercheurs des EPST ou EPIC (cf. Formulaire 2.3 du dossier de l'unité)	7	7
N3 : Nombre d'autres enseignants-chercheurs et chercheurs (cf. Formulaire 2.2 et 2.4 du dossier de l'unité)	1	0
N4 : Nombre d'ingénieurs, techniciens et de personnels administratifs titulaires (cf. Formulaire 2.5 du dossier de l'unité)	1.35	1.5
N5 : Nombre d'ingénieurs, techniciens et de personnels administratifs non titulaires (cf. Formulaire 2.6 du dossier de l'unité)	0	0
N6 : Nombre de doctorants (cf. Formulaire 2.8 du dossier bilan de l'unité et formulaire 2.7 du dossier projet de l'unité)	0	2
N7 : Nombre de personnes habilitées à diriger des recherches ou assimilées	4	5

This section covers the activity of the three experiments: BaBar, CKMFitter and LHCb. As several physicists of these groups are involved in two or three experiments we have considered in a common section the activity related to B-physics.



- **Assessment on scientific quality and production :**

The teams of Annecy are recognized by the quality of their technical realizations. In the experiment BABAR, the group conceived and built the gas system of drift chambers. The physicists had important responsibilities in the running of the detector BABAR during its phase of data taking. In an identical way, the team of the LAPP was in charge of the construction of a part of detector LHCb mechanics. They also conceived and realized successfully a part of the digital electronics of the LHCb calorimeter.

The BaBar experiment published more than 420 papers in renowned international journals such as PRL and PRD. The Annecy group has participated actively in this general effort since the beginning. More recently, it is very present in the measurements of the angle of the unitarity triangle, γ . This expertise acquired on BABAR will be re-used for the data analysis of LHCb where the measure of the angle γ constitutes one of the main objectives.

The physicists of the LAPP have a driving role in CKMFitter project which aims to combine the various experimental measurements and to confront them with the theoretical models. This project had a huge international success. Their Web site received more than 500 visits a month and their paper is quoted more than 600 times in publications.

Finally, the physicists of the LAPP were very fast in the analysis of the first LHCb data taken in 2009. They demonstrated in particular the good performances of the electromagnetic calorimeter by showing the first mass peaks of π^0 and η particles.

- **Assessment on the influence, the attraction and the integration of the team or project in its environment :**

Both BaBar and LHCb groups have trained a significant number of PhD students (one thesis defended a year on average for each project) and have attracted a continuous stream of quality post-docs.

The CKMFitter project obtained an independent funding from ANR thanks to a young LAPP researcher who in addition was awarded the bronze medal of the CNRS for his work in this project.

Project :

It is necessary to emphasize the very good coherence of the project because gradually the BaBar members leave this experiment that reached its end of data taking period and join the group LHCb, so bringing their experience for the study of the angle γ . In addition, the common activity in the project CKMFitter served as natural glue between both experiments.

The group LHCb chose to be involved in analyses such as $B \rightarrow J/\Psi \eta$ which are both original and promising and which allows the group to be present in very important analyses (measurement of $2\beta_s$).

Finally, the group manages to cover all phases of the analysis because their presence in the group CKMFitter gives them the possibility of participating in the phenomenological interpretation of the experimental measurements.

- **Conclusion :**

The teams of Annecy participate in international collaborations (within which the quality of their work, both for the construction of equipment and for the data analyses) are very recognized. They have ensured continuity and coherence in their strategy for the whole group (BaBar-CKMFitter-LHCb). With the first data of LHCb, a promising future appears for the B physics team of the LAPP.



Name of the team : AMS/HESS/CTA

Name of team leaders : Mrs Sylvie ROSIER-LEES and Mr Giovanni LAMANNA

	Dans le bilan	Dans le projet
N1 : Nombre d'enseignants-chercheurs (cf. Formulaire 2.1 du dossier de l'unité)	1	1
N2 : Nombre de chercheurs des EPST ou EPIC (cf. Formulaire 2.3 du dossier de l'unité)	3.5	3.5
N3 : Nombre d'autres enseignants-chercheurs et chercheurs (cf. Formulaire 2.2 et 2.4 du dossier de l'unité)	1	2
N4 : Nombre d'ingénieurs, techniciens et de personnels administratifs titulaires (cf. Formulaire 2.5 du dossier de l'unité)	9.95	8
N5 : Nombre d'ingénieurs, techniciens et de personnels administratifs non titulaires (cf. Formulaire 2.6 du dossier de l'unité)	0	0
N6 : Nombre de doctorants (cf. Formulaire 2.8 du dossier bilan de l'unité et formulaire 2.7 du dossier projet de l'unité)	2	0
N7 : Nombre de personnes habilitées à diriger des recherches ou assimilées	6	6

- Assessment on scientific quality and production :

The LAPP has been engaged for more than 10 years in the space experiment AMS devoted to the search for antimatter in cosmic rays. It had already contributed to the first prototype flown in 1998 on the shuttle "Discovery". The experiment is designed to investigate important issues in Cosmology, namely if part of cosmic antimatter is of primordial origin or is produced through exotic phenomena such as the annihilation of Dark Matter particles. The final experiment AMS-02 should be installed on the International Space Station (ISS). The LAPP group has been responsible for the instrumentation of the electromagnetic calorimeter, its assembly and integration. The calorimeter was further exposed to electron and proton beams of several energies at CERN in 2007 and the LAPP group analysed the corresponding data. These activities led to four publications in refereed reviews and to the defence of two Ph.D. theses in LAPP.

However, due to the uncertainties in the future of the ISS, the launch of AMS-02 has continuously been delayed. Therefore in 2006, the LAPP group decided to join the ground-based experiment HESS in gamma-ray astronomy, since some of the goals of AMS-02, in particular the search for Dark Matter annihilation products, can be reached through the detection of very-high-energy photons. The HESS experiment, located in Namibia, consists of 4 telescopes detecting extensive showers created by cosmic particles in the atmosphere. It has been successfully operated since 2003 and has now produced a catalogue of about 100 astrophysical sources emitting in the TeV range. The admission of LAPP to the HESS collaboration was obtained through its commitment to building part of an additional very large telescope (HESS II) equipped with a 3 tons camera. The LAPP is responsible for an original mechanical system allowing for automatically unloading the camera from the telescope arms and bringing it to an experimental hall for maintenance and calibration tests. This system was presented to the committee during its visit. Since 2006, the work of the LAPP team in the framework of HESS data analysis led to the defence of one Ph.D. thesis and to 3 presentations by LAPP physicists in international conferences. Among the 36 papers published by HESS in refereed reviews since 2006, the LAPP team essentially contributed to those related to Dark Matter search and to pulsar wind nebulae. In addition, an article on an original analysis method of HESS events was based on the thesis work carried out at LAPP.



In 2010, due to NASA recent decisions, the AMS-02 experiment has been revived and is supposed to be installed on the ISS in September. The LAPP group must now face additional tasks, whereas, simultaneously, a large collaboration is being formed in view of creating an international observatory, "Cherenkov Telescope Array" (CTA) whose sensitivity should be 10 times better than that of HESS. In this framework, the LAPP technical team started to study light mechanical structures for very large telescopes and LAPP physicists are developing several computing tools (use of the computing grid and event simulation).

- Assessment on the influence, the attraction and the integration of the team or project in its environment :

The AMS-02 experiment is carried out by a collaboration of 50 institutes in 16 countries, led by Prof. S. Ting (Nobel laureate). Due to the performance of the electromagnetic calorimeter and to its contributions in working groups on Dark Matter, the LAPP team is well visible in the collaboration. On the national level, this team also actively participated in the working groups of two CNRS research groupings, namely "GDR Phénomènes Cosmiques de Haute Energie " and «GDR SUSY» (super-symmetry).

The HESS experiment involves about 100 physicists in 32 laboratories, mainly in Germany and France. In this collaboration, the LAPP group has been particularly appreciated due to the unprecedented achievement of the camera unloading system. This team is now more and more involved in the analyses of astrophysical sources as well as in the search for gamma-rays from the annihilation of Dark Matter particles.

- Assessment on the strategy, the management and the life of the team or project :

With AMS, the LAPP group has been involved in an original albeit risky space project, due to the uncertainties on the future of the ISS. The launch being continuously delayed, the decision of the team to join HESS in 2006 was well justified, in order to address the search for Dark Matter through different means. Similarly, the technical choice of LAPP in the building of HESS II was very appropriate due to the expertise in automation already acquired by LAPP engineers (cf. OPERA).

In parallel, in the analysis of HESS data, LAPP physicists have stated their interest for the physics of astrophysical sources.

However, the group must be strengthened in order to face the restart of AMS-02, as well as the participation to CTA. Taking the present commitments of the team into account, the limited technical task of LAPP in the space project POLAR - not yet approved - should only be considered as a backup activity for keeping this expertise.

- Assessment on the project :

With HESS II and CTA, the long-term project of the group is well centred on very-high-energy gamma-ray astronomy, i.e. the study of objects such as supernova remnants, neutron stars, black holes and relativistic jets in which violent cosmic phenomena take place. The scientific reward here is guaranteed. In addition, exotic phenomena such as Dark Matter annihilation may be discovered.

With the new very large telescope scheduled for 2012, HESS II will open new possibilities of combined observations with gamma-ray satellites such as the « Fermi Large Area Telescope ». In parallel, R&D activities on CTA telescopes will be carried out, followed by the building of prototypes and of that of final instruments, in view of starting the operation at the end of the present decade.



- Conclusion :

- Opinion :

The technical achievements of the LAPP team, both for AMS and HESS are remarkable. It is now mandatory to get the best scientific return from this work, which requires a significant increase of the number of physicists in the group.

- Strengths and opportunities :

The physics programme is rich and promising, both in AMS and HESS. Furthermore, the team has used the technical expertises of LAPP in an optimal way.

- Weaknesses and risks :

The weak point is of course the presently too low number of permanent physicists, now in charge of three projects (AMS, HESS and CTA). It will be important to carefully select the physics topics addressed by the group in order to avoid dispersion.

- Recommendations :

The committee approves the strategy of the director of LAPP aiming at reinforcing the group by one permanent physicist for HESS and CTA and two post-docs on AMS. The priority should clearly be the long-term activities HESS and CTA. The LAPP being soon linked to the Doctoral School of the University of Grenoble, the opportunity of strengthening the contacts with theoretical astrophysicists from LAOG, also involved in HESS and CTA is encouraged.

Name of the team : OPERA

Name of team leader : Mr Dominique DUCHESNEAU

	Dans le bilan	Dans le projet
N1 : Nombre d'enseignants-chercheurs (cf. Formulaire 2.1 du dossier de l'unité)	0	1
N2 : Nombre de chercheurs des EPST ou EPIC (cf. Formulaire 2.3 du dossier de l'unité)	3	3
N3 : Nombre d'autres enseignants-chercheurs et chercheurs (cf. Formulaire 2.2 et 2.4 du dossier de l'unité)	1	1
N4 : Nombre d'ingénieurs, techniciens et de personnels administratifs titulaires (cf. Formulaire 2.5 du dossier de l'unité)	0.4	1.5
N5 : Nombre d'ingénieurs, techniciens et de personnels administratifs non titulaires (cf. Formulaire 2.6 du dossier de l'unité)	0	0
N6 : Nombre de doctorants (cf. Formulaire 2.8 du dossier bilan de l'unité et formulaire 2.7 du dossier projet de l'unité)	0	1
N7 : Nombre de personnes habilitées à diriger des recherches ou assimilées	5	5

- Assessment on scientific quality and production :

The OPERA experiment is dedicated to the detection of neutrino oscillations through the apparition of tau neutrinos in an almost pure beam of muon-neutrinos produced at CERN. The detector is located 730 km away from CERN, in the Gran Sasso underground laboratory, in Italy. OPERA should improve our knowledge of the neutrinos sector of particle physics, in particular on the mixing angles.



The LAPP group took a crucial responsibility in the building of the detector in which the target is made of a large number of “bricks” (i.e. sandwiches of emulsion and lead plates), thus requiring a complex handling and management, both during the building phase and during data taking in view of further analysis. This task, which requires an advanced automation system, was successfully carried out under the responsibility of the group, thanks to the continuous presence of the technical team of the LAPP in the Gran Sasso laboratory from 2006 to 2008

Data taking started in 2007 and 2008, allowing for a thesis defence in LAPP. Using these first results, the group has developed event reconstruction algorithms, signed five publications in refereed reviews and gave five presentations in international conferences. However, the bulk of the statistics available to-date has only been obtained in 2009 and the group is now centring its activity on the analysis of the new data.

- **Assessment on the influence, the attraction and the integration of the team or project in its environment :**

The OPERA experiment is carried out by a large international collaboration of 5 European countries (among which France and Italy) as well as Russia, China, Japan and Israel. The LAPP group has taken a well visible position in the collaboration: one member has been the permanent representative of French laboratories in the Collaboration Board during this period. The “Brick Manipulation Project Leader” has always been a physicist from LAPP. As far as data analysis is concerned, a LAPP researcher is co-convener of the working group on “Physics of oscillations”.

Advantage has been taken from the experience acquired in automation through the conception and building of the brick manipulator. This know-how turned out to be useful in the framework of another project of LAPP, namely the camera of the HESS II telescope.

- **Assessment on the strategy, the management and the life of the team or project :**

In the framework of OPERA data analysis, the LAPP group chose to centre its activities on a few crucial points: the reconstruction algorithm of two-vertex events and the study of the background due to charmed particles.

The group actively participated in the “Neutrinos” research grouping (GDR) of CNRS, two of its members being conveners of working groups. Furthermore, in collaboration with LAL (Orsay), the group was part of the R&D action “PMm2” funded by ANR in view of future neutrino detectors. This development has now been successfully concluded.

- **Assessment on the project :**

The OPERA experiment should go on taking data at least until 2012 in order to collect enough tau-neutrino candidate events. From now on, the group must concentrate its activities on data analysis. The committee appreciates that the group could be strengthened at the end of 2009 by the arrival of a “maître de conference” and of a new Ph.D. student, since it is mandatory for the group to fully take advantage of the scientific reward of OPERA.

Beyond the OPERA experiment, several orientations are presently considered for the future of neutrino physics. Concerning very large detectors, one possible technique is based on the detection of charged particles through Cherenkov Effect in water. In line with the preceding “PMm2” development, the LAPP group considers collaborating with a team of APC-Paris VII to build a prototype (MEMPHYNO) to be operated in the Modane underground laboratory.

- **Conclusion :**

- **Opinion :**

The OPERA group of LAPP achieved a high-quality work in the building of the detector and now plays an important role in event reconstruction and data analysis.

- **Strengths and opportunities :**

The experience already acquired by the LAPP physicists, particularly in the reconstruction and analysis tools already developed, should allow them to get the most out of new data and to successfully extract the rare tau-neutrino candidates.



- Weaknesses and risks :

The number of permanent physicists in the group is modest if one takes account of a forthcoming retirement. The recent arrival of additional researchers has contributed to maintaining the group size above the critical level to reach their data analysis goals. On the other hand, the future of neutrino physics beyond OPERA is still uncertain. The commitment of the group in the MEMPHYNO project is certainly a good choice but its opening on a very large future experiment is not guaranteed.

- Recommendations :

In the following years, the priority in the group activities should clearly be the analysis of OPERA data.

Name of the teams : LC Détecteurs / LAVISta / CTF3

Name of team leaders : Mrs Catherine ADLOFF, Mr A. JEREMIE and Mr S.

VILALTE

3 teams are grouped in a common project :

- ILC (resp. : C. ADLOFF)
- LAVista (resp. : A. JEREMIE)
- CTF3 (resp. : S. VILALTE)

ILC	Dans le bilan	Dans le projet
N1 : Nombre d'enseignants-chercheurs (cf. Formulaire 2.1 du dossier de l'unité)	1	1
N2 : Nombre de chercheurs des EPST ou EPIC (cf. Formulaire 2.3 du dossier de l'unité)	1.5	1.5
N3 : Nombre d'autres enseignants-chercheurs et chercheurs (cf. Formulaire 2.2 et 2.4 du dossier de l'unité)	0	0
N4 : Nombre d'ingénieurs, techniciens et de personnels administratifs titulaires (cf. Formulaire 2.5 du dossier de l'unité)	10	10
N5 : Nombre d'ingénieurs, techniciens et de personnels administratifs non titulaires (cf. Formulaire 2.6 du dossier de l'unité)	1	1
N6 : Nombre de doctorants (cf. Formulaire 2.8 du dossier bilan de l'unité et formulaire 2.7 du dossier projet de l'unité)	1	1
N7 : Nombre de personnes habilitées à diriger des recherches ou assimilées	2	2

• Appréciation sur la qualité scientifique et la production :

Besides its main stream activities addressing on-going or mid-term projects, the laboratory is also preparing for the next generation of collider experiments at the energy frontier, for which the flagship project is an e+e- linear collider. LAPP is involved in both collider options, ILC and CLIC, and contributes to the development of innovative beam instrumentation techniques as well as of a novel particle detection system.

The latter is an original approach to hadron calorimetry designed for event reconstruction based on particle flow (PFA). It consists in using thin gas chambers of the micromegas technology as active detection systems and in restricting the signal encoding to 2 ADC bits only. This is enough for PFA and allows minimising the power consumption and the complexity of the calorimeter read-out (which will require several thousand meters squared of chambers).



The team has adapted a front-end read-out ASIC design to the signals delivered by micromegas. It has also realised a read-out board which was integrated on the chamber in a way minimising its total thickness. The activity thus produced a deliverable including a complete detection and read-out chain. It was operated at the CERN-SPS. The test beam data, analysed by the team, established the proof of principle of the approach. This achievement was presented at several international conferences (e.g. LCWS-2008, IEEE-NSS/MIC-2008) and was incorporated in several publications.

This new approach of hadron calorimetry is an option for the SiD project, one of the two experimental concepts developed for the ILC. The team realised a detailed study of the SiD hadron calorimeter (HCAL) and provided its design for the Letter of Intent (LoI) published in 2009. It also contributed to the edition and coordination of the LoI.

The development is integrated in two large, international, detector R&D collaborations, called CALICE (53 institutes, 16 countries, 300 members) and RD51 (60 institutes, 21 countries) in which LAPP has a coordination responsibility. Within this framework, the next steps of the development consist in evolving towards the challenges of large surfaces in a magnetic field. An important driving force for this development is the Technical Design Report of the SiD concept, to be delivered in 2012.

The beam instrumentation group made a judicious choice for their engagement for the Linear Collider: stabilisation of the machine components and particularly the final focus. With beams of nm-size an active stabilisation at the sub-nm-level is a prerequisite to maintain luminosity of the colliding beams of CLIC where there is less beam-beam feedback during a bunch train. This engagement resulted from an early activity for both the ILC and CLIC to characterise the stabilisation requirements of various possible sites of the linear collider, a project funded by the European Commission. During this project the group obtained both the support table and the measurement equipment to understand the demands. The expertise has grown considerably. The proximity to the mechatronics department facilitated a thorough development for an active stabilization using piezo movers, which quite surprisingly achieves the required goal. Proper modelling of the relevant support components and their eigenmodes was necessary. The group is participating in the Advanced Test Facility (KEK, Japan) that will address the viability of the concept in a practical context. This activity is very special; currently there is no other group worldwide that strives for such precision for stabilisation as is required for e.g. CLIC. Applications for telescope mirror components can be envisaged.

The group is also developing special beam instrumentation and ancillary electronics circuitry that facilitates the determination of the beam position at CTF3. In addition, an electronics crate standard is developed that allows control of the beam over the entire length of the CLIC linacs.

Concluding, the team has made very valuable contributions to the design of future experiments at a linear collider, and has reached a high international visibility. It has also well defined and high profile plans for the coming four years, driven by the SiD TDR. It has chosen a demanding topic for beam stabilisation where it has acquired world-leadership. On all these activities the team will however face two serious difficulties. One is inherent to the present situation of the linear collider project, because of its still poorly defined timeline. It may therefore be worthwhile to incorporate alternative application domains in the development plan. The other difficulty is related to the team manpower, which is not guaranteed beyond 2010. Given the project quality, it is very desirable that the necessary resources be found.

Note de l'unité	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
A+	Non noté	Non noté	Non noté	Non noté



Nom de l'équipe : VIRGO

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
Non noté	A+	A+	A+	A+

Nom de l'équipe : ATALS

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
Non noté	A+	A+	A+	A+

Nom de l'équipe : LHCb / BABAR

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
Non noté	A+	A+	A+	A+

Nom de l'équipe : AMS / HESS / CTA

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
Non noté	A	A	A	A+

Nom de l'équipe : OPERA

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
Non noté	A+	A	A	A



Nom de l'équipe : CMS

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
Non noté	A	A	A	A

Nom de l'équipe : LC Detectors

Note de l'équipe	Qualité scientifique et production	Rayonnement et attractivité, intégration dans l'environnement	Stratégie, gouvernance et vie du laboratoire	Appréciation du projet
Non noté	A+	A	A	A+



Chambéry, le 19 avril 2010

Le Président de l'Université de Savoie,

à

**Monsieur le Directeur de la Section des unités de
recherche
AERES
20 Rue Vivienne
75002 PARIS**

Présidence

Affaire suivie par :
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N/Réf. : PRE/GA/sch/2009-10/193

**Objet : Rapport du comité d'experts concernant l'unité de recherche
« Laboratoire d'Annecy-le-Vieux de Physique des Particules » LAPP
Directeur : Yannis KARYOTAKIS**

Monsieur le Directeur,

Je tiens à remercier les membres du comité d'évaluation de l'AERES pour la production du rapport concernant l'unité de recherche intitulée « Laboratoire d'Annecy-le-Vieux de Physique des Particules ».

Je vous prie de bien vouloir trouver ci joint, les observations de portée générale sur le rapport d'évaluation formulées par le directeur de l'unité, auxquelles je souscris.

Je reste à votre disposition pour tout complément d'information et vous prie d'agréer, Monsieur le Directeur, l'expression de ma considération distinguée.


Gilbert ANGENIEUX

Siège social

Université de Savoie
B.P. 1104
73011 Chambéry cedex
France

Annecy-le-Vieux, 21 avril 2010

Objet : Observations au Rapport AERES

Chers collègues,

Je vous remercie pour votre rapport et le temps que vous avez consacré à notre laboratoire. Dans la grande majorité vos remarques et observations sont justes et bien accueillies par la direction et les différents groupes. Je tiens toutefois à apporter deux précisions.

- Le laboratoire fait partie de l'Université de Savoie (UdS) et nos liens ne peuvent être que très forts. Le LAPP est sous tutelle administrative du CNRS et de l'UdS, les enseignants-chercheurs participent à l'enseignement de l'université, et nous collaborons avec les laboratoires de l'université sur des programmes de recherche communs. En résumé le LAPP se sent partie de l'UdS.
- La physique des neutrinos a une longue tradition au laboratoire qui a participé depuis 30 ans à toutes les expériences pionnières. Dans notre stratégie pour le futur cette physique tient une place importante. Ceci n'est pas reflété dans votre rapport. Vous trouverez ci-dessous quelques points détaillés à ce sujet.

Le groupe OPERA s'étonne des termes employés pour qualifier son activité dans le résumé de l'appréciation globale de l'unité : "*A small but significant participation in the OPERA experiment*" ne représente pas de façon juste la réalité, d'ailleurs reconnue plus loin (page 16) : "*The LAPP group took a crucial responsibility in the building of the detector (...) both during the building phase and during data taking in view of further analysis*".

Dans les chapitres consacrés aux atouts et faiblesses du laboratoire, le groupe est choqué que la physique du neutrino soit la seule thématique à n'être mentionnée que dans les faiblesses. Il lui semble qu'elle devrait figurer dans l'autre partie, au même titre par exemple que l'astrophysique, car elle diversifie le programme de l'unité, garde une culture "neutrino" établie de longue date et constitue une base pour de futures activités.

Aucune mention de la physique des neutrinos n'apparaît dans le chapitre des recommandations à la direction de l'unité. De même le programme de recherche du laboratoire, jugé du plus haut niveau de qualité dans l'appréciation des résultats de l'unité, liste l'ensemble des programmes expérimentaux engagés au LAPP, à l'exception du programme neutrino.

Concernant l'évaluation individuelle de l'équipe OPERA, l'équipe exprime son désaccord sur la recommandation concernant les activités du groupe, qui peut être interprétée comme la négation de ses efforts à s'engager dans la préparation d'une future expérience Neutrino

En vous remerciant de votre travail remarquable,

Cordialement



Jean KARYOTAKIS
Directeur