CSIC PLAN OF ACTION 2005-2009

External Peer Review Panel on Theoretical and Experimental Physics for assessment on the Strategic Plans of the CSIC Centers and Institutes

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1 The peer review procedure

This Report describes the history of and the approach followed for the assessment of the scientific quality of the research Strategic Plans (2005-2009) proposed by CSIC Institutes in the area of Theoretical and Experimental Physics

1.1 Historical background: long term policy decisions

The 116 Institutes and Centers of the Spanish National Research Council (CSIC) act autonomously, under the umbrella of eight large scientific areas covering various fields of scientific and technological research. For each area, a Scientific Committee supervises and coordinates the activities of its associated Centers and Institutes. These areas are:

- Humanities and Social Sciences
- Biology and Biomedicine
- Natural Resources
- Agricultural Sciences
- Physics and Physical Engineering
- Material Sciences and Technologies
- Food Sciences and Technologies
- Chemistry and Chemical Engineering

CSIC Institutes and Centers have been requested last February to define, through a standardized in-house process, their own draft proposal of Strategic Plan (2005-2009) that should incorporate the different research approaches within the scope of their activities.

External Peer Review Panels have been set up for assessing the documents of the Strategic Plans (2005-2009) proposed by Institutes or Centers, and to advise the Area Scientific Committees on diverse aspects of their strategic positioning.

1.2 The research quality assessment guidelines

The Peer Review aims at an external assessment of the planned research activities and implementation strategies. Its scope focuses primarily on the Institute as a whole.

The members of this External Peer Review Panel take the responsibility of addressing various Institutes in the area of experimental and theoretical physics. They should assess in depth the Strategic Plan of Institutes and Centers that work on fields of research in which they are most familiar, taking into account the mission and the vision of CSIC which are summarized as follows:

Mission:

- To perform high-quality scientific and technological research in most of the fields of knowledge
- To carry out the management of national large facilities
- To train researchers and to provide highly-specialized formative activities
- To transfer knowledge to society performing high-quality contract research for the private sector and spreading science and technology for all
- To foster and participate in public-private partnership activities
- To advice and assess national and regional governments on science and technology issues

Vision:

- As a whole, to become one of the top research institutions among the ones of its kind in Europe.
- Additionally, to become a key element in the articulation of the research activity at national and regional levels in Spain.
- Regarding individual Institutes and Centers, to host some of the leading research institutes in Europe in fields included in the large scientific areas of Humanities and Social Sciences, Biology and Biomedicine, Natural Resources, Agricultural Sciences, Physics and Physical Engineering, Material Sciences and Technologies, Food Sciences and Technologies, and Chemistry and Chemical Engineering.

1.3 The assessment procedure

CSIC, through the Scientific Committee in each Area, appointed an External Peer Review Panel (EPRP) for seven Institutes in the area of theoretical and experimental physics. Proposals for members of these panels have been provided by ESF. The Panel is formed by the following international experts:

Professor Roberto Battiston (Chairman)	Member of the Board of Administration of INAF, Director of the INFN Section of Perugia, Italy
Professor Muhsin Harakeh	Chairman of NuPECC, Director Kernfysisch Versneller instituut; The Netherlands
Professor Johann Kühn,	Professor of Theoretical Physics Universität of Karlsruhe (TH), Germany, Member of the of the Kollegium der Deutschen Forschungsgemeinschaft
Professor Massimo Martinelli	Director of the Istituto per i Processi Chimico-Fisici, CNR, Pisa, Italy
Professor Giancarlo Righini	Head of Optoelectronics Department, Institute of Applied Physics, CNR, Florence, Italy
Professor Dietrich Wegener	Chairman Evaluation Committee of the Leibniz Society, Professor Emeritus University of Dortmund, Germany

Two members of the CSIC Scientific Area Committee, Professor Antxon Alberdi and Professor Tony Pich, acted as Contact Officers of the External Peer Review Panel. They did provide to the members of the Panel information on CSIC and on the review procedure as well as a copy of the Strategic Plan Proposals.

The Chairperson and the Contact Officers of the External Peer Review Panel arranged the corresponding meeting with the directors of the Institutes or Departments. These arrangements did include:

- Organization of the presentation of topics so as to allow production of results within two days;

- Selection of suitable written data (additional to the Strategic Plan Proposal) for the information of the Panel;

- Formulation of key questions to focus on essential points.

The External Peer Review Panel did elaborate the present Report addressing the questions listed in the guidelines as well as a series of synthesized comments and recommendations. Both, comments and answers to the key questions are based on the content of the Strategic Plan Proposal and the hearing from the representatives of the Institutes.

1.4 Running the assessment

On September 19 and 20, the Panel met at the CSIC Instituto de Astrofisica de Andalucìa in Granada to run the presentations/interviews/discussions with the Directors of the Institutes and the Departments with the following agenda:

- Monday, September 19, 9:30-11:30, Instituto de Fisica Teorica (IFT)
- Monday, September 19, 12:00-13:30, Instituto de Matematicas y Fisica Fundamental (IMAFF)
- Monday, September 19, 15:30-17:30, Instituto de Fisica Corpuscular (IFIC)
- Monday, September 19, 18:00-19:30, Instituto de Fisica de Cantabria (IFCA)
- Tuesday, September 20, 8:30-10:30, Instituto de Estructura de la Materia (IEM)
- Tuesday, September 20, 11:00-12:30, Instituto de Optica (IO)
- Tuesday, September 20, 12:30-14:00, Departamento de Fisica Interdisciplinar (IMEDEA)

On September 20-22 the Panel met in closed session to discuss the outcome of the interviews and to edit the present Report.

1.5 Remarks on the review procedure

The Panel appreciated the effort CSIC and all Institutes have invested in the preparation of the Strategic Plans (2005-2009) and the overall quality of the documentation submitted for evaluation. In one case (IFT) the Strategic Plan was prepared in Spanish language and then a longer interview has been necessary to acquire relevant information needed for the review.

The information included in the plans was very useful for the review process. However, some of the information, e.g.: non-staff, publications and so on was not coherently presented in the various strategic plans; not in all cases the information per department is available, which is a problem if other panels evaluate other parts of one institute. A more uniform definition of the format for these data would have helped in the review process.

It would also have been useful for the Panel to receive a synthetic introduction to

a) the CSIC administrative system, including the relationships with university and regional administrative systems. This information is important for the correct reading of the budgetary tables in the reports.
b) the RyC fellowships system
c) the recruiting and funding system for post-doc and PhD fellowships
d) the organization of multi-institute centers
e) the role and duties of CSIC Institute Directors
f) CSIC policy for maintenance and investment for facilities and services

Some information was provided in a meeting, previous to the Panel sessions, with Rafael Rodrigo, Scientific and Technical Coordinator of the Physics and Physical Engineering Division of the CSIC, and the Contact Officers.

The Panel also noted that it would have been very beneficial for the review process to visit the relevant Institutes, including meeting with the personnel in all categories, research, technical and administrative, although the Panel understands that the time available for providing this review was not allowing for this step.

The Panel particularly appreciated CSIC logistical support during the meetings in Granada.

2 General recommendations by the External Peer Review Panel

The Panel makes the following **15 observations** and conveys to CSIC the corresponding general recommendations. It should be noted that they are not given in order of priority.

(A) **COMMON ORGANIZATIONAL AND STRUCTURAL PROBLEMS**

1) Organization of the Institutes in Departments.

This organization of the activities within a given Institute does not seem, in some cases, to derive from a scientific strategy or justification but more from researcher free initiative, sometimes related to more personal reasons. In certain cases this creates the negative impression of an excessive fragmentation of departments into sub-critical groups within a given Institute, with a corresponding increase of the requests for resources for the consolidation of many small groups. A more focused and coordinated structuring into a smaller number of larger Departments should be a priority for action of the Directors of the Institutes.

2) Role of the Institute Director

The ability of the Institute Director to implement research strategies within own Institute appears quite limited by the lack of autonomy and resources under his/her responsibility. The Review Panel recommends the implementation of policies giving additional power and resources to the Institutes, including some administrative autonomy (e.g. decisions on fellowships for postdoctoral researchers and PhD-students, contracts and agreements involving the institute, organization of the Institute, maintenance and upgrade of infrastructure, etc.).

3) Institute budget

The Panel notes that internal budget supports, basically, only personnel. Only a very limited fraction of all other costs, such as telephone, PCs, etc., is covered by the internal budget and these costs have to be paid mostly from the projects. This is not a comfortable situation to be in. The Review Panel recommends assigning a suitable material budget to the Director, which could be used for utilities, maintenance and upgrades as well as buying materials that are needed for day-to-day running of the institute.

4) Average age of the research staff

The age of the CSIC research staff is quite high, and actions should be taken towards the hiring of a generation of younger researchers. In this regard hiring of RyC fellows to permanent position is encouraged since this younger personnel has been selected by an international panel and is in general of very high quality. Improvement of the selection process for post-doc is also recommended, in order to keep the highest possible quality among the younger research personnel. An actively advertised program for postdoctoral researchers which is in particular attractive also for non-Spanish candidates and comparable with corresponding programs of the European Union is an important element to achieve a balanced age structure.

5) Technical personnel

The Panel notes a serious problem concerning the shortage of permanent technical personnel, due both to the difficulty in getting these positions from the central government as well as to the not so attractive economical conditions. Engineers and technicians are needed for the experimental research activities in the laboratory, to install and operate computers and computer farms, to run modern CAD software, to participate in the construction and in the installation of large HEP and nuclear physics experiments and so on. The lack or

loss of key technical personnel would have devastating effects on the competitiveness of scientific groups. In some cases the Panel has been informed that due to retirement of personnel, basic workshops in certain institutes or centers would just close. Although the Panel recommends systematic exploitation of common technical shops and facilities shared with the university or with other institutes as well as the use of outsourcing practices, it should be stressed that a minimum number of skilled technical personnel is needed in the institutes which carry on experimental researches or run heavily computer-based activities. In order to attract and maintain good technical personnel, economic conditions for this type of positions should be improved and a career path for technicians should be implemented.

6) Training of highly qualified technical personnel

CSIC research groups and activities have an excellent training capability for technicians and engineers in the field of advanced technologies (precision mechanics, electronics and microelectronics, radiation detectors, software and networking, etc.). Many of these trainees would eventually move to the industrial sector, bringing an important social benefit both at regional and national levels. Although this process is a virtuous one and it belongs to CSIC mission, it is often felt as a negative one at the Institute level, due to the great difficulty in maintaining a minimum number of these technical positions to support ordinary, long-term needs of the research activities. This situation induces a never-ending process of basic training of temporary technical personnel, often by the researchers, which negatively affects the efficiency and the reliability of the system. The Panel recommends CSIC to implement remedies to face the scarcity of qualified technical staff personnel but at the same time to develop and implement a policy which gives visibility to the institute training activity of temporary technical personnel, a policy which could also get the financial support from ministries other than the Research Ministry and by the local administrations.

7) Administrative personnel

The Panel notes a critical situation in some institutes concerning adequate support of administrative personnel, some of which on temporary positions, some retiring soon. The Panel recommends to take actions to ensure that minimal but adequate administrative support is maintained at the institutes and centers. The systematic lack of English speaking secretarial personnel should be corrected.

8) Patents, Technology Transfer and Spin-offs

The Panel noted that a limited number of patents is produced by these CSIC Institutes. Technology Transfer activities are almost non-existing and there is a need for a policy for CSIC to support spin-offs. The Panel is here considering basic research institutes and the Panel does not expect that these TT activities will represent a dominant fraction of the overall activities; however, it is important to recognize, support and stimulate them, defining clear policies, by including boundaries, and strategies in this field. It should be also stressed that TT activities require resources, both in personnel and in budget, and medium-term efforts and policies.

(B) CONNECTIONS WITH INSTITUTIONS

9) CSIC and the University system

The close collaboration of some institutes with the local university(ies) is a strength for the organization of these institutes and it should be consolidated whenever it exists and, if possible, extended to other CSIC institutes. This collaboration brings benefits to both systems. Among the problems to solve is that transfer of staff personnel between the two systems is almost not existing. The salary of CSIC personnel should be made

similar to the corresponding career level of university personnel, also taking into account the fact that CSIC personnel can and should contribute to teaching activities.

10) Ramon y Cajal fellowships

The RyC program is excellent in recruiting young, promising researchers truly from the international market.

These researchers lead most important lines of research in various CSIC Institutes and are instrumental in improving the level of research at CSIC towards international standards. This program should be continued and strengthened, in the sense that RyC should become almost a necessary step, in any case a reference for quality, for the career of a CSIC permanent staff. However, the Panel stresses that there are weaknesses in this program which should be addressed. First of all this program should not depend on the uncertainties of policies and should be made a structural part of the Spanish research system..These fellowships should track to a permanent position. The long term implications of the hiring policy on the age structure should be taken into account. Second the Panel noticed as a very negative aspect of the current program the difficulty in hiring foreign RyC to permanent position, due to bureaucratic limitations which tend to erase the very positive effect of this program on the Spanish research system. Although the Panel acknowledges that the causes of these limitations are not due to CSIC, a priority for CSIC should be to find solutions to these problems suggesting changes in the rules within the Spanish administrative system.

(C) DISCIPLINARY AND THEMATIC AREA ASPECTS

11) Theoretical physics in CSIC Institutes

The recent creation of IFT is seen as an important step into strengthening and organizing theoretical physics research within CSIC. The Panel encourages CSIC to implement policies to concentrate within IFT theoretical research activities located in other CSIC institutes, in particular in the Madrid region, when they are not logically incorporated into the main stream of the host institute. For example, the Panel was particularly surprised by the split of theory groups working in Cosmology among IMAFF, IEM and IFT, all of them having a reasonable/good size and scientific quality. This trend should be discouraged and good practices encouraged, for instance, consolidating these activities within IFT.

12) Research in Particle and Nuclear Physics

High energy, nuclear and astroparticle physics is a very relevant part of the research performed at some CSIC Institutes. These activities look well directed and managed by groups having good international visibility and very well connected to the international laboratories. The Panel notes, however, that the size of the collaborations in HEP, the internal organization of these groups, the complexity of the facilities and of the experiments as well as the visibility of the individual researchers within large groups or publications having large number of authors, pose very different issues than in other field of research within CSIC. On the short term the Panel recommends to adopt policies which recognize the different needs of these institutes versus other CSIC institutes. On the medium term the Panel recommends to develop an overall coordination at the Spanish level of all institutes (also outside CSIC) working on HEP, to improve the effectiveness of Spanish participation in large HEP experimental (and theory) networks of scientists.

13) Super Computing

The panel noted a good development of GRID based activities, in particular in the field of HEP groups collaborating with the large CERN LHC Collaborations. A focused effort should be made to consolidate and coordinate the investments in the field of parallel Super Computing (e.g., lattice QCD, low energy nuclear physics, complex and non-linear system, quantum chemistry and so on). There is a fast growing request for

this kind of resources and the right balance should be found by CSIC among the investments performed at the institute level and investment performed at national level. The Panel recommends that a special committee should be formed to review the current status and to recommend the CSIC strategy in the field of Super Computing, taking into account the available networking and GRID resources for distributed computing.

3 Reports of Reviews of CSIC Institutes ad Departments

3.3 Review of the Instituto de Fisica Corpuscular (IFIC)

3.3.1 General considerations

IFIC is a joint institute of CSIC and the University of Valencia (UVEG). It includes two departments of theoretical and experimental physics. In terms of staff research personnel the two departments are of equal strength. The coherent research programs of the departments allow for a close cooperation within the institute and enhance the institutional visibility. IFIC belongs to the leading institutes in Europe in its field.

		CSIC	University
Permanent staff	Theory	4	20
Permanent staff	Experimental	13	8
RyC	Theory	5	4
RyC	Experimental	1	4
Post-Doc	Theory	6	8
Post-Doc	Experimental	3	1
PhD student	Theory	9	15
PhD student	Experimental	16	9
Administrative		NA	NA
Technical support			

3.3.2 Evaluation of the research groups, including recommendations

Theory Department

1 Visions and Strategy: Clear orientation towards one common goal: to explore the fundamental laws of nature in close cooperation with experiment, and to remain one of the leading European institutes in this field with high international profile.

2 Consistency of strategy and action: The joint institute with UVEG gives access to excellent young PhD–students which is an important basis for the innovative research program. The internal coherence and consistency of the research lines allows for excellent cooperation within the theory group and between theory and experiment (many examples could be specified if needed) and enhances the international visibility of the department and the institute. The staff is well prepared to compete in this field with the international environment. The participation in large European Research projects is an important mission of CSIC, with CERN, FAIR/GSI and the ILC as important examples. The members of the IFIC theory group have participated and contributed in an important way to this program, and have cooperated with CERN. This helps to exploit the large Spanish investment in international laboratories.

3 Portfolio of research lines

and

4 R & D needs and strategies: The portfolio reflects current and future trends. It should be consolidated and partly enhanced to fully exploit the future possibilities. It should be mentioned that a huge investment in computing hardware is needed if the Institute wants to play an internationally leading role in lattice gauge theory.

5 Comparison with other leading research institutes The department belongs to the leading European Institutes, comparable in its quality to a Max-Plank Institute in Germany or the Institute for Particle Physics Phenomenology in Durham (UK).

Research Dimensions Assessment

6 Benchmarking with respect to others:

and

7 Performance: Activities and results are excellent. The Department has a large number of publications with high rate of citations in leading journals. It is well recognized internationally and the scientific staff intensively participates in conferences and workshops. The large number of RyC shows that the institute and its research lines are attractive to junior researchers.

8 External and international collaborations: The Department has contacts and is well embedded within the Spanish system. It cooperates with many international institutions like CERN, INFN Frascati or GSI (Darmstadt, Germany). The participation in seven EU networks is remarkable. This is one indication for the international reputation of the Department and enhances the funding of the institute.

9 Training: The association with UVEG gives access to excellent PhD students. The number of 25 PhD students is impressive. Together with 14 post-docs (not counting RyCs) this can be considered one of the justifications for strengthening of the Department. The Department is evidently very attractive for highly competent junior researchers (RyC), also for non-Spanish applicants.

10 Scientific diffusion: Efforts to present research results to a broader community are adequate.

Manpower and Resources

11 Staff and skills: The overall composition of theoretical vs experimental lines of research is adequate. The theory group has a remarkably large number of international post-docs in comparison to other institutes.

12 Efficient use of resources: The available resources are used efficiently and adequately.

13 Funding model: The joint institute allows for an efficient use of resources of both CSIC and UVEG. A significant imbalance of CSIC-funded vs UVEG-funded positions is noted. Although this can be considered as a positive sign of the CSIC capacity in driving this field, the relative proportion of CSIC-funded vs UVEG-funded staff positions should become more balanced.

Present and future organization of the Theory Department and research perspectives

14 Emerging research areas: In view of the increasing demands for understanding of the results coming from LHC, the preparations for FAIR/GSI and ILC and the increasing importance of astroparticle physics a consolidation and strengthening of the research lines presented by the Theory Department is strongly supported. The university should be encouraged to act along the same line.

Experimental Department

Mission, Vision and Strategy

1. Visions and Strategy: The institute has as common goal the investigation of phenomena at the frontier of fundamental physics. This is realized by a close cooperation of the theory and experimental Departments, which is a special strength of the institute and could serve as example for other

institutions. Following this strategy IFIC has become one of the leading institutes of particle physics in Europe.

2. Consistency of strategy and action: The physics program of the experimental groups is realized in the framework of large international collaborations. Concentrating on selected key experiments as DELPHI in the nineties and ATLAS, in the future, at CERN, ANTARES in astroparticle physics, K2K in neutrino physics, IFIC became a key player in the field. The institute in addition actively contributes to future projects as ILC, T2K and FAIR/GSI, thus influencing the long-term program in the field and embedding its physics program in the international trend.
3. Portfolio of research lines:

   and
4. R & D needs and strategies: The recent topics covered by the institute are concentrated on research areas internationally agreed as the most important ones. The R&D work is based on the hardware activities of IFIC and the results achieved in recent years. The decision to initiate a program in medical physics to transfer its experience in detector development should be pursued further as a sideline activity.
5. Comparison with other leading research institutes: The contribution of IFIC in hardware, data analysis and detector development are comparable to the contribution of leading European institutes as NIKHEF in the Netherlands, the Max-Plank institutes in Germany, INFN laboratories in Italy and Saclay in France. The close and successful cooperation of staff at UVEG and CSIC in one institute provides a special advantage to IFIC in comparison with its competitors.

Research Dimensions Assessment

6. Benchmarking with respect to others: see 5.
7. Performance: The results of the experiments have been published in journals with the highest impact factor; the citation rate is high. The large number of invited talks and the organization of international conferences underline the international recognition of the work of IFIC. The Department participates in a large number of EU networks. The development work in medical physics resulted in two patents
8. External and international collaborations: All groups at the Department are members of international collaborations. The recognition of IFIC scientists follows from the fact that they occupy leading positions in the collaborations.
9. Training: The large number of PhD students, and post-doc and RyC researchers underlines the contribution of the institute to education. The institute trains technical personnel at high level which – due to the missing permanent positions – often leave the institute after a few years. They are an important contribution to strengthen the technological basis of the Valencia region. On the technology transfer side, the institute has applied for two patents which meanwhile have been transferred to the industry.
10. Scientific diffusion: Members of the institute are strongly involved in the diffusion of scientific results to the public.

Manpower and Resources

11. Staff and skills: The overall sharing of positions between the experimental and theoretical Departments is balanced. The experimental Department suffers from the fact that not enough permanent technical staff is available; after having been trained to a high level they usually leave the institute. Although this is advantageous for the regional industry, for the institute it means loss of important technical know how.

12. Efficient use of resources: The available resources (personnel, infrastructure, etc.) are used in a very efficient way.
13. Funding model: IFIC is a good example of the efficient combination of the strength of a university and a research institute. The lack of permanent positions for technical staff is a problem. The overall funding profile of the department is adequate.

Present and future organization of the Institute or Center and research perspectives

14. Emerging research areas: The institute is strongly engaged in the development of experiments which will define the direction of the field in the foreseeable future. This is true for the groups in particle physics – with LHC as the most important accelerator and ILC internationally discussed as the next facility –, in astroparticle physics with ANTARES, neutrino physics with K2K and T2K and for the nuclear physics groups with nTOF as the running and FAIR/GSI as the future project. A small group - presently the most productive of IFIC - is engaged in the B-physics program at Stanford. Its contribution is highly estimated in the collaboration. The R&D work on radiation hard m.i.p. detectors and electronics is a good investment for the future. IFIC is actively engaged in GRID computers acting as TIER-2 center for ATLAS in Spain. This activity has generated a high level of expertise in GRID and e-science in the institute. It may be of use for other research fields in the institute beyond particle physics, such as nuclear physics, medical physics and astroparticle physics and clearly is also of importance for the training of young scientists. The institute plans, in cooperation with different departments of UVEG, to engage more strongly in medical physics; this field should, however, remain a sideline of the institute program.
15. Development opportunities: The responsibilities IFIC has taken over in the field of GRID computing are an important contribution to the Spanish engagement in ATLAS. Besides being an important investment for science in general, they are also important for the technology basis of the country. The plan for a hadron facility for medical application presented by the institute sounds interesting but neither the expertise nor the manpower available at IFIC are sufficient to take over the leadership for such a project.
16. Collaborative efforts: A very effective collaboration within the departments and between them exists and is the basis of the strength of the institute.
17. Institute organization: The organization of the institute is adequate. The strengthening of the research lines by increasing the scientific staff and the high level technical personnel is supported by the Panel.
18. Coherence: The high quality of the research at IFIC clearly fits into the mission of CSIC. The departments have an international high standing and the results achieved are a key element in the Spanish contribution to particle and nuclear physics. The institute has acquired two patents; this underlines the efforts of the institute to support technological development.

3.3.3 Evaluation of the Institute as a whole

IFIC has a sound vision of its research program and a strategy to achieve its goals which in the past turned out to be successful. It has become one of the leading European institutes in the field with a high international profile. The close cooperation between UVEG and CSIC researches in a joint institute as well as the close collaboration of theoretical and experimental physicists is the basis of the success. A significant imbalance of Staff funded by CSIC vs. UVEG is observed in the theory department.

The institute has published a large number of papers in leading journals of the field with a high citation rate. The institute is very attractive for young scientists from Spain and foreign countries. The research

program of the experimental and the theoretical groups is embedded in international collaborations. The activities of the different collaborations are to a large extent well balanced, and the observed trend of fragmentation of the experimental particle physics program will likely end, once LHC starts in 2007/2008.

IFIC has started a few sidelines of research which allow to transfer to application the knowledge collected in the R+D work for detectors and the engagement in distributed computing. These lines are supported by the Panel as sideline of its research program, but the institute should avoid an over-commitment in this area.