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

Department for the evaluation of
research units

AERES report on unit:

Centre de Mathématiques et de Leurs Applications

CMLA

Under the supervision of
the following institutions
and research bodies:

ENS Cachan

Centre National de la Recherche Scientifique - CNRS



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 2006¹,*

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

On behalf of the expert committee,

- Mr Jean PONCE, 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: | Centre de Mathématiques et de Leurs Applications |
| Unit acronym: | CMLA |
| Label requested: | UMR |
| Present no.: | UMR 8536 |
| Name of Director (2013-2014): | Mr Nicolas VAYATIS |
| Name of Project Leader (2015-2019): | Mr Nicolas VAYATIS |

Expert committee members

| | |
|----------|---|
| Chair: | Mr Jean PONCE, ENS Paris |
| Experts: | Mr Christophe BERTHON, Université de Nantes (representative of CoNRS) Mr Michel BRONIATOWSKI, Université Pierre et Marie Curie Paris, (representative of CNU) Mr Massimiliano PONTIL, University College London, England |

Scientific delegate representing the AERES:

Mr Antoine HENROT

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

Ms Clotilde FERMANIAN, CNRS - INSMI

Ms Isabelle LERAY (directrice de l'école doctorale n°285)

Mr Stefano MARULLO, Université Paris-Descartes

Ms Sylvie POMMIER, ENS Cachan

Mr Daniel VANDERHAEGEN, CEA-DAM



1 • Introduction

History and geographical location of the unit

CMLA has been created on January, 1st 1990 in École Normale Supérieure de Cachan near Paris.

Management team

The director is Mr Nicolas VAYATIS, the vice-director is Mr Florian DE VUYST.

AERES nomenclature

ST1 Mathématiques.

Unit workforce

| Unit workforce | Number as at 30/06/2013 | Number as at 01/01/2015 |
|--|-------------------------|-------------------------|
| N1: Permanent professors and similar positions | 8 | 8 |
| N2: Permanent researchers from Institutions and similar positions | 3 | 3 |
| N3: Other permanent staff (without research duties) | 6 | 7 |
| N4: Other professors (Emeritus Professor, on-contract Professor, etc.) | 2 | 2 |
| N5: Other researchers from Institutions (Emeritus Research Director, Postdoctoral students, visitors, etc.) | 17 | 6 |
| N6: Other contractual staff (without research duties) | 6 | |
| TOTAL N1 to N6 | 42 | 26 |

| Unit workforce | Number as at 30/06/2013 | Number as at 01/01/2015 |
|--|-------------------------|-------------------------|
| Doctoral students | 26 | |
| Theses defended | 38 | |
| Postdoctoral students having spent at least 12 months in the unit* | 5 | |
| Number of Research Supervisor Qualifications (HDR) taken | 4 | |
| Qualified research supervisors (with an HDR) or similar positions | 13 | 11 |



2 • Assessment of the unit

CMLA is an applied mathematics laboratory, whose research is motivated and validated by real applications. Its activities span three main areas : fluid modeling and simulation, signal and image processing, and machine learning. CMLA is an excellent laboratory, and its members have received many national and international prizes. It maintains many academic, industrial, and international scientific collaborations, and its faculty is in charge of the internationally renown MVA masters program. The scientific strategy of CMLA could, however, be improved, with the aims of identifying core research objectives within each of the three focus areas, and attracting the young faculty that will be the key to the future of the laboratory at the 10-year horizon.

Strengths and opportunities related to the context

The main strength of CMLA is its recognized scientific excellence. Others include its abundant funding and its interactions with industry, CEA-DAM through the LRC-MESO, CNES, and other Cachan laboratories through the Farman Institute. The deep involvement of CMLA members in teaching at ENS Cachan and in the MVA masters program is another important strength. New opportunities include the Digiscope Equipex, as well as the new Cognac G biology initiative, joint with University Paris Descartes.

Weaknesses and threats related to the context

CMLA has a structure similar to that of a (small) US academic department, with its faculty members organized in three core areas (hubs), and working more or less independently with their own students and post-docs.

The presentation of the lab activities is deliberately very flat. For example, instead of identifying main research themes within each hub, the CMLA dossier lists a total of 30 essentially independent projects spread among the three hubs. This makes it very difficult to identify a scientific strategy.

Another concern is that the CMLA faculty consists of nine senior researchers and only two junior ones, and the committee did not feel that the laboratory was trying particularly hard to attract new and young talent. This begs the question of the future of CMLA in ten years.

Other risks have been identified by the CMLA members themselves: the move of ENS Cachan to Saclay poses a risk of attrition if some of the faculty members refuse to follow. IT support is also lacking, which is important given the large part of the CMLA activities dedicated to computing. The committee strongly agrees on both issues, although the decision to move to Saclay appears to already have been acted by ENS Cachan.

Finally, given the numerous computer science related activities of CMLA (extending all the way to scientific computing on GPUs), the committee was a bit surprised of the lack of interactions between CMLA and LSV, the computer science department of ENS Cachan.

Recommendations

The previous evaluation committee recommended that CMLA structures itself into teams with a finer granularity than the existing hubs. CMLA has chosen not to follow this recommendation and continues to affirm a flat organization into projects within each hub. This committee does not believe that arbitrarily grouping members of CMLA into teams is necessary. However, it feels that the main scientific themes pursued within each hub should be identified and put forward. The presentation of CMLA's activities as a number of unrelated projects is simply not satisfactory.

Scientific strategy could also be improved, especially regarding the recruitment of young faculty. This is a very important point that will determine the long-term future of the laboratory. The various « tutelles » and partner institutions of CMLA, in particular ENS Cachan and CNRS of course, but also perhaps CEA-DAM and University Paris Descartes, must assist the laboratory in this endeavour. But it is also the responsibility of the CMLA direction to develop a vision of the laboratory's future, and to attract brilliant young candidates at the "chargé de recherches" and "maître de conférences" levels. Inria has been identified as a potential partner by the CMLA members. This is an interesting idea. However, its success will require not only the high-level negotiations between institutions alluded to in the dossier, but also a convincing bottom-up argument demonstrating the scientific benefits for these institutions.



Given the crucial role of information technology (and computer science in general) in all scientific activities of CMLA, IT support must also be improved, again with the help of the « tutelles » and partner institutions. Interactions with computer science should be improved as well.

Finally, the CMLA direction has asked the committee for its opinion on the sustainability of the IPOL project. IPOL is an interesting and promising initiative, that probably needs a wider range of contributors (besides CMLA members and a core group of outside authors) to achieve its real potential. Its founders may wish to pair up with a learned society (such as SIAM, with which they already have some co-publishing agreement) if they want or need additional editorial resources. Other initiatives such as (for example) the Inria push for open-access journals may also prove useful in this context.



3 • Detailed assessments

Assessment of scientific quality and outputs

The publication record of CMLA is very good, with about 200 articles in the review period, most of them in leading international journals, plus another 100 conference papers. The laboratory hosts a large number of PhD students and post-docs, and 38 PhD and 9 “HDR” theses have been defended in the review period.

The research themes pursued in the three hubs of CMLA are timely, and well motivated by both scientific questions and applications. The emergence of the machine learning hub show that CMLA can develop new research groups in emerging and important domains.

The IPOL on-line journal started and maintained by CMLA members also has a good potential for impact since it makes peer-reviewed image processing software available to the community at large, along with evaluation tools.

Assessment of the unit's academic reputation and appeal

As stated earlier, CMLA is an excellent laboratory, and its members have received many national and international awards, including the Gauss, Monpéti, and Inria prizes, and a Sr. ERC grant. One of them is a member of the French Academy of Sciences, and two more are members of the “Institut Universitaire de France”. Several more have been invited to deliver plenary lectures at prestigious venues, such as the International Mathematics Conference. Several PhD theses have also been recognized by French awards. The CMLA researchers are very active in the academic community, and they include the co-director of the Jacques Hadamard Mathematical Foundation, the editor-in-chief of the International Journal on Finite Volumes, and associate editors for many international journals.

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

The interaction with CEA-DAM (through the LRC-MESO), CNES, and industry (for example DXO) is excellent, with many contracts and “CIFRE” PhD theses. Several pieces of software for scientific computing and image processing have been released by CMLA, and several of them are now used by CEA and CNES. Several patents have been issued; one of them is licensed to a US company, with another one leading to a spinoff on scoring and ranking high-dimensional data. CMLA has also been named one of the three NVIDIA CUDA research centers in France. In addition, one of its faculty members is the chief scientific editor of the popular magazine “La Recherche”, and the CMLA work on tsunamis has been written about in the MIT Technological Review and the Economist.

Assessment of the unit's organisation and life

CMLA is managed by a team consisting of its director and associate director, its administrator, and the head of the IT team. This follows the suggestions of the previous evaluation committee. Scientific decisions are made in a collegial fashion by a steering committee consisting of all senior faculty members.

Work conditions at CMLA are excellent, as confirmed by all its members met by the committee, from faculty and PhD students to administrative and technical staff. The scientific life of the laboratory is enriched by numerous seminars

Assessment of the unit's involvement in training through research

The CMLA faculty is deeply involved in teaching at ENS Cachan. It also participates in several masters programs. The MVA program stands out among these, and offers an outstanding and widely recognized M2-level curriculum in image processing, machine learning, neurosciences, and computer vision, with a strong emphasis on geometry, statistics, and analysis. Nearly 60 students attend the MVA program, many of them from one of the “écoles normales supérieures” or one of the top French engineering schools, and the majority of these students go on to do a PhD at CMLA or one of the other mathematics laboratories in the Paris area. PhD students at CMLA are enrolled in the “Ecole doctorale sciences pratiques”, ED 285 of ENS Cachan.



Assessment of the strategy and the five-year plan

CMLA's five-year strategy is declined along three axes: (1) New scientific projects: the dossier lists 7 new projects, that are listed without particular structure or link with each other, very much like the existing projects. They look interesting but do not reveal an overall scientific strategy. (ii) Flagship initiatives linked to multi-core computing and the NVIDIA Center, the Digiscope display wall and its applications, and the IPOL and SPOL journals. (iii) A development plan with cross-hub projects, interfaces, and new interactions: this includes a proposal to use the modeling and simulation of complex systems as an opportunity for the different hubs to collaborate; the COGNAC C initiative, joint with University Paris-Descartes, and involving both the SIP and MLDMA hubs; the potential creation of a joint digital data lab with an industrial partner to be identified; the CMLA involvement in the Farman Institute; and a new interdisciplinary ANR project involving biological and social sciences. CMLA members have identified IT support as a strategic need, and the committee fully agrees. Creating a joint Inria/CMLA team on multi-core processing is also seen as an opportunity for growth, and it is certainly a path to investigate, although getting Inria involved may require a clearer scientific plan than sketched in the dossier. Beyond its clear scientific interest, the Cognac-C initiative is also seen as an opportunity for additional resources, notably space. Overall, the five-year strategy is reasonable, but lacks a clear vision of the main scientific objectives to be achieved.



4 • Theme-by-theme analysis

Theme 1: Complex Systems, Fluids and Waves

Manager's name: Mr Florian DE VUYST

Workforce

| Theme workforce in Full Time Equivalents | As at 30/06/2013 | As at 01/01/2015 |
|---|---------------------|---------------------|
| FTE for permanent professors | 6 | 6 |
| FTE for permanent EPST or EPIC researchers | 5 | 5 |
| FTE of other permanent staff without research duties (IR, IE, PRAG, etc.) | 1 | 1 |
| FTE for other professors (PREM, ECC, etc.) | | |
| FTE for postdoctoral students having spent at least 12 months in the unit | 2 | |
| FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students | | |
| FTE for other contractual staff without research duties | | |
| FTE for doctoral students | 10 | |
| TOTAL | 24 | 12 |

• Detailed assessments

The scientific activities of this group essentially focus on numerical analysis and scientific computing problems coming from industry. Many of these activities remain strongly linked to the LRC-MESO, and industrial contracts provide funding for several PhD theses.

CSFW is built around several key themes: kinetic models, multifluid flows, free surface flows, scientific computing. During the last four years, the efforts devoted to kinetic models have taken off, leading to a large number of articles published in top international journals. The other activities are more mature, with a well recognized CSFW expertise. The team has obtained important modelling results (for instance, kinetic models), and participated to the emergence of new numerical algorithms (for instance, finite volume methods), with a real expertise in industrial codes, linked to new developments in parallel and high-performance computing. The group has clearly invested in this direction, and has been labelled NVIDIA CUDA Research Center.



The committee recommends that CSFW members ponder the pros and cons of having so many industrial research contracts: although they provide CSFW with financial autonomy and guarantee the industrial pertinence of its research, there is a risk that they may lead to "too" applied mathematics, away from the expertise in PDEs and numerical analysis that has been a key factor in CMLA's reputation. In a similar vein, although being concerned with parallel, high-performance, and GPU computing is not only natural, but mandatory for a team as involved in scientific computing as CSFW, too much focus on these areas may lead its members to stray away from their initial expertise in applied mathematics.

Conclusion

▪ Strengths and opportunities:

The scientific production of the group is very good. A numerical evaluation of the publications leads to more than one article per permanent researcher and per year. These articles are mostly published in leading international journals (ARMA, SIAM J. Numer. Anal., for instance). In addition, the CSFW faculty members advise a dozen PhD students and over ten post-docs, with a dozen PhD and one "HDR" theses defended in the review period.

The collaboration of this team with the CEA with the joint-lab LRC-MESO is very positive and fruitful. The scientific project of CSFW for the next five years follows in the footsteps of the previous one, with an emphasis on many-core computation and the Digiscope display wall.

▪ Recommendations:

Given the wide variety of problems already addressed, it indeed seems reasonable not to attempt to diversify much further. Since the hub's faculty consists almost exclusively of full professors, the evaluation committee strongly recommends recruiting rank B personnel such as assistant professors.



Theme 2: Signal and Image Processing

Manager's name: Mr Jean-Michel MOREL

Workforce

| Theme workforce in Full Time Equivalents | As at 30/06/2013 | As at 01/01/2015 |
|---|---------------------|---------------------|
| FTE for permanent professors | 2 | 2 |
| FTE for permanent EPST or EPIC researchers | 3 | 3 |
| FTE of other permanent staff without research duties (IR, IE, PRAG, etc.) | | |
| FTE for other professors (PREM, ECC, etc.) | 1 | 1 |
| FTE for postdoctoral students having spent at least 12 months in the unit | 2 | |
| FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students | | |
| FTE for other contractual staff without research duties | | |
| FTE for doctoral students | 12 | |
| TOTAL | 20 | 6 |

• Detailed assessments

The SIP projects provide a very wide range of approaches and achievements, which have their roots in analysis, differential geometry and partial differential equations, and multifractal analysis. Along with these main topics, statistical issues are also handled, and a strong effort is made in order to address randomness and its analysis. A careful look at the SIP activities provides a strong impression of outstanding performance and of a very deep insight in the mathematical bases of their approaches. The SIP research also has a strong applied impact, and its results have proven useful in many aspects of image and video processing and analysis. Applications range from biology, cytology, medical diagnosis, anatomy, satellite imaging and design, etc.

The leaders of the SIP group are well known leaders in their various fields of expertise, and have earned major awards and prizes during the evaluation period. This includes the Gauss Prize in 2010, the Montpetit Prize of the Académie des Sciences 2010, the Grand Prix INRIA 2013 and plenary lecture invitations to distinguished international events in the field. The range of publications is quite large (about 95 papers in journals, 70 in proceedings, and several books), and the interaction with many collaborators in both the academic and industrial communities is impressive.



Overall, although the research in the SIP group is presented as 17 independent projects, it spans a few main topics: quasicrystals and irregular sampling, with the aim of reducing the number of measurements necessary to recover a signal whose Fourier transform has a compact support; mathematical and computational models of shape that are adapted to the analysis of biological structures in the human brain or heart for example; image analysis and remote sensing, including classification, rectification, stereovision and texture analysis; image restoration, including denoising, demosaicking, and flicker removal; and image synthesis, including accelerated realistic rendering. Methodological tools investigated include stochastic image and shape models, non-smooth optimization, Gestalt theory, spatio temporal correlation, and a contrario methods. Several of these topics are covered in the “Twelve labours of image processing” ERC project, which encourages reproducible research in image processing, notably with the creation of the IPOL on-line journal, and its sister publication dedicated to sound processing, SPOL.

Conclusion

- **Strengths and opportunities:**

SIP is a major international contributor in its fields of expertise. The number of new ideas, insights, and innovations obtained is impressive.

- **Recommendations:**

Some of the activities are close to learning theory, which is a relatively new branch of CMLA. Undoubtedly this is an important move which should be encouraged. It might be of great interest for CMLA to attract new talent from statistics or related fields.



Theme 3: Machine Learning and Massive Data Analysis

Manager's name: Mr Nicolas VAYATIS

Workforce

| Theme workforce in Full Time Equivalents | As at 30/06/2013 | As at 01/01/2015 |
|---|------------------|------------------|
| FTE for permanent professors | 1 | 1 |
| FTE for permanent EPST or EPIC researchers | | |
| FTE of other permanent staff without research duties (IR, IE, PRAG, etc.) | | |
| FTE for other professors (PREM, ECC, etc.) | | |
| FTE for postdoctoral students having spent at least 12 months in the unit | 1 | |
| FTE for other EPST or EPIC researchers (DREM, etc.) excluding postdoctoral students | | |
| FTE for other contractual staff without research duties | | |
| FTE for doctoral students | 4 | |
| TOTAL | 6 | 1 |

• Detailed assessments

The MLMDA group has proved to be a strong international player on topics pertaining both machine learning and well as statistical analysis. The research results obtained are at the intersection of mathematical statistics and machine learning theory. They show both depth and breadth. For example, the series of innovative papers on learning ranking functions has been very well received by both the machine learning and statistical communities. More recently, the group has initiated a series of more applied "data sciences" projects which promise to be a wealthy strategy to fund new PhD positions and make advances in more computational aspects of machine learning such as online learning and big data. This strategy is well supported by a number of industrial partners.

Among the projects undertaken by the MLMDA group, some stand out:

i) the study of predictive models for scoring and ranking high dimensional data. This has produced a series of rigorous and innovative papers which have appeared in some of the top journals in machine learning and applied mathematics;

ii) the development of novel methods for inference over graph data, such as link prediction and graph clustering. This line of research has had notable impact in applications fields such as collaborative filtering and e-commerce, among others;



iii) recent work at the intersection of machine learning and complex systems which has led to novel methodologies for estimating the maximum of functions by means of active learning strategies. Other related work has also received press release in top popular science journals.

Conclusion

▪ Strengths and opportunities:

Overall, the review committee judges the research output in MLMDA to be of excellent quality. This is demonstrated by the large volume of top quality journals (e.g. Machine Learning and Journal of Machine Learning Research) as well as several papers in top conferences in machine learning (Neural Information Processing Systems and International conference on Machine Learning). It is important to stress that such journals are increasingly targeted by people working in applied mathematical departments and the review process is highly competitive. In addition, we mention that some of the outgoing PhD students have found postdoctoral positions in leading international universities and highlight that the group has collaborations with top schools (INSEAD, Pompeu Fabra, Duke) and companies (Google).

▪ Recommendations:

The machine learning theme also fits well within the MVA master program, and we believe that the research activity in this area should be further boosted. To this end, we encourage recruiting new junior faculty members who would contribute to both teaching and new innovative research directions.



5 • Conduct of the visit

Visit date:

Start: Thursday, November 28th , at 8:30

End: Thursday, November 28th , at 18:30

Visit site : Ecole Normale Supérieure de Cachan

Address : 61 Avenue du Président Wilson, 94230 Cachan

Specific premises visited: laboratory, offices, image wall, library

Conduct or programme of visit:

| | |
|---------------|--|
| 08:30 - 09:00 | meeting of the committee |
| 09:00 - 09:45 | general presentation of CMLA |
| 09:45 - 10:00 | presentation of LRC-MESO |
| 10:00 - 11:00 | scientific talks (4 x15 mn) |
| 11:15 - 11:35 | meeting with pole coordinators |
| 11:35 - 12:00 | meeting with the steering committee |
| 12:00 - 12:10 | meeting with the direction team |
| 12:10 - 12:30 | visit of the lab |
| 13:30 - 13:50 | meeting with the administrative people |
| 13:50 - 14:10 | meeting with the PhD and post-doc students |
| 14:10 - 14:20 | meeting with rank B people |
| 14:20 - 15:00 | meeting with the director of ED and the heads of teaching structures |
| 15:00 - 16:00 | meeting with the unit's supervising institutions and bodies |
| 16:15 - 16:45 | presentation of the Farman Institute |
| 16:45 - 18:45 | final meeting of the expert committee |

Specific points to be mentioned:

The visit was well organized and informative.



6 • Supervising bodies' general comments

à

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

N/Réf.: PPZ/SP/CD 96

Objet : Réponses rapport d'évaluation - S2PUR150007923 - CMLA - Centre de Mathématiques et leurs Applications - 0940607Z

Monsieur le Directeur,

L'Ecole normale supérieure de Cachan a pris connaissance du rapport d'évaluation du comité d'experts. L'Ecole se félicite de l'évaluation très positive des résultats obtenus par le laboratoire au cours des cinq dernières années, résultats qui constituent une validation *a posteriori* de la stratégie scientifique conduite par le CMLA. Le fait que le thème 3 « Machine Learning and Massive Data Analysis », tout récemment créé, soit évalué très positivement, est, par exemple, un élément tout à fait significatif sur la capacité du CMLA à s'engager dans des choix stratégiques fructueux.

Concernant les recommandations, l'ENS Cachan partage, avec le CMLA, l'avis du comité sur l'importance de préparer le futur du CMLA et d'attirer les talents du CMLA de demain. Un poste de maître de conférences a justement été publié en 2014, cette décision faisant suite à un redéploiement interne, depuis une autre discipline, fruit d'une très longue réflexion et de délicates négociations. Par ailleurs, les projets partenariaux du laboratoire, tels que le développement du LRC ou d'une équipe projet INRIA, participent pleinement de cette stratégie de construction du futur.

Je souhaite maintenant apporter des réponses à quelques recommandations ou remarques du comité d'experts qui me paraissent diverger de celles que nous même faisons à l'ensemble de nos laboratoires et, singulièrement, au CMLA et ont été détaillées dans le résumé de cinq pages de la politique de recherche de l'ENS Cachan, résumé qui a été fourni aux comités de visite de chacun de nos laboratoires.

*Rapport d'évaluation AERES - Page 9 : « The committee recommends that CSFW members **ponder the pros and cons of having so many industrial research contracts**: although they provide CSFW with financial autonomy and guarantee the industrial pertinence of its research, there is a **risk that they may lead to "too" applied mathematics**, away from the expertise in PDEs and numerical analysis that has been a key factor in CMLA's reputation »*

Comme il est écrit dans le rapport « axes stratégique de recherche », la spécificité de la recherche à l'ENS Cachan, héritée de son passé d'école normale de l'enseignement technique, histoire qui a aujourd'hui un siècle, réside dans l'importance conférée à des fronts de recherche d'excellence où les questions de recherche fondamentales sont à l'épreuve de questions industrielles, technologiques, économiques ou sociétales. Cette orientation technologique et appliquée est revendiquée, sous l'appellation Aristotélicienne de « sciences pratiques », par l'établissement comme un **élément identitaire de sa politique de recherche** et va à l'encontre d'une séparation des sciences et technologies, des sciences dites dures et des sciences humaines et sociales, séparation qui prévaut, hélas, souvent en France. La contrainte, l'épreuve du réel, sont des éléments importants du processus créatif et contribuent à stimuler l'ouverture de fronts de recherche nouveaux, y compris de recherche fondamentale. Le contact avec les autres disciplines est également un facteur que nous encourageons. En ce sens, bien au-delà de l'autonomie financière et de la pertinence industrielle qu'apportent l'activité contractuelle ; c'est surtout une autre manière de faire de la recherche qui est portée par l'ENS Cachan et avec excellence par le CMLA.

Rapport d'évaluation AERES - Page 4 : « Other risks have been identified by the CMLA members themselves: the move of ENS Cachan to Saclay poses a risk of attrition if some of the faculty members refuse to follow. »

Les cinq dernières années ont été marquées par des choix structurants, par l'ouverture de chantiers très importants pour l'avenir de l'École et par des transformations très profondes de son contexte de travail. On pourra juger de ce contexte en rappelant quelques jalons : changement d'équipe de direction en 2009 (puis en 2012), réalisation de l'autonomie de l'antenne de Ker Lann en ENS de Rennes (2009 puis en 2012-2013), participation active au plan campus Paris-Saclay (depuis 2009), vote du CA pour la participation à l'Idex Université Paris-Saclay (2009 puis 2010), changement des statuts et du mode de gouvernance de l'établissement (en 2011), passage aux responsabilités et compétences élargies (en 2011), vote du conseil d'administration décidant le déménagement sur le campus Paris-Saclay (2011), élaboration dans cette perspective d'une pré-programmation immobilière détaillée et obtention de la dotation nécessaire de 180 M€ (2012), choix du cabinet Renzo Piano Building Workshop (en 2013) pour la construction de la nouvelle ENS, avec un déménagement programmé en 2018, reconfiguration progressive de nos formations (L3, M, D) et de nos partenariats universitaires en fonction de cet adossement (à partir de 2012) et élaboration d'une nouvelle carte de formations en master et doctorat (en 2013).

Ces mutations constituent un point charnière pour notre établissement, où les opportunités et les risques prennent naturellement plus d'ampleur que dans d'autres contextes. Le CMLA est un laboratoire qui dispose des meilleurs atouts pour pouvoir saisir les opportunités et limiter les risques. Son implication dans l'ensemble des actions Paris Saclay en mathématiques (fondation Hadamard, l'école doctorale Hadamard...) le place d'ailleurs déjà en excellente position. L'école est néanmoins tout à fait consciente et très soucieuse, du risque d'attrition, mais compte aussi sur l'intérêt que peut avoir, pour le CMLA, le fait que cette revendication d'une manière de faire de la recherche inspirée des questions industrielles, économiques et sociétales, est **partagée par les porteurs du Projet-Paris Saclay**, projet qui regroupera dans un même espace, les membres fondateurs académiques (universités, grandes écoles et organismes) et des centres de recherche et de formation industriels, tels que, entre autres, Danone, Thalès, Horiba, EDF, Renault, PSA, Air Liquide, Alcatel-Lucent, entre autres, deux pôles de compétitivités System@tic et Mov'eo et une SATT. Ce nouvel environnement devrait à offrir au CMLA un espace d'épanouissement plus large qu'aujourd'hui.

Rapport d'évaluation AERES - Page 4 : "IT support is [] lacking" puis plus loin "Finally, given the numerous computer science related activities of CMLA (extending all the way to scientific computing on GPUs), the committee was a bit surprised of the lack of interactions between CMLA and LSV, the computer science department of ENS Cachan"

Le CMLA est membre de l'institut Farman qui est dédié à la modélisation et à la simulation des systèmes complexes. L'institut Farman fédère les laboratoires CMLA, LSV, LMT, SATIE et LURPA. Les échanges scientifiques entre ces laboratoires sont vivants, autour de projets Farman, soutenu par de (petits) fonds d'amorçages, mais aussi par l'organisation commune de colloques (colloque sur la réduction de modèle) ou d'autres actions. En termes de IT-support, l'école s'est engagée, via l'institut Farman, dans un projet de contrat plan état région, à hauteur de 3 M€ entièrement consacrés, dès 2015, à l'achat de matériel informatique et mutualisé avec Centrale-Supelec et à terme sur Paris Saclay avec un hébergement à l'IDRIS en 2018. Cette action s'accompagnera d'une mise en réseau des personnels IT-Supports, en vue d'un partage et d'une montée en compétences en HPC et d'une diminution de certaines tâches de service support par la voie de la mutualisation. Par ailleurs, il a été demandé au CMLA de se décharger de certaines tâches informatiques qui ne sont pas des tâches de support à la recherche (serveurs d'e-mails) pour les centraliser et les automatiser au niveau de la DSI de l'ENS Cachan. Enfin un ingénieur de recherche a été recruté fin 2013 pour développer l'activité autour de l'équipex digiscope mur d'image.

En terme de collaborations avec les autres laboratoires, le LSV est un excellent laboratoire mais dont les thématiques le mettent moins en situation de collaborer avec le CMLA que d'autres laboratoires de Farman, tels que le LMT, par exemple, ou le LURPA. La collaboration entre le LMT et le CMLA n'est pas que virtuelle, elle est également **matérialisée par un lien physique (fibre haut débit de 10 Gbit/s)**, qui en connectant l'équipex digiscope (mur d'image), le cluster du LMT (1000 cœurs) et le tomographe (equipex matmeca - production dynamique d'images tridimensionnelles), connecte également le CMLA avec les équipes structure et système (HPC), génie civil et matériaux du LMT, et les activités scientifique autour du HPC et du traitement massif d'images.

Au-delà de ces remarques, l'établissement est également attentif aux remarques qui sont formulées par le directeur du CMLA, Nicolas Vayatis, que vous trouverez dans une lettre en annexe de celle-ci.

Je vous prie d'agréer, Monsieur le Directeur, l'expression de mes salutations distinguées.

Pierre Paul Zalio
La Vice-Présidente Recherche
Sylvie POISSON
Présidente de l'ENS Cachan
POISSON

Lettre du directeur du CMLA, Nicolas Vayatis

M. Le Président du Comité AERES, M. Le délégué AERES,

as the Director of CMLA, I take note of the final report for the evaluation of our unit.

I want to point out that we consider this document as an important feedback on the positioning, organization, management and strategy of CMLA, from which we expected useful recommendations for us and for our leading institutions ('tutelles').

We are proud of the overall assessment from our distinguished peers, members of the evaluation committee, which highlights the "scientific excellence" (page 4) and the "deep involvement in teaching" (page 4) of the researchers of CMLA, and praises our academic reputation (page 6), our flourishing interaction with the social, economic and cultural environment (page 6), and the quality of work conditions for all our members (page 6).

Now, there are some specific points on which we feel that some additional elements need to be provided:

- ▶ Scientific strategy and objectives

We think that the positioning (interdisciplinary application-driven research) and the high level objectives (cf. flagship projects: tools for reproducible research, exploration of new technologies and hardware for scientific computing and visual interaction, strategic partnership for medical applications) have been clearly stated during the visit and in the main report we provided (page 3), and fully describe our scientific strategy and orientation for the next five-year plan (Section 4, from page 34). The report of past and ongoing scientific projects was deliberately presented "in a flat form" because it reflects our scientific organization which is nonhierarchical, transversal and project-based research grounded on the core expertise and tools developed within each group. Our numerous achievements and distinctions confirm our ability to develop and implement a long-term vision for our research.

- ▶ Attracting young faculty

We appreciate the fact that the committee underlines the need, *at this stage of the development of the CMLA*, for recruiting young faculty (with tenure positions). Thanks to its policy focused on attracting quite young senior faculty, CMLA was successful in developing a critical number of highly visible hubs in applied mathematics that could now host and greatly benefit from the opening of several juniors faculty positions. The conclusion of the committee confirms our assessment about the present composition of our permanent research staff that is highly unbalanced between senior and junior positions, as mentioned in our report (page 5):

"We also point out the asymmetry between junior faculty (two positions) and senior faculty (nine positions). This asymmetry is the result of the CMLA strategy over the years in a context where permanent positions were obtained in an incremental manner starting from two positions in 1989. It is undoubtedly thanks to this strategy that CMLA has reached its critical mass and has become a leading center for training and research in the field of applied mathematics at the international level. From now on, further new positions could be offered to junior scientists to bridge the generational gap but despite the needs, obtaining new openings in the present context is more than difficult."

This aspect is now a source of concern for us and we expect support from our 'tutelles' to pursue our development with additional positions through which the trend shall be inversed. At the same time, we aim at other sources for funding and augmenting our human potential directly or indirectly (INRIA, Université Paris-Descartes, industrial chairs). As a matter of fact, we receive several letters from brilliant and gifted young mathematicians from France and abroad which express the desire of joining the CMLA but we did not have the resources to hire them until now. The positive evolution

is that we have an opening in 2014 for a MCF (associate professor) position, thanks to the support of ENS Cachan.

▶ IT support

We mentioned in our report (page 5) the fact that, given our scientific orientations, our unit was undersized in terms of IT support. This point was also raised in the evaluation report and we agree on what is stated, up to some clarification. Indeed, we would like to emphasize the fact that the lack of IT personnel is the issue, and not computing facilities since CMLA has enough funding for equipping projects and researchers with personal computers and mutualized servers for storage, and we can also have access to computing resources on-campus (such as the cluster at the Mechanics Lab LMT) or remotely (through CEA). In the case of IPOL, we reported to the committee that the project simply needed two permanent staff to be sustainable on the long term, namely one research engineer and one journal manager. Institutional support from ENS Cachan or CNRS in terms of one engineer position would allow consolidating this initiative.

To conclude this letter, I would like to warmly thank the members of the committee for their visit and their work, and for the useful recommendations.

Sincerely,

A handwritten signature in black ink, appearing to be 'N. Vayatis', written over a horizontal line.

Prof. Nicolas Vayatis
Director of CMLA