INFN INTERNAL REVIEW COMMITTEE (CVI): PROGRESS REPORT:

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Executive Summary

The CVI of INFN met June 30-July 2, 2003. Of particular interest on this occasion was the reaction of INFN to the new CIVR guidelines. Therefore, in addition to listening to the reports from the INFN Executive and the Presidents of the five national scientific committees (CSN), the CVI heard an interesting discussion of the preparations for the CIVR evaluation.

The work of INFN is extremely impressive. It operates as full partner and leader on a world and European scale. Italy should take pride that collaboration with Italian physicists supported through INFN is very broadly sought. Thus, this Executive Summary can be concise.

INFN science continues to be strong. Its work in all of the scientific committees is of a very high quality, world class in many cases, European class in most. The resources of the institute are directed in a well chosen manner to the key forefront issues of physics. In turn, there being healthy internal competition for the resources, both financial and human, has led to a very well organised management of those resources. The system appears to be very responsive to the changing requirements of government.

It is not yet clear how well the new CIVR system matches to the work of an institution such as INFN. The CVI looks forward to a flexible implementation of the guidelines such that the global collaborative performance of INFN, and its worldwide partnerships, be well measured. Meanwhile, INFN is responding well to the new guidelines provided by the CIVR. It is anticipated that one year from now, the institute will stand ready to be a leading participant in the new evaluation system. In no small part this comes from a proactive approach for which INFN is to be commended.

Opportunities for the dissemination of technology to industry, to medicine, and to other science arise from advances in technology generated within INFN and its world collaborations. While INFN is clearly one of the strongest of the Italian scientific institutes, it is not possible for INFN to do everything. Realising these opportunities depends on INFN forging strong partnerships with the target communities. It is only by establishing strong bonds and by encouraging the exploitation of the results of its work by others, that INFN can maximise its impact on Italian, European, and world society.

1. Introduction

The concept of international peer review committees is built into the INFN fabric at several levels. The concept is used at the Program Advisory Committee level for the INFN accelerator laboratories, and at the Scientific Policy Committee level. Recently the larger sections have also adopted the practice of having international visiting committees. At the level of the institute itself, ad hoc international reviews were conducted at the request of the President. It was therefore natural for the INFN President to turn to this approach in conjunction with the CIVR evaluations introduced in 1999. Since that time, the internal evaluation committee, CVI, has met at least annually. The current committee membership including three new members is given in Appendix A.

This year the CIVR approach is in transition. Future evaluation will be conducted on a triennial basis and the INFN submissions will include a report from the CVI. The committee will conduct its review in the non-reporting years, when it will produce a Progress Report. Since the first full triennial review of INFN is intended for 2004, the 2003 report is termed a Progress Report. Since the methodology is new, the committee had the opportunity to review the initial attempts to work with the new system and its prescriptions. For INFN, it represents an opportunity to get feedback on their approach.

The report, in Section 2, will first summarise and characterise the quality of the work being conducted under the auspices of INFN in each of the scientific lines. This is based on the ex-post facto consideration of the results. This year the committee was not provided with the three year plan, so did not formally evaluate that plan. Nevertheless, each of the lines is managed and monitored through a National Scientific Committee (CSN) and aspects of the future plans were included in the reports from those committees.

The Virgo gravitational wave interferometer is a major addition to the INFN portfolio. It is now under the umbrella of the European Gravitational Observatory, a joint France-Italy endeavour. The committee had a first opportunity to hear about this new organisational entity and will record its impressions in Section 3 of the Report.

An important aspect of an institution such as INFN is that it be well managed. Section 4 of the report covers resource management. In section 5, the committee records its views on how INFN is responding to the new CIVR procedures. Finally, in Section 6, we conclude with some remarks and recommendations.

In preparing this report, the committee was informed by a large volume of written material, well prepared by the INFN Directorate and by the individual scientific committees and their working groups. In addition the committee heard an excellent suite of presentations; the agenda for the three day meeting in Rome is included in Appendix B.

In all of its work the committee found that the INFN personnel and its Headquarters staff were impeccable in their approach and professionalism.

2. The Scientific Programme: The National Committees:

The work of the INFN is organized according to five primary scientific lines. Associated with each of these lines is a national scientific committee with representation from all of the INFN entities (sections and laboratories) which manages the activities. The committee found that the situation in four areas merited a commentary as a result of their importance to the institute.

The Gran Sasso Laboratory was the first laboratory of its kind in the world and its construction and operation has placed Italy in a special position with respect to the rest of the world. During the past year defects in the infrastructure and operations at the Gran Sasso Laboratory have led to restrictions in the operations. Very recently INFN imposed an embargo on all operations involving unusual manipulation of liquids in the laboratory. This internal action occurred simultaneously with a court order, which applied imposed restrictions on one of the experimental halls. In order to move towards regularisation of the situation, a state of emergency has been declared which covers the Gran Sasso Laboratory and some of the surrounding region. Under the direction of a government-appointed commissioner, the infrastructure of the drainage system and aqueduct system and their interaction with the Laboratory and the tunnel will be expeditiously inspected and the mutual integrity of the systems re-established. Along with an aggressive approach to safety and environmental management by INFN and the Laboratory, it is hoped that these initiatives will result in a return to normalcy within months. Inside the last week, permission has been obtained which allows recommencement of the assembly of the OPERA experiment. The international community is very concerned that indeed these issues be resolved and that the very important physics opportunities be vigorously pursued.

During the course of the past few months, approval was accorded by the German government for the construction of a Free Electron Laser at the DESY Laboratory in Hamburg. No final decision was taken with respect to the related construction of a large linear electron-positron collider. In the light of these developments, the committee was interested in the strategy of INFN.

With respect to a Free Electron Laser, there are initiatives in Italy to construct an FEL, which, while smaller in energy and scale than that intended for DESY is nevertheless significant. Similar initiatives in several different countries could impact the DESY FEL, for which non-German funds would be required. The committee recommends that Italy continue to discuss its initiatives within the established European organisation(s) to ensure that it develops an approach to these exciting devices which is coherent with that of the rest of Europe. In particular the committee assumes that INFN, perhaps through the Italian representative, participates in the discussions in ESFRI (European Strategy Forum for Research Infrastructures)

We also heard that INFN will continue its collaboration on linear collider research and development with DESY, in particular participating in the Tesla Test Facility, TTF2. In addition, INFN expects to sign a memorandum of understanding with CERN to participate in CLIC, which is a research and development project with a future potential in the arena of higher energy, multi-Tera-electron-Volt, linear colliders.

In a final general comment, the committee would like to remark that Italy has been a longstanding leader in the investigations into the use of Hadron Therapy for the treatment of cancer. In recent years there have been large scale and well focussed initiatives in several countries in Europe. The committee tends to the opinion that it may well take a strong initiative on the part of INFN to bring to fruition such a project in Italy. The clear candidate appears to be the CNAO project in Pavia. Strong leadership is required because the confluence of diverse interests, scientific, technical, medical and social, may not happen spontaneously.

2.1 Experimental Subnuclear Physics with Accelerators: CSN I

The large European Laboratory, CERN, is the natural primary focus of the Italian work in sub nuclear physics with accelerators. For many years the LEP (Large Electron Positron) collider experiments dominated the INFN activities at CERN. Today, while analyses continue to be finalised and published, the activities of those large groups have been deployed elsewhere. Currently at CERN, a new fixed target initiative, COMPASS, which plans to work both with muon and hadron beams, has completed its first year of operation with the full apparatus. The data volume is impressive and presages interesting results.

INFN initially ensured a role in the search for understanding of CP violation in the quark sector, by participating in a series of successful kaon decay experiments at CERN. These appear to have largely achieved their goal of establishing the existence of the phenomenon of direct CP violation in the kaon sector. Future results on this issue will come from the KLOE experiment at the DAΦNE collider at Laboratori Nazionale di Frascati (LNF). The DAΦNE ϕ-factory collider is now making great strides towards achieving the required luminosity. The yield of data on ϕ meson decays is enormous.

Spectacular progress in CP-violation is coming from the BaBar experiment at Stanford Linear Accelerator Laboratory working within the Beauty or Bottom sector. Here also CP violation has been established. This experiment is very successful; the INFN technical contributions are large and the spokesman of the experiment is currently an INFN physicist. (INFN scientific leadership of the large, world-wide collaborations characteristic of this field is not unusual.) A future INFN presence in this subfield is ensured by strong INFN participation in both the LHC-B experiment at the future Large Hadron Collider at CERN and the new experiment, BTeV, being planned for the Fermilab Tevatron.

At Fermilab, the CDF experiment is taking data. New results are extending the work from the operations during the '90s. The experiment, again with strong INFN contributions to apparatus and analysis, is operating very well and a plethora of new results is expected at the summer conferences in 2003.

The past, and the present, both of which we have briefly described above, set the scene for the future. Four years from now, the LHC at CERN will operate with its mammoth Atlas and CMS experiments and the also impressive LHC-B and ALICE experiments (see the CSN III report). The scale of the experiments is unprecedented even for this field of archetypical "big science". Nevertheless, the state of advanced production, in some cases completion, of many subsystems speaks to a challenge, which has, in fact, been largely met. However, now is not a time for complacency; achievement of complete, installed, and operational experiments still remains. The end game in such enterprises often depends on innovation, since the solutions to problems are necessarily constrained by what already exists. The lien on resources will represent the most important strain, during the next three years, on the healthy sub-nuclear particle physics program.

In the longer term future, the field anticipates the construction somewhere in the world of a large linear electron-positron collider. Within Europe, INFN has been a strong collaborator with DESY and others in the Tesla R&D work. At the present time, the goal is to fully establish all the parameters to assure 500 GeV, and the potential to achieve approximately 1 TeV, of energy in the centre of mass. In this area, INFN confirms its partnership in the Tesla Test Facility at DESY. It is hoped that the particle physics field worldwide can make both a technology choice and generate bids-to-host such a machine inside the next few years. In the longer term, INFN participates in an R&D initiative (CLIC) based at CERN, which uses novel techniques to deliver the power to the beams. INFN foresees establishing a memorandum of understanding to formalise this work.

The technology advances in this general area of linear-electron accelerators has generated considerable interest in the potential for Free Electron Lasers based on these concepts. The science of materials, chemistry, and biology appears to have a considerable appetite in this realm. This presents both major opportunities and significant challenges for the accelerator community in many countries. We have therefore raised the concern that a coherent approach be retained. This was addressed earlier in this section.

The scale of the computing foreseen for high energy physics experiments in the LHC era is unprecedented. It can be argued that it would be unachievable were physicists confined to pre-existing paradigms. The solution appears to be the maximal exploitation of distributed computing; the GRID. This approach has the added value that it obviates the need for all physicists to concentrate themselves at the site of the experiment. Rather, it permits the transport of the data, the analysis, and the excitement of the physics, back to the home countries and institutions. This has evident socio-economic impact. In the best traditions of the field, this initiative under the auspices of EGEE (Enabling Grids for E-science and industry in Europe), is a societal leader.

2.2 Astroparticle and Neutrino Physics: CSN II

INFN continues to play a leading role in astroparticle physics across the full spectrum of activities, to some of which we will come back in more detail below. The Committee notes with satisfaction that young INFN researchers were awarded the Shatki P. Duggal Award in recent years, and that conferences in the field of Astroparticle physics, that started as an Italian initiative, are now important international events (TAUP, AMALDI). The productivity and impact of the research performed under the auspices of CSNII has been measured in anticipation of the new national evaluation procedures and both are excellent in comparison to other large European countries.

Gran Sasso National Laboratory, the largest laboratory of its kind in Europe, is one of the focal points of the CSN II scientific activities with the potential of major impact or even major discoveries in particular in the field of dark matter searches, neutrinoless double beta decay, neutrino oscillations (CNGS: CERN Neutrino beam to Gran Sasso), low energy (solar) neutrinos. Some of the projects at the Gran Sasso national laboratory are experiencing delays because they have to wait for the conclusion of a procedure concerning safety rules and regulations. Hopefully this issue will be settled soon between the political authorities and the management of the laboratory.

INFN is consolidating its important role in determining the astroparticle physics agenda through its participation in ApPEC (Astroparticle Physics European Coordination) and by its prominent participation in a funding request to the EU in the 6^{th} framework programme (ILIAS)

The astroparticle physics programme INFN is supporting is covering the entire field: gamma rays, neutrinos, cosmic rays up to the highest energies, and gravitational waves. We will not discuss the whole programme here in detail; in general the progress is excellent and many new results are to be expected in the coming years. Borexino is nearing completion (sensitive to ^{7}Be solar neutrinos); OPERA is being installed (looking for appearance of ν_τ in the CERN beam to Gran Sasso, CNGS); Icarus has demonstrated its feasibility with a large potential for using CNGS and for looking for proton decay and dark matter searches; Cuoricino is starting to take data (sensitive to neutrino mass less than 1 eV; Cuore ultimately to reach 0.01 eV).

We would like to comment on the accelerator-based neutrino programme. CSN II foresees a 10 year programme of CNGS (CERN neutrino beam to Gran Sasso) and wants to concentrate the efforts on this programme. The OPERA Collaboration, with a sizeable international component, will look for tau-neutrino appearance and has also some sensitivity to $\sin^2 2\theta_{13}$. Although the potential of Icarus is large it is not yet a truly international collaboration with a clearly defined timeline. We agree that CSN II concentrate on the exploitation of CNGS and that a 10 year programme be worked out in detail, at the same time we see discussions in the neutrino community on superbeams, neutrino factories. These deliberations are occuring in many parts of the world. INFN physicists should take an active part in these developments. So we recommend the formulation of a long term strategy of the accelerator-based neutrino programme including CNGS and the longer term future.

The Cosmic Ray Physics, Gamma and Neutrino astronomy programme of CNS II is very rich with participation in a large number of leading initiatives. The exploratory nature of many of these projects, in the sense that new territory is being explored, justifies this broad programme. The latest addition to this field is a high energy neutrino observatory at the bottom of the Mediterranean Sea. INFN groups play a prominent role in Antares, to be installed in the coming years, and are further developing the underwater neutrino telescope concept in the NEMO collaboration, performing site studies near Sicily. It is very probable that after a successful start of Antares a Very Large Volume Neutrino Telescope will be built as a European initiative; a site off the Sicilian coast is a realistic possibility.

The gravitational wave programme, including resonant bars and the VIRGO interferometer, is very exciting and every effort should be made that INFN be part of the discovery of this phenomenon that will draw very much attention inside and outside the scientific community. The resonant bars will still be competitive for several years and simultaneous running with the aim of observing coincidences should be maximized.

In conclusion CNS II plays a very prominent role in the exciting fields of astroparticle physics and neutrino physics and we can look forward to many new results the future.

2.3 Nuclear Physics: CSN III

The INFN program in nuclear physics has significant involvement in all key areas of today's forefront nuclear physics research. The Italian program in nuclear physics is highly international and of high quality. Following the recommendations from the committee's previous reports, the program has been further consolidated in terms of its number of experiments. The reduction results, to some extent, from the involvement in larger experiments, such as ALICE at the LHC. But there has also been a conscious effort to consolidate programs for higher research efficiency.

The key areas in nuclear physics research today are: i) the study of the quark-gluon structure and dynamics of hadrons ii) the exploration of the phase diagram of strong-interaction matter, including the transitions between the regimes of hadronic and quark-gluon matter, iii) the study of the atomic nucleus, including properties and reactions that play an important role in explosive nucleosynthesis and nuclear astrophysics; and iv) aspects of fundamental symmetries and interactions as revealed in the nucleus as a micro-laboratory, or in the deconfined, and chirally symmetric, quark-gluon plasma. In addition, nuclear physics has traditionally impact on other sciences such as nuclear medicine, surface and solid state physics, materials research, environmental physics, geology, and areas concerned with human history such as radioisotope dating and trace analysis in archaeology and art.

The studies in the area of quark and hadron dynamics involve 9 experiments with about equal share in electromagnetic and hadronic probes. Electromagnetic probes are employed at TJNAF in the AIACE experiment with the highly successful CLAS spectrometer program, and the ELLETRO high-resolution spectrometer to study spin structure functions and spectroscopy of hyperons and hypernuclei. At the GRAAL Compton backscattering apparatus at the ESRF beams of high-energy polarized photons are employed in vector meson investigations. Tagged polarized photons and polarized targets are at the heart of studies of the GDH sum rule at MAMI and ELSA. In HERMES at DESY, spin physics, transversity, and DVCS studies with polarized internal targets are providing interesting results (as does the COMPASS experiment which, however, is under the auspices of CSN I).

The program with hadronic probes is centred on the DEAR, and FINUDA experiments at DAΦNE, Frascati. Beams of kaons from phi decay are used in studies ranging from anti-kaon nuclear scattering lengths, to tests of chiral perturbation theory and hypernuclear spectroscopy. Further studies include the DIRAC experiment at CERN and reactions with low-energy pion beams at JINR (Dubna) .

A major activity in the Italian nuclear physics program, with nearly 40% of its researchers, is the study of hadronic matter phase transitions. This program has two distinct activities: one at low energy (i.e. one to about ten times the nuclear Fermi energy) and one at the highest energies (SPS to LHC). The SPS program is about to terminate. The major effort in the ultra-relativistic-energy program is now directed at the ALICE experiment at the LHC. Here the Italian effort, with 100% responsibility for the time-of-flight barrel and the zero-degree calorimeter, and with 30-50% responsibility in other key components, is central to the project.

The Italian nuclear physics program also plays a central role in the study of nuclear matter at low energies, i.e. the liquid-to-gas phase transition of nucleonic systems and the equation of state. At LNS, Italian scientists in international collaboration have developed unique instrumentation for these studies (FIASCO and CHIMERA). At the lowest energies, the PRISMA-CLARA experiment at LNL will make the connection to the energy region well below the FERMI energies. The Italian groups have also played major roles in related experiments at foreign facilities, such as the GSI synchrotron. The plan is to continue these studies, with the aim to explore the isospin degree of freedom with beams of short-lived ('radioactive'), very neutron-rich nuclei.

The nuclear structure program of the Italian groups is focussed on gamma-ray spectroscopy and takes a lead position in Europe, due to its earlier construction of the GASP detector and involvement in EUROBALL. The current program includes the RISING experiment at GSI (building on EUROBALL cluster detectors), a national setup at LNL (EUROBALL clover detectors, GASP and the PRISMA spectrometer), and developments for the future AGATA gamma-ray tracking detector.

The Italian low-energy nuclear physics program has the advantage of two national facilities: the tandem-superconducting linac system at LNL and the tandem-superconducting cyclotron facility at the LNS. INFN last year constituted a review and coordinating committee to assess the current status, future plans and opportunities and, in particular, the coordination of the two programs to maximize science output. The conclusions of that committee were that the two Italian laboratories indeed can play a major role, both in the medium-range and the long-range nuclear physics program within the European context.

To reach that goal, the coordinating committee found it important that the current projects to upgrade the facilities be completed in an expeditious way: the ALPI modifications and the positive-ion PIAVE injector at LNL, and the CHIMERA and the EXCYT projects at the LNS. This would provide the basis for LNL to become the leading laboratory in Europe for high duty-cycle, high-quality low-energy heavy-ion beams. At LNS, it would provide the instrumentation for a focussed program in nucleonic matter studies in the Fermi-energy regime and for selected reactions in nuclear astrophysics

The coordinating committee encouraged R&D towards future capabilities. In the committee's opinion this would best be aimed, at the LNL, at high-current proton linacs utilizing expertise in low-energy superconducting accelerating cavities. For the LNS it was felt that the laboratory's involvement in other activities (the CATANA therapy project and the NEMO neutrino detector) needs to be monitored to identify longer-term research directions.

Overall the Italian program in nuclear physics is of excellent quality. The program addresses key areas of today's nuclear physics research as, for example, summarized in various long-range plans (The DOE/NSF NSAC Long Range Plan, the upcoming NuPECC Long Range Plan, the NRC Decadal Assessment of the Physical Sciences, etc.). An important aspect that requires attention in the new future is the reorientation of the program towards upcoming major international facilities and opportunities. These long range planning efforts reinforce the need to continue the consolidation and coordination process at all levels.

2.4 Theoretical physics: CSN IV

Activities of this group have continued in all five branches of theoretical physics covered by INFN. Although the figures show considerable overall stability, some evolution across the subfields can be discerned.

Field and String theory remains a strong area of research and is attracting a growing number of young researchers, particularly in the latter subject. Although this can be felt at first as increasing the gap between the interests of CSN I and CSN IV, it should be stressed that there has been lately an evolution in the scope of string theory activity from mostly mathematical work to the understanding of its implications for accelerator and astro/cosmo-particle experiments.

Phenomenology of Fundamental Interactions, the other traditionally strong area of Italian theoretical physics, has also continued to produce a stable quantity of research at the highest international level. Because of the point made above one can identify, with satisfaction, an increase in the interaction between the Field and String Theory and Phenomenology efforts.

Nuclei and Nuclear matter group, while continuing successfully its traditional lines of research in Nuclear structure and Nuclear reactions, has shown the further development of its component addressing the physics of relativistic heavy-ion collisions and the search for the quark-gluon plasma, a development that was recommended by the CVI a couple of years ago. Work in this area has become increasingly visible internationally.

The fast development of Astro-particle physics and Gravitational Waves is also perfectly in line with our previous recommendations. It covers a variety of subjects, from cosmological models, to neutrinos, to gravitational wave sources. In fact, the most recent figures show that this Sector has overtaken by now Mathematical Methods, which is probably also suffering from the competition from Field and String Theory. Nevertheless, this sector continues to produce high-quality results.

CSN IV has one special project, ApeNEXT. The project is following smoothly its course with a 0.4 Tflops prototype due for the fall of 2003. Existing software can be used to test the performance of the machine and a decision about constructing a large ApeNEXT system (with 10 Tflops capability) will be taken by the end of the year. There will be also an effort to make more commonly used languages (e.g. C) available on the machine.

2.5 Technological and interdisciplinary research: CSN V

The development of new instrumental technologies for experiments in nuclear, sub-nuclear and astroparticle physics as well as interdisciplinary applications of such technologies and the possible transfer to industrial applications opens a wide span of activities in CSN V. The research projects are divided in three fields, development for detectors, accelerators and interdisciplinary applications, with equilibrium between funding of each of the fields.

Interdisciplinary collaborations are well established between CSN V and several fields of research. Examples are SCRIBA for cultural heritage, NANO at the interface to material science, and BIOR in radiobiology. In all these areas the expertise in accelerator techniques, imaging, and software are successfully combined to study properties of various materials and interactions. The implementation of INFN research in the Universities as well as the use of the facilities provided by the INFN national laboratories provides a particularly fruitful environment for these interactions.

The impressive participation of CSN V in the field of mammography is particularly worthy of merit and illustrates the possibilities of collaboration between CSN V and the medical sector. The activities in this domain range from the development of digital detectors for improved radiography, to operating a facility using synchrotron light, to providing software tools based on HEP techniques for CAD, and to deploying GRID infrastructure for distant evaluation of images in an European wide network. The participation of eight INFN and Physics Departments and seven hospitals in the GPCALMA collaboration has ensured an adequate development of tools and their direct application in the medical sector.

Over the last 10 years, INFN has acquired considerable knowledge related to hadrontherapy with R&D programs in dosimetry, imaging and accelerator techniques and plans to further contribute in this field. The CATANA proton facility for the treatment of ocular tumors is a good example for the convergence of the various developments in an operational complex and illustrates the possibility to use the expertise within CSN V to develop future facilities. The CNAO project clearly offers a promising possibility for the future. The results from LIBO and the outlay of the PALME project represent an interesting approach to upgrade existing cyclotrons in hospitals in order to give them the possibility to treat deep seated cancers. The viability of these ideas is not yet clear. However, in these and other analogous approaches, the contact with potential users and private companies should be more clearly established to properly plan and realise the projects.

The most direct transfer of knowledge and technology between INFN and industry occurs through the education of students and post-doctoral researchers, from which a large fraction finds future employment in industry and through the industrial production of experimental equipment. Direct cooperation between INFN and industry could be facilitated by increased promotion of the INFN activities and clarifications on rights of intellectual property. However it has to be stressed, that in this field of collaboration between public research and industry, both parties need to gain experience and define the part of involvement possible within the frame of mutual competence and aims. Some reorientation of the existing INFN structures to recognise this need, may be appropriate.

3. The European Gravitational Observatory (EGO)

EGO is a consortium with, for the moment, two members (INFN, Italy and CNRS, France), set up as a private company under Italian law. Its most immediate task is the completion, commissioning, and operation of the VIRGO interferometer at the Cascina site. EGO will also provide the necessary computing infrastructure for data analysis. Although its most immediate task is a very important one, which might lead to the discovery of gravitational waves, EGO's mandate goes beyond this. It aspires to be *the* European centre for gravitational wave research, and to exploit the new observational window far beyond the discovery of gravitational waves. To this end EGO would like to organise networks and promote, coordinate, and perform R&D for new antennas, for example an interferometer at liquid He temperature deep underground. In order to play this leadership role it will be necessary for EGO to enlarge its membership. It is unclear at the present time whether EGO is able to collect sufficient international support to realise its ambitious mission beyond VIRGO.

4. Resource and financial Management

Since 1997 INFN, like all the other Institutes of the Public Sector, is constrained by various limits, beginning with cash limits in 1997 and ending with staff limit:

- the budget authorisation of the Institute is constrained by a cash limit so that a forced saving is imposed; the cash limits apply bimonthly (with possible derogation's);
- operational expenses are limited at 90% of the 2001 level and procurements are centralised by a public corporation;
- increases in permanent staff are forbidden;
- temporary staff is limited to 90% of the average of the 1999-2001 level.

Past cash-flow limits to budget authorisation led, in the past to determined forced savings. This year, the accrued balance will allow INFN to reach the increased cash flow limit. For the first time in several years there is a reduction of 2% cut in the 2003 budget authorisation.

The medium term financial plan 2004-2006 has been developed assuming that the trend in budget authorisation and the restrictive cash limits will continue. INFN is conscious, and the committee is concerned, that in the long run, the scientific activity will be harmed, if the financial laws continue to impose these restrictions. It is hoped that the restrictions are indeed temporary. Meanwhile, INFN has coped with these restrictive rules; it has used forced savings as a flexible instrument by which to conditionally finance some large projects.

There is a 3% shift of money from personnel to research as a result of the above limits. This creates a real danger of a worsening of the human capital (mainly young researchers), which is as important as physical capital; in fact in the research field fisical and human capitals do not substitute each other but are mainly complementary; if staff recruitment limits should contract the entire field of research will be threatened.

5. INFN Response to New CIVR Procedures

The discussion of metrics, by which society may judge the worth of its initiatives, can be contentious. This year the CIVR has introduced a new methodology. The committee is somewhat concerned that the global performance of the institute, as compared for example, to that of individual University researchers, may not be well measured. Nevertheless, INFN has embraced the need to participate and, a straightforward approach has been adopted.

Along with the other subfields, CSN I has taken a rational approach to defining products for submission to CIVR. Thus far, it has included both publications and projects and this fits the field well. It gives a place for the very impressive technical contributions to the large experiments at the B Factories, at the Tevatron and at the LHC. Of note is the fact that, with the relative hiatus in physics results coming out of CERN, the evaluation process gives a place to the excellent contributions to the advance of the science represented by major collaborations on, for example, the Atlas Tracking system. It is already clear that the restricted set of products assembled in this preliminary exercise, exceeds the need both in number and in quality. Validation of these products should be straightforward.

We note with satisfaction that preparation for the evaluation of CSN II, is proceeding well and coherently, in particular through the selection of 'products' (e.g. papers, projects) and the preparation of 'product presentation cards'. We expect CSN II to contribute very positively to the forthcoming evaluation of INFN research by the CIVR

The CSN III, Nuclear Physics preparations for the CIVR process are also well advanced. The group is currently working on a fairly rigorous selection procedure. This feature, that the potential numbers of products far exceeds the minimum requirements is common to all INFN sectors. The strong European character of the work in this group is also reinforced by its choice of projects.

In order to comply with the new guidelines, CSN IV has provided a list of about 90 "products" (meaning for CSN IV accepted publications) across the five areas, as well as examples of "cards" for presenting each product. The chosen format fits nicely in a single page and has the essential information with electronic links to more detailed data. It includes an estimate of the relative impact of the product based on citations (relative to top numbers in each specific area) that appears to be a useful parameter at least for CSN IV.

For CSN V, the richness and the wide-range of the activities is reflected in the variety of publications chosen for the CVIR review, which amounts to 60 papers, for 140 FTE in CSN V, selected for 2001/2002. The selected papers are equally distributed in the three fields with a mean impact factor of 1.53, corresponding to their publication in journals specialized in instrumentation and an average INFN property of 0.69. This reflects the international and interdisciplinary collaborations. The four projects selected for the CVIR review, SCRIBA, GPCALMA, ADROTERAPY and TAORMINA, particularly emphasise the interdisciplinary aspect and/or the potentially high socio-economic impact of the research activities. The preparation of the CIVR review is well underway.

Preparation for the new CIVR guidelines has led already to a rather uniform and recognisably coordinated format across all scientific committees. This is good and should be carried as far as possible. It also appears clear that the Chairmen of the scientific councils have participated strongly with their working groups. INFN should be complimented on this and encouraged to hold to the approach. To an outsider, the picture is of a very professional approach.

6. Conclusions, Remarks, Recommendations

INFN science continues to be strong. Its work in all of the scientific committees is of a very high quality, world class in many cases, european class in most. The resources of the institute are directed in a well chosen manner to the key forefront issues of physics. In turn, there being healthy internal competition for the resources, both financial and human, has led to a very well organised management of those resources. The system appears to be very responsive to the changing requirements of government.

It is not yet clear how well the new CIVR system matches to the work of an institution such as INFN. The CVI looks forward to a flexible implementation of the guidelines such that the global collaborative performance of INFN, and its worldwide partnerships, be well measured. Meanwhile, INFN is responding well to the new guidelines provided by the CIVR. It is anticipated that one year from now, the institute will stand ready to be a leading participator on the new evaluation system. In no small part this comes from a proactive approach for which INFN is to be commended.

Opportunities for the dissemination of technology to industry, to medicine, and to other science arise from advances in technology generated within INFN and its world collaborations. While INFN is clearly one of the strongest of the Italian scientific institutes, it is not possible for INFN to do everything. Exploitation of these opportunities depends on INFN forging strong partnerships with the target communities. It is only by establishing strong bonds and by encouraging the exploitation of the results of its work by others, that INFN can maximise its impact on Italian, European, and world society.

Appendix A – Membership of the committee

- Dr. U. Bassler, LNPHE- U. Paris VI/VII, France
- Prof. C. Castellano, ESAOTE SpA, Genova, Italy
- Prof. J. Engelen, Nikhef, The Netherlands
- Prof. W. F. Henning, G.S.I., Darmstadt, Germany
- Dr. H.E.Montgomery(Chair), Fermi National Accelerator Laboratory, U.S.A
- Prof. R. Paladini, University Roma 1, Italy
- Prof. G. Veneziano, CERN., Geneva, Switzerland

Past Member: Prof. R.H.Siemssen, K.V.I., The Netherlands
Prof. L. Mandelli (Scientific Liaison), University of Milan, Italy

Appendix B

Agenda of the INFN CVI Meeting

Rome, 30 June – 2 July 2003

Monday, June 30

09:00 Welcome and Introduction from the President of INFN — *E. Iarocci*
Discussion and approval of the Agenda
Closed session

09:30 Report on the status and achievements of the INFN and the new Guidelines for evaluation of research — *E. Iarocci*
Discussion

Break

11:10 Report on the experimental subnuclear physics with accelerators-CSN1 — *U.Dosselli*
Discussion

12:20 Report on the experimental subnuclear physics without accelerators, astroparticle and neutrino physics-CSN2 — *F. Ronga*
Discussion

13:30 *Lunch*

14:30 Report on the experimental nuclear physics-CSN3 — *E.Chiavassa*
Discussion

15:40 Report on the theoretical physics-CSN4 — *C.M.Becchi*
Discussion

Break

17:00 Report on the technological and interdisciplinary research-CSN5 — *U.Bottigli*

Discussion

18:20 Closed Session

19:15 Queries and questions to the INFN Executive Board and to the Scientific Committee Chairmen

20:30 *Social Dinner*

Tuesday, July 1

09:00 Report from the GLV on the evaluation procedure according to the new Guidelines — *A.Bertin*

Discussion

10:10 Report on the activities of the European Gravitational Observatory — *F. Menzinger*
Discussion

Break

12:00 Responses to queries and questions posed to the INFN Executive Board and to the Scientific Committee Chairmen

12:30 Closed session

13:00 *Lunch*

14:00 Report on resource management: budget and personnel — *A.Scribano*, *G.Ricco*

Discussion

15:30 Closing discussion with the Executive Board

17:00 Closed session (report drafting)

Wednesday, July 2

9:00 Closed session (report drafting and preparation of closeout presentation)

Break

11.30 Closed session (report drafting and preparation of closeout presentation)

13:00 *Lunch*

14:00 Closeout: Comments and remarks by the CVI members
Discussion
Closure of the official part of the meeting

15:00 Closed session (draft of the final report)

Thursday, July 3 and Friday, July 4

Finalization of the report by H.E. Montgomery. Committee members may contribute.

Final remarks

- INFN Executive Members will be present to the presentations and discussions. All other invited participants will be present at the presentations and at the pertinent discussions.
- The time reserved for the presentations of the scientific programs are expected to be equally shared between presentation and discussion.