Evaluation of the

Institute of Nuclear Physics

Polish Academy of Sciences

Krakow

By the International Scientific Advisory Board

March 2007

1. Introduction

On 1 September 2003 the Henryk Niewodniczański Institute of Nuclear Physics (INP) in Kraków joined the Polish Academy of Sciences and became its largest research institutions. In November 2004 Professor Legocki, then the President of the Polish Academy of Sciences, constituted the Scientific Advisory Board (SAB) of the INP. The role of this Committee is to advise on the scientific activities of the Institute, to review its scientific output and future plans, to assess the state and strategy of the Institute, in particular the quality of its research as measured on an international scale, and to provide recommendations in order for the Institute to strengthen its position and future research goals.

In February 2005 the first review took place, resulting in a number of observations and recommendations. On 5/6 February 2007 the SAB (the list of members is given in **Appendix 1**) reviewed the Institute a second time, heard presentations by the Director, Professor Jeżabek, the heads of the five research divisions and young researchers, visited several laboratories, and spoke to Ph.D. students and junior researchers. The programme is given in **Appendix 2**. The SAB met in closed session to formulate its major findings and recommendations which were finally presented to the Directorate and the division heads.

2. General Conclusion and Recommendations

2.1 Development since 2005

The Institute has developed during the past two years in a very positive way. The general and specific recommendations of the SAB in 2005 have to a very large extent been successfully implemented:

- In fundamental research the Institute has continued to strengthen its role in Poland and has cultivated its strong links to the international scientific community. This is documented by the fact that the Institute has increased its scientific ranking inside Poland, now being in the first category among all Polish scientific institutions.

- The Institute has been able to secure a substantial increase in third party funding. In addition, it received significant support from grants to improve the local infrastructure. It obtained, for example, in 2006 2.4 M€ from EU structural funds for a considerable improvement of the laboratory equipment for material engineering and other areas.
- The Institute modified and improved its recruitment process of the personnel.
- The Institute's structure has been significantly reorganised by combining 25 scientific departments into five divisions.

2.2 General Recommendations

The SAB makes the following general recommendations concerning the structure, funding, and common issues:

Recommendations:

The Institute is encouraged to continue its successful process of reorganisation. As part of this reorganisation it is important to ensure that the competence in and the structure of the technical groups matches well the scientific needs.

The Institute should make every effort to maintain its increased level of income, e.g. by continuing to apply for European structural funds. As in the last two years this income should be used predominantly to upgrade the research facilities and equipment of the Institute in order to fully exploit its human potential.

The Institute is pursuing successfully a number of outreach activities. These activities should be made as visible as possible and be further strengthened.

3. Evaluation of the material provided by the Institute

Prior to their meeting the members of the Scientific Advisory Committee received the Report on Research Activities 2005-2006. This detailed report was a very helpful and good introduction to the session during which practically all important aspects of research at the Institute were covered in very well prepared review talks. In addition,

the discussion with Professor Jeżabek, the other Directors, and Division Heads provided the Board members with valuable information on the organization and governance of the Institute. All this formed an adequate basis for the present review.

In its evaluation the Scientific Advisory Board based itself on the following criteria:

- Scientific standing and visibility on international level
- Qualified participation in international collaborations
- Choice of the major subjects and their relative weight
- Comparison with similar research done at other institutions in Poland
- Impact factor and other measurable parameters
- In-house facilities and infrastructure
- Third source funding

4. Research

The Institute of Nuclear Physics is structured in five divisions which reflect the major research areas:

- Experimental Particle Physics and Astrophysics (19.3%)
- Nuclear and Strong Interactions Physics (15.1%)
- Theoretical Particle and Nuclear Physics (9.8%)
- Condensed Matter Physics (12.4%)
- Application of Physics and Interdisciplinary Research (28.0%)

The numbers in brackets reflect the structure of the statutory costs with respect to the particular fields of research activities in 2005 and 2006. An additional 9.0% are spent on development and construction and 6.4% on education and public outreach.

In the following sections the major themes of research are reviewed and more detailed recommendations are being made:

4.1 Particle Physics and Astrophysics

The recommendation of 2005 was that particle physics should be maintained at its present level, including the support of the infrastructure.

The experimental research in particle physics at the Institute has a well established tradition and a widely acknowledged reputation. On the experimental side, there has

been a visible participation over the years in major world-wide collaborations such as DELPHI at LEP, NA49 at the SPS, H1 and ZEUS at HERA etc., which is continuing and projecting well into the future with, for example, PHOBOS at RHIC, BELLE at KEK and ATLAS at the LHC. The participation in the Auger project is well in line with the early tradition of the Institute in cosmic ray physics. Thus, experimental research in particle physics has been and still is at the front line of world research.

During the two years since the last Review there has been a shift in the activities. On the one hand the work in the DELPHI Collaboration has been coming to a conclusion, and also the involvements in ZEUS and H1 at HERA will soon enter their final stage by focusing on the data analysis. On the other hand, there has been a very visible growing contribution to BELLE, in particular through the observation of a new vector meson D_{sJ} (2715). In astro-particle physics, there has been an increasing participation in the Auger project and in the ICARUS and WARP experiments at Gran Sasso. The Institute is also strongly involved in the feasibility study of the SUNlab (Sieroszowice Underground Laboratory). This laboratory could be potentially very important for the future European effort in neutrino physics.

The research in relativistic heavy-ion physics in NA49 at CERN and at PHOBOS collaboration at RHIC has continued successfully. The SAB notices that the two groups are in separate divisions of the Institute although their physics is almost identical. The next stage of the restructuring should combine these two groups in the same division.

Overall the particle physics activities of the Institute have a remarkably high and established standard with great international involvement, recognition, and visibility. Particle physics is a very important component of the overall research achievements and future potential of the Institute. The domain of particle physics at the Institute, being of very high level, also in comparison with other East European countries, should continue to be strongly supported.

The excellent performance of the Institute has its origin not only in the very good individual research contributions but also in a particularly strong infrastructure, which is of key importance for playing a visible role in the field.

Recommendations:

Particle physics should be maintained at its present level, including the support of the infrastructure.

The next stage of the restructuring should combine in the same division the two groups investigating relativistic heavy ion collisions.

4.2 Nuclear and Strong Interactions Physics

The recommendation of 2005 was that the long-term programme on hadronic interactions should be critically reviewed. The future activities should be mainly focused on the study of very exotic nuclei and be concentrated on a limited number of projects in which the groups could play a very visible role. Care should be taken to strengthen the participation in European projects on detector developments and new facilities.

Today, the scientific activity of the division of nuclear and strong interactions physics is driven by a few emerging scientific questions related to the phases of nuclear matter from the early universe to the liquid-gas transition, the structure of exotic nuclei and their role in astrophysical processes as well as the properties of rapidly rotating nuclei.

These keys topics have been identified in the recently established long-range plan of the Polish nuclear physics community and follow the main lines of the long range plan established by the European community through NuPECC.

The physics of hadronic interactions at intermediate energies were conducted at COSY with excellent measurements of the eta –meson mass (GEM collaboration). Others topics include heavier mesons production (ANKE collaboration) and proton spallation studies on a number of nuclear targets. In this sector, a new collaboration with the WASA team at COSY has been recently initiated.

Following the recommendations of the previous Scientific Advisory Board, involvements in the preparation of ultra-relativistic heavy ion collisions at LHC-CMS and ALICE-experiments have been reinforced. Important and visible contributions to the ALICE central TPC detector were achieved.

In the sector of hadronic interactions the committee strongly recommends to reorient the activities at COSY and Dubna towards the LHC-ALICE experiment in order to be more present in the new and exciting ultra-relativistic heavy ion collisions physics program at CERN.

In the field of Nuclear Structure and reactions, the group of the institute has been able to initiate new themes, in particular very exciting results have been obtained for unstable neutron rich isotopes (^{9}He ,^{5}H, tetraneutron system) at Dubna and SPIRAL at GANIL.

For heavier masses, the structure of exotic Cr isotopes, ^{68}Ni, N=Z nuclei below ^{100}Sn were sucessfully investigated using fragmentation processes at GSI within the RISING Collaboration.

Recently, the deep inelastic reaction process was used both at Argonne and at Legnaro to produce and study very neutron-rich isotopes in the f-p shell. In particular, first excited states of K, Ar isotopes were identified by the PRISMA-CLARA collaboration.

It is worth mentioning the experiments looking at properties of Hot Giant Dipole Resonances at high temperature, with large gamma arrays, carried out by the local group. The original results of such investigations (large deformations, evolution of the width of the GDR with temperature) have been reported in many important Nuclear Physics conferences.

Looking forward, the nuclear structure and reactions groups are very active and present in the preparation of the next generation of “exotic” nuclei facilities both at FAIR at GSI and SPIRAL2 at GANIL. They are also involved in the design and construction of the next generation of Advanced GAmma Tracking Array AGATA. The committee believes that these groups have now well focused goals oriented towards the new European ventures under construction and play a visible role in the community.

Recommendations:

For the hadronic interactions, a strong focus on the physics of ultra relativistic heavy ions collisions is strongly recommended, mainly oriented towards the ALICE experiment at LHC .

For the nuclear structure and reactions, the present and future lines of research are quite well defined. The committee supports the involvement of the nuclear physics groups in the preparation of the next generation of "exotic beams" at FAIR and SPIRAL2 in Europe and the contributions to the next genration of gamma array AGATA. Care should be taken to strengthen these collaboratives ventures and to match the resources (both human and financial) with the needs of these new scientific opportunities.

4.3 Condensed matter physics

The recommendation of 2005 was that a restructuring of the activities (at present five groups) should be considered, as the number of groups appears too large and the size of the groups varies considerably. The exchange within the department should be increased while maintaining international presence. In addition to working with neutrons more use of synchrotron radiation should be strengthened, particularly for the study of surfaces and interfaces. The groups are encouraged to start a visitor programme.

The restructuring process which was recommended by the previous review has resulted in the formation of a single body under which all condensed matter work, experimental and theoretical, is now assembled. This is to be applauded. The restructuring provides a firm foundation for a consolidation of the process in the near to medium-term future. There is a very diverse set of research programmes currently being undertaken, many of high quality, but the task now must be to form a coherent mass of these diverse projects, with a well-defined unifying factor, whilst at the same time respecting, as far as is reasonable, the autonomy of scientists. Nevertheless benefits would accrue by the setting of common goals and the creation of a clearer identity and the expression of a common strategy for the future. This is important when one looks at the position of condensed matter research in what is, at least nominally, a nuclear physics laboratory. A more general comment concerns the

infrastructure. One can appreciate the steps which have been taken in improving general infrastructural aspects. This needs to continue to be emphasised since it creates a motivational environment for staff and makes the research programme more effective in the longer term.

The Institute has played a definitive role in achieving Polish membership of the international neutron Laboratory, the Institute Laue-Langevin in Grenoble. Poland has a history of such research activity, pioneering many techniques, and this is its rightful position. This membership must now be fully capitalised upon, and there are signs that this indeed is happening. The Institute could establish itself as the centre of such activities in Poland, acting as a spokesman for Polish involvement in the European Spallation Source project where both scientific and technical input can pay dividends. The proposal for a synchrotron source in Poland should provide an opportunity for the Institute to further strengthen its position as a natural source of effort for large-scale facilities for condensed matter research particularly in partnership with the programme being pursued in the Applied Physics and Interdisciplinary Research Department.

It is heartening to see the large number of enthusiastic young scientists in evidence. This is a very positive sign of the underlying health of the Laboratory for the future. They need to be given further opportunities to fully play their parts, both in-house and in the international arena wherever this is possible financially. Indeed the talks by young scientists in the review process were a very positive initiative and impressed the panel.

Recommendation:

The restructuring process should continue with the goal of forming a coherent programme, with a well-defined unifying factor. This will help in establishing a clearer identity and a common strategy for the future.

The improvement of the general infrastructure needs to continue since it makes the research programme more effective in the longer term.

The Polish membership in ILL should be fully capitalised upon, and there are signs that this indeed is happening.

4.4 Theoretical Physics

The recommendation of 2005 did not include an explicit recommendation concerning theoretical physics activities as these were evaluated together with the experimental activities.

Research in the Theoretical Physics Division at the Institute comprises mainly theoretical particle and nuclear physics and the applications of the particle and nuclear physics to theoretical studies in astrophysics and cosmology (including gravity), with the main aim of understanding of the fundamental structure and history of the universe.

The Krakow group has in the past made highly visible and important contributions to the interpretation of results at LEP1, LEP2, RHIC and HERA. Today, the most important part of theoretical research is related to the experiments at the Large Hadron Collider (LHC) at CERN which will start data taking in 2007. The analysis of the forthcoming experimental data needs much more accurate predictions in a form of theoretical perturbative calculations, both within the Standard Model of the strong and electroweak corrections as well as beyond the Standard Model. In addition, work is being done on better modelling of the non-perturbative phenomena, mainly in the sector of the strong interactions. Other areas of research are related to physics at other colliders, such as Tevatron, ILC and *B*-factories.

Collisions of ultra-relativistic heavy ions have become one of the main research interests in the Division, since they are a major source of information on particle and jet production and interactions, as well as on phases of the hadronic matter. The main research activity on heavy-ion collisions was focused on hydrodynamical studies of the hadronisation process as well as on extending statistical approach to studies of the particle correlations, which provide more information on the process than the one-body observables.

The institute is very active and successful in these areas of theoretical physics, in close interaction with the experimental groups of the institute. The group has an excellent publication record. Overall the particle and nuclear theoretical physics of the Institute has a remarkably high and established standard with great international involvement, recognition, and visibility and a close link the most exciting areas of research in the years to come.

Recommendations:

Maintain the present profile and give a strong support to the group now that the LHC starts and additional opportunities of relevance and visibility arise.

Theoretical particle, nuclear and astro-particle physics should be maintained at its present level. The Institute should address the question which of the two possible models for a structure would be more effective for research, maintaining the present Theory Division or integrating the activities with the respective experimental groups.

4.4 Application of Physics and Interdisciplinary Research

The recommendation of 2005 was that the research directed to applications in medicine should be strengthened. Attention should be paid to a close cooperation with the medical disciplines. Further investment in the area of radiation monitoring is recommended.

The Institute has a wide-ranging and balanced programme of applied and interdisciplinary research. The research activities are applied to the areas of medical and biological research, medical diagnostics and therapy, environmental protection and radiation protection. They benefit from the pure physics research at the Institute with its unique competence, providing the critical “human and intellectual mass” required for successful applied research.

The level of research at the Institute in the applied and interdisciplinary fields continues to be of high international standard. This is documented also by several collaborations with leading European and international research institutes. For example, the successful completion of the project of measuring radiation doses from cosmic ray exposure in an anthropomorphic phantom outside the International Space Station (ISS) of the European Science Agency (ESA) provides a solid basis for assessing radiation exposure and related risks for astronauts. The experience and the know-how accumulated in general, and in measurement technologies in particular, are efficiently transferred to applications of scientific and practical relevance. For example, advanced radiation detector technology and nuclear technologies are employed very successfully to research in medicine, environmental research and monitoring and geophysical research.

The two laboratories accredited to provide calibration and dosimetry service for radiation protection and medical applications in about 30 countries have improved their technical infrastructure significantly and they continue to provide income to the Institute.

The Institute is using existing equipment, in particular two accelerator facilities, to carry out relevant research projects and developments mainly for medical and radiobiological applications. This includes an isochronous cyclotron which is being prepared for the radiation treatment of eye melanoma with accelerated protons and which is the largest ongoing project at IFJ. The other example is the microprobe/ microbeam facility at the Van de Graaff accelerator which provides an important research tool for fundamental radiation biology and other medical research.

Both projects have made marked progress. The proton radiation therapy project is close to the completion of the construction phase, planned for the end of 2007, and the accreditation should be completed till the end of 2008. However, it must be noted that the long-term success of this project will depend on adequate equipment.

Currently successful research on biological systems on different levels (cells, tissue, and animal) is carried out in different departments of the Division. The efficiency of the work could be improved by better coordination and common use of resources such as laboratories and personnel.

Recommendations:

INP should make all efforts to obtain funding of a modern, dedicated accelerator to replace the 25 year old, home-built cyclotron for proton therapy.

The research on biological systems should be better coordinated and possibilities for increasing operational efficiency should be exploited by e.g. using common resources and integrating research projects.

There is uncertainty concerning the future of radioactive isotope research and production. Efforts should be made to define the long-term objectives in this area and reflect these in the organizational structure of, e.g. the radiochemistry department.

The research directed to applications in medicine should be further strengthened. Attention must be paid to a close cooperation with the medical disciplines.

5 Interaction with Universities and Outreach

The Institute is continuing to pursue an active cooperation with Polish universities, mainly in Krakow. Several employees of the Institute are involved in teaching and organising seminars as well as advanced laboratory practice.

The committee recommends to pursue and strengthen the present active cooperation with Polish univiersities, in particular in making available the know-how and its technical platforms (detectors, ion beams, electronics, computing) to master students, also in neighbouring fields.

The International Post-Graduate Study Course at the INP has in 2006/07 72 students from universities of several countries. The success of this programme is reflected in a significant growth in the number of applications.

The Institute is reaching also younger students by organizing talks in high schools. This is one example of the substantial involvement of the Institute in outreach activities. The SAB strongly supports these actions towards outreach and encourages the Institute to strive for even more visibility in the regional and national areas.

6 Resources

The tables in **Appendix 3** show the distribution of budget and personnel between the major areas of research and activities in the Institute. In 2005 and 2006 around 61% of the budget went into personnel, lower by 4 % compared with the situation in 2005.

The Institute is financed mainly from the State budget of the Ministry of Science and Higher Education. In 2006 the core financing was 4.8 M€, representing about 45 % of the Institute's total budget of 10.7 M€.

The SAB noted with great interest that the institute was able to increase its budget substantially, mainly through a quickly growing income from international projects, which in 2006 brought more than 2.2 M€. In addition, the Institute received

substantial grant money, 2.4 M€, for local infrastructure and equipment. These grants were used for investments in the field of materials engineering, ion implantation techniques, surface physics and advanced equipment for dosimetry. In addition, the medical equipment for the proton radiotherapy of eye melanoma has been funded by the Ministry of Health and the X-ray micro-beam facility by the Polish Foundation of Science.

The grants have enabled the institute to start the necessary renewal of equipment. This will remain an ongoing process, limited by the available resources. The SAB encourages the Institute to continue its efforts to receive structural funds from the EU, but recognised that it might be difficult to maintain grants from third source funding at the same high level as during the past two years.

The success of the Institute in the competition for European funds has led to an award by the Ministry of Science and Higher Education in the category of the Institutes of the Polish Academy of Sciences.

The SAB has also discussed the present system of budget and grant allocation to the Institute and its projects: The quality of scientific output of research establishments is currently measured mainly by the number of ISI-listed publications. The members of the Institute have published 700 papers in international journals. In the 2006 evaluation of all scientific institutions in Poland, the Institute was ranked in the first category. Nevertheless, the SAB is of the opinion that the present rules for funding according to the number of publication do not adequately support the research requiring large groups, which are necessary in Particle Physics and Nuclear Physics.

7 Structure of the Institute

Following the 2005 recommendations of the Scientific Advisory Board the Institute structure has been significantly reorganised with the goal to strengthen the programme oriented work and the five main fields of research. The former 25 scientific departments have been combined into 5 divisions in order to improve the management and the efficiency of work. The scientific activities of the Institute in 2006 are structured into 7 main topics and sub-divided into 48 tasks.

The members of the SAB are impressed by what has been achieved in this process in two years time. It became clear in the discussions with the Directorate that the

reorganisation process is not considered completed. The Board encourages the Institute to continue the process in areas which have not yet been optimised. Attention should be paid to avoiding a fragmentation of the excellent technical staff.

Apart from scientific departments, the Institute has three technical sections. The main accelerator facilities at the Institute are the AIC-144 isochronous cyclotron, the 2.5 MeV Van de Graaff accelerator for protons and a 14 MeV neutron generator.

Three EU-accredited Dosimetry Laboratories, providing individual and environmental dosimetry, calibration of radiation protection instruments operate at the Institute. A radiation monitoring station at the Institute provides continuous data acquisition of ambient dose rate and on the radioactive contamination of air for the Polish National Atomic Agency. The Institute is able to provide regional authorities with radiation emergency support, should such need arise.

8 Long-term Scientific Strategy of the Institute

In the fields of particle physics, particle astrophysics and nuclear physics the strategy of the institute, as outlined by the directorate, is well aligned with the long-range plans of the Polish scientific communities. These plans for the period 2008 – 2016 have recently been published in a report which was made available to the members of the Scientific Advisory Board.

In the area of elementary interaction physics the Polish scientists have identified three areas of priorities, connected strictly to the global research programme in this area. These priorities are i) the scientific programme at CERN, ii) neutrino physics, astrophysics of particles and cosmology and iii) the preparation of the scientific programme and detectors for the ILC.

In nuclear physics a range of programmes has been identified, ranging from exotic nuclei to hadron therapy. The FAIR project at GSI in Darmstadt is considered as the most interesting European project, the second being SPIRAL2, involving a large group of Polish physicists.

The SAB came to the conclusion that the scientific programme of the Institute is well coordinated with the priorities of the Polish scientific communities.

9 Summary and Outlook

The Scientific Advisory Board came to the conclusion that the Institute during the past two years has done excellent research of high international visibility in its five main areas of research. The Institute has undergone a successful major structural change which has helped in focusing the efforts. The SAB is of the opinion that the structure of the institute should continue to evolve in order to match even better the new scientific opportunities available at the European and International levels. The Board has been very impressed by the fact that the Institute was able to secure a very substantial increase in third source funding and encourages the Institute to continue on the path.

The Board is of the strong opinion that the excellent scientific and technical potential, in close cooperation with scientists from the universities, will ensure that the Institute will continue its dynamic development as a remarkable and highly visible research centre.

10 Acknowledgement

The Board would like to thank the Directorate of the Institute of Nuclear Physics and all members of the Institute involved in the evaluation for the information, the preparation of the material, the clear talks, the guided tours, the discussion, and the hospitality.

Appendix 1

Members of the Scientific Advisory Board (SAB)

1. **Guido Altarelli**
   Universitá di Roma Tre and European Organization for Nuclear Research CERN
   CH-1211 Genève 23
   SWITZERLAND
   Tel. (+41) 22 76 74145
   E-mail: Guido.Altarelli@cern.ch
2. **Sidney Gales**
   Directeur GANIL
   Boulevard Henri Becquerel
   BP 55027
   F-14076 Caen Cedex 5
   FRANCE
   Tel: (+33) 2 31 45 45 91 ; (+33) 1 44 96 47 58
   E-mail: gales@in2p3.fr and gales@ganil.fr
3. **Hans Georg Menzel**
   Hans Georg Menzel
   European Organization for Nuclear Research CERN
   Building 24 Department SC
   CH-1211 Genève 23
   SWITZERLAND
   E-mail: Hans.Menzel@cern.ch
4. **Colin Carlile**
   Professor of Physics, Neutron Instrumentation,
   European Spallation Source - Scandinavia,
   Physics Department, Lund University, Box 117
   SE 221 00 LUND
   Sweden
   E-mail: colin.carlile@nuclear.lu.se
5. **Albrecht Wagner (Chair)**
   Director
   Deutsches Elektronen-Synchrotron DESY
   Notkestrasse 85
   22607 Hamburg
   GERMANY
   Te. (+49) 40 8998 2408
   E-mail: albrecht.wagner@desy.de
6. **Andrzej Kajetan Wróblewski**
   Institute of Experimental Physics
   Warsaw University
   ul. Hoża 69
   00-681 Warszawa
   Tel. (22) 621 4771, (22) 621 2804
   E-mail: akw@fuw.edu.pl

Observer on behalf of the Minister for Science and Higher Education:
Andrzej Galkowski
Institute of Plasma Physics and Laser Microfusion – Euratom Association
Hery str. 23
01-497 Warsaw
Tel. 48(22) 6381460
E-mail: andrzej.galkowski@ipplm.pl

Appendix 2

Review of Research Activities at the INP in 2005-2006

Monday, 5 February 2007

9:00	M. Jeżabek	Report on implementation of the SAB recommendations
9:15	S. Jadach	Theoretical Physics
9:45	P. Malecki	Particle Physics and Astrophysics
10:30	J. Styczen	Nuclear Physics and Strong Interactions
11:00		*Coffee*
11:30	T. Wasiutynski	Condensed Matter Physics
12:00	P. Olko	Applications of Physics and Interdisciplinary Research
12:45		*Lunch*
13:45		Visit to the laboratories, local infrastructure Meeting with Ph.D. students and postdocs
16:00 – 18:45		Closed Session with and without the directorate and division heads

Tuesday, 6 February 2007

9:00 – 12:00	10 talks given by young researchers representing scientific highlights
12:00 – 13:00	Closed Session
13:00 – 13:30	Close-out

Appendix 3

Budget and personnel allocation

Table 1 Budget allocation

Research area	% of budget	%
Particle physics and astrophysics (exp)	19.3	
Nuclear and strong interaction physics (exp)	15.1	
Condensed matter physics	12.4	
Theoretical Physics - particle physics - nuclear physics	9.8	5.8 4.0
Applied physics and interdisciplinary research	28.0	
Development and construction	9.0	
Education, popularization	6.4	

Table 2 Personnel allocation (Status: end of 2006**)**

Research area	Number of researchers*	Number of technical support**	Total	Percent
Particle physics	40	25	65	20.8
Nuclear physics	36	6	42	13.5
Condensed matter physics	28 (8)	3	31	9.9
Theoretical physics	14 part phys 11 nucl phys	4	29	9.3
Applied physics and interdisciplinary research	63 (4)	47	110	35.3
Technical sections	2	33	35	11.2
Total	194	118	312	100

* Professors, associate professors (dozents), adjoints (senior researchers) and research assistants
** Engineers and technicians
(Number) in brackets give number of theorists in this division